NGĀ PAE O TE MĀRAMATANGA

## Title of project:

# He Moemoea mō Te Whanganui-a-Orotū: A Vision Plan and Health Assessment for the Napier Estuary

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Te Whatu's Lament

Kia horo te haere ngā taumata ki Te Poraiti
Ko te kāinga tēnā i pepehatia e ō tīpuna
Ko rua te paia ko Te Whanga
He Kainga te ata
He Kainga ka awatea
He Kainga ka ahiahi,
e Tama e i

Go quickly to the heights of Poraiti
That is the land in a proverb of your ancestors
The storehouse that never closed is Te Whanga
A meal in the morning
A meal at noon
A meal in the evening

## Summary


### Project and Client

*He moemoea mō Te Whanganui-a-Orotū: A vision plan and health assessment for the Napier Estuary* is a two-year research programme (2005–2007) that was undertaken by Manaaki Whenua –Landcare Research in association with Te Taiwhenua o Te Whanganui-a-Orotū (Taiwhenua). This programme carried out a comprehensive review of existing literature and historical and environmental data that provided a baseline for biophysical research and the foundation for the *25-Year Living Document* – a collection of tangata whenua and other organisations' aspirations for the future of Te Whanganui-a-Orotū (Napier Estuary). This research was funded by the Research Fund of Ngā Pae o Te Māramatanga: The National Institute of Research Excellence for Māori Development and Advancement.

### Objectives

- Develop and strengthen partnerships with tangata whenua, organisations with statutory responsibilities over the estuary, and community groups
- Review the literature to summarise Māori values, current management regimes, monitoring data and science pertaining to the yellowbelly flounder and cockles
- Develop a 25-year living document for the Napier Estuary that articulates tangata whenua, local government and community aspirations for the future of the estuary
- Undertake biophysical research to characterise the level of pollution and impacts on the fauna living in the Napier Estuary
- Engage with a local secondary school to assist with and promote the research
- Conduct a hui involving tangata whenua, community groups, end-users, and other relevant stakeholders at project-end to disseminate the research findings

### Methods

- Partnerships were initiated between the research team, hapū representatives and other relevant parties at the pre-application stage. These were strengthened by numerous kanohi ki te kanohi (face-to-face) visits, establishing clear lines of reporting, and electronic updates from research and research planning processes.
- A literature review of historical and culturally significant events and issues was conducted using information from the Waitangi Tribunal WAI 55 Report, Court minute books, Web material, and other significant historical records and publications. This was then used to form the foundation of the 25-year living document. Scientific and monitoring data relating to the estuary were obtained from a range of sources including 'grey literature' (unpublished reports and articles) relating to water, sediment and biological quality held by government organisations and in scientific publications.
- Interviews with kaumātua, other tangata whenua, and end-users of the estuary (e.g. councils, non-governmental organisations and community groups) were conducted according to a standard interview and ethical procedure to record their aspirations for the estuary, define their environmental preferences, organisational roles and functions, and provide a clear direction for future use and acceptable development of the estuary.
- Sampling locations and strategies for the fish survey/capture of yellowbelly flounder were developed with assistance from kaumātua (elders). Contaminants normally associated with stormwater were measured in the sediment and the edible flesh of cockles

and yellowbelly flounders. A range of biological endpoints (flounder health status, reproductive fitness, and biomarkers of exposure to contaminants) were measured in fish collected from the Napier Estuary and compared with those of flounder caught in the Pōrangahau Estuary. A 'catch and release' fish survey of relative abundance of fish in the Napier Estuary was conducted using a range of capture methods including box, fyke, seine, and gill nets and the data compared with previous fish surveys.

- A senior Māori student from Napier Girls High School was identified and involved in the research project. Other Māori students (junior through to senior) and senior chemistry students were engaged through a site visit and seminars.
- A pōwhiri (formal welcome) to welcome guests was staged at the estuary and followed by a research data presentation at the National Aquarium of New Zealand.

**Results**

- A strong relationship has been formed with Te Taiwhenua o Te Whanganui-a-Orotū, hapū representatives and end-user organisations. The managing of this multi-disciplinary multi-organisation programme has provided a number of useful learning experiences.
- Important historical and political events leading to the current issues relating to the estuary today are discussed. Tangata whenua who were interviewed wanted to see the rejuvenation of Te Reo Māori (Maori language), tikanga (correct cultural practices) and kawa practices (traditional processes) relating to the management and promotion of the estuary as a way to support intergenerational transfer of information and raise cultural awareness of the estuary. Emphasis was also placed on cleaning up the estuary and its catchment through culturally and environmentally sustainable remedial actions and appropriate current and future development. These views were also articulated in the responses from other community and regulatory groups who were interviewed.
- Chemical residue analyses show that the Tyne St Drain has elevated levels of contaminants. Other sites in the estuary have much lower levels and this was also reflected in the levels of metals in tissue samples from cockle and yellowbelly flounder. However, EROD and bile data from yellowbelly flounders suggest that PAHs are causing a biological response. Data from the fish survey suggest that fish diversity is similar to a survey conducted 20 years ago.
- The senior Māori student from Napier Girls High School became involved in sample collection, tissue processing and analysis, and data processing and enjoyed the interaction. Other initiatives (site visit and seminars) received a positive response from students and staff.
- The pōwhiri and formal presentation, held at the estuary and New Zealand National Aquarium respectively, were attended by approximately 60 participants. Positive feedback was received from many participants.

**Conclusions**

- We consider that the relationships formed have played a significant role in producing a range of positive outcomes. These have also underpinned the considerable in-kind support the project has received.
- Tangata whenua want to have a greater role in management of the estuary and environs and to raise cultural awareness amongst Māori and the public. Similar to the general community were aspirations to improve the water quality through culturally, socially, and environmentally sustainable management and development.
- The approach taken with Napier Girls High School resulted in a series of positive outcomes for both the research team and the students and school

- Te Hui Whakamutunga was very successful. The inclusion of a strong cultural approach was not only appropriate but effective at capturing the audience and demonstrating the power and potential of collaborative research.

**Recommendations**

- Adopt the experiences and processes learned in this research and align them to future collaborative research initiatives with this and other Māori organisations.
- Strengthen the relationships between tangata whenua and the Department of Conservation (DOC) in view of the likely changes to DOC's role within Te Whanga following resolution of the WAI 55 claim and enactment of empowering legislation. Facilitate hapū members working more closely with the department's staff to gain an increased understanding of the estuary and its core functionality.
- For tangata whenua: Adopt options for building environmental research capacity (monitoring, data collection and analysis) such as the schemes mooted by central government and the Ministry for the Environment that would allow tangata whenua representatives to work alongside council staff in an internship/apprenticeship role.
- Facilitate the re-establishment of strong whānau relationships with the estuary by liaising with community interest groups (e.g. Ahuriri Protection Society and Forest & Bird) to create greater synergies and promote better understanding of each other's values – many of which are aligned with hapū aspirations for better water quality, fewer discharges into the estuary, and a more robust monitoring system.
- Implement wānanga based around different aspects of Te Whanga (historical and environmental issues, current and potential uses, management systems and aspirations). This will enable hapū members to gain a better understanding of Te Whanga from a mātauranga Māori perspective, and its hydrology, geology, ecology, tidal and freshwater influences, and prepare the hapū for having a greater role in estuary management after the Wai 55 claim settlement.
- Promote the health and well-being (in both the spiritual and physical sense) of the hapū of Te Whanganui-a-Orotū, and support the transfer of intergenerational knowledge to assist in building hapū capacity and influence.
- Assess the efficacy and location for construction and enhancement of wetlands around the estuary perimeter and adjacent to the streams discharging into the estuary to help alleviate effects of stormwater runoff and enhance habitat for tāonga species.
- Increase interaction with the Pathways Trust to explore opportunities for highlighting historically significant sites both within and around the perimeter of the estuary to promote hapū history and make locals and tourists aware of tikanga and kawa values.
- Integrate into the *25-Year Living Document* the environmental research data generated from this study and any future research initiatives, and evaluate these against existing information gaps and management options to generate new research priorities.
- Carry out further research (environmental-chemistry and biological-effects-based testing) at Site 1 to characterise the extent of the contaminant plume and level of biological impact to provide information that could guide future remediation and mitigation of impacts to this ecologically and culturally significant mahinga kai area.
- Conduct further basic biological and physiological research in yellowbelly flounders to establish this species as a core indicator species for sensitive estuarine ecosystems.
- Consider using Māori processes (pōwhiri and hui) as an effective dissemination tool for multi-disciplinary/multi-organisational research projects.

# 1. Introduction

*He moemoea mō Te Whanganui-a-Orotū: A vision plan and health assessment for the Napier Estuary* is a two-year research programme (2005–2007) that was undertaken by Manaaki Whenua –Landcare Research in association with Te Taiwhenua o Te Whanganui-a-Orotū (Taiwhenua). This programme carried out a comprehensive review of existing literature and historical and environmental data that provided a baseline for biophysical research and the foundation for the *25-Year Living Document* – a collection of tangata whenua and other organisations' aspirations for the future of Te Whanganui-a-Orotū (Napier Estuary). This research was funded by the Research Fund of Ngā Pae o Te Māramatanga: The National Institute of Research Excellence for Māori Development and Advancement.

This research aimed to address hapū-specific issues related to anthropogenic pressures on Te Whanga, and to generate an acceptable framework that aligned with the principles of kaitiakitanga that lead to long-term sustainable management of the Napier Estuary and its environs. Implicit in this is the requirement for expertise in Māori environmental, cultural and social issues, resource management, and integrated science and cultural biomonitoring. To achieve these goals, we have formed a multidisciplinary team of established and entry-level researchers from Manaaki Whenua, Ngāti Kahungunu, Napier Girls High School, and Scion. This team brings together a mix of people with a high level of competence in kaupapa Māori issues, ecotoxicology, marine biology, and resource management to work on tangata whenua issues. This issues-based approach poses a number of unique challenges that the research team had to address. The contentious nature of past and present management decisions (discharge of stormwater into the estuary, and perceived lack of tangata whenua input into management of the estuary) coupled with the political backdrop of the Waitangi Tribunal Claim 55 have created a political climate reflective of the aspirations and responsibilities of the broad range of stakeholders, end-user and interest groups with interests in the future of the estuary. Therefore early in the process the function of the project was identified and in particular the role of the research information generated by it to assist and inform kaitikitanga processes relating to this natural resource (Fig. 1). Clear research questions and process were identified to provide focus and maintain the objectivity of the research. This included adopting an inclusive and transparent approach, particularly around communication, ensuring the research was closely aligned with the expertise of the project team, adopting a proactive management approach where possible, and developing realistic project outputs and outcomes within the scope of the available expertise and project resourcing. To help facilitate many of these a local champion was identified and engaged.

For clarity subsequent sections of this report have been organised according to research objectives. The literature review of Māori values, current management regimes, environmental monitoring data and scientific literature pertaining to the yellowbelly flounder and cockles is attached as an addendum to this report. Data and material not included in the main body of this report, including a glossary of Māori terms used throughout this report, is appended.

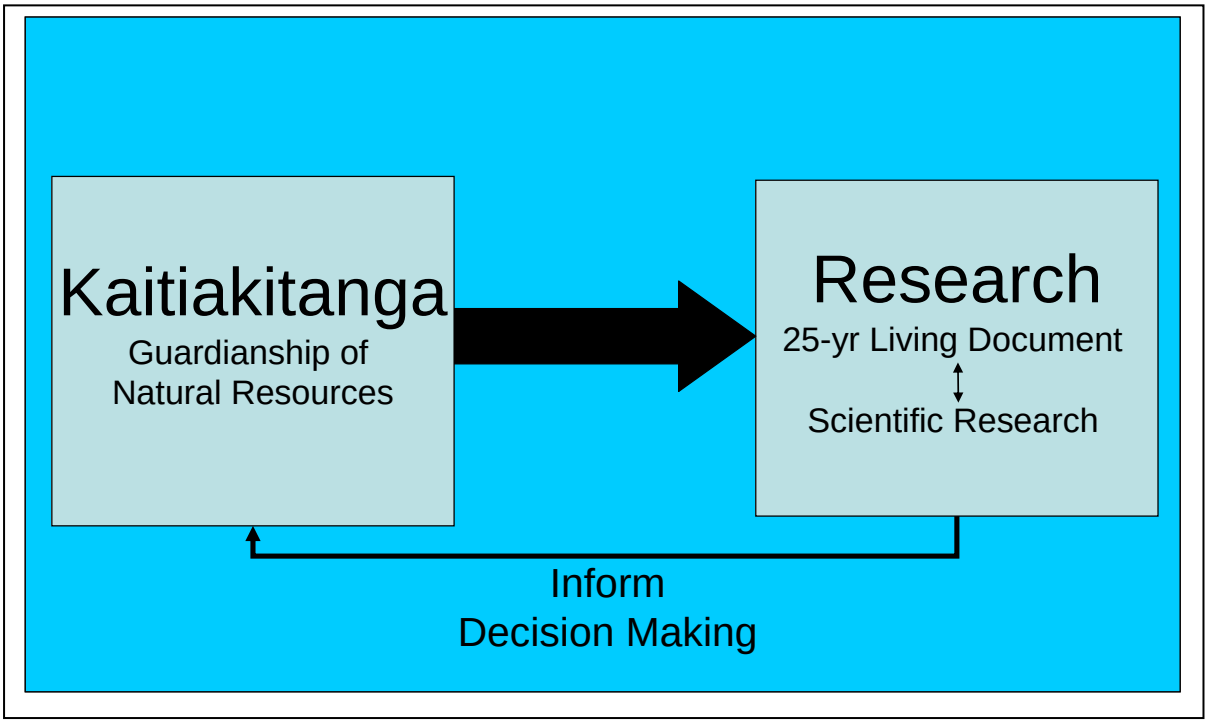


**Fig. 1** Approach adopted during this research.

## 2. Background

Estuaries are areas of unique biodiversity with cultural and recreational values that make them important landscape icons in New Zealand. They are the link between the freshwater and marine environments and largely because of this they experience periodic and rapid fluctuations in environmental conditions (McLay 1976). Estuaries are also regions of significant biodiversity due to the abundant supply of nutrients that is deposited by rivers and the range of environments they posses – characterised predominately the different ranges in salinity (McLay 1976). It is for these biodiversity values and their close proximity to the sea that estuaries have often been preferentially occupied and settled because of these biodiversity values.

The Napier Estuary and its associated wetlands are located adjacent to and immediately to the north of the City of Napier, Hawke's Bay (39°30'S, 176°52'E) (Fig. 2).


**Fig. 2** Location of Te Whanganui-a-Orotū (Napier Estuary), Hawke's Bay, East Coast, North Island.

Today the estuary and outfall channel cover approximately 470 ha with 275 ha under water at high tide. This is only 12% of the original 3840 ha of freshwater lagoon that existed before the 1931 earthquake uplifted areas of the lagoon by 2 m, exposing approximately 33% of the lagoon floor. Even though land reclamation and drainage, and channelisation, have also modified the estuary it continues to support a diverse range of bird, fish, plant and invertebrate species primarily due to the variety of substrates, salinity levels, and plant communities that provide a range of habitats.

It is the most significant wetland along the entire length of the eastern coastline of North Island between East Cape and Wellington, due to the general lack of coastal wetlands (Hume et al. 1990), and because of this it has important ecological, recreational, historical and cultural values.

The Tutaekuri and Waiohingahinga (Esk) rivers that once emptied into the estuary have been redirected and now flow into the sea to the south of Napier via a man-made channel. The main freshwater inflows to the estuary now come from a number of small streams and drains. Maximum daily freshwater inflow into the estuary varies greatly, but on average, the seawater to freshwater ratio is approximately 10:1, and the average tidal exchange is in the order of 495 million litres.

The total catchment area is 13 128 ha although the contribution from the Hastings district and Napier City drainage network includes other catchments. The soils of the Napier Estuary catchment have been formed on siltstones, sandstones and limestone, and are generally very stable. Estuarine sediments are mainly fairly coarse marine sands and gravels on the lower section of the estuary, graduating to finer alluvial silt deposits further up the estuary.

The estuary is relatively shallow, with about 60% of its bed being exposed at low tide. The approaches to the Pandora Bridge constrict tidal flow into and out of the estuary, delaying and muting tidal influences. Recent research carried out since the installation of the motorway bridge indicates that the tidal influx does not drain completely before the next tidal cycle. There is some seepage occurring near the beacons adjacent to the northern margin of Napier Airport. The tidal range at sea in the Napier area varies between 1.8 m (spring tides) and 1.3 m (neap tides); the tidal range in the middle of the estuary varies between 0.52 m (spring tides) and 0.2 m (neap tides).

The pH of the estuary ranges from 7.2 to 9.4 and the temperature fluctuates between 9.5 and 30°C. The tidal influence and freshwater influx result in salinities between 0.32 to 23.7‰. Dissolved oxygen ranges from 7.7 to 13.1 $g/m^3$, ammonium nitrogen from 0.054 to 0.550 $g/m^3$, nitrate nitrogen from 0.086 to 0.590 $g/m^3$, and ortho-phosphorus from 0.141 to 0.421 $g/m^3$.

## 3. Objectives

- Develop and strengthen partnerships with tangata whenua, organisations with statutory responsibilities over the estuary, and community groups
- Review the literature to summarise Māori values, current management regimes, monitoring data and science pertaining to the yellowbelly flounder and cockles
- Develop a 25-year living document for the Napier Estuary that articulates tangata whenua, local government and community aspirations for the future of the estuary
- Undertake biophysical research to characterise the level of pollution and impacts on the fauna living in the Napier Estuary
- Engage with a local secondary school to assist with and promote the research
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## 4. Partnerships

Robust relationships are crucial when collaborating with Māori organisations on research projects that focus on their issues and environmental aspirations. Critical for this project was the prerequisite to develop collaborative links with tangata whenua. This was facilitated primarily through Te Taiwhenua o Te Whanganui-a-Orotū (a government-legislated structure that is mandated by constituents of the seven hapū of Te Whanganui-a-Orotū). This relationship sustained a kaupapa Māori research approach (carrying out research methods that are consistent with the practices and customs of the participants) and supported and fostered a collaborative learning environment (improving people's actions understandings and situations through collaborative action). Strategic linkages were also made with organisations that have legislated management responsibilities relating to the management of the Napier Estuary, or community groups who had direct contact with or a vested interest in the estuary and surrounding environment.

## Methods

Given the contentious nature of some of the issues facing the past and present management of the Napier Estuary the research team adopted a transparent approach and objective stance with respect to the research.

## Tangata Whenua

Communication issues early in the research project between the research team and the Taiwhenua resulted in discussions and an agreement for the research team to operate in line with the tikanga and kawa principles of the Taiwhenua that was articulated in a Terms of Reference between both parties (Appendix 1). In summary the Terms of Reference acknowledged that the research objectives align with the tikanga principles of the Taiwhenua because they address mana whenua and mana moana issues and aspirations. The principles of kawa referred to current governance and management relationships between tangata whenua and local and regional authorities that have legislated management responsibilities for the estuary. These set out clear operating procedures for the research team when dealing with these authorities and required the research team to work through mandated tangata whenua representatives. This served to keep the Taiwhenua informed of our activities and interactions with these agencies and also provided a tangata whenua safety net for the research team. On lower-level operational issues relating to these agencies communication would occur through the existing networks of Morry Black (an environmental consultant who acted as the local champion for this research). Communication requirements were also covered under these principles and included:

- An electronic copy of a summary of research progress and dialogue with agencies will be sent to the Taiwhenua representatives every quarter
- A summary of outcomes from significant meetings with key agencies will be sent to the Taiwhenua for their information
- Regular meetings between Morry Black and Maia Kaukau (Service Coordination Manager for the Taiwhenua)

Commercialisation of intellectual property, although not envisaged to arise from this project, would be handled by taking the appropriate steps to ensure all benefits are apportioned appropriately. Furthermore, information deemed by tangata whenua to be culturally sensitive was handled according to the wishes of tangata whenua.

## Other organisations

Local government agencies were approached through existing Taiwhenua relationships. Contact with other organisations was facilitated through individual members of the research team. Communication of preliminary results and updates occurred only after the information had been released to the Taiwhenua and occurred through a number of kanohi ki te kanohi meetings, electronic correspondence, and popular articles.

## Results

Adopting the Terms of Reference improved lines of communication between the research team and the Taiwhenua and provided a clear procedure for the research team when interacting with government agencies.

Maintaining an impartial approach, while maintaining an awareness of the political context surrounding the estuary, appeared to underpin a willingness for various organisations to interact with this project. We feel this confidence in the research approach is reflected by the

depth and number of relationships formed (Appendix 2) and the range of support that was donated to this research.

**Conclusions**

For collaborative research with Māori communities it is important that appropriate processes are established that maintain high standards of conduct, meaningful research objectives are agreed to, and a clear pathway to achieving them is decided on. In the course of this project we have learned that:

- Partnerships mean equity both in terms of resources and responsibility
- A communication strategy developed at the front end of a project is vital
- An awareness of the political context underpinning the issues will assist in the management of the project
- Reaching consensus on realistic goals, particularly the limitations around research capacity, will translate to manage high expectations and result in achievable outcomes
- Transparency in all aspects of the research is important
- Maintaining the validity of the research process will provide confidence in the approach
- Tangata whenua involved in this project regard relationships as long term and therefore an awareness and commitment needs to be made by researchers.

**Recommendations**

That the experiences and processes learned in this research will be adopted and aligned to future collaborative research initiatives with this and other Māori organisations.

# 5. The 25-year Living Document

## 5.1 Introduction

The Napier Estuary is of significant value to tangata whenua and the wider Napier community. A remnant of Te Whanganui-a-Orotū, it is situated on the northern margin of Napier city and to the west of the Napier Port and Inner Harbour. The upper estuary follows the line of the Poraiti Hills behind the Napier Airport and the Landcorp Farm. The total area is around 450 ha with approximately 275 ha under water at high tide. (Napier City Council et al. 1992)

Te Whanganui-a-Orotū provided sustenance for local whānau and hapū for many generations. Oral histories and whakapa have established that Māori occupation dates back at least to the 12th century AD. This has been confirmed by radiocarbon dating of archaeological samples from Roro-o-Kuri and other former islands, and from major pā sites around the original perimeter of Te Whanganui-a-Orotū.

The development of a 25-year living document for Te Whanganui-a-Orotū evolved from a series of hui with the Taiwhenua and Manaaki Whenua between May and August 2004. At these hui the concerns of the seven hapū in relation to the estuary were discussed at length. Following the 1931 Napier earthquake there was an acceleration of land drainage and reclamation. Industrial expansion around the estuary's southern perimeter from the 1950s onwards had resulted in numerous discharges into the estuary with resultant decline in water quality and perceived health of estuarine fauna. Tangata whenua agreed there needed to be an

increased focus on Te Whanga based on the core values of the hapū, and to which the wider community could contribute. Rezoning of land, increasing urban development, proposed expansion of the Napier Airport and the Napier Port facility, and increasing traffic flows were all cited as potential threats to tangata whenua wishes for estuary restoration and the revival of kaitiakitanga.

The living document signals tangata whenua and community preferences for management of this tāonga over the longer term. The research has highlighted a significant number of values and aspirations that are generally acceptable to the wider community and which will help address most of the tangata whenua concerns. These will help guide future management decisions relating to Te Whanga and the surrounding catchment.

## 5.2 Methods – Literature Review

The first component of the 25-year living document was to conduct a literature review of historical, cultural, and environmental data from within Te Whanga and its surrounds to characterise the key Māori values associated with this tāonga. These values could then be used as the foundation for the 25-year vision document, for reviving mātauranga practices as they related to Te Whanga, and for guiding hapū direction in future management decisions while providing a unique cultural database to assist hapū development. In addition, the values and uses other sectors of the community associated with the estuary were explored to assist in producing a balanced document.

A range of historical documents was sourced from libraries and personal collections. Information was gathered from court minute books, a Web search, environmental research reports, and council and Department of Conservation records and from the Internet. At a hui with the Waitangi 55 Kaumātua Komiti (committee) early during project development the komiti recommended and endorsed the use of their extensive claimant evidence from the Waitangi Tribunal hearings for Te Whanganui-a-Orotū (Wai 55). This valuable resource provided researchers with extensive and comprehensive cultural information as well as guidance to other literature sources relevant to the estuary.

The literature review was completed in February 2006. The key values to emerge from the review of the Wai 55 literature highlighted specific hapū rohe (areas) for traditional food harvest and cultural practices within the original Te Whanga catchment, while allowing for a general sharing of its resources during periods of seasonal abundance. Knowledge of Te Whanga and its resources helped form the basis of hapū mātauranga, and transferring mātauranga Māori to each succeeding generation was often achieved by younger hapū members working or harvesting alongside their older whānau, through regular wānanga, or through particular whānau who showed aptitude or ability in specific areas and being taught by more learned members of the whānau. This tuākana-teina (older sibling to younger sibling mentoring) approach was the more common method used for the transfer of intergenerational knowledge.

## 5.3 Methods – Interviews

Supporting the 25-year vision plan is a range of information gained from a series of semi-structured interviews with kaumātua, other hapū members (n = 9), and structured interviews with representatives from agencies and community groups (n = 9) who have management roles and other interests within the estuary. The research approach recognised that the estuary

has multiple stakeholder groups and the data collection methods were designed to reflect and include all relevant values and perspectives. Interviews focused on drawing out and documenting aspirations for the estuary from which could be built a set of priorities and management principles to benefit both the estuarine ecosystem and the community.

Determining the aspirations of tangata whenua for future estuary management was a major component of this research. There has often been a perception amongst hapū members that cultural preferences have not been given relevant weighting in past management practices for this tāonga (treasured possession). Likewise, the subtle variations in traditional hapū environmental management systems were not acknowledged when formulating policy in local planning documents. For these interviews we selected kaumātua and whānau from several different hapū so that a range of learned opinions and aspirations could be obtained in relation to the different hapū rohe, so that any variations in hapū management which do exist can be acknowledged in future management decisions.

**Interview process – Process document**

Before commencing the interviews the proposed process was drafted and submitted to Te Taiwhenua o Te Whanganui-a-Orotū for approval (Appendix 3). It identified a range of interview themes and gave an overall direction and outlined how the interviews would be conducted, recognising the cultural differences between tikanga Māori (Māori customs and traditions) and tikanga Pākēhā.

This document included consideration for the principles and ethics contained in the Association of Social Science Researchers code (Manaaki Whenua 1996, unpublished) which gives a broad outline of interview process and identifies safeguards for participants' interests. Differences between Māori and European cultures and preferences necessitated separate interview processes. The first engaged with tangata whenua representatives and was influenced by their cultural relationships and values, which cover a broad range and an holistic world view, whereas interviews with other sectors of the community generally have a more specific focus governed by each group's level of interest. The remaining interviews targeted a range of end-users with interests in the estuary and included:

- The Department of Conservation
- Commercial fishermen (marine and eel)
- Napier City Council
- Hawke's Bay Regional Council
- The Napier Port Harbourmaster
- Royal Forest and Bird Protection Society of New Zealand
- Ahuriri Protection Society
- Recreational users

The entities whose activities involve the estuary can be categorised into four main sectors, among others:

- Those groups with environmental concerns
- Agencies with management responsibilities
- Recreational users
- Those whose land use activities impact on the estuary

Representatives from key sectors (Table 1) were interviewed to help analyse the current management system, gauge how well it is performing, and to find aspirations for future management and uses for Te Whanga. To facilitate this process the research team approached

key organisations and identified appropriate people from each sector to take part in the interview process.

**Table 1** Sectors identified and their key areas of interest

| **Tangata whenua** →→ | **Environmental** → | **Management** → | **Recreational** → | **Peripheral** → |
|---|---|---|---|---|
| Ngāti Matepu<br>Ngāti Hinepare<br>Ngāti Parau<br>Ngāti Mahu<br>Ngāi Tawhao<br>Ngāti Tū<br>Ngāi Te Ruruku | Forest and Bird<br>Ahuriri Protection Society<br>Study groups | Department of Conservation<br>Napier City Council<br>Hawke's Bay Regional Council<br>Ministry of Fisheries | Ahuriri Walkers Group<br>Kayakers<br>Board sailors<br>Joggers<br>Duck shooters<br>Waka ama<br>Swimmers | Airport Authority<br>Port Authority<br>Developers<br>Farmers<br>Lifestyle block owners<br>Transit New Zealand |

Hapū relationships with the estuary are varied and not confined to specific areas. In addition there are spiritual, historical, ancestral and social elements to their connections to Te Whanga that pre-date European colonisation. Interviews with kaumātua and rangatahi were carried out with appropriate regard for tikanga and kawa practices and protocols and before commencing each interview the following procedures were adopted:

*Informed Consent*

- An overview of 'He Moemoea mō Te Whanganui-a-Orotū' was given to provide a context to the interview process.
- Permission was gained to record each interview for transcribing at a later date.
- An explanation was provided regarding the use and outcome of the information recorded during the interview and on the transcribed hard copy.
- Participation was entirely voluntary and the interview could be stopped at any time.
- The option of commencing the interviews with a karakia was provided.

*Privacy and confidentiality*

- The interviewer ensured that the interviewee was fully aware of the process and the protection mechanisms in place for any sensitive information that may arise as a result of the interview.
- The option to omit sensitive information from the final report was provided if wished by the interviewee.
- To ensure compliance with the above two clauses a hard copy of their interview summary was supplied to participants prior to drafting of the final report.
- Participants were informed of the Terms of Reference existing between the research team and the Taiwhenua.

*Other considerations*

- Interviews were held at a location where participants felt comfortable and relaxed.
- A reasonable effort was made to conduct the interviews in a manner and at a time convenient to participants.

- The rights of the researchers in regard to the terms of the research contract requirements were recognised by contributing parties.
- Once these matters had been addressed the permission slip was signed by both the participant and the interviewer.
- A directive from the Taiwhenua to hold interviews with kaumātua during the warmer months was observed.
- At the conclusion of the interview a koha was given in acknowledgement of their time and expertise.

**Interview process – tangata whenua interviews**

The Taiwhenua and key kaumātua guided the compilation of a list of kaumātua and whānau from which the interviewees were selected. Those selected have all lived within close proximity to Te Whanga for many years and whakapapa to the seven hapū who exercise kaitiakitanga over the estuary. Illness, tangi or other engagements prevented all of the interviews from being carried out. However, tangata whenua that were interviewed provided a good selection of those deemed to have a sound understanding of mātauranga Māori and how it related to the estuary. Nine people participated in the interviews.

It is acknowledged that a significant amount of traditional and cultural information has already been recorded as part of the evidence given by hapū members at the Waitangi Tribunal hearings into the Whanganui-a-Orotū claim. Almost all of this information is retrospective and was articulated again during the interviews. To focus on information that could expand on existing cultural data and further define hapū aspirations for future estuary use and management an interview form was developed to guide the conversation, and included:

- Protocols, practices and methods used for the collection, preservation and sharing of kai species within Te Whanga
- Historical accounts and testimony on mahinga kai species
- Enhancement options for mahinga kai including rāhui, taiāpure and mātaitai
- Information and significance relating to the Māori names for sites and locations around Te Whanga
- Ideas on present and future uses for Te Whanga
- Elements of protection or enhancement for those characteristics of the environment of special value to Māori
- Filling in perceived information gaps identified from the literature review
- Aspirations for the management of the Landcorp Farm, which the Waitangi Tribunal has recommended be returned to the hapū

**Interview process – interviewees with the wider community**

The second series of interviews with other end-user groups was more targeted. In relation to the estuary, agencies with statutory management roles and functions are governed by Local Government Act legislation and the plans formulated under the Resource Management Act, the Conservation Act and the Wildlife Act. There are also fishing regulations which apply within the estuary as part of the wider coastal area. Responsibility for management of Te Whanga lies with local bodies and the Department of Conservation on behalf of the Crown.

In addition there exist urban development strategies and long term council community plans, which had the views of the community taken into account during their preparation. To some extent the direction which future management of the estuary takes is indicated in these

planning documents. However, there is some flexibility for further Māori input into these documents through Māori consultative committees, and pending settlement of the Wai 55. As with the rezoning of parts of the Ahuriri and Pandora areas from light industrial to residential and commercial zoning, activities around the estuary and their impacts are changing.

The interview process with local government (Table 2) focused on what is happening now under the current planning regime in relation to estuary management, the efficacy of that management, and whether there are increased opportunities likely to develop for tangata whenua to share in estuary management processes. Key agency personnel were selected who were well informed of their respective organisation's role and functions with respect to the estuary and its environs.

Representatives from other organisations (Table 2) and sectors were interviewed to gauge responses and aspirations, thus providing information from a cross section of the community, which would enable the research to collate opinions and present a balanced approach to future estuary management.

**Table 2** Key organisations with interests in the estuary

| |
|---|
| Landcorp Farm |
| Ministry of Fisheries |
| Hawke's Bay Regional Council |
| Napier Port Authority |
| Napier Airport Authority |
| Forest and Bird |
| Ahuriri Protection Society |
| Ahuriri Walkers Group |
| School Groups |
| Department of Conservation (DOC) |
| Napier City Council |
| Recreational Users |
| Waka ama and P Class Yachting |
| Commercial Fishermen |
| Developers |

Not all of these sectors were willing to take part in the interviews but nine people from different organisations participated. The results of the interviews represent the opinions of most sectors.

By including key points of view from the wide range of people with interests in the Napier Estuary, our report seeks to document a range of issues that can contribute to future management, use and enhancement options for the estuary, in a fashion that aligns with the tikanga of the Taiwhenua and with wider community aspirations.

## 5.4 Results – Tangata whenua

It was common for these interviewees to discuss evidence presented at the Wai 55 hearings or recorded in the reviewed literature. When this occurred it was considered prudent to allow the korero to continue and then lead the interview back to the issues of relevance to the research study. Major themes to emerge from the tangata whenua interviews related to cultural matters and the desire for healthy water and healthy food gathered from the estuary.

### Cultural

Increased use of karakia was espoused as a way to help bring back traditional cultural practices relating to the estuary, as increased relevance being given to spiritual beliefs and practices would ensure an appropriate level of reverence for Te Whanga, for the many significant cultural sites within, and hopefully more use of mātauranga as an endorsement for estuarine management. The majority of the tangata whenua interviewees supported a return to some form of traditional management system for the estuary. It was not explained how this could be achieved given the legal force behind current environmental plans, although hapū members revealed that they would like to eventually see their own hapū management plans being part of the mix. Ngāti Marangatutaua (Ngāti Tū) has already gone some way towards formulating a hapū management plan, which they hope will be included in future decision-making processes.

For some hapū it was mentioned that wānanga (institute of learning, forum for discussion and debate) relating to the building of a new wharenui, to replace the one lost several years back at Waiohiki, could help revive interest in hapū history and traditional practices. The wānanga would ensure that the stories and history were robust and aligned with hapū aspirations for the foreseeable future, creating a direct connection between the tūpuna and tangata whenua of today. Then the carvings for the new whare tupuna at Waiohiki will reflect an accurate portrayal of the tangata whenua whakapapa, history, tikanga and other issues of relevance.

Reverting to the original Māori names for significant sites within Te Whanga so that the history could ‘be brought back’ was a common theme expressed by interviewees. They suggested that some sites could be signposted with the original Māori name, a short whakamārama (explanation) about the history, and more plantings of indigenous species, particularly on wāhi tapu (sacred) sites. There was a preference for fencing off these sites to protect them from encroachment and misuse.

Some tangata whenua supported wānanga because this distinctly Māori forum is the best way to disseminate indigenous knowledge, and it could be tailored to suit the kawa (formal procedures/protocols) around each host marae. Some wānanga had already been held which had achieved the dual purpose of enhancing whanaungatanga (relationships) and educating the people on the tohu (environmental indicators) and the relationship between them and the seasonal influences on fish, birds and weather. Other hapū interviewees supported more wananga as a means of bringing the whānau back together to share the stories around their collective past, particularly for the reviving of the maramataka (Māori calendar) and knowledge of cultural indicators (tohu) which signal what is happening in the natural world, and the alignment between these tohu and seasonal harvesting of natural resources from Te Whanga and the adjacent coastline of Tangitu as is evidenced in the following whakataukī (proverbial saying):

Ka tūwhera au Maungaharuru ka kati a Tangitu
Ka tūwhera au Tangitu ka kati a Maungaharuru
When the mountain is open the seabed closes
When the seabed opens, the mountain closes.

Education of rangatahi and mokopuna was seen as imperative to preserving mātauranga Māori. One aspiration was to include Te Whanganui-a-Orotū in the education system to help Māori and the wider community better understand the relevance and significance of the estuary to tangata whenua, as it was felt that this was not widely known or understood. If the community learnt about their cultural values they felt there would be better integration and less friction over the estuary.

There was also the call for the increased use of Māori management models including rāhui, taiapure and/or mātaitai to regulate access to particular kai species and allow for better management mechanisms that tangata whenua could be part of. The concepts of tapu, rāhui and noa had always served them and their ancestors well in the management of Te Whanga and their role as kaitiaki. There was an overall perception that current planning was not inclusive enough of tikanga (process, the right way of doing) values, although it was acknowledged that relationships between the Napier City Council and the Taiwhenua were quite good. The majority of tangata whenua interviewees supported some form of co-management of the estuary. It was acknowledged that proper management including monitoring and estuary enhancement would require significant financial resources and a substantial increase in the hapū skill base.

There was a lack of resources for tangata whenua to get involved in many of the (estuarine) environmental issues that they felt they should be involved in. One potential solution put forward, was that some form of centralised system should be developed. This would include one or two skilled people from each hapū, perhaps at Taiwhenua level, who could be called in for specific take (tasks) depending on the issue at hand and the available expertise – Te Taiao o Te Whanganui-a-Orotū.

**Healthy water and healthy kai**

Tangata whenua have always associated healthy water with healthy kai and they were adamant that the practice of allowing contaminants to enter an estuarine system and relying on dilution as a management tool was not the best option. The presence of contaminants in the estuary and in the kaimoana, even at low levels deemed safe by food standards, was unacceptable to most of those interviewed.

An increase in the hapū knowledge and skill base was seen as essential for the Taiwhenua and constituent hapū to better enable them to share in management responsibilities relevant to Te Whanga. The death of a number of key kaumātua during the time frame of this project was seen as a loss of a significant amount of the collective mātauranga. The opportunities available in the environmental management and science fields are seen as key areas that need to be exploited by tangata whenua. There were areas where the interface between science and mātauranga were mutually supportive and these needed to be explored and further rationalised.

Restoration of the estuary would assist in restoring some of the mana of the hapū as it would allow for customary harvest of some kai species to resume and whānau to positively reconnect with Te Whanga.

An indication was given that developments around the estuary that involved earthworks and land disturbance should be regulated so that this did not occur during the winter months. It was stated that Environment Bay of Plenty had a restriction on such activities to stop sediment and runoff from adversely affecting waterways and estuaries.

Increased mitigation of stormwater flows and reduced effects from contaminants were expressed as desired outcomes. Options mentioned throughout the interviews were for retention ponds, wetland creation, and riparian plantings. Increased wetland areas could then serve as refuge for juvenile species of aquatic fauna. Partnerships with the Department of Conservation, councils, community groups or developers were favoured. Another idea was for the planting of some rongoa species that could supplement or help facilitate the spiritual and physical reconnection of the hapū to the estuary.

A common perception was that existing shellfish beds at Tangoio and the area known as The Wreck were becoming smothered with sediments due to the Port breakwater extension causing sand to accumulate further along the coast. It was believed that tidal processes that had previously deposited sand along the Westshore beachfront had been altered causing more sand to accrete around Tangoio and Whirinaki.

There were concerns over the number of subdivisions and increased discharges of stormwater into the Taipo Stream. The increase in impervious surfaces from these will be substantial once they are all completed, with added risk if further subdivision of lifestyle blocks is permitted in the future.

Tangata whenua consider that the lack of resources is a major barrier to their aspirations of carrying out their preferred programmes around the estuary. Aligned with this was the perception that many rangatahi had become disassociated from the estuary and their culture. It was felt that this may be one of the main reasons for unstable Māori youth within Napier. One option mentioned was to further develop tourism initiatives around the wider Te Whanga area highlighting its history, using the estuary to teach tourists about our tupuna, and using any profits to feed back into estuary restoration and/or employment opportunities.

The identification and encouragement of whānau who showed an aptitude or willingness to learn about different elements of estuarine environments, Te Whanga history, or recreational pursuits centred on Te Whanga was seen as a constructive way to reconnect the whānau with their tāonga. These people could be encouraged to pursue career pathways of mutual benefit to themselves and the estuary. Using Te Whanga as a training ground for tangata whenua would support tikanga and its relevance within sustainable management systems.

Sharing of kai was a common theme to emerge from tangata whenua interviews. The current fishing regulations placing limits on the gathering of kai was seen as a hindrance to whanaungatanga as these do not allow for the sharing of kaimoana amongst extended whānau as a normal activity or cultural right.

Interviews with fishermen who had caught tuna (eels) within Te Whanga in the 1980s and early 1990s revealed that tuna were prolific up until the mid-1990s and that low tuna numbers were a relatively recent phenomenon. Commercial fishermen stated that the decimation of the eel fishery was partly caused by overfishing, but mostly by habitat loss and reduced water quality. Some places where these fishermen had required waders to set their eel nets at low

tide in the past were now only ankle deep or dry land. Sedimentation and water abstractions in the upper catchment were thought to be the major cause.

One question posed for interview participants asked what their preferences were for the Landcorp Farm given that return of the farm to tangata whenua as part of the resolution of the Wai 55 claim was likely. The main themes to emerge from this line of enquiry were:

- To hold a series of wānanga to reach a consensus view on future management options for the farm.
- Retention of the existing core farming activity, which is essentially the fattening of stock from other Landcorp properties. This could continue as it was the key function of the farm and the property was geared to that enterprise, was making money at it and employing people. This could be used as a training ground for tangata whenua who showed an interest in farming-related activities.
- To increase water volumes and spatial extent through deepening and widening of some of the channels, as it was acknowledged that with predicted climate change and warmer mean temperatures, there would need to be increased water flows around the estuary to assist in cooling, and to prevent eutrophication in the upper estuary and some of the existing shallow ponds. Dredging would be required to remove some of the sediments where they had accumulated over time. This could be of benefit to the estuary as a whole as spoil could then be used around some low-lying areas creating better protection from predicted sea level rise and flood risk from some of the more intense rainfall events.
- Fencing off of all wāhi tapu on the farm and better provision for the cultural landscape that had been lost or severely compromised from past activities.
- Giving more thought to other activities utilising the natural water resource – eel farming, aquaculture etc. – but retaining the core farming activity and only embarking on other enterprises if due diligence and research indicated their viability.
- The proposed expansion of the Napier Airport was a major issue. Some tangata whenua felt that there was a lot of pressure being applied from central and local government agencies to influence what the hapū could do with the Landcorp Farm before it was returned as part of the Treaty settlement process. Several reports had been commissioned looking at the economic benefits of the airport being upgraded to international standard, but generally it was felt that the values of the hapū and the estuary were not being given enough weighting in the process. Airport expansion would place an increased burden on the estuary prior to it being cleaned up, making restoration more difficult to achieve. There was also the perception that airport expansion would severely limit the options for tangata whenua aspirations in relation to the future use or development of the Landcorp Farm due to extended flight paths and increased noise and air traffic.

### 5.5 Results – The wider community

Agencies with statutory management roles within the Napier Estuary have historically tended to look at the estuary as separate from the wider coastal area, but lately have been giving increased consideration to it as part of the wider coastal environment. This is more in accord with the Māori world view that acknowledges the connectivity between the separate parts of the environment.

Those interviewed from regional and territorial authorities are in the process of drafting new stormwater policies which will give greater consideration to environmental and amenity values given the increase in public use and growing awareness that the estuary is a unique

habitat. The estuary has previously been identified as of national significance, but this was not always a priority given the number of stormwater and industrial discharges that had previously been allowed to discharge directly into it. Lately there has been growing awareness of the potential effects of stormwater discharges on estuarine environments.

The Ahuriri area has undergone rapid growth recently with construction of apartment buildings and popular restaurants drawing many tourists as well as locals to the area. Some apartments were using the proximity of the estuary as a marketing tool expounding the recreational values and environmental utilities of the area. Councils and some of the environmental groups showed support for increased recreational use of the estuary and its surrounds provided there is a parallel increase in community education and awareness to ensure that environmental values are not compromised.

It was felt that the inner harbour may be contributing to the contamination of the middle and uper estuary due to tidal flows. The slipway and boat maintenance activity and discharges from bilge pumps etc. was seen as a risk to estuarine health. Past use of antifouling paints containing tributyltin (TBT) and the sanding and painting of fibreglass hulls had (in some people's view) contributed to total contaminant loadings in the estuary. Dispersal through tidal action was believed to be exacerbating the decline in overall estuarine health

Within the past few years there has been a gradual shift within management structures. The overland drain initiated by Napier City Council will divert a major percentage of Napier's stormwater to a new outlet near Awatoto to the south of Napier. This will feed into a retention pond before filtering through to the ocean, relieving pressure on Napier's drainage system and significantly decreasing stormwater volume and contaminants entering the estuary in the short term. The amount of runoff from new and emerging subdivisions and the expanded highway network may undo some of the benefits if sufficient mitigation is not factored into the process.

The effects of climate change and predicted sea-level rise on the estuary was mentioned in two of the interviews. Changes in rainfall patterns and the occurrence of severe rainfall events were already causing the Taipo Stream to breach its banks in the upper reaches around Taradale, and scouring some banks lower down the catchment. Representatives from community groups and non-government organisations were generally supportive of a more protective approach to the estuary and its resources. They held some similar aspirations to tangata whenua although the means to achieving desired outcomes were sometimes expressed in a different way. Extension of the airport runway and the values of the estuary as significant bird habitat and a wildlife refuge were seen by some to be incompatible.

One group advocated for public amenity values to be actively promoted. Although there was an associated risk to avifauna from increased numbers of people (and dogs) accessing the estuary, they felt that a public awareness programme incorporating safety issues and best practice, with increased educational initiatives at both the school and community level, would result in more people taking responsibility for the estuary and a more caring attitude, with increased support likely for enhancement projects. A number of schools were already including the estuary in their environmental education. The 'enviroschools' concept was gaining in popularity with several schools now coming over from Hastings on a regular basis for science, ornithological or marine studies, as well as regular P Class yachting.

A number of groups regularly engage in estuary clean-up operations and tree planting projects. They see the benefits that will accrue for the whole community due to increased public amenity values, and often collaborate with the Department of Conservation and local councils for Arbour Day, World Wetland Day and other events.

Some participants in this group felt that the current planning regime did not offer enough protection. The discharge structures and pumping stations adjacent to the motorway were highly visible and they felt these gave the impression that the estuary was a dumping ground for contaminants. Views were expressed that climate change and the warmer temperatures being predicted would help to accelerate weed growth in the relatively shallow estuary and detract from species' health and abundance.

The Department of Conservation expressed a willingness to work closer with tangata whenua and were aware of the management dynamics being likely to change once the Wai 55 claim was resolved. They manage land within the estuary and also adjacent to the Taipo Stream on behalf of the Crown and have worked closely with tangata whenua and non-government organisations (NGOs) over some estuary issues in the past and appeared willing to foster better relationships.

Grazing of stock in close proximity to the estuary was seen as a problem along with pastoral runoff. There didn't appear to be any controls over these matters as the grazing of stock and application of fertilisers are unregulated. Some of those interviewed queried the effects of these activities on groundwater systems given the limestone underneath much of the Poraiti and Eskdale hills, and existing springs.

The adequacy of stormwater and wastewater disposal systems from the subdivisions was questioned. Interview participants from tangata whenua and community groups were concerned about the cumulative effects of these on the estuarine ecosystem. Riparian planting and constructed wetlands were seen as a potential solution although agreement with landowners would be required.

## 5.6 Conclusions

The key aspirations to emerge from the interviews with tangata whenua can be categorised under the following main themes:

- Mentoring and educational processes to promote awareness of tikanga Māori and mātauranga to build capacity and skills within ngā hapū to facilitate increased involvement in estuary management processes and activities
- More recognition and provision for tikanga Māori values within statutory planning frameworks, monitoring and development strategies
- Exploring and initiating co-management scenarios for specific issues within the estuary and more influence in decision-making processes
- Reverence and protection for wāhi tapu within Te Whanganui-a-Orotū
- A decrease in discharges of contaminants into the estuary and mitigation of adverse effects from both source and non-point source discharges
- Habitat enhancement and protection, and an increase in species' health and abundance
- Income creation from hapū tourism initiatives

For the other agencies with interests and management responsibilities in the Napier Estuary, the main issues were:

- Increased mitigation of adverse effects from human activities particularly the effects from built environments and sedimentation
- Overall estuarine health and species enhancement and protection
- An increase in public amenity values within the estuary, and more community involvement and use
- Better integration of estuary management processes with increased public input
- Preparation for and mitigation of the expected effects of climate change
- Further research into effects of discharges of persistent contaminants on the benthic community

Tangata whenua do not have the capacity to respond effectively to all of the resource management issues with the potential to affect the estuary. Presently the Taiwhenua responds where they can, but in many cases, resources are limited for the substantive responses necessary for important issues. The number of plans and strategies, proposed designations, and constantly changing legislation at central government place the Taiwhenua and the hapū they represent in a constant reactive state mode, and it is necessary to remain vigilant and aware of plan changes, new strategies, rezoning issues, designations and emerging legislation. Resolution of the Wai 55 claim may allow for more meaningful input into decision-making processes where they impact on Te Whanga, but there is an immediate need for identifying and leveraging opportunities for input into environmental management, as they arise.

The proposed Regional Coastal Environment Plan 2006 now gives greater recognition to the connectivity between estuaries and the coastal environment, and the relationship between some land uses and their effects on estuarine and marine environments. The New Zealand Coastal Policy Statement is also under review as well as the Conservation Management Strategy. The Taiwhenua, community groups, and non-government agencies can have their concerns taken into account in relation to estuary management provisions through these reviews.

There is acknowledgement amongst statutory managers that past practices (within the estuary) have been insufficient to adequately protect estuarine fauna and flora and natural ecosystem functionality. The current planning regime for the estuary is being reviewed on a regular basis to assess its effectiveness and gauge whether it is achieving the key objective of ‘maintaining the life-supporting capacity of the estuary’. The new estuarine ecology monitoring programme will augment the State of the Environment monitoring and hopefully lead to better understanding of effects of land use activities and discharges. It also creates an opportunity for tangata whenua to become familiar with the programme and take part in its inception and development. In addition they will be able to record improvements in estuarine habitat over time as the programme develops, while learning new skills and methodologies that can be aligned with cultural health indicators. Even at this early stage this will provide significant information on the effectiveness of the coastal plan towards achieving its key objective in relation to the estuary, of *the maintenance of the life-supporting capacity of the Ahuriri Estuary*.

Napier City Council will soon divert 30% of Napier’s stormwater away from the estuary via the overland drain and retain it in ponds north of Awatoto before eventual seepage to the ocean. This will reduce contaminant loadings on the estuary in the short to mid term. If

stormwater flows from rural land and the new subdivision is managed appropriately, there is scope for gradual improvement of the health of the estuary.

New stormwater policy is currently being drafted that is likely to bring more stringent regulations for stormwater discharges. The new policy will class receiving environments according to their sensitivity, cultural use, and public amenity values. Two strands of stormwater research have recently been completed within Hawke's Bay that will allow a more robust stormwater management regime to be put in place, and presents the hapū with opportunity to influence estuary management direction and outcomes.

There is a willingness displayed among councils and government departments to actively engage with tangata whenua over resource management issues relating to the estuary. With NGOs there is a desire to have better understanding of the Māori world view and mātauranga. There is a growing alignment between traditional management systems and Western science which could benefit both cultures and the environment if allowed to flourish.

In addition, a number of industrial outlets have recently been discontinued and more stringent requirements imposed on remaining discharge consents from industrial premises bordering the estuary. The Regional Resource Management Plan recently becoming operative has compelled this, and gradual clean-up of the estuary is becoming a reality

Although some hapū are familiar with the roles that different entities have within the estuary, there is some confusion over responsibilities within the separate parts of the estuary, and how the provisions in the various planning documents are applied. There is a need for wānanga or workshops to increase hapū understanding of how the relevant planning provisions work within the estuary context, and to maximise opportunities for consideration of their preferences

## 5.7 Recommendations

### Social issues

Strengthen the relationships between tangata whenua and the Department of Conservation (DOC) in view of the likely changes to DOCs role within Te Whanga following resolution of the Wai 55 claim and enactment of empowering legislation. To facilitate hapū members working more closely with the department's staff to gain an increased understanding of the estuary and its core functionality.

For tangata whenua to adopt options for building environmental research capacity (monitoring, data collection and analysis) such as the schemes mooted by central government and the Ministry for the Environment that would allow tangata whenua representatives to work alongside council staff in an internship/apprenticeship role.

Facilitate the re-establishment of strong whānau relationships with the estuary by liaising with community interest groups (e.g. Ahuriri Protection Society and Forest and Bird) to create greater synergies and promote better understanding of each other's values – many of which are aligned with hapū aspirations for better water quality, fewer discharges into the estuary, and a more robust monitoring system.

**Cultural and environmental issues**

Implement wānanga based around different aspects of Te Whanga (historical and environmental issues, current and potential uses, management systems and aspirations). This will enable hapū members to gain a better understanding of Te Whanga from a mātauranga Māori perspective, and its hydrology, geology, ecology, tidal and freshwater influences, and prepare the hapū for having a greater role in estuary management after the Wai 55 claim settlement.

Promote the health and well-being (in both the spiritual and physical sense) of the hapū of Te Whanganui-a-Orotū, and support the transfer of intergenerational knowledge to assist in building hapū capacity and influence.

Assess the efficacy and location for construction and enhancement of wetlands around the estuary perimeter and adjacent to the streams discharging into the estuary to help alleviate effects of stormwater runoff and enhance habitat for tāonga species.

Increase interaction with the Pathways Trust to explore opportunities for highlighting historically significant sites both within and around the perimeter of the estuary to promote hapū history and make locals and tourists aware of tikanga and kawa values.

That the environmental research data generated from this study and any future research initiatives be integrated into the *25-Year Living Document* and evaluated against existing information gaps and management options to generate new research priorities.

## 5.8 The 25-yr Living Document

*The 25-Year Living Document* adopts a process that will assist in achieving the aspirations of the Taiwhenua as representatives of tangata whenua, and the aspirations of the wider community. By applying a mechanism that promotes and supports the *25-Year Living Document*, we will be promoting achievement of shared aspirations while allowing time for enhanced relationship development to occur. The following process (Fig. 3) is envisaged as a constructive way to ensure that the values of the community as a whole will make a meaningful contribution to sustainable management of the Napier Estuary.

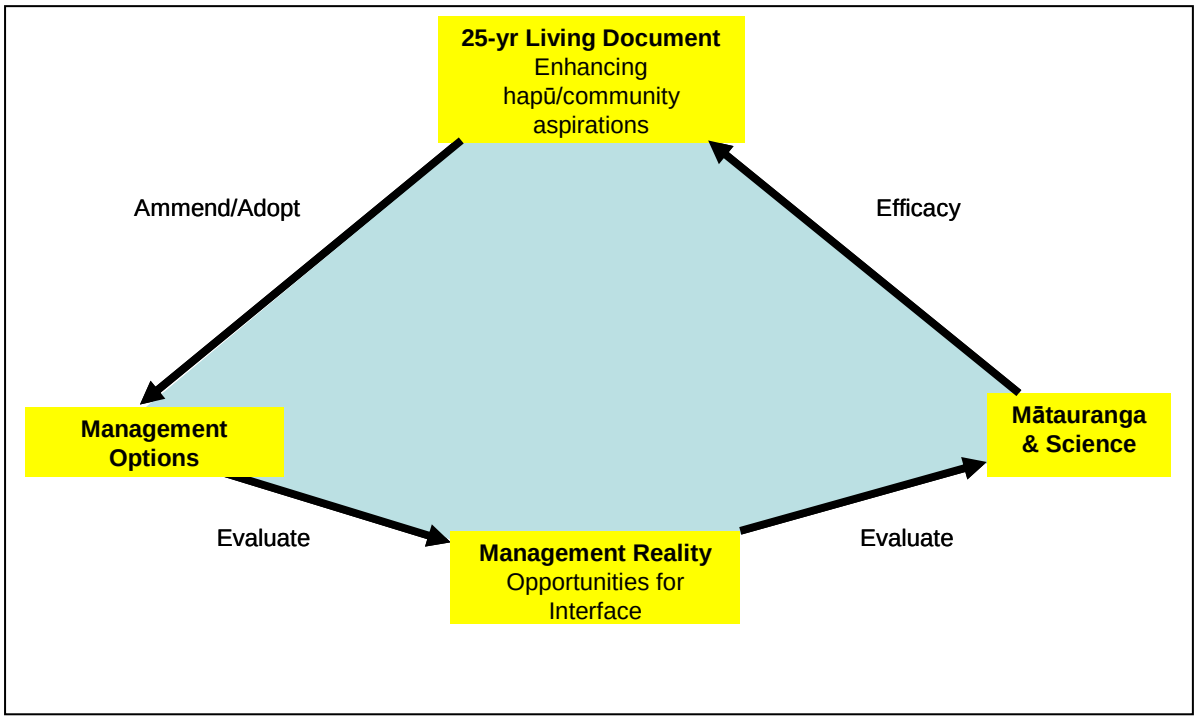



**Fig. 1** *The 25-yr Living Document* – operational process.

### 5.9 Mātauranga and science

Mātauranga and science will be mutually supportive and create an interface where relationship development, mentoring, and the sharing of knowledge and research results can occur. The data acquired can then be interpreted and analysed to see how it can be used to help achieve the wishes of the community (as expressed in the living document). As the database grows, a clearer picture of the state of the estuary will become apparent.

Shared aspirations will factor into management options via contributions to the statutory planning framework, lobbying at Māori and Environment Committee fora, and advocacy at the national level. As results from the ecological and SOE monitoring become available, a clearer picture will emerge and directly influence management decisions if plan provisions or resource consent conditions are deemed to be inadequate.

Tangata whenua will have opportunity to influence the decision-making process more effectively by taking part in estuary research and monitoring, keeping aware of the results and advocating for ways to achieve their aspirations at each stage. Significant issues arising from evaluating plan effectiveness will then direct future research requirements.

Audit and review of the living document at 5-yearly intervals will indicate progress towards achieving desired outcomes and the effectiveness of the document as a tool for contributing to overall sustainable management of Te Whanganui-a-Orotū.

# 6. Scientific Research

This scientific research has been driven by hapū-specific issues related to anthropogenic pressures on Napier Estuary – in particular stormwater management and the potential impacts on water and fauna health. Tangata whenua have engaged with this research as a step towards characterising stormwater contamination in the estuary and effects on two taonga species. This information will assist them in their responsibilities as kaitiaki.

## 6.1 Methods

The scientific research was divided into three main components:

- Analysis of sediment samples and edible-tissue samples from cockles and flounders for a range of stormwater contaminants
- Development and application of biomarkers of exposure to stormwater contaminants in the yellowbelly flounder
- One-off fish survey of the lower estuary (the area between the new embankment and Pandora bridges).

### Sediment sampling

Seven sediment samples were collected from the lower, middle and upper reaches of the Napier Estuary (Fig. 4).

Sites were selected based on their proximity to stormwater drains and/or significant mahinga kai (Māori food gathering area). Site 7 was chosen as a reference site because of an absence of urban stormwater inputs. Each site was logged using a handheld Global Positioning System (GPS) locator (12XL, Garmin, USA) (Appendix 4). Sediment sampling coincided with low tide in the estuary so that sediment could be collected from as close to the low tide mark as possible. Composite samples (0.5-m-square 5-dice configuration) were taken using a clean stainless steel corer (diameter 7.5 cm). Sediment to a depth of 10 cm was extracted and the composite samples pooled into a labelled plastic bag. Air was extruded from the sample bag and the sample was then double bagged with a card label for security. The corer was washed in the surrounding water in between each sample. All samples were then frozen at −20°C pending metal and organic contaminant analysis.


**Fig. 2** Sites where sediment was collected in the Napier Estuary and the Main Outfall Channel. Site 1 is adjacent to the Tyne St Drain and within a flounder nursery; Site 2 is adjacent to the combined Plantation/County/George Drive Drain outlet and within a cockle bed; Site 3 is adjacent to the Purimu Drain outlet and within a cockle bed; Site 4 in the middle estuary; Site 5 adjacent to agricultural drain; Site 6 adjacent to the Bayview Drain; Site 7 upper estuary. Base map courtesy of Google Earth (2006).

### Cockle sampling and tissue collection

At low tide cockles were collected at two sites within the lower Napier Estuary (Fig. 3) and one site in Pōrangahau Estuary. The location of each site was recorded with a hand-held GPS unit (Appendix 4). A stainless steel trowel was used to dig up cockles, which were washed thoroughly in estuary water to remove as much sediment as possible and then shucked to remove the tissue. Cockle tissue from each site was pooled then placed into labelled plastic bags and frozen at −20°C prior to shipping to Hills Laboratory for metal residue analysis. A minimum of 40 g wet weight tissue per site was required for these analyses.

### Yellowbelly flounder sampling and tissue collection

Gill nets (nylon monofilament; 60 m in length; 25 meshes deep; stretched mesh size 11.25 cm (4½ inch); net bagged by tying a 50-cm cord between the float and lead lines every 5 m) were set in the middle of the Lower Napier Estuary (Fig. 5) and Pōrangahau Estuary during 20–24 June 2005 . The nets were set on the outgoing tide and fished for approximately 3–4 h. The bagged 11.25-cm mesh net was set with the mouth of the net opening into the incoming tide.

Fish were transported to large aerated seawater holding-tanks (Hawke's Bay Fisheries Ltd). Body weight and fish length were measured and blood samples (up to 1 mL) were drawn

from the caudal blood vessel using heparinised needles and syringes. Plasma was isolated by centrifugation (600 g and 8°C) and frozen at −20°C and stored until analysed. Fish were then stunned by a blow the head and killed by spinal severance. Fish were weighed and sexed according to the presence of testis or ovaries. The liver and gonads were removed and weighed. The apex portion of the liver and entire gall bladder (containing the bile) was removed and snap-frozen in liquid nitrogen then stored at −80°C until analysed. Access to the saccular otoliths was achieved by making a cutting through the skull along the anterior posterior axis. Fine forceps were used to remove the otoliths from the saccular endolymph of the brain cavity and peel away the surrounding membrane sac. Otoliths were then dried on a paper towel and then stored in Eppendorf tube for reading.

**Chemical residue analyses**

*Sediment and tissue metals:* Samples were double bagged, and frozen at −20ºC until being couriered on ice to Hill Laboratories (Hamilton) for analysis of total recoverable cadmium(Cd), copper (Cu), mercury (Hg), lead (Pb), zinc (Zn) in sediment and total Cd, Cu, Hg, Pb, Zn, nickel (Ni), chromium (Cr) and arsenic (As) concentration in cockle and flounder tissue.

Sediment samples were air dried and ground to pass through a 2-mm sieve. A representative sample was extracted and analysed using the US-EPA Method 200.2 for Total Recoverable Metals. Briefly 1 g of sample was digested in nitric acid / hydrochloric acid before being analysed by inductively coupled plasma – mass spectrometry (ICP-MS) according to US-EPA Method 200.2. The limit of detection (mg/kg) for trace levels of each metal are: Cd, 0.02; Cu, 0.2; Hg, 0.01; Pb, 0.04; and Zn, 0.4.

Tissues samples were homogenised, from which a representative sample was extracted and analysed as for the sediment samples. The method detection limit (MDL) or minimum trace metal concentration (mg/kg) that can be measured in tissue and reported with 99% confidence that the analyte concentration is greater than zero are: Cd, 0.002; Cu, 0.005; Hg, 0.002; Pb, 0.003; Zn, 0.005; Ni, 0.005; Cr, 0.02; and As, 0.005.

*Sediment organics:* The sediments were received and stored at −18°C. Each sediment sample was thoroughly mixed. A 10-g sample was dried at 50°C for 24 h. The percent dry weight was calculated using the following equation:

% dry weight = (dry weight × 100)/10.

Organochlorine insecticides (OCs) and polychlorinated biphenyls (PCBs) were analysed using a single-extraction, three-stage clean-up method. A 40-g aliquot of sediment was spiked with 50 ng of aldrin and alpha BHC (beta hexochlorocyclohexane) as internal standards and shaken with mixed hexane/acetone solvent (80 ml of 3:2 ratio sonicated for 10 min followed by shaking at 300 rpm). The extract was filtered and partitioned with water and the hexane layer removed and concentrated. The resulting crude extract was subjected to gel permeation chromatography (GPC). The fraction containing the OCs and PCBs was concentrated and further fractionated using Florisil® column chromatography. Fraction A contained all the PCBs and several OCs such as p.p DDE and the aldrin internal standard. Fraction B contained the chlordanes and the remainder of the OCs including dieldrin and alpha BHC internal standard.

Quantitative analysis was performed using high resolution gas chromatography with ion trap MS/MS detection. Retention times and spectral matches were used to identify compounds. Calibration standard solutions were prepared from pure (>99%) analytical standards. Chlordanes were quantitated using standards of the cis- and trans-chlordane isomers supplied by the US-EPA. A multiplication factor of 2.33 was applied to the sum of the isomers to derive equivalent technical chlordane levels.

Polynuclear aromatic hydrocarbons (PAHs) were analysed using a single-extraction, two-stage clean-up method. A 40-g aliquot of sediment was shaken and mixed with hexane/acetone solvent (as mentioned above). The extract was partitioned with water and the hexane layer removed and concentrated. The resulting extract was subjected to alumina column chromatography and the PAHs analysed by high performance liquid chromatography (HPLC) with fluorescence detection and quantitated against a mixed standard supplied by the US-EPA.

Chlorophenols were analysed using a single-extraction, two-stage clean-up method. A 40-g sample of sediment was acidified and shaken with mixed hexane/acetone solvent. The extract was partitioned with water and the hexane removed. The resulting extract was subjected to acid/base washing. The phenols were derivatised to their acetate by the adittion of acetic anhydride. Quantitative analysis was carried out by high resolution gas chromatography with ion trap MS/MS detection. Retention times and spectral matches were used to identify compounds. Calibration standard solutions were prepared from pure (>99%) analytical standards.

The detection limits for OCs, PCBs, PAHs and chlorophenols was 0.05, 0.05, 0.3 and 0.5 ng/g dw respectively. Limits of quantitation (LOQ) were set at three times the detection limit. Results less than the LOQ are reported but the levels are in the region of uncertainty. Where compounds were not detected n.d. is shown in the report tables (Appendix 5)

Recovery experiments were carried out for most compounds by spiking subsamples of the sediment at two levels (0.3 and 3.2 ng/g dw) of each component and analysing through the method. The recoveries for each class of compound are:

| | |
|---|---|
| DDT Compounds | 80–95% |
| Dieldrin | 92% |
| Lindane | 75–80% |
| Chlordanes | 75–85% |
| PCBs | 70–100% |
| PAHs | 70–100% |
| Chlorophenols | 70–100% |

Recoveries of the alpha BHC and aldrin internals standards added to each sample were consistent with mean recovery of 88 ± 13 and 62 ± 14% respectively at the 95% confidence level, and CVs within 21%. The results are not corrected for recovery.

*Bile and PAH metabolites:* Metabolites of PAHs were detected in the bile of yellowbelly flounder by measuring the fluorescence of a diluted bile sample at a certain wavelength pair, a method known as fixed wavelength fluorescence (FF) (Lin et al. 1996). Briefly, bile samples were diluted 1:1000 in 48% methanol and stored in the dark at room temperature overnight. Fixed wavelength fluorescence was measured at the

excitation/emission wavelength pairs of 290/335, 341/383, and 380/430 nm. At FF 290/335 mainly naphthalene-type metabolites (typically associated with petroleum products) are detected, at FF 380/430 benzo[a]pyrene-type metabolites are detected (Lin et al. 1996; Krahn et al. 1987), and at FF 341/383 mainly pyrene-derived metabolites are detected (Aas et al. 2000a). Measurements were performed in quartz cuvettes using a Hitachi F2000 fluorescence spectrophotometer with slit widths set at 10 nm for both excitation and emission wavelengths. The concentration of the bile pigment biliverdin was estimated spectrophotometrically from absorbance of the diluted bile samples at 380 nm (Doumas et al. 2006).

Inter-group biliverdin concentrations were compared statistically but individual bile concentrations were not normalised to biliverdin concentrations. There appears to be no simple relationship between indicators of feeding status and individual bile PAH concentrations (Richardson et al. 2004) and the large inter-individual variation in biliverdin concentration (Aas et al. 2000a) and bile protein concentration (Vuorinen et al. 2006) have been shown to produce noise which may overshadow the advantages of normalisation.

**Biological assays**

*Ethoxyresorufin-O-deethylase (EROD) activity:* The EROD assay was based on the method of Pohl and Fouts (1980), adapted for a 96-well plate reader (Lorenzen & Kennedy 1993). The hepatic mixed-function oxidase enzyme activity was estimated in post-mitochondrial supernatant (PMS) using a BMG Fluostar fluorescence plate reader (BMG Technologies, Germany). Liver samples were homogenised in a cryopreservative phosphate buffer (0.1 M phosphate, 1 mM ethylenediaminetetra-acetic acid, 1 mM dithiothreitol, and 20% glycerol) and spun at 10000g to obtain the supernatant. Resorufin was determined using an excitation and emission wavelengths of 544 nm and 590 nm, respectively. Protein content was estimated from fluorescamine (Sigma) fluorescence (excitation filter 390 nm, emission filter 460 nm) against a bovine serum albumin standard (Sigma).

*Plasma sex steroids:* The 17β-estradiol and testosterone concentrations in the plasma of fish were measured by radioimmunoassay (RIA) by the methods described by McMaster et al. (1992). Briefly, steroids were extracted from plasma samples with diethyl ether. Samples were then reconstituted with Phosgel (5.57 g $Na_2HPO_4$, 1.28 g $NaH_2PO_4*H_2O$, 1 g gelatin, 0.1 g thimersol, 800 mL distilled water) and incubated with antisera in the presence of radiolabelled steroid. Following the addition of a dextran-coated carbon solution the radioactivity of each sample was determined on a scintillation spetrophotometer. Testosterone and 17β-estradiol were obtained from Sigma. Testosterone and estradiol antibodies were obtained from ICN (Costa Mesa, CA, USA). Tritiated testosterone and estradiol were obtained from Amersham Biosciences (Little Chalfont, Buckhamshire, UK). The plasma samples from females were analysed for both estradiol and testosterone, while the samples from males were analysed for testosterone only.

**Otolith reading**

Yellowbelly flounder otoliths have an opaque centre (nucleus) that is surrounded by a concentric arrangement of semi-transparent (hyaline) and opaque rings in succession (Colman 1974), which were clearly visible when viewed at 40× magnification from the concave side with a dissecting microscope (Leica MZ12, Germany). Because the growth rings could be clearly discerned no further treatment was necessary.

**Fish survey**

A catch and release fish survey was carried out on 28–30 November 2005 to encompass two

tidal cycles. A range of capture devices (Table 3) were used throughout the lower estuary (Figs 5, 9, 10).

**Table 3** A description of the capture devices used for the fish survey.

| Description | Dimensions |
|---|---|
| Nylon monofilament gill net | 60 m long; 25 meshes deep; stretched mesh size 11.43 cm (4.5”) |
| Nylon monofilament gill net | 60 m long; 25 meshes deep; stretched mesh size 11.43 cm (4.5”) |
| Nylon monofilament gill net | 10 m long; 60 meshes deep; stretched mesh size 3.81 cm (1.5”) |
| Knotless nylon mesh seine net | 5–6.5 mm mesh size |
| Knotless nylon fyke net | 3.81 cm (1.5”) stretch mesh pot, 91.4 cm (3’) outer wing, 182.9 cm (6’) long 61.0 cm (2’) high lead |

The gill nets and fyke nets were set on the incoming tide (the status of the tide in the lower estuary preceded the status at the Napier Port by between 30 and 60 min) and deployed in and around the main channel (Fig. 5) for approximately 1–3 h. The gill nets were checked approximately every 60 min to remove captured fish. Net positions were recorded with a handheld GPS unit and captured fish were identified and fork length (the length between the fork of the tail and the nose) recorded before being released.

The seine net was dragged at 19 locations in the lower estuary (Fig. 5) 3 h on either side of low tide. The captured fish were then identified and the total number of any one species recorded to provide an indication of species diversity at that site. Fish body length (fork length) was recorded for 20 randomly selected individuals per species.

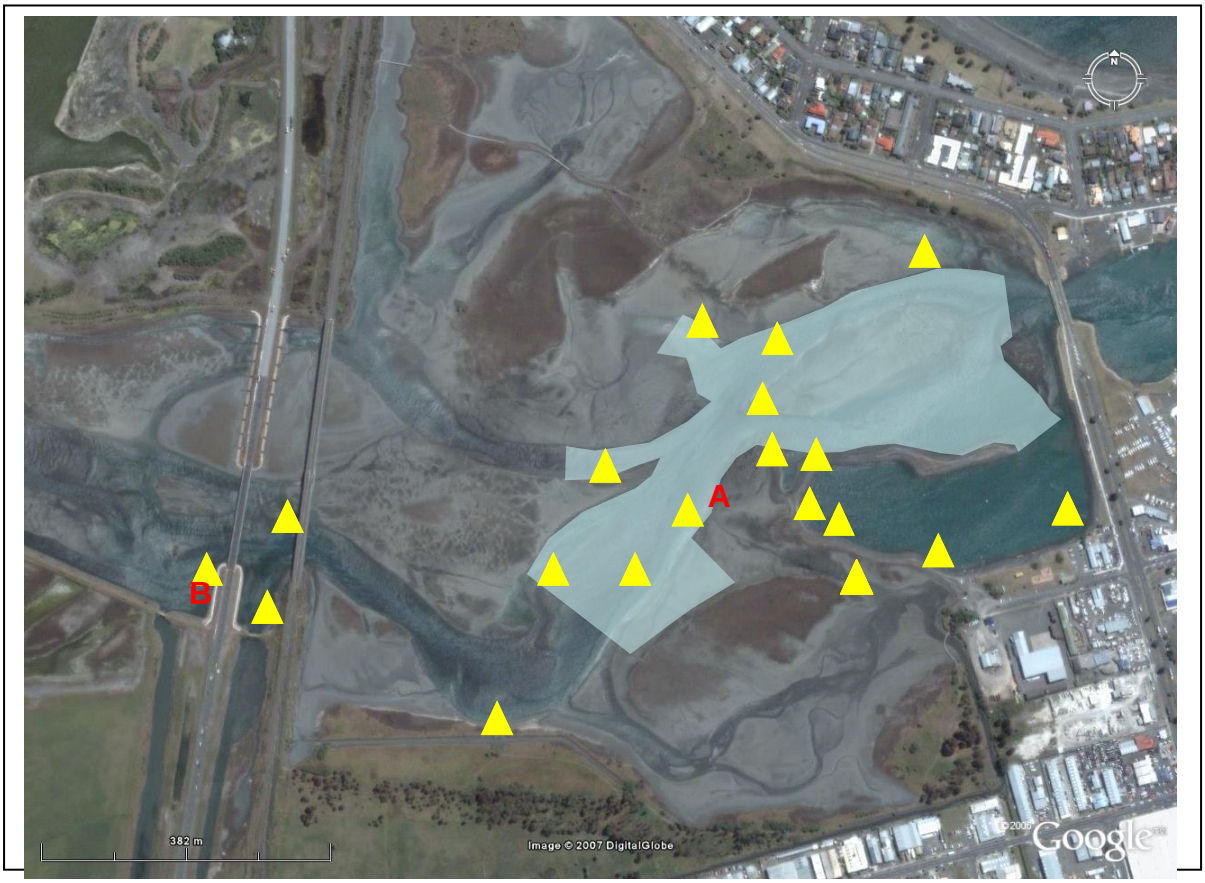



**Fig. 3** Locations in the lower estuary where the fish survey was carried out with seine nets (▲) and gill nets and fyke nets (shaded blue). Yellowbelly flounders that were collected for metal residue and biological analysis were captured within the blue area. Sites where cockles were collected for metal residue analyses are indicated (A, B). Base map courtesy of Google Earth (2006).

### Statistical analyses

GenStat (Release 8.1, UK) was used to perform the statistical tests. Male and female flounder data were analysed separately. Mann–Whitney U tests were used to assess site differences in mean flounder tissue metal residue levels. The growth of male and female flounders captured from both study sites was modelled using the von Bertalanffy method to calculate a nonlinear regression using fork length and otolith age data. In tables and text, tissue weight data are expressed as an index of body weight (hepatic and gonadal somatic indices). However, for statistical analysis of tissue weight changes, liver and gonad weights were analysed using analysis of covariance (ANCOVA) with body weight as a covariate (Packard & Boardman 1988). Tissue and body weights were log-transformed prior to analysis. A two-sample *t*-test was used to calculate site differences in female flounder estradiol and testosterone, and male flounder testosterone concentrations. For the remaining analyses (EROD, bile FACs and biliverdin concentration) analysis of variance (ANOVA) was used to compare sample means with site as the dependent variable. The assumptions of ANOVA were assessed using residual plots. All data are presented graphically as mean ± standard error of the mean, unless otherwise stated. Statistical significance was observed when $P < 0.05$.

## 6.2 Results

### Chemical residue analyses

*Sediment residues:* The concentration of recoverable metals (a measure of bioavailability) at Site 1 was consistently higher than at other sites (Table 4). All the metal species measured at this site exceeded the regional baseline levels (RBL) for the Hawke's Bay region. Furthermore, Pb and Zn levels also exceeded ANZECC/AWRC guideline values suggesting that remedial/management action is required or that further investigation to consider the fraction that is bioavailable is warranted. The concentration of Zn at Sites 2 and 3 also exceeded RBL but were well below ANZECC/AWRC values. Sediment collected from Site 7 showed concentrations of Zn, Pb and Cd that were above RBL but were below guideline values.

**Table 4** Metal concentrations in sediment

| | Total recoverable (mg/kg dry weight) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Metal | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 | Site 7 | RBL[a] | Guideline values[b] |
| Cd | *0.38 | 0.06 | 0.07 | 0.04 | 0.04 | 0.03 | *0.13 | 0.05–0.10 | 1.5, 10 |
| Cu | *46.8 | 8.9 | 5.8 | 8.5 | 12.4 | 12 | 17.9 | 15–20 | 65, 270 |
| Hg | *0.13 | 0.05 | 0.04 | 0.06 | *0.07 | 0.03 | 0.06 | 0–0.06 | 0.15, 1 |
| Pb | **76 | 9.3 | 9.24 | 9.16 | 9.43 | 5.09 | *15.7 | 10–15 | 50, 220 |
| Zn | **226 | *76.8 | *105 | 45.1 | 44.9 | 25.2 | *64.4 | 20–50 | 200, 410 |

RBL = Regional Background Level; [a]Strong (2004); [b]Interim Sediment Quality Guidelines (ISQG) low, high (ANZECC/AWRC 1992, adapted from Long et al. 1995); NA = no data available; ** = exceeds low ISQG trigger value; * = exceeds regional background concentrations for sediment

The concentration of PAHs in sediment from Site 1 was orders of magnitude higher than any other site (Table 5).

**Table 5** PAH concentrations in sediment

| | ng/g dry weight | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| PAH | Site 1 | Site 2 | Site 3 | Site 4 | Site 5 | Site 6 | Site 7 | RBL | Guideline values[a] |
| Anthracene | 143 | 5.23 | 3.18 | 1.46 | 2.93 | 3.72 | 2.92 | NA | 85, 1100 |
| Fluoroanthene | 1149 | 19.4 | 12.6 | 7.15 | 19.9 | 22.3 | 18.3 | NA | 600, 5100 |
| Pyrene | 1332 | 21.4 | 13.2 | 8.31 | 22.9 | 27.5 | 10.4 | NA | 665, 2600 |
| Chysene/benz[a]anthracene | 901 | 19 | 12.1 | 6.63 | 21.6 | 31.5 | 9.2 | NA | NA |
| Benzo[b]fluoranthene | 680 | 18.9 | 12.6 | 7.15 | 21.1 | 16.4 | 14 | NA | NA |
| Benzo[k]fluoranthene | 343 | 6.81 | 4.36 | 2.55 | 4.79 | 7.15 | 3.64 | NA | NA |
| Benzo[a]pyrene | 680 | 13.6 | 8.51 | 5.4 | 10.3 | 17.6 | 11.2 | NA | 430, 1600 |
| Dibenz[a,h]anthracene | 330 | 7.26 | 12.6 | 2.49 | 6.99 | 9.21 | 2.76 | NA | 63, 260 |
| Benzo[g,h,i]perylene | 380 | 12.1 | 8.43 | 4.37 | 8.6 | 9.54 | 6.55 | NA | NA |
| Σ PAHs | 5938 | 123.7 | 87.58 | 45.51 | 119.1 | 144.9 | 78.97 | NA | |

RBL = Regional Background Levels; [a]Interim Sediment Quality Guidelines low, high (ANZECC/AWRC 1992 adapted from Long et al 1995); ** = exceeds low ISQG trigger value; NA = no data/guideline available;

Four of the five ISQG low trigger values were exceeded suggesting that remedial/management action is required or that further investigation to consider the fraction that is bioavailable is warranted. The PAH concentrations at the remaining sites were not appreciably different to the reference site.

Residue data for the organochlorine pesticides and polychlorinated biphenyls were either not detected or present at very low concentrations and therefore are not discussed any further. However, the data can be viewed in Appendix 5.

*Tissue metal residues:* No site-specific differences in the metal tissue concentrations were observed in either the edible tissue of cockles or yellowbelly flounders (Table 6). Female flounders captured at Pōrangahau had significantly higher tissue Pb concentrations compared with female flounders caught at the Napier Estuary ($W = 44$, $P < 0.001$) but the overall levels of Pb are considered to be low.

**Table 6** Metal concentrations in the tissue of cockles and flounders.

| | Total Recoverable (mg/kg wet weight) | | | | | | | Guideline values | |
|---|---|---|---|---|---|---|---|---|---|
| Metal | Cockles[a] | | | Flounders | | | | Tolerable limit | Max. level |
| | Napier Estuary | | Porangahau | Napier | | Porangahau | | mg/kg per day[b] | mg/kg[c] |
| | Site A *n* = 1 | Site B *n* = 1 | *n* = 1 | Male *n* = 11 | Female *n* = 34 | Male *n* = 9 | Female *n* = 9 | | |
| Cd | 0.0243 | 0.0390 | 0.0619 | 0.0007 | 0.0007 | 0.0007 | 0.0009 | 0.007 | |
| Cu | 1.35 | 1.01 | 0.83 | 0.13 | 0.10 | 0.11 | 0.10 | 0.2 | 2, NA |
| Hg | 0.017 | 0.022 | 0.020 | 0.029 | 0.044 | 0.045 | 0.044 | 0.005 | 0.5, 0.5 |
| Pb | 0.111 | 0.130 | 0.044 | 0.004 | 0.004 | 0.10 | *0.11 | 0.025 | 2, 0.5 |
| Zn | 12.6 | 10.8 | 9.22 | 7.2 | 5.5 | 7.1 | 5.8 | 1 | |
| Ni | 0.55 | 0.57 | 0.79 | BDL | 0.03 | BDL | 0.07 | NA | |
| Cr | 0.022 | 0.443 | 0.258 | 0.029 | 0.030 | 0.015 | 0.154 | NA | |
| As | 5.37 | 6.00 | 5.94 | 1.59 | 1.61 | 1.08 | 1.10 | NA | 1,2 |

[a]Metal concentrations are based on a composite sample of cockles; [b]Tolerable limits of consumption for an adult (20th Australian total diet survey FSANZ 2003); [c] Maximum levels of metal contaminants in food (FSANZ Food Standards Code 2007); NA = no data or guideline value available; * = $P < 0.001$; BDL = below the detection limit

*Bile and PAH metabolites:* In female flounder there were significant differences between the Napier and Pōrangahau sites in the levels of both bile naphthalene ($t_{16} = 3.01$, $P = 0.008$) and pyrene metabolites ($t_{16} = 4.66$, $P < 0.001$) (Fig. 6a). In male flounder only the difference in pyrene metabolites ($t_7 = 3.37$, $P = 0.010$) was significant between the two sites (Fig. 6b). There were no significant differences in the level of benzo(*a*)pyrene metabolites in fish from the two sites of either sex.

There were no significant differences in bile biliverdin concentrations between the two sites in either female ($t_{18} = 1.29$, $P = 0.212$) or male ($t_{13} = 2.11$, $P = 0.055$) flounder indicating that the feeding status of the two groups was similar.

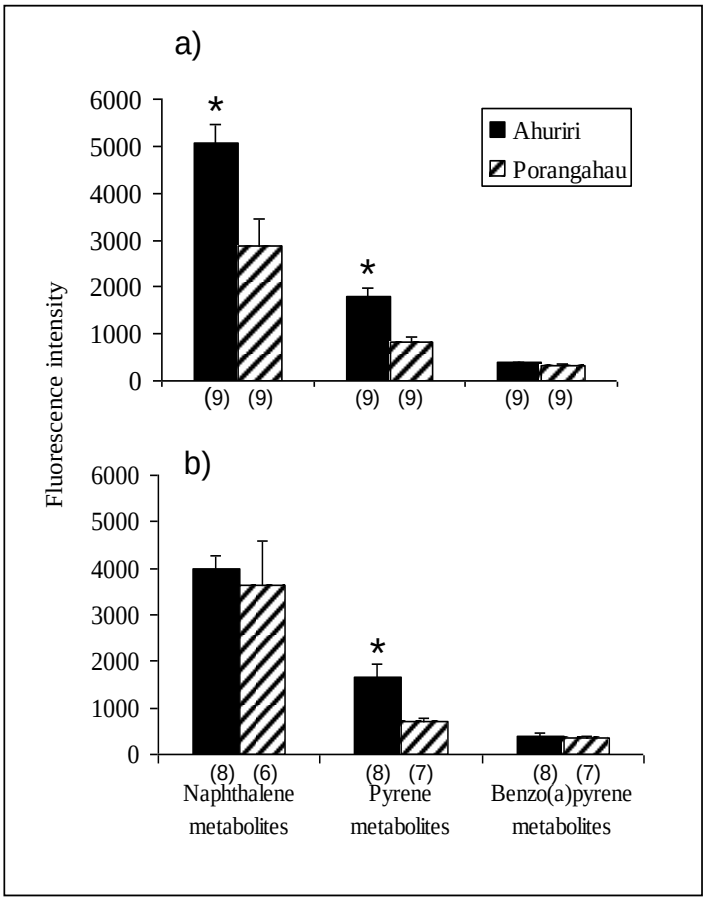



**Fig. 4** Fixed wavelength fluorescence of bile reflecting biliary PAH metabolite levels: (a) female yellowbelly flounder, (b) male yellowbelly flounder Levels are expressed as fluorescence intensity (mean ± standard error). The number of fish sampled (*n*) is shown in brackets below the bars. Fixed wavelength fluorescence was measured at the excitation/emission wavelength pairs of 290/335 (naphthalene metabolites), 341/383 (pyrene metabolites), and 380/430 (benzo(*a*)pyrene metabolites). * $P < 0.001$

*EROD activity:* There were highly significant differences in ethoxyresorufin-*O*-deethylase (EROD) activity between the Napier and Pōrangahau sites in both male ($t_{18} = 7.49$, $P < 0.001$) and female ($t_{18} = 5.70$, $P < 0.001$) yellowbelly flounder (Fig. 7).

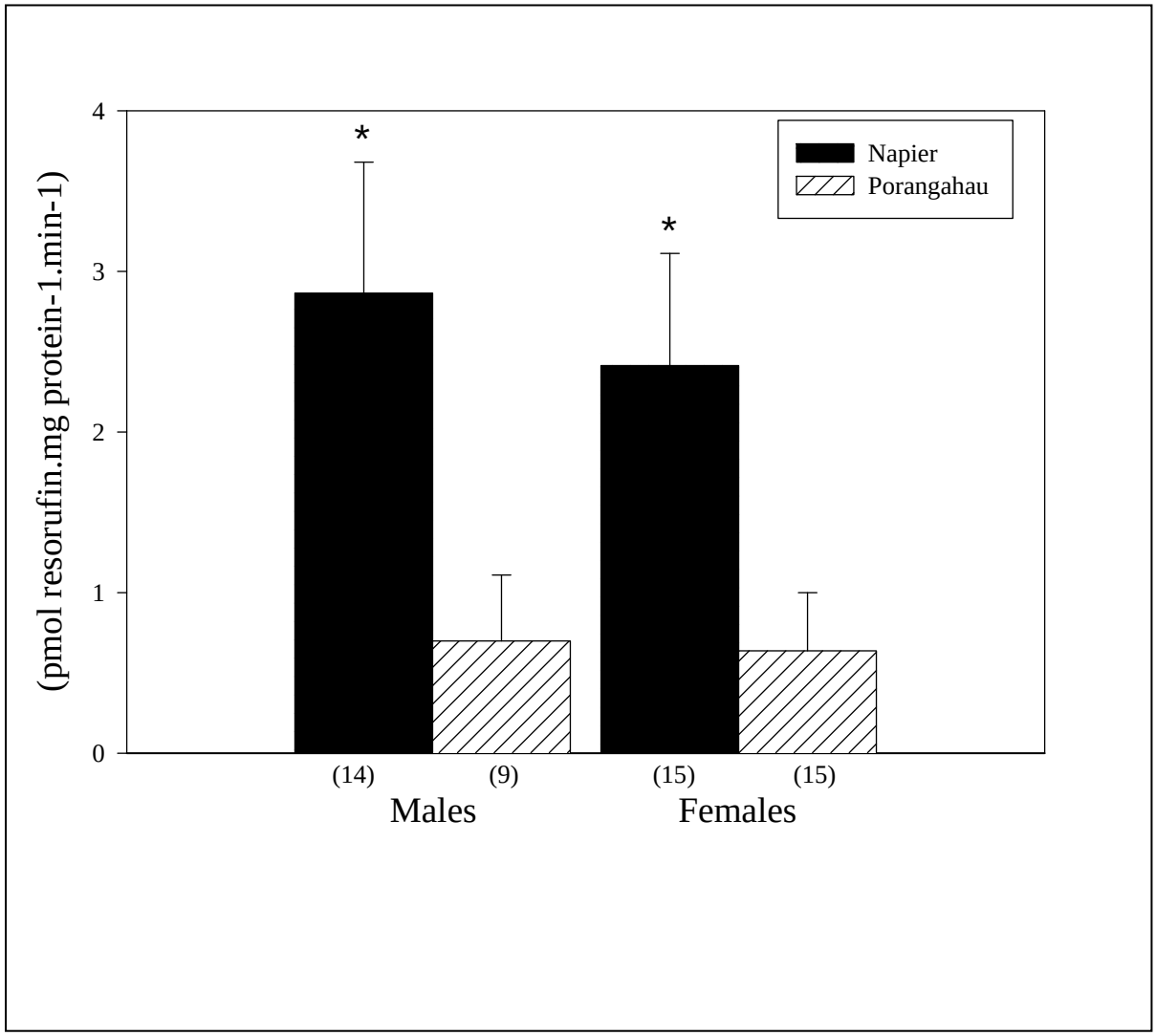



**Fig. 5** EROD activity in male and female flounders; * $P < 0.0001$.

*Plasma sex steroids:* There was a significant difference in plasma testosterone (T) between male flounder from the Napier (mean 2.84 ± 0.54 ng/mL) and Pōrangahau (mean 4.31 ± 0.30 ng/mL) sites ($t_{14} = 2.51$, $P = 0.025$), but no significant differences in either plasma estradiol (E2) (Napier 1.59 ± 0.34, Pōrangahau 1.04 ± 0.23 ng/mL) or T (Napier 3.12 ± 0.71, Pōrangahau 1.82 ± 0.32 ng/mL) levels between female flounder from the two sites. There was a high level of variance in both plasma T and E2 levels in female flounder from the Napier site, due to the presence of several reproductively ripe fish, which may have masked any significant differences between the sites.

**Fish survey**

A total of 16 species of fish were trapped in the lower estuary using three different sampling techniques. Seine netting was the most effective trapping device deployed and a wide range of fish species were caught, particularly small fish. The larger fishes are more able to evade the seine net and other capture devices and therefore may not be represented well in this survey.

Table 7 Species abundance in the Napier Estuary

| Common name | Scientific name | Abundance[1] | Abundance[2] |
|---|---|---|---|
| Yellowbelly flounder | Rhombosolea leporine | +++ | +++ |
| Sand flounder | Rhombosolea plebeian | +++ | +++ |
| River flounder | Rhombosolea retiaria | ++ | - |
| Common sole | Peltorhamphus latus* | + | - |
| Yellow-eyed mullet | Aldrichetta forsteri | +++ | +++ |
| Grey mullet | Mugil cephalus | ++ | ++ |
| Kahawai | Arripis trutta | ++ | + |
| Parore | Girella tricuspidata | +++ | + |
| Short-finned eel | Anguilla australis schmidtii | +++ | + |
| Long-finned eel | Anguilla dieffenbachia | + | - |
| Cockabully | Tripterygion nigripenne | ++ | +++ |
| Common bully | Gobiomorphus cotidianus | ++ | + |
| Inanga | Galaxias maculatus | + | + |
| Common smelt | Retropinna retropinna | ++ | +++ |
| Spotty | Pseudolabrus celidotus | + | ++ |
| Stargazer | Geniagnus monopterygius | + | - |
| Trevally | Caranx lutescens | + | ++ |
| Red cod | Physiculus bachus | + | - |
| Gurnard | Chelidonichthys kumu | + | - |
| Snapper | Chrysophrys auratus | + | - |
| Moki | Latridopsis ciliaris | + | - |
| Skate | Raja spp. | + | - |
| Spiny dogfish | Squalus spp. | + | - |
| School shark | Galeorhinus australis | + | - |
| Brown trout | Salmo trutta | + | - |
| Garfish | Reporhamphus ihi | + | - |
| Barracouta | Thyrsites atun | + | - |
| Blue mackerel | Scomber japonicus | + | - |
| Kingfish | Seriola grandis | + | - |
| Herring | Clupea sp. | - | +++ |
| Clingfish | | - | + |
| Wrasse | | - | + |

- = not encountered; + = rare; ++ = frequent; +++ = common

[1]Kilner & Akroyd (1978) survey

[2]Present study

* Kilner and Akroyd (1978) identified this as *Peltorhamphus novaezealandiae* but according to Hume et al. (1990) it should be correctly classified as *Peltorhamphus latus* (See also James (1972) and Roper & Jillett (1981)).

Herring and yellow-eyed mullet were the most abundant species caught making up just under 80% of the total number of fish caught. For the purposes of this research herring, yellow-eyed mullet, yellowbelly flounder, sand flounder, common smelt and cockabully were classified as common (>100 in number). The grey mullet, river flounder, sole, inanga, spotty and trevally were frequent (≥10 in number), while the remaining species were classed as rare (<10 captured).

Herring, yellow-eyed mullet and juvenile flounder (mixed species) occur throughout the lower estuary. A large number of small juvenile flounder were caught adjacent to the Tyne St Drain and this observation corroborates previous studies and local Māori knowledge (Heitia Hiha and Bevan Taylor, pers. comm. 2005). Static gill nets (**Fig. 7**) and fyke nets (Fig. 10) placed in and around the main channel captured a number of larger and more transitory species including grey mullet, trevally, spotty and parore in addition to larger yellowbelly flounder and yellow-eyed mullet.

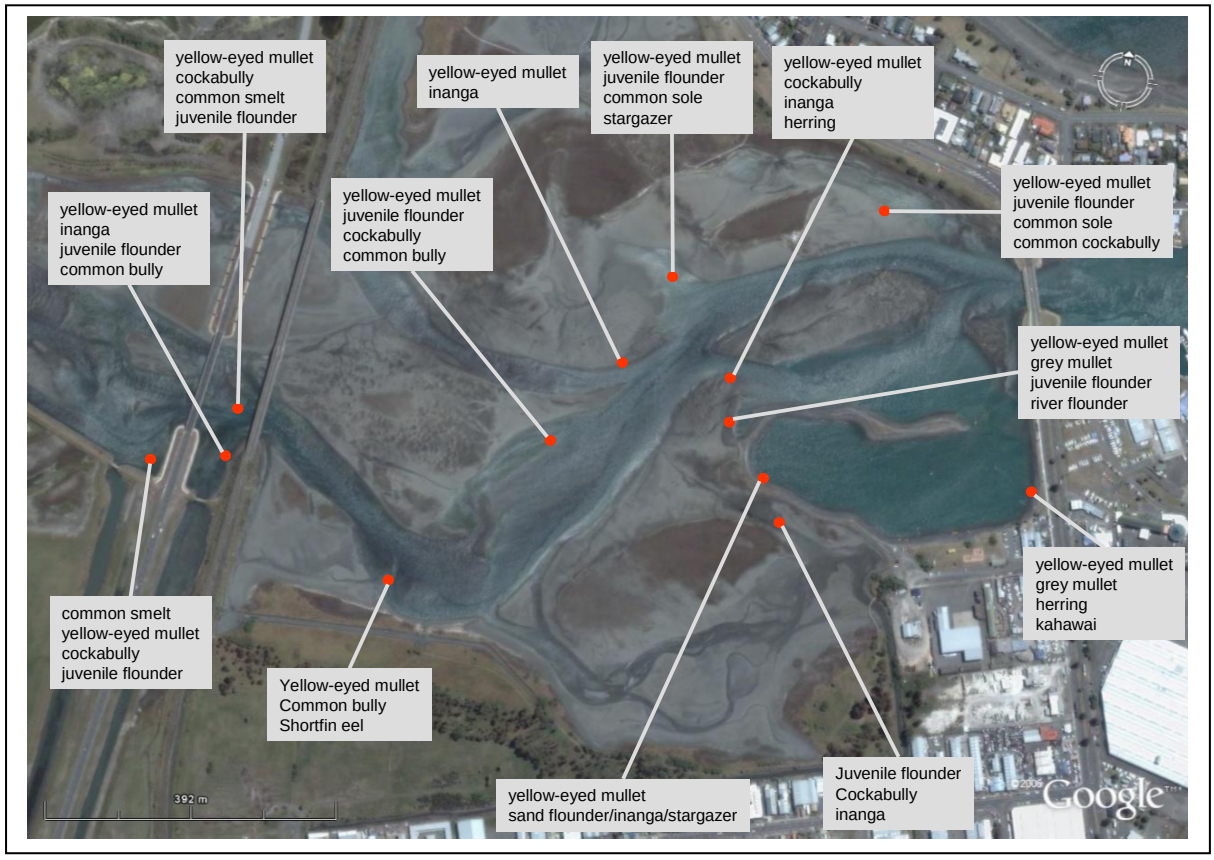
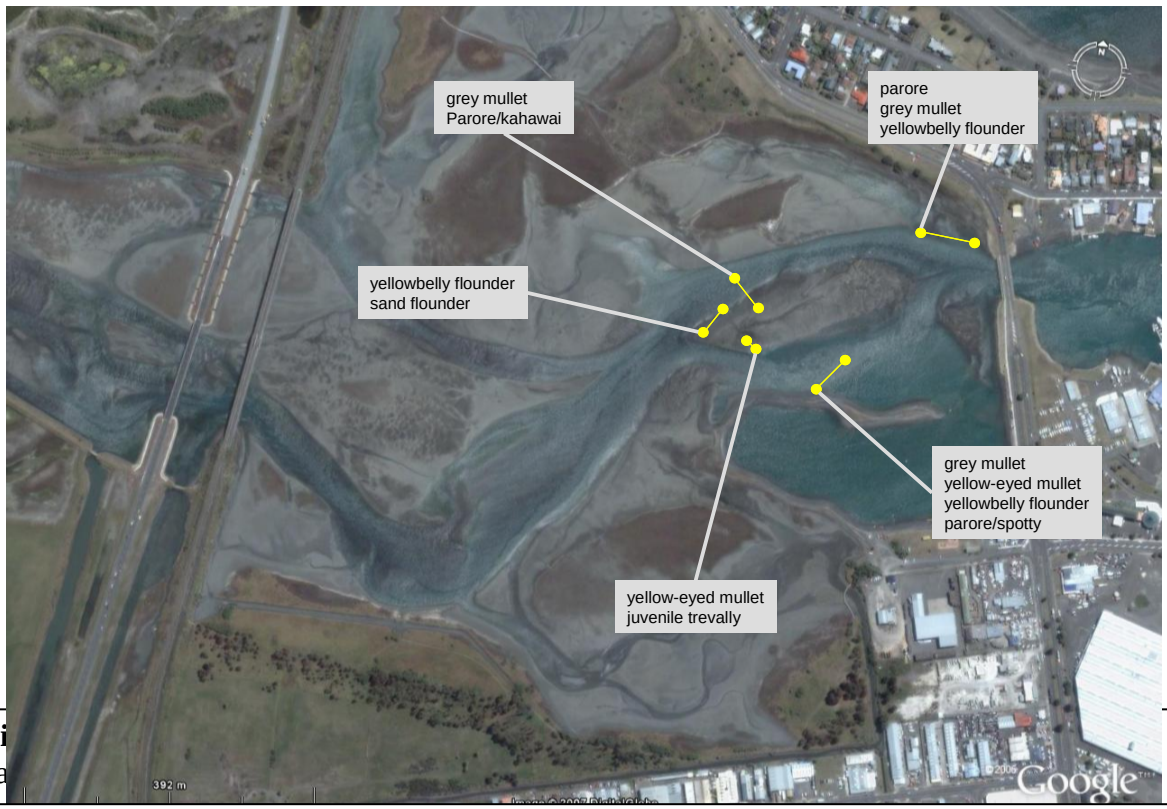



**Fig. 6** Sites where seine netting captured more than 100 fish. The four most common species are ranked with the most abundant species at the top. Base map is courtesy of Google Earth (2006).


grey mullet
Parore/kahawai
parore
grey mullet
yellowbelly flounder
yellowbelly flounder
sand flounder
grey mullet
yellow-eyed mullet
yellowbelly flounder
parore/spotty
yellow-eyed mullet
juvenile trevally
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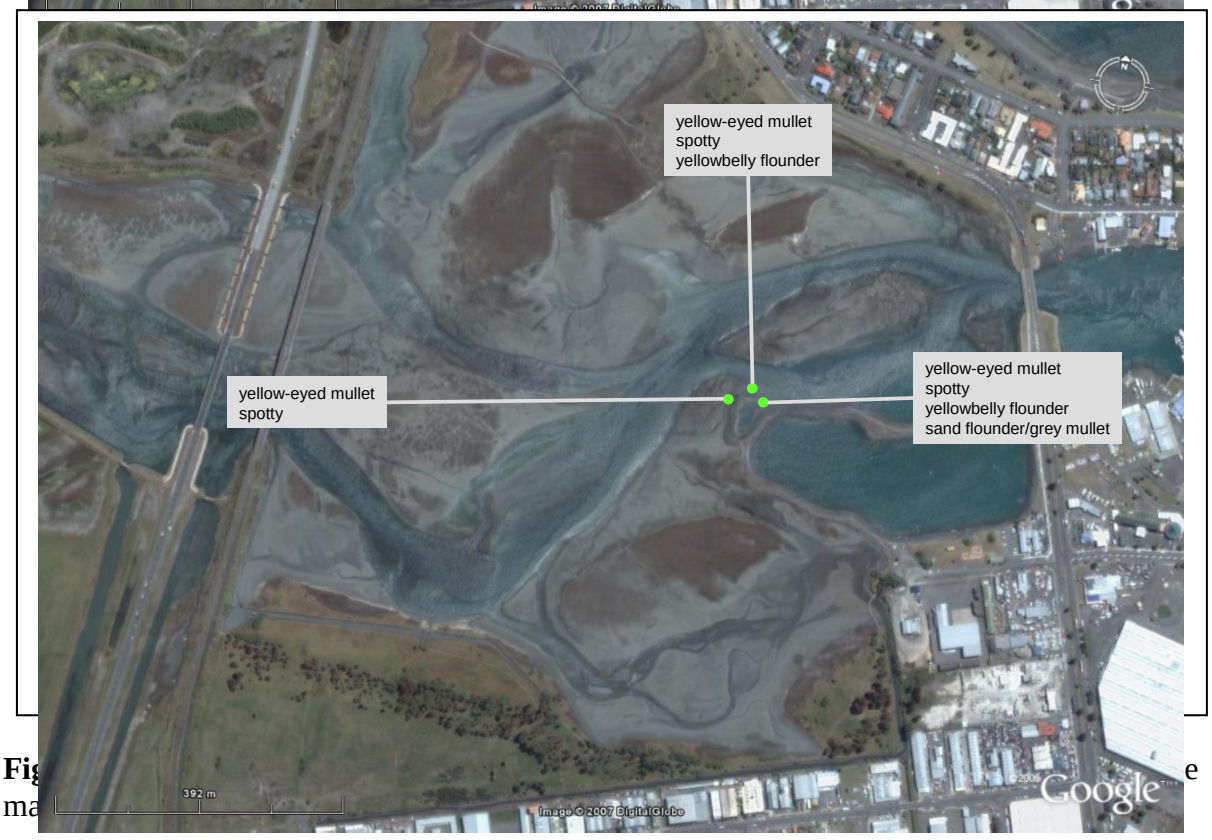
yellow-eyed mullet
spotty
yellowbelly flounder
yellow-eyed mullet
spotty
yellow-eyed mullet
spotty
yellowbelly flounder
sand flounder/grey mullet
392 m
Image © 2007 DigitalGlobe
Google

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## 6.3 Conclusions

The elevated sediment levels of PAHs and metals at site Site 1 would suggest that they have originated from the Tyne St Drain. In contrast, the concentrations of metals and organic chemicals in sediment from Sites 2–7 were generally low and are similar to previous surveys where elevated levels of metals have been detected in the drains that discharge into the estuary, but only low levels of metals have been measured in the estuary itself due to the drains trapping metal-laden sediment (Don 1997; Bennett 2006). In contrast to the other drains Tyne St Drain is a concrete channel that would have less of an ability to trap contaminated sediments. This could explain the high levels of contaminants in the estuary.

Direct PAH inputs into the Napier Estuary could come from stormwater runoff and accidental oil spills from the Pandora light industry area, road runoff, atmospheric deposition and motorboat activity in the Napier marina. Molecular ratios of individual hydrocarbons have been developed to distinguish between pyrogenic (combustion) processes, petrogenic (derived from fossil fuels), and diagenic (derived from transformation processes in the soil) sources (Hylland 2006). The fluoroanthene/pyrene ratio if <1 is characteristic of petroleum hydrocarbons while a ratio >1 indicates pyrolytic origin (Sicre et al. 1987). The fluoroanthene/pyrene ratio at Site 1 (0.86) would suggest that the PAHs are of petrogenic origin. Similarly the ratio of phenanthrene/anthracene if <10 indicates pyrogenic origin while >10 implies diagenic origin (Baumard et al. 1998). Unfortunately, phenanthracene was not determined in this experiment and both ratios need to be considered to provide an estimate of the source of PAH (Baumard et al. 1998).

The elevated levels of metals measured at Site 1 all exceeded RBL and in the case of Pb and Zn exceeded the low interim sediment guideline values suggesting that further research is required (ANZECC/AWRC 1992). These metals are all consistent with the types of light industry present in the catchment area of the Tyne St Drain. The RBLs were exceeded for Zn at the Pirimu and Plantation/County Rd/George Drive drains and this is consistent with urban stormwater runoff. While three metals exceeded the RBLs at Site 7 (reference) the concentrations remain close enough to the RBL to not warrant further comment.

The analyses of cockle and flounder edible flesh for heavy metals showed no site-specific differences and the concentrations in tissues collected from both the Napier and Pōrangahau estuaries were low. Cockles had higher concentrations of metals compared to flounders and this highlights their ability to bioaccumulate metals (both ambient and man-made). From a food human health perspective the metals of most concern are As, Cd, Hg, and Pb (NZFSA 2005) and the levels measured in this research are consistent with data taken in other regions (Table 8) except for As. The risk from consumption of cockles and yellowbelly flounder collected from the Napier Estuary is likely to be negligible due to the amount of flesh that would need to be consumed before the threshold is triggered (Table 6).

In the bile of flounder comparison of the ratio of FF290/335 (napthalene-type metabolites) to FF380/430 (benzo(*a*)pyrene-type) can indicate the relative amount of PAH metabolites derived from petrogenic and pyrogenic sources in an estuary (Aas et al. 2000b). A high ratio of naphthalene to benzo(a)pyrene-type metabolites, as found in this study, shows a dominance of two- and three-ring compounds over five-ring compounds, indicating exposure to napthalene-rich petroleum products such as unburnt fuels (fuel spills or leakage from industry), rather than combusted petroleum compounds (e.g. motor vehicle emissions).

**Table 8** Heavy metal concentrations in cockle and flatfish tissue from New Zealand (mg/kg wet weight)

| Location | Cockles | | | | Location | Flatfish | | | |
|---|---|---|---|---|---|---|---|---|---|
| | As | Cd | Hg | Pb | | As | Cd | Hg | Pb |
| [1]Waikato | 6.9 | | | | [4]East Coast South Island | 4.1 | | 0.4 | <0.1 |
| [1]Raglan | 3.2 | | | | [5]Single site | | 0.3 | | NA |
| *[2]Puhipuhi | | | 0.03 | | | | | | |
| [3]Various | | 0.19 | | 1.8 | | | | | |

[1]Robinson et al. (1995); [2]Hoggins & Brooks (1973); [3]Nielson & Nathan (1975); *Background levels of mercury; [4]Smith (1986); [5]Fenaughty et al. (1988).

Although there was a several-fold difference in EROD activity between flounder from the two sites, all fish in this study had EROD activities more representative of values from reference groups of flounder in other studies carried out in estuaries around the world (Aas et al. 2000b; Mondon et al. 2001; George et al. 2004; Kirby et al. 2004).

The levels of plasma estradiol and testosterone measured in the yellowbelly flounder in this study compare well with values from the closely related *R. tapirina* (Barnett & Pankhurst 1999; Sun & Pankhurst 2004). In *R. tapirina*, both plasma estradiol and testosterone concentrations were <1 ng/mL outside the vitellogenic period, increasing to >1.5 ng/mL during vitellogenesis. Sun and Pankhurst (2004) report that in *R. tapirina* increased plasma concentrations of vitellogenin and E2 are robust indicators of vitellogenesis, while an increased plasma concentration of T indicates impending oocyte maturation. The plasma sex steroid concentrations of female yellowbelly flounder measured in this study therefore indicate that the fish were in the vitellogenic period. This is supported by high gonadosomatic indices (GSI) and observation of the ovaries.

## 6.4 Fish survey

Knox and Kilner (1973) have classified five distinctive groups of fish that use estuaries. These are listed as species that:

- Move into estuaries primarily to breed
- Live their whole life cycle in the estuary
- Migrate in and out of estuary with the tide but which spend their juvenile stages in the estuary
- Are transitory, entering the estuary at irregular times or are seasonal
- Use the estuary as a migratory route to their breeding grounds

The goals of this research were not to provide a detailed analysis of fish abundance in the Napier Estuary. Reliable estimates are very difficult to obtain due to the multiplicity of factors that influence fish species' composition and abundance. These include tidal changes in salinity and water levels in the lower and middle estuary, the movement of fish in and out of the estuary for feeding and breeding; abiotic seasonal factors, and long-term cyclic variations in fish populations (Kilner & Akroyd 1978). The purpose of the fish audit was to provide a qualitative comparison of fish species captured in this research with the intensive fish survey undertaken by Kilner and Akroyd (1978). However, even this comparison must be considered within the following context:

The Kilner and Akroyd research consisted of seven sampling events, each 3–4 days long, carried out over a 14-month period, compared with this research that consisted of one sampling event over a 3-day period.

It was clear that the different fish species are not caught in relative proportion to their abundance but rather the size, number and variety of fish vary according to the mesh size and type of fishing gear used and location that the gear was deployed – and this differed between the two studies.

The Kilner and Akroyd fish survey was carried out at 43 different locations within the estuary including the upper, middle and lower estuary, compared with this research, which was focused solely on the lower estuary. Despite these differences there are still some useful comparisons that can be drawn between the two studies.

Kilner and Akroyd managed to capture a total of 29 different species over the 14 months they sampled in the upper, middle and lower estuary (Table 7). In comparison 16 species were caught in the lower estuary using the intensive one-off sampling regime employed in this research. While we did not observe all of the species that have previously been recorded in the estuary, the relative abundance of those species that were captured followed a similar pattern to that measured by Kilner and Akroyd (1978) (Table 7).

The distribution of fish between the two studies also has some similarities. For instance the presence of the flounder nursery in the tidal-flat stream area adjacent to the Tyne St Drain; kahawai, parore, travelly and grey mullet in the seep channels where salinity is usually high; and the presence of large flounder that had moved onto the tidal flats to feed during the rising tide. While it is difficult to draw comparisons on fish distribution between the two studies one would assume that while the diverse range of habitats (deep swift channels, shallow channels, tidal-flat streams, tidal flats, rocky shorelines) within the lower estuary are maintained then they would continue to support a wide diversity of fish diversity and production.

The authors are aware of a fish survey that has been undertaken in the Napier Estuary by Department of Conservation staff (Clinton Duffy, pers. comm. 2005). Unfortunately the results of this survey were not available at the time of writing this report and are not included in this analysis.

### 6.5 Recommendations

**That further research (environmental chemistry and biological effects based testing) is carried out at Site 1 to characterise the extent of the contaminant plume and level of biological impact to provide information that could guide future remediation and mitigation of impacts to this ecologically and culturally significant mahinga kai area**

**That further basic biological and physiological research is conducted in yellowbelly flounders to establish this species as a core indicator species for sensitive estuarine ecosystems**

# 7. Engaging a Local Secondary School

A strong theme throughout this research was to build Māori capability through involvement in this project. Part of this initiative was to engage the services of a Māori postgraduate to work on this project. However, initial attempts to recruit a university postgraduate or even an undergraduate Māori student were unsuccessful and therefore the decision was made to approach schools to engage with a senior Māori student. This highlights the significant shortage of Māori science undergraduate and postgraduate students who are specialising in the environmental sciences. This solution, however, aligns closely with Te Taiwhenua o Te Whanganui-a-Orotū Mātauranga strategy and more broadly with the Ngāti Kahungunu Iwi youth strategy, which have already built a strong foundation with the release to schools of a Māori publication about Te Whanganui-a-Orotū. This research will complement ongoing initiatives to involve Māori students and tangata whenua representatives in research and will aid the development of management tools for the estuary.

## 7.1 Methods

An introductory letter was sent to principals or head of science teachers of several high schools in the Napier–Hastings area to ascertain the level of interest in allowing a senior Māori student to participate in this research. Feedback from these schools was positive and a relationship was subsequently formed primarily with Napier Girls High School. A personal approach by a member of the research team resulted in another senior student, from Taradale High School, who is also tangata whenua, being involved in this research. The letter was followed by kanohi ki te kanohi (face-to-face) meetings at Napier Girl's High School, principally with Anne Herbert (Head of Science) and Jenny Cracknell (Head of Māori), who championed this interaction at the school level, and later with the Principal and the senior student. All were very supportive of this initiative and the school provided assistance to the student to partake in the project. Members of the research team also visited the student's family in Pōrangahau, who gave their blessing to the initiative.

A copy of the senior student's year timetable was provided in order to design her level of involvement to align with her own academic and senior headgirl responsibilities, which were a priority. Her involvement in Napier included assisting the research team with field sampling of fish, and the collection and preservation of fish tissue. The exchange was completed by flying the student to Manaaki Whenua (Lincoln) to complete ageing of the flounder otolith ear bones that she had removed as part of the tissue collection in Napier, and enter these into our database.

At Napier Girls High School members of the research team also provided a brief overview of the results to senior biology students and a personal biography of our journeys into science to the Māori students. Furthermore, junior Māori students were invited to observe the research team at the estuary during the fish survey, where they also participated in identifying fish caught during seine netting.

## 7.2 Results

It was important to establish realistic expectations and goals for the student (Merihera Tipene) at the outset. There was no suggestion that she would be obliged to undertake a

career in science. Instead the purpose was to enhance the student's knowledge and experience by giving her the opportunity to be involved in an environmental science project and to interact with its personnel. In this respect her significant academic commitments were paramount and the team's expectations and the student's responsibilities in this project had to reflect this. Tasks the student was involved in included a mixture of field and lab work that contributed directly to the project data. We found the student enjoyed a 'hands-on' approach, while the team environment facilitated dialogue about aspects of the project and science in general. The student also visited Manaaki Whenua's (Landcare Research) laboratory facilities to complete analyses on samples she collected during the field study.

A perhaps unforeseen benefit to the student from this exchange was that on her initiative she based part of her formal Māori course internal assessment on the project research she was involved with. This provided an opportunity for members of the research team to reciprocate the assistance she gave to the project.

Relationships with the Napier Girls High School extended beyond those with the senior student. Presentations to senior biology students and Māori students provided important opportunities for role modelling and were an adjunct to the students' own research that is carried out at the estuary. A group of junior Māori students also visited the study site where they were given a brief overview, after which they participated in some fish sampling and identification. 'These interactions were tremendous eye-openers to these students, who are now keen to be involved further in the Estuary project,' said Anne Herbert and Jenny Cracknell.

While there were no expectations placed on the senior student to pursue an education or career in science, there was positive feedback from school staff and her parents indicating that she enjoyed the opportunity to be involved and felt that it had broadened her horizons with respect to considering a career in science. Other students who were involved also relished the opportunity to play a part in the future of their immediate environment

## 7.3 Conclusions

In reality it is difficult for researchers based outside of the New Zealand University/Whare Wānanga system to engage with Māori environmental postgraduate and undergraduate students. Engaging with a secondary school resulted in a range of positive outcomes that arguably had a greater impact than if only a student had been employed in this research. Benefits of this interaction included:

- Building the capacity of students by providing hands-on experience in an environmental science research project
- Demonstrating that science can be interwoven with Māori issues thus providing a tangible link between these
- Providing 'beyond the classroom' experiences of science research
- Introducing other opportunities for future engagement and other avenues for involving students in environmentally relevant issues and research
- Providing opportunities for mentoring – demonstrating that environmental research/science is a viable career for Māori.

### 7.4 Recommendations

Interaction with hapū members and students from Napier Girls' High School throughout the research project has shown there is a keen interest amongst rangatahi (adolescents) and mokopuna (children) for reconnecting with the estuary, for gaining a better understanding of cause–effect relationships from impacts of human activities on estuarine fauna, and highlighted opportunities for careers within the sciences and related fields.

We recommend that other researchers consider this as an option in research programmes.

## 8. Hui Whakamutunga – Celebrating Success

The concept of holding a final hui was centred on presenting the research findings to tangata whenua. However, throughout the course of this research project considerable 'in-kind' contributions from a range of individuals and organisations were received to assist this research project to achieve a range of outputs (Appendix 6). Therefore, it was decided to extend the invitation to everyone who had played a role in this project. The research team also decided to use this event to invite representatives from organisations who have an interest in the estuary and who might be interested in being involved in future research at the estuary (Appendix 7).

### 8.1 Methods

The research team met on several occasions to discuss hui logistics. It was decided that guests should be formally welcomed (pōwhiri) at the estuary, and this be followed by presentations at the National Aquarium of New Zealand (which had donated the use of its facilities for this hui). The traditional tauranga waka (site where waka were moored), where three poupou have been erected in remembrance of the cultural significance of this site, was selected to hold the pōwhiri. Located right inside the estuary it provided an appropriate backdrop and served as a reminder to participants of the context for this research.

The project team then created formal invitations, along with detailed programmes and maps. Approvals to use the site, catering, and other event logistics were organised and confirmed. This event was funded by the Ngā Pae o te Māramtanaga Knowledge Exchange Programme.

### 8.2 Results

Approximately 40–60 people were present at the pōwhiri and the presentations at the National Aquarium. Joe Te Rito (Ngā Pae o Te Māramatanga) guided the guests (manuhiri) through the process and spoke on their behalf. A pounamu taonga was presented to Ngā Hapū Tokowhitu o Te Whanganui-a-Orotū to signify the relationship formed between the research team and tangata whenua and the Napier community and the collective desires of all those present to see the estuary returned to a level of health reminiscent of earlier times.

The presentations took place in the viewing gallery of the National Aquarium. Thomas Heremia (MC) welcomed people to the event and Heitia Hiha (kaumātua) opened the evening with a karakia. After brief introductions Heitia Hiha provided a brief overview of the cultural

history and significance of the estuary from the time of their ancestors through to the current generations. A mōteatea, composed by Tamatea Pokaiwhenua Pokaimoana and describing the abundance of food that the former estuary provided, was performed as support for his presentation. James Ataria then provided a brief overview of the research project and was followed by Morry Black, who presented some of the major findings he has documented from existing literature and the interview process he undertook and how these will provide a foundation for the 25-year living document. James Ataria then showed participants some of the key results from the biophysical research undertaken in the estuary. He was followed by Jenny Mauger and Riordan Kemp, who discussed the interaction of this research project with the schools and other tanagata-whenua-driven education initiatives. Louis Tremblay then provided a synopsis of all the previous presentations with a view towards how the 25-year living document will provide the foundation for a range of tangata whenua driven projects. James Ataria completed the presentations by thanking all those who have assisted the research.

## 8.3 Conclusions

Considerable interest and support was generated during both events. The pōwhiri achieved its purpose of providing an up-front acknowledgement of the context of this research – driven by tangata whenua concerns about the health of their tāonga. Many participants were extremely thankful for the opportunity to be involved and felt drawn into the purpose (kaupapa) of the day. The mixture of speakers and order of presentations was very effective. Again the kaupapa of the event was reinforced to participants, making the presentations flow easily into each other. General comments after the presentation included the need for more research that is aligned strongly with community issues and with the community. The strong presence of Māori tikanga throughout the project was emphasised as a positive example of how Māori should be engaging with science and scientists.

## 8.4 Recommendation

That consideration is given to using Māori processes (pōwhiri and hui) as an effective dissemination tool for multi-disciplinary/multi-organisational research projects.

# 9. Acknowledgements

Ehara taku toa i te toa takitahi - Engari taku toa i te toa takitini
My success is not that of the individual - but due to the multitudes

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## Appendix 1 Terms of Reference

He Moemoea mō Ahuriri: A vision plan and health assessment for the Ahuriri (Napier) Estuary

1. Parties

Manaaki Whenua
Te Taiwhenua o Te Whanganui-a-Ōrotu (TWAO)

2. Background

The Ahuriri Estuary in Napier is of significant value to both tangata whenua and to the Hawke's Bay community as a whole. Historical and current environmental pressures, together with some questionable management processes over the years, have caused almost total disconnection between the tangata whenua and the estuary. In 2004, two years of funding was secured from Ngā Pae o Te Māramatanga to implement a research project that was aligned primarily to tangata whenua concerns about the current state of the Ahuriri Estuary.

Underpinning this research programme is the relationship between the research team and tangata whenua who are represented by TWAO. To facilitate a 'mode of operation' that aligns with tikanga and kawa principles central to TWAO, it was agreed that a Terms of Reference agreement be signed between the above-listed parties in lieu of a formal Memorandum of Understanding.

3. Responsibilities of Manaaki Whenua

Tikanga Principles

The proposed research aligns with the tikanga principles of TWAO because each of the following research objectives fits alongside mana whenua and mana moana issues and aspirations of the TWAO and the tangata whenua they represent.

Objective 1 Strengthening of the Partnership
Objective 2 Literature and Historical Data Survey
Objective 3 25-Year Living Document
Objective 4 Fauna Distribution and Health Survey
Objective 5 Science Promotion – Mentoring and Role Modelling
Objective 6 Final Reporting

Kawa Principles

Governance and Management relating to Te Whanganui-a-Ōrotu
On all matters of governance and management of the estuary, and communication with the below-listed authorities, the research team will coordinate discussions through the TWAO representative/s that have been appointed to a board or advisory group within that organisation (Table 1). If an organisation does not have TWAO representation then Maia Kaukau will be the first point of contact.

**Table 1 Key agencies and the appropriate TWAO representative/s**

| Organisation | Taiwhenua Representative |
|---|---|
| Department of Conservation | Tipu Tareha |
| Napier City Council | Bevan Taylor, Maia Kaukau, Tipu Tareha |
| Hawke's Bay District Council | Heitia Hiha, Noreen Taylor, Tipu Tareha |
| The Napier Port Authority | Tipu Tareha |
| The Napier Airport Authority | Tipu Tareha, Heitia Hiha, Maia Kaukau |
| Ministry of Fisheries | Tipu Tareha |
| Pandora Industrial Estate | Tipu Tareha |
| Upstream pollution sources | Maia Kaukau |
| TWAO Contact | Contact Details |
| Maia Kaukau | orotu1@paradise.net.nz (06 835 1853) |
| Tipu Tareha | orotu1@paradise.net.nz (06 835 1853) |
| Heitia Hiha | |
| Bevan and Noreen Taylor | |

3.2 Kawa: On operational matters relating to this research

All operational issues with the above agencies will occur via Morry Black's existing networks.

3.3 Kawa: Communication

An electronic copy of a summary of research progress, dialogue with agencies will be sent to the TWAO representatives (Maia Kaukau and Tipu Tareha) every quarter.

A summary of outcomes from meetings with key agencies will be sent to TWAO for their information.

Morry Black will meet with Maia Kaukau on a regular basis. These meetings will be held on Sundays or at a time most convenient.

3.2 Kawa: Intellectual Property

It is not envisaged that intellectual property will arise from this research. However, if opportunities for the commercialisation of intellectual property are discovered, appropriate steps will be taken to ensure all benefits are apportioned appropriately.

Information deemed by tangata whenua to be culturally sensitive will be handled according to the wishes of tangata whenua.

4. Responsibilities of Te Whanganui a Ōrotu

4.1

4.2

5. Intention of the Parties

It is agreed that these Terms of Reference reflect the Parties' current intentions for this research project and any future research endeavours between both organisations. However, they are not legally binding on the Parties and the Parties may, by mutual agreement, alter their intentions at any time should their focus, ability or desire to proceed alter.

SIGNED FOR MANAAKI WHENUA
NAME:

Charles Eason (Science Manager)

DATE:

SIGNED FOR TE TAIWHENUA O TE WHANGANUI-A-OROTŪ
NAME:

Maia Kauakau (Chief Executive Officer)

DATE:

## Appendix 2 Significant relationships formed during the research project

| Name | Organisation |
|---|---|
| Heitia and Margaret Hiha | Kaumātua, WAI 55 Claimants |
| Noreen Taylor | Kaumātua, WAI 55 Claimants |
| Bevan Taylor | Kaumātua, WAI 55 Claimants |
| Fred Reti | Kaumātua, WAI 55 Claimants |
| Miki Unahi | Kaumātua |
| Ana Madarasz | Environmental Scientist, Hawke's Bay Regional Council |
| Thomas Heremia | Tangata whenua (FTP Consultancy) |
| Graham Sevicke-Jones | Manager Environmental Monitoring, Hawke's Bay Regional Council |
| Brett Stansfield | Environmental Scientist, Hawke's Bay Regional Council |
| Neil Grant | Department of Conservation |
| Hans Rook | Department of Conservation |
| Whetu Tipiwai | Kaupapa Atawhai Manager, Department of Conservation |
| Jason Strong | Environmental Scientist, EAM Ltd |
| Peter Frizzell | Engineer & Consultant, Napier Port Authority |
| Anne Herbert | Head of Science, Napier Girls High School |
| Jenny Cracknell | Head of Māori, Napier Girls High School |
| Mary Nixon | Principal, Napier Girls High School |
| Charlie Rycroft | Regional Harbourmaster |
| John O'Shaughnessy | Town Planning Manager, Napier City Council |
| Charles Te Paa | Business Support Manager, Napier City Council |
| Raymond Tipene | Tangata whenua (Pōrangahau) |
| Clinton Duffy | Marine Biologist, Department of Conservation |
| Noel Watson | Protection Officer, Hawke’s Bay District Health Board |
| Joe and Nino D'Esposito | Manager, Hawke’s Bay Seafoods |
| Jim Hutchens | Deputy Chair, Ngāti Kere Rohe Trustees |
| Grant Northcott | Scientist, HortResearch |
| Kerry Hewitt | Senior Supervisor, New Zealand National Aquarium |
| Viv Phillipson | Events Coordinator, New Zealand National Aquarium |
| Rob Yarroll | Operations Manager, New Zealand National Aquarium |
| Ngahiwi Tomoana | Chairperson, Ngāti Kahungunu Iwi Incorporated |
| Aramanu Mitchell | General Manager, Ngāti Kahungunu Iwi Incorporation |

## Appendix 3 Finalised Interview Process

# HE MOEMOEA MŌ AHURIRI

## INTERVIEW PROCESS

### SUMMARY

One of the main components underpinning the 25-Year Vision Plan for the Ahuriri Estuary will be the information gained from a series of interviews with ngā hapū o Te Whanganui-a-Orotū, agencies who share management responsibilities within the estuary, and other diverse end user groups. The interviews will focus on drawing out interviewee aspirations for the estuary from which we will build a set of priorities and management principles which will benefit the estuarine ecosystem and the community through increased awareness and positive action.

Determining the aspirations of tangata whenua for future management of the estuary will be a major component of this research. Cultural preferences have not been given significant weight in past management practices for their taonga. Likewise, the subtle variations in traditional hapū environmental management systems were not always acknowledged when formulating policies for the estuary in local planning documents. For the purpose of these interviews we intend to select kaumatua from several different hapu so that a range of learned opinions can be obtained in relation to the different parts of the estuary and its surrounds, and any variations in hapū management, which do exist, can be determined and acknowledged in future management decisions.

### 1. OBJECTIVES AND TIMETABLE

The main objectives for the interview process and a timetable for achieving them are listed below.

**Figure 1: Objectives**

| Objective | Completion Date 2006 |
|---|---|
| To develop an interview process | March |
| Identify organisations to interview | March |
| Identify key personnel within those organisations | March-April |
| Identify key personnel from Te Whanganui-a-Orotū | March-April |
| Draft permission slip for tangata whenua | March |
| Create budget for interview process through to completion | March-April |
| Complete interviews with all groups | Mid July |
| Transcribe interviews and summarise main points | August/September |
| Draft interview report<br>Edit and review<br>Final report | September<br><br>November |

## 2. METHODOLOGY

2.1 Interviews will be conducted with consideration for the principles and ethics contained in the Association of Social Science Researchers code (1996), which gives a broad outline of interview process and safeguards participants' interests.

2.2 Differences between Māori and European cultures and preferences have necessitated that the interviews be carried out in two parts.

2.2.1 Interviews with tangata whenua will be influenced by their cultural relationships and values, which cover a broad range, and a holistic worldview whereas those with other sectors of the community generally have a more specific focus governed by each group's level of interest.

2.2.2 Other than tangata whenua there are a wide range of end-users with interests in the estuary. These include: -

- The Department of Conservation
- Ministry of Agriculture and Fisheries
- Napier City Council
- Hawke's Bay Regional Council
- Napier Port Authority
- Napier Airport Authority
- Royal Forest and Bird Protection Society of New Zealand
- Ahuriri Protection Society
- School Study Groups
- Recreational users

2.3 There are also other entities whose activities around the estuary margin or throughout the catchment have actual and potential impacts due to runoff, soil compaction and diverse land uses. These include farmers, lifestyle block owners, and developers for example, and can be categorised into four main sectors *inter alia*: -

- Those groups with environmental concerns
- Agencies with management responsibilities
- Recreational users
- Those whose land use activities impact on the estuary

2.4 Representatives from key sectors will be interviewed to help analyse the current management system, gauge how well it is performing, and to find aspirations for future management and uses for Te Whanganui-a-Orotū. To facilitate this process the research team has fostered relationships with most groups to be interviewed. We propose to identify key people from each sector to take part in the interview process.

**Figure 2:** Agencies and their key areas of interest

| **Tangata whenua** → → | **Environmental** → | **Management** → | **Recreational** → | **Peripheral** → |
|---|---|---|---|---|
| Ngāti Matepu<br>Ngāti Hinepare<br>Ngāti Parau<br>Ngāti Mahu<br>Ngāi Tawhao<br>Ngāti Tū<br>Ngāi Te Ruruku | Forest and Bird<br>Ahuriri Protection Society<br>Study Groups | Department of Conservation<br>Napier City Council<br>HB Regional Council<br>Ministry of Agriculture and Fisheries | Ahuriri Walkers Group<br>Kayakers<br>Board sailors<br>Joggers<br>Duck shooters<br>Waka ama<br>Swimmers | Airport Authority<br>Port Authority<br>Developers<br>Farmers<br>Lifestyle block owners<br>Transit NZ |

Hapū relationships with the estuary are varied and not confined to particular areas. In addition there are spiritual, historical, ancestral and social elements to their connections to Te Whanganui-a-Orotū extending back beyond early European colonisation.

## 3. NGĀ HAPŪ O TE WHANGANUI-A-OROTŪ

### 3.1 **Rationale**

Interviews with tangata whenua will help provide direction as to future sustainable management opportunities and aspirations for Te Whanganui-a-Orotū and its surrounds. Wairuatanga and tikanga values originate from Māori concepts that have a different focus to current resource management priorities. The interview process with tangata whenua will allow for expression of these values, while focussing around a number of central themes, yet remain flexible enough to permit interviewees to express their thoughts freely.

3.2 Maps and photos of Te Whanganui-a-Orotū will be used, where appropriate, to prompt participants and help the interviewer to understand exactly which locations are being referred to in any kōrero.

**Figure 3:** Themes and prompts for tangata whenua interviews

| **Issue** | **Topics** |
|---|---|
| Water | Quality Quantity Salinity Wetlands Habitat Area Streams Lakes Swamps Waiora |
| Kai Species | What species Condition Boundaries Extent Maramataka Quantity Health Indicators |
| Riparian | Enhancement Habitat Suitable areas Opportunities |
| Birds | Variety Species Customary Uses Seasons Indicators |
| Plants | Food Timber Fibre Rongoaa Seasonal traits/efficacy Birds-Plants-Interaction |
| Significant Cultural sites | Kainga Pā sites Waahi Tapu Boundaries Healing Wairuatanga Significance of names |

| | |
|---|---|
| Landcorp Farm | Effects of current use on estuary<br>Ideas for potential future use |

Interviews with kaumatua and rangatahi will be carried out with appropriate regard for tikanga and kawa practices and protocols.

Before commencing each interview the following procedures will be adopted.

## 3.3 **Informed Consent:**

- A brief explanation will be given including the rationale behind 'He Moemoea mō Te Whanganui-a-Orotū', and an outline of the purpose of the interview in relation to the research project
- Permission will be sought to record each interview for transcribing at a later date.
- An explanation will be given regarding what will happen with the information recorded during the interview and the hard copy of the interview
- Participation is entirely voluntary and may be stopped at any time
- Interviews may commence with karakia

## 3.4 **Privacy and Confidentiality**

- We will ensure that the interviewee is aware of the process and the protection mechanisms in place for any sensitive information which may arise as a result of the interview
- Such information will be omitted from the final report if it is the interviewee's wish.
- To ensure compliance with the above two clauses a hard copy of their interview summary will be supplied to participants prior to drafting of the final report
- Participants will be informed of the Terms of Reference existing between the research team and Te Taiwhenua O Te Whanganui-a-Orotū

## 3.5 **Other considerations**

- Interviews will take place where participants feel comfortable and relaxed
- Reasonable effort will be made to conduct the interviews in a manner and at a time convenient to participants
- The rights of the researchers in regard to the terms of the research contract requirements will be recognised by contributing parties
- Once these matters have been addressed the permission slip will be signed by both the participant and the interviewer
- The person being interviewed has the right to stop the interview at anytime

- At the conclusion of the interview a koha will be given in acknowledgement of their time

3.6 After seeking guidance from representatives of Te Taiwhenua o Te Whanganui-a-Orotū we have compiled a list of kaumatua from which the interviewees will be selected. They have all lived within close proximity to Te Whanganui-a-Orotū for many years and whakapapa to the seven hapū who exercise kaitiakitanga over Te Whanganui-a-Orotū. Rangatahi will also be included in the process. This will help broaden the scope of the interviewees and provide an indication of the extent and degree of intergenerational knowledge.

3.7 Interview participants will be selected from the following list: -

| | | |
|---|---|---|
| Heitia Hiha | Noreen Taylor | Peggy Nelson |
| Frederick Reti | Labour Hawaiikirangi | Hine Pene |
| Joe Northover | Hine Reti | Rere Puna |
| Bill Prentice | Boycie Spooner | Reo Spooner |

3.8 It is acknowledged that a significant amount of traditional and cultural information has already been recorded as part of the evidence given by hapū members at the Waitangi Tribunal hearings into the Whanganui-a-Orotū claim. Almost all of this information is retrospective. Our interviews will focus on information that expands on existing cultural data and defines hapu aspirations for future management. Opinions will be sought relating to:

- Protocols, practices and methods used for the collection, preservation and sharing of kai species within Te Whanganui-a-Orotū
- Historical accounts and testimony on mahinga kai species
- Enhancement options for mahinga kai including rahui and taiapure
- Information and significance relating to the Māori names for sites and locations around Te Whanganui-a-Orotū
- Ideas on present and future uses for Te Whanganui-a-Orotū
- Elements of protection or enhancement for those characteristics of the environment of special value to Māori
- Filling in perceived information gaps identified from the literature review
- Aspirations for the management of the Landcorp Farm which the Waitangi Tribunal has recommended be returned to the hapū

## 4. BUDGET

A budget will be set to quantify approximate costs for conducting the interviews, transcribing them to hard copy and drafting and completing the final report. The budget will cover: -

- Wages for the interviewers
- Compensation for secretarial duties
- Koha for participants
- Fuel and Stationery
- Digivoice recorder
- Accessories

## 5. COMMUNITY ENGAGEMENT

5.1 The second series of interviews with other end user groups will be more specific. Agencies with statutory management roles and functions are governed by Local Government Act legislation and the plans formulated under the Resource Management Act, the Conservation Act and the Wildlife Act. These place responsibility for management with local bodies and the Department of Conservation.

5.2 In addition there are existing Urban Development Strategies and Long Term Council Plans, which have had community views taken into account in their drafting. To some extent the direction which future management of the estuary takes is indicated in these local planning documents, however, there is a degree of flexibility plus other issues arising from the Waitangi claim and pending settlement options. As with the rezoning of parts of the Ahuriri and Pandora areas from light industrial to residential and commercial zoning, activities around the estuary and their impacts are changing.

5.3 The interview process with local government and end users will therefore focus on what is happening now under the current planning regime and whether there are increased opportunities likely to develop for tangata whenua to share in estuary management processes. To this end, for our interviews we have selected personnel who are well informed of their respective agency's future roles and vision with respect to Te Whanganui-a-Orotū and its environs.

**Figure 4:** Key organisations and personnel

| | |
|---|---|
| Landcorp Farm | John Ferguson |
| Ministry of Agriculture and Fisheries | Wayne Ormsby |
| Hawke's Bay Regional Council | Liz Lambert, Gavin Ide |
| Napier Port Authority | Garth Cowie, Charlie Rycroft |
| Napier Airport Authority | TBC |
| Forest and Bird | Isabel Morgan |
| Ahuriri Protection Society | Lloyd Beech |
| Ahuriri Walkers Group | Diane Turner |
| School Groups | School Principal, Central |
| Department of Conservation | Ken Hunt |
| Napier City Council | John O'Shaughnessy |
| Commercial Eeling | Andy Pattison |
| Developers | From - Esk Hills, Ahuriri Quadrant, Kopaki |

5.4 By including key points of view from the wide range of people with interests in the Ahuriri Estuary, our report seeks to document a range of issues and aspirations that can direct future management, use and enhancement of the estuary, in a fashion that aligns with Te Taiwhenua o Te Whanganui-a-Orotū tikanga and kawa and wider community aspirations.

## Appendix 4 GPS locations

Locations in the Napier Estuary where sediment was collected (Field trip 1)

| Group | ID | Description | Lat | Long | Easting | N |
|---|---|---|---|---|---|---|
| New | 40 | Taradale stormwater drain | −39.4838 | 176.8589 | 2841879 | 61 |
| | 44 | Bayview stormwater drain | −39.4838 | 176.8589 | 2841925 | 61 |
| New | 41 | Heitia anectdotal dump site | −39.4847 | 176.8668 | 2842552 | 61 |
| New | 42 | Purimu drain | −39.4867 | 176.8753 | 2843259 | 61 |
| New | 43 | Plantation/Georges Dr/County drain | −39.4868 | 176.8764 | 2843370 | 61 |
| New | 44 | Tyne St drain | −39.4868 | 176.8871 | 2844282 | 61 |
| New | 55 | Upper Estuary Landcorp Farm | −39.4473 | 176.8439 | 2840766 | 61 |

Locations where cockles were collected (Field trip 1)

| Group | ID | Description | Lat | Long | Easting | N |
|---|---|---|---|---|---|---|
| New | 45 | Purimu drain | −39.4852 | 176.8835 | 2843985 | 61 |
| New | 46 | Lower Napier Estuary | −39.4848 | 176.8838 | 2844011 | 61 |
| New | 55 | Mid-Porangahau Estuary (Raymond, Cara, Louis) | | | 2825150 | 60 |
| New | 47 | Mid-Porangahau Estuary (Jamie, Morry, Mike) | −40.2536 | 176.6982 | 2824508 | 60 |

Gill net locations for flounders (Field trip 1)

| Group | ID | Description | Lat | Long | Easting | N |
|---|---|---|---|---|---|---|
| New | 49 | Porangahau gill net 1 15º | −40.2763 | 176.6741 | 2822359 | 60 |
| New | 50 | Porangahau gill net 1 set over night | −40.2736 | 176.6738 | 2822348 | 60 |
| New | 51 | Porangahau gill net 1 set overnight | −40.2731 | 176.6742 | 2822385 | 60 |
| New | 52 | Porangahau gill net 2 set overnight | −40.2785 | 176.6723 | 2822196 | 60 |
| New | 53 | Porangahau gill net 3 set overnight | −40.2786 | 176.6713 | 2822108 | 60 |
| New | 54 | Porangahau gill net 3 set overnight | −40.2788 | 176.6715 | 2822127 | 60 |
| New | 28 | Napier Estuary public lunch ramp | −39.4822 | 176.8891 | 2844484 | 61 |
| New | 29 | Napier Estuary box trap net | −39.4839 | 176.8866 | 2844255 | 61 |
| New | 30 | Napier Estuary gill net | −39.4841 | 176.8855 | 2844165 | 61 |
| New | 31 | Napier Estuary 2nd gill net close to bridge | −39.4833 | 176.8875 | 2844336 | 61 |
| New | 32 | Napier Estuary 2nd gill net close to bridge (Sth end) | −39.4833 | 176.888 | 2844379 | 61 |
| New | 33 | Napier Estuary 1st gill net set (Sth end) | −39.483 | 176.8878 | 2844368 | 61 |
| New | 34 | Napier Estuary 2nd gill net close to bridge (Nth end) | −39.4833 | 176.888 | 2844368 | 61 |
| New | 35 | Napier Estuary 3rd gill net set (Sth end) | −39.4845 | 176.8855 | 2844161 | 61 |
| New | 36 | Napier Estuary 3rd gill net set (Nth end) | −39.4842 | 176.8855 | 2844164 | 61 |
| New | 37 | Napier Estuary 2nd gill net set 2nd time (Nth end) | −39.4838 | 176.8864 | 2844244 | 61 |
| New | 38 | Napier Estuary 2nd gill net set 2nd time (Sth end) | −39.484 | 176.8866 | 2844255 | 61 |
| New | 39 | Napier Estuary | −39.4838 | 176.859 | 2841890 | 61 |

Collection device locations (fish survey) Field trip 2

| Group | ID | Description | Lat | Long | Easting | N |
|---|---|---|---|---|---|---|
| LR9.txt | 1 | Seine Napier Estuary 001 | −39.486 | 176.8875 | 2844326 | 61 |
| LR9.txt | 2 | Seine Napier Estuary 002 | −39.4856 | 176.8857 | 2844172 | 61 |
| LR9.txt | 3 | Seine Napier Estuary 003 | −39.4856 | 176.8854 | 2844144 | 61 |
| LR9.txt | 4 | Seine Napier Estuary 004 | −39.4861 | 176.8857 | 2844171 | 61 |
| LR9.txt | 5 | Seine Napier Estuary 005 | −39.4854 | 176.8835 | 2843981 | 61 |

| | | | | | | |
|---|---|---|---|---|---|---|
| LR9.txt | 6 | Seine Napier Estuary 006 | −39.4857 | 176.8832 | 2843958 | 61 |
| LR9.txt | 7 | Seine Napier Estuary 007 | −39.4854 | 176.882 | 2843854 | 61 |
| LR9.txt | 8 | Seine Napier Estuary 008 | −39.4844 | 176.883 | 2843942 | 61 |
| LR9.txt | 9 | Seine Napier Estuary 009 | −39.4844 | 176.8847 | 2844089 | 61 |
| LR9.txt | 10 | Seine Napier Estuary 010 | −39.4849 | 176.8847 | 2844093 | 61 |
| LR9.txt | 11 | Seine Napier Estuary 011 | −39.485 | 176.8852 | 2844130 | 61 |
| LR9.txt | 12 | Gill net 4.5" Napier Estuary 012 | −39.4858 | 176.8835 | 2843986 | 61 |
| LR9.txt | 13 | Seine Napier Estuary 013 - Ignore | −39.486 | 176.8832 | 2843952 | 61 |
| LR9.txt | 14 | Gill net 4.5" Napier Estuary 014 (other end of Waypoint 012) | −39.4863 | 176.8839 | 2844010 | 61 |
| LR9.txt | 15 | Seine Napier Estuary 015 | −39.4856 | 176.8771 | 2843432 | 61 |
| LR9.txt | 16 | Seine Napier Estuary 016 | −39.4863 | 176.8758 | 2843320 | 61 |
| LR9.txt | 17 | Seine Napier Estuary 017 | −39.4861 | 176.877 | 2843421 | 61 |
| LR9.txt | 18 | Seine Napier Estuary 018 | −39.4874 | 176.8798 | 2843653 | 61 |
| LR9.txt | 19 | Seine Napier Estuary 019 | −39.4835 | 176.885 | 2844119 | 61 |
| LR9.txt | 20 | Seine Napier Estuary 020 | −39.4832 | 176.885 | 2844122 | 61 |
| LR9.txt | 21 | Seine Napier Estuary 021 | −39.4837 | 176.8847 | 2844097 | 61 |
| LR9.txt | 22 | Seine Napier Estuary 022 | −39.4833 | 176.8836 | 2843999 | 61 |
| LR9.txt | 23 | Seine Napier Estuary 023 | −39.4821 | 176.8867 | 2844275 | 61 |
| LR9.txt | 24 | Seine Napier Estuary 024 | −39.4853 | 176.8896 | 2844506 | 61 |
| Waypoint missed | | Gill net 4.5" Napier (A) | | | | |
| Waypoint missed | | Gill net 4.5' Napier Estuary (other end of previous Waypoint) | | | | |
| LR9.txt | 25 | Gill net 4.5" Napier Estuary (B) | −39.4841 | 176.8847 | 2844095 | 61 |
| LR9.txt | 26 | Gill net 4.5' Napier Estuary (other end of previous Waypoint) | −39.4837 | 176.8848 | 2844103 | 61 |
| LR9.txt | 27 | Gill net 1.5" Napier Estuary (C) | −39.4841 | 176.8852 | 2844140 | 61 |
| LR9.txt | 28 | Gill net 1.5' Napier Estuary (other end of previous Waypoint) | −39.4841 | 176.8854 | 2844152 | 61 |
| LR9.txt | 29 | Gill net 4.5" Napier Estuary 029 | −39.4845 | 176.885 | 2844119 | 61 |
| LR9.txt | 30 | Gill net 4.5" Napier Estuary 030 (other end of previous Waypoint) | −39.4845 | 176.8849 | 2844112 | 61 |
| LR9.txt | 31 | Gill net 4.5" Napier Estuary 031 | −39.4846 | 176.8851 | 2844129 | 61 |
| New | MOB | Gill net 4.5" Napier Estuary 032 (other end of previous Waypoint) | −39.4864 | 176.8759 | 2843327 | 61 |
| New | 1 | Gill net 4.5" Napier Estuary 001 | −39.4845 | 176.8864 | 2844240 | 61 |
| New | 2 | Gill net 4.5" Napier Estuary 002 (other end of previous Waypoint) | −39.4841 | 176.8868 | 2844274 | 61 |
| LR8.txt | 3 | Fyke Napier Estuary 003 | −39.4847 | 176.8846 | 2844086 | 61 |
| LR8.txt | 4 | Fyke Napier Estuary 004 | −39.4846 | 176.8852 | 2844133 | 61 |
| LR8.txt | 5 | Fyke Napier Estuary 005 | −39.4845 | 176.885 | 2844117 | 61 |
| LR8.txt | 6 | Fyke Napier Estuary - no fish caught | −40.2656 | 176.6796 | 2822873 | 60 |
| LR4.txt | 1 | Gill net 4.5" Pandora Bridge | −39.4824 | 176.8884 | 2844417 | 61 |

Locations where sediment was collected for copepod bioassay

| Group | ID | Description | Lat | Long | Easting | N |
|---|---|---|---|---|---|---|
| New | 1 | Tyne St drain (new site) | −39.4865 | 176.8862 | 2844211 | 61 |
| New | 2 | Westshore lower Napier Estuary | −39.483 | 176.8828 | 2843938 | 61 |
| New | 4 | Purimu drain | −39.4865 | 176.8751 | 2843261 | 61 |

| | | | | | | |
|---|---|---|---|---|---|---|
| New | 43 | Plantation/Georges Dr/County drain | −39.4868 | 176.8764 | 2843370 | 61 |
| New | 44 | Tyne St drain (site where sediment for chemistry collected) | −39.4868 | 176.8871 | 2844282 | 61 |
| New | 47 | Taradale Drain | −39.4838 | 176.8589 | 2841879 | 61 |
| New | 55 | Upper Estuary Landcorp Farm | −39.4473 | 176.8439 | 2840766 | 61 |

# Appendix 5 Biophysical data

## Sediment Organochlorine Residues (n.d. = not detected)

| | A1 Taradale Stormwater Drain | A4 Drain Westside of New Motorway | A5 Drain Westside of Old Motoroway | A6 Humber St Drain | A7 Land |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| Dry Matter g/100g as received | 74.7 | 73.9 | 73.4 | 66.5 | 4 |
| Heavy Metals mg/kg dry wt | | | | | |
| Total Recoverable Cd | 0.04 | 0.07 | 0.06 | 0.38 | 0 |
| Total Recoverable Cu | 12.4 | 5.8 | 8.9 | 46.8 | 1 |
| Total Recoverable Hg | 0.07 | 0.04 | 0.05 | 0.13 | 0 |
| Total Recoverable Pb | 9.43 | 9.24 | 9.3 | 76 | 1 |
| Total Recoverable Zn | 44.9 | 105 | 76.8 | 226 | 6 |
| | | | | | |
| % Dry weights | 72.7 | 73.17 | 74.49 | 69.28 | 3 |
| Organochlorine Insecticides ng/g dry weight | | | | | |
| o,p'-DDE | n.d. | n.d. | n.d. | 0.07 | n |
| p,p'-DDE | 0.23 | 0.29 | 0.53 | 1.59 | 0 |
| o,p'-DDD | 0.05 | n.d. | 0.08 | 1.42 | n |
| p,p'-DDD | 0.33 | 0.22 | 0.41 | 6.56 | 0 |
| o,p'-DDT | n.d. | n.d. | n.d. | n.d. | n |
| p,p'-DDT | n.d. | n.d. | n.d. | n.d. | n |
| tans chlordane | n.d. | n.d. | n.d. | n.d. | n |
| cis chlordane | n.d. | n.d. | n.d. | n.d. | n |
| **Equiv. Tech** | **n.d.** | **n.d.** | **n.d.** | **n.d.** | **n** |
| gamma.-Lindane | n.d. | n.d. | n.d. | n.d. | n |
| Heptachlor | n.d. | n.d. | n.d. | n.d. | n |
| heptachlor epoxide | n.d. | n.d. | n.d. | n.d. | n |
| dieldrin | n.d. | 0.1 | n.d. | n.d. | n |
| endrin | n.d. | n.d. | n.d. | n.d. | n |
| oxychlordane | n.d. | n.d. | n.d. | n.d. | n |
| HCB | n.d. | n.d. | n.d. | n.d. | n |
| | | | | | |
| Polychlorinated Hydrocarbons (PCB's) ng/g dry weight | | | | | |
| pcb 18 | n.d. | n.d. | n.d. | 0.12 | n |
| pcb 15 | n.d. | n.d. | n.d. | 0.06 | n |
| pcb 54 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 28 + 31 | n.d. | n.d. | n.d. | 0.2 | n |
| pcb 52 | n.d. | n.d. | n.d. | 0.12 | n |
| pcb 49 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 47 | n.d. | 0.05 | n.d. | 0.08 | n |
| pcb 44 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 40 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 121 | n.d. | n.d. | n.d. | 0.14 | n |
| pcb 101 | n.d. | n.d. | n.d. | 0.27 | n |
| pcb 87 | n.d. | 0.09 | 0.13 | 0.56 | n |
| pcb 110 | n.d. | 0.05 | 0.08 | 0.51 | n |
| pcb 77 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 151 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 118 | n.d. | 0.07 | 0.11 | 0.58 | n |
| pcb 153 | n.d. | 0.08 | 0.16 | 0.33 | n |
| pcb 105 | n.d. | 0.07 | 0.08 | 0.5 | n |
| pcb 141 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 138 | n.d. | 0.06 | 0.09 | 0.24 | n |
| pcb 185 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 156 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 180 | n.d. | n.d. | n.d. | 0.17 | n |
| pcb 170 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 195 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 194 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 206 | n.d. | n.d. | n.d. | n.d. | n |
| pcb 209 | n.d. | n.d. | n.d. | n.d. | n |
| | | | | | |
| Chlorophenols ng/g dry weight | | | | | |
| 2,4,6 trichlorophenol | n.d. | | n.d. | 2.4 | n |
| 2,3,5 trichlorophenol | n.d. | | n.d. | n.d. | n |
| 2,4,5 trichlorophenol | n.d. | | n.d. | n.d. | n |
| 2,3,6 trichlorophenol | n.d. | | n.d. | n.d. | n |
| 2,3,4 trichlorphenol | n.d. | | n.d. | 0.7 | n |
| 2,3,5,6 tetrachlorophenol | n.d. | | n.d. | n.d. | n |
| 2,3,4,6 tetrachlorophenol | n.d. | | n.d. | n.d. | n |
| 2,3,4,5 tetrachlorophenol | n.d. | | n.d. | 1 | n |
| pentachlorophenol | n.d. | 1.6 | n.d. | 2.1 | n |

## Appendix 6 Outputs from the research project

Paper
Ataria J, van den Heuvel M, Northcott G, Tremblay C, Tremblay L (in prep.). Stormwater impacts on the Napier Estuary.

Reports
Ataria J, Hack L 2007. Toxicity assessment of sediments from Te Whanganui-a-Orotū using the copepod bioassay. Landcare Research Contract Report LC0607/066, prepared for The Hawke's Bay Regional Council. 17 p.

Ataria J, Black M 2006. Cockles collected from the Pōrangahau Estuary and sent to the Cawthron Institute for analysis of faecal coliforms. A confidential summary of results provided to Central Hawke's Bay District Council.

Poster
Lowe C, Ataria J, Tremblay L 2006. Yellowbelly flounder (*Rhombosolea leporina*) as a bioindicator of the health of the New Zealand estuarine environment. SETAC North America, Montreal, Canada, 5–9 November 2006.

Conference presentations
Ataria J 2007. The Napier Estuary: stormwater impacts on a traditional Māori food gathering resource. Canadian Aboriginal Science and Technology Society (CASTS) cdonference, Calagary, Canada, 3–5 October 2007. (*Abstract submitted and dependent on funding.*)

Black M 2007. The Napier Estuary: The development of a 25-year living document as a tool for leveraging Māori engagement into resource management and collaborative research opportunities. Canadian Aboriginal Science and Technology Society (CASTS) conference, Calgary, Canada, 3–5 October 2007. (*Abstract submitted and dependent on funding.*)

Influences on regional policy development
The research funded by Ngā Pae o Te Māramatanga has provided tangata whenua with statistical and scientific data that will enable them to contribute effectively to the development of emerging regional stormwater policy. Hawke's Bay Regional Council, territorial authorities and Māori are currently in the process of drafting new stormwater policies, which will eventually be included in the operative Regional Resource Management Plan and the proposed Regional Coastal Environment Plan by way of plan change and variation.

The suite of environmental data accumulated by Māori and their research partners from this project has identified a number of key issues and, along with regional council's species and State of the Environment monitoring, will provide a broad picture of the current state of the estuary, and identify the steps necessary to help enhance ecological values of the Napier Estuary, and other estuarine environments region-wide.

Regional Coastal Environment Plan Hearing, 26 July 2007 (Hawke's Bay Regional Council, Napier): Parts of the report were used as evidence to highlight the significance of Te Whanganui-a-Orotū to tangata whenua from the historical heritage perspective and to gain recognition of Māori values in the plan.

Presentations guest lectures

Ataria J 2007. He moemoea mō Te Whanga: An example of collaborative research with Māori. Guest lecture in May 2007 to Ecol 608 (Methods in Ecology) at Lincoln University,.

Ataria J, Black M 2006. He moemoea mō Te Whanga. Presentation to the International Research Advisory Panel for Ngā Pae o Te Māramatanga, Langham Hotel, Auckland, 9 November 2006.

Ataria J, Black M, Hiha H, Mauger J, Kemp R 2006. Hui Whakamutunga – Celebrating success. Final presentation of results of 'He Moemoea mo Te Whanga' to tangata whenua and invited guests. The National Aquarium of New Zealand, Napier, 2 March 2006.

Ataria J 2006. He moemoea mō Te Whanga: An example of research addressing Māori resource management issues. Llecture provided to Māori Studies (MAST) 319 (Te Kaitaikitaka Māori Environmental Management) students, Lincoln University, September.

Ataria J, Black M, Mauger J 2006. Research overview and results presentation to senior biology students, Napier Girls High School.

Ataria J, Black M, Mauger J 2006. Māori working in science and research presentation to Māori students, Napier Girls High School.

Ataria J 2006. He moemoea mō Te Whanga. Presentation to the Honourable Steve Maharey (Minister of Education, and Science and Technology), Ngā Pae o Te Māramatanga, Auckland University, 31 August 2006.

Ataria J 2006. Māori resource management research issues and experiences. He moemoea mō Te Whanga. Māori and Indigenous (MAI) Postgraduate Students presentation, Te Whare Whakakōtahi, Lincoln University, August 2006.

Popular articles
Ataria J 2007. Hui celebrates new understanding of estuary. Manaaki Whenua – Landcare Research Annual Report.

Ataria J 2007. Hui whakamutunga. Ngā Pae o Te Māramatanga Annual Report.

Ataria J 2006. He moemoea mo te Whanganui-a-Orotū: A vision plan and health assessment for the Ahuriri Estuary – case study. In. Supporting and encouraging Māori and Pasifika into science and technology, health and engineering: Case studies of programmes. Royal Society of New Zealand Science and Technology Education Committee. 27 p.

Ataria J 2006. Whanaketanga Māori ki Manaaki taiao: Te Whanganui-a-Orotū (Māori development and environment: The Napier Estuary as an example). Manaaki Whenua (Landcare Research) Annual Report. Pp. 14–15.

Ataria J 2006. He moemoea mo Te Whanga. Ngā Pae o Te Māramatanga Annual Report.

Ataria J, Kaukau M 2006. Tāonga studied. The big picture (Hawke's Bay Regional Council Ratepayers' magazine). April. P. 6.

Appendix 7 Hui Whakamutunga Invitations

ACKNOWLEDGEMENTS

The research team would like to acknowledge Ngā Pae o Te Māramatanga for providing funding for these investigations. The team also thanks the significant contributions provided by individuals and organisations during this research.

THE CORE RESEARCH TEAM

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# PROGRAMME

## *Hui Whakamutunga – Celebrating Success*

Napier, 2
March 2006

Te Taiwhenua o Te Whanganui a Orotū

Ngā Pae o te Māramatanga

Landcare Research
Manaaki Whenua

## ABSTRACT

Te Whanganui-a-Orotū (Napier Estuary) is of significant value to both tangata whenua and the Hawke's Bay community as a whole. However, industrial activity, urban and agricultural runoff, and residential development around the estuary have created concerns about its quality and the diversity of life it supports.

The research project 'He Moemoeā mō Te Whanganui-a-Orotū – A vision plan and health assessment for the Ahuriri Estuary' is a step towards characterising the impact of stormwater on the estuary and detailing tangata whenua, community and government organisation aspirations for the Napier Estuary. Driven primarily by tangata whenua issues the research team has collected and analysed sediment and biological samples for a range of chemicals and have carried out biological testing of flounder samples. A literature review and interviews with representatives of tangata whenua groups, community and local government organisations have been conducted to gauge what are the main issues with respect to local aspirations for the estuary.

Today we will give an overview of the project, present some results and discuss future research directions. We will also examine initiatives to build Māori capacity through participation in this research.


## PŌWHIRI (FORMAL WELCOME)

| | |
|---|---|
| 4:00 pm | Gather at northern side of the estuary over the Meeanee Quay bridge |
| 4:15 pm | Assemble for a brief overview before walking to poupou<br>Pōwhiri/welcome<br>Hongi/hariru – handshake |
| 5:15 pm | Afternoon tea (snacks and liquid refreshments) |
| 5:35 pm | Proceed to the National Aquarium |
| HE WHAKAATURANGA (PRESENTATIONS) | |
| 6:00 pm | Introduction – Thomas Heremia (MC) |
| | Te Whanganui-a-Orotū (Napier Estuary) – A brief history of this resource and why the estuary is important to tangata whenua Presented by Heitia Hiha (Kaumātua – elder) |
| | He Moemoeā mō Te Whanga – A brief background and overview of the research project Presented by James Ataria (Researcher) |
| | Biophysical approach – An overview of the approach and selection of results, conclusions and recommendations Presented by James Ataria and Louis Tremblay (Researchers)<br>25-year Living Document – An overview of the approach, results, conclusions and recommendations Presented by Maurice Black (Researcher)<br>Capacity-Building outcomes – Going back to school! Presented by Jenny Mauger (Researcher) |
| | Way forward – Some overall conclusions and irons in the fire Presented by Maia Kaukau (Manager, Te Taiwhenua o Te Whanganui-a-Orotū) and James Ataria |
| | Acknowledgements James Ataria |
| | Questions and comments (20 minutes) |
| 8:00 pm | Food and liquid refreshments and free time to wander through the National Aquarium |