

# Assessing the Holistic Health of Coastal Environments:

Research Design and Findings from  
Cross-Cultural Research, Manaaki Taha Moana  
Phase 1



**Manaaki Taha Moana**

MTM Report No. 6  
December 2011

**Manaaki Taha Moana: Enhancing Coastal Ecosystems for Iwi**

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Derrylea J Hardy

Murray G Patterson

Huhana Smith

Aroha Spinks

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## **Nga Mihi**

Tuia i runga, tuia i raro, tuia i waho, tuia i roto, tuia te here tangata, ka rongo te pō, ka rongo te ao.

Ka tuku te ia o whakaaro kia rere makuru roimata atu ki te kāhui ngū kua hoki atu ki te waro huanga roa o te wairua, rātou kei tua o te ārai, takoto, okioki, e moe.

Tātou ngā waihotanga o te reka ki a tātou, ā, e mihi kau atu ana mātou ki a kōutou i kotahi ai te whakaaro i raro i te korowai whakamarumarū o tēnei taonga, Manaaki Taha Moana (MTM).

Tihei Mauri Ora, ki a tātou katoa.

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## EXECUTIVE SUMMARY

Tangata whenua have been concerned for some time about the degradation of coastal resources, the loss of kaimoana (seafood) or the increasing toxicity of remaining marine species, sedimentation, pollution, eutrophication of waterways, and the associated negative impact that such issues have on cultural identity and sense of pride (mana). For this reason, funding was successfully gained from the Ministry for Science and Innovation in New Zealand (formerly the Foundation of Research Science and Technology) for a 6-year environmental restoration study. The research programme, 'Manaaki Taha Moana: Enhancing Coastal Ecosystems of Importance to iwi and hapū', runs from 2009-2015. The research is being conducted in the hope of finding ways to stem the decline and degradation of coastal ecosystems. This report provides an overview of Phase 1 of MTM.

Manaaki Taha Moana (MTM) builds upon previous research undertaken with Ngāti Raukawa ki te Tonga that examined land-based ecosystems. The MTM research is focusing on ways to restore coastal ecosystems and services of most importance to iwi and hapū in two regions: the Horowhenua coastline (from the Hokio Stream to Waitohu Stream) and in Te Awanui Tauranga Harbour. Accordingly, over the course of the 6-year programme, the MTM research aims to assess and help restore the holistic health of coastal ecosystems, including the economic, ecological, social and cultural aspects of coastal health. Our research goal is that actions will be implemented to enhance the resilience of coastal ecosystems so that they can make a positive contribution to iwi identity, survival and welfare.

The purpose of this report is to provide a contextual background to MTM within the wider cross-cultural coastal restoration context in New Zealand, to describe the rationale for the MTM programme overall, and to provide an overview of MTM Phase 1. Additional reports detail the specific research activities undertaken in both the Horowhenua and the Tauranga case studies of MTM Phase 1 (see [www.mtm.ac.nz](http://www.mtm.ac.nz)). However, this report focuses on the design, methods, key findings and recommendations of the 'stocktake' in Phase 1, in both case study regions. It is intended that this report will clarify the rationale for, and usefulness of, the methods utilised in Phase 1, particularly the participatory action and kaupapa Māori research methods. Likewise, it is hoped readers will gain a better appreciation of how the diverse research activities within MTM Phase 1 'fit together', leading to the recommended case studies for detailed research in Phase 2.

Accordingly, this report describes the first phase of MTM, which has been purposefully designed as an integrative, dynamic cross-cultural research project in New Zealand to help restore coastal ecosystems and their services that are important to local Māori. The report (i) provides a rationale for the MTM research design and methodology; (ii) describes some innovative participatory action research methods utilised in Phase 1 to facilitate involvement of local communities; (iii) outlines plans for ongoing detailed case studies; and (iv) makes recommendations for future coastal research that can empower local communities to positively engage in coastal restoration and sustainable resource management practices.



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The first section of the report provides an overview of MTM aims and objectives, the make-up of the MTM research team, and the key research activities completed thus far. Section 2 provides a brief introduction to the study of coastal ecosystems and ecosystem services. Section 3 explores knowledge and relationships that indigenous peoples, including Māori, have with the environment and discusses the importance of environmental research in New Zealand involving tangata whenua and mātauranga Māori (Māori knowledge). Section 4 outlines participatory action research and kaupapa Māori research, and describes why such methods are used in the MTM research programme to actively engage with local communities in the research.

The report then goes on to describe the key research that was undertaken during Phase 1 in Horowhenua and Tauranga. The first objective of MTM was to develop a knowledge base of the past and current state of coastal ecosystems and their services in the two case study regions. This first 'stocktake' phase of MTM involved compiling and summarising existing knowledge about coastal environments, including western science and mātauranga Māori, to find identify research 'gaps' that required ongoing detailed investigation in Phase 2 of MTM.

The report concludes with a summary of achievements in the MTM programme thus far. This is followed by a short discussion of issues pertinent to the MTM research, including: the need for greater understanding of coastal ecosystem services and associated research; with tangata whenua; greater community awareness about contributors to, and consequences of, coastal degradation; and the role of participatory action research methods in cross-cultural environmental research.

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## 1. OVERVIEW OF MTM

Manaaki Taha Moana (MTM) is a six-year programme, running from October 2009 to September 2015, with research being conducted primarily in two areas: Tauranga moana and the Horowhenua coast (from the Hokio Stream to Waitohu Stream). This programme builds upon Massey University's previous research with Ngāti Raukawa ki te Tonga in the lower north island: 'Ecosystem Services Benefits in Terrestrial Ecosystems for iwi' (MAUX0502).

Key features of this research are that it is: cross-cultural; interdisciplinary; applied/problem solving; technologically innovative; and integrates the ecological, environmental, cultural and social factors associated with coastal restoration. Further, the cross-cultural emphasis and the partnership with tangata whenua is facilitated by the research team including Māori researchers from each local rohe, with the leadership of Waka Taiao and Te Awanui Trust in Tauranga, and Taiao Raukawa in Horowhenua, made up of iwi/hapū representatives.

This report is one in a series of reports and other outputs from the research programme "Enhancing Coastal Ecosystems for Iwi: Manaaki Taha Moana" (MAUX0907), funded by the Ministry for Science and Innovation (previously known as the Foundation for Research Science and Technology, and the Ministry of Research, Science and Technology). Readers are encouraged to visit the MTM programme website (<http://www.mtm.ac.nz>) to read more about this research programme, and for copies of the Phase 1 outputs.

### 1.1. Aim of MTM

The central research question is: "how can we best enhance and restore the value and resilience of coastal ecosystems and their services, so that this makes a positive contribution to iwi identity, survival and welfare in the case study regions?"

Thus, MTM aims to restore and enhance coastal ecosystems and their services of importance to iwi and hapū. To do this, MTM research will increase our knowledge of coastal ecosystems that are most important to iwi and hapū, including research to better understand what activities are occurring that degrade them, and to prioritise actions that need to be implemented to restore coastal health. MTM will utilise both western science and mātauranga Māori (Māori knowledge).

Action Plans will be produced with iwi and hapū for improving coastal ecosystems and their services in each rohe (area). The research team will work as closely as possible with iwi and hapū, and other 'end user' groups, in the case study regions to develop tools that enable research findings to be utilised in their care and management of coastal resources. Mechanisms will also be put in place to facilitate uptake amongst other iwi in New Zealand.

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## 1.2. Objectives of MTM

To achieve the MTM research aim, the research has been broken down into three smaller objectives:

*\* Objective One: Develop a Knowledge Base of Coastal Ecosystems and their Services in the two Case Study Regions.*

This objective is focussed on determining the extent of critical coastal ecosystems and their services in both of our case study regions (Tauranga Moana and the Horowhenua coast). The relevant research questions are: What are they? Where do they occur? How can they be measured in biophysical, cultural and other terms? How culturally significant are they? How much are they worth or valued?

*\* Objective Two: Determine how to Enhance and Restore Specified Coastal Ecosystems and their Services in the two Case Study Regions.*

The MTM team will harness and build on the knowledge from Objective One to answer the central research question of: 'how can we best enhance and restore the value and resilience of coastal ecosystems and their services, so that this makes a positive contribution to iwi identity, survival and welfare in the case study regions?'

This will be achieved through detailed case studies in both regions, on topics of importance to local iwi and hapū in ascertaining how to go about restoring coastal ecosystems and their services. The MTM team will also work in with other 'end user' groups and local councils who may also be undertaking complementary-focussed research.

*\*Objective Three: Implementation and Benefit Transfer to other Iwi.*

A condition of involvement of both Tauranga Moana iwi and Ngāti Raukawa in this research programme is that the research be implemented to bring about real change in the state of coastal ecosystems in their rohe. Both Tauranga Moana iwi and Ngāti Raukawa have catalogued the poor state of many coastal ecosystems in their rohe, recalling accounts from tribal elders, for example, of the abundant kaimoana found 30 to 40 years ago, but no longer today. Both iwi groups are committed to arresting these trends and are keen, through this research programme, to put in place Action Plans and other mechanisms to improve the quality of the coastal environment.

Figure 1 broadly portrays the various objectives and phases of MTM.

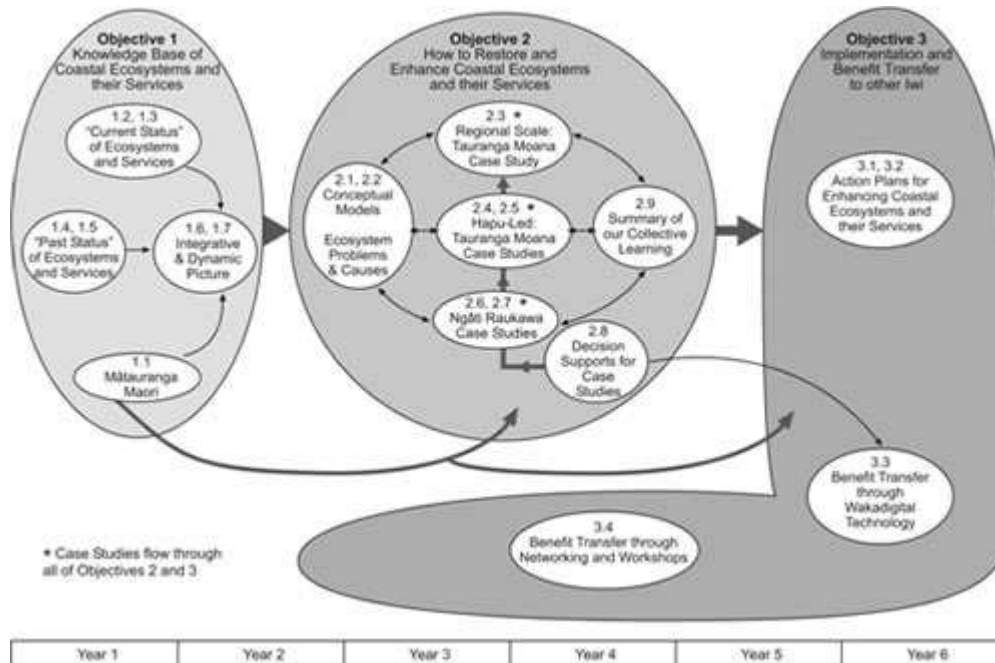


Figure 1: MTM Project Timeline

### 1.3. The Manaaki Taha Moana (MTM) Research Team

Professor Murray Patterson is the Science Leader of MTM (M.G.Patterson@massey.ac.nz). Researchers from a number of different organisations make up the MTM Research Team: Waka Taiao Ltd with support of Te Manaaki Awanui Trust in the Tauranga moana case study (who are also participants in various aspects of the research); and Taiao Raukawa and Dr Huhana Smith in the Horowhenua coast case study. In addition, researchers and practitioners from the following organisations are part of both the Tauranga and Horowhenua research teams: WakaDigital Ltd; Cawthron Institute; and Massey University.

In the Horowhenua case study, the MTM team also collaborates with the School of Architecture and Design and postgraduate Masters students at Victoria University to develop action plans with hapū for coastal restoration.

The MTM research team does its best to engage extensively with local communities and end users through a variety of means, described more fully in section 5.3.

### 1.4. Other Outputs from MTM Phase 1

This report provides an overview of the research activities for Phase 1 of MTM, which focussed on 'building up a knowledge base of coastal ecosystems and their services', in both case study regions (see Figure 1, Objective One, Years 1-2).

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The research tasks associated with MTM Phase 1 are described more fully in Section 5. In summary, these were:

- A 'stocktake' of what is already known about the state of coastal ecosystems in each rohe (Tauranga Moana, and Horowhenua coast from the Hokio Stream to Waitohu Stream), including both mātauranga Māori and western science knowledge. Results were made available in:  
-written reports  
(see: [http://www.mtm.ac.nz/knowledge\\_centre-publications.php](http://www.mtm.ac.nz/knowledge_centre-publications.php)); and  
-searchable on-line Digital Libraries that anyone can use to discover what reports and other information exists about the state of coastal ecosystems in each rohe  
(see: [http://www.mtm.ac.nz/client/knowledge\\_centre-digital\\_library.php](http://www.mtm.ac.nz/client/knowledge_centre-digital_library.php)).
- A scoping systems dynamics model of Tauranga Harbour and the inter-relationships between the various factors that contribute to its health. This model was developed through a series of 'mediated modelling' workshops in which stakeholders helped develop the model and can go on to use the model to identify and solve problems.  
(see: <http://www.mtm.ac.nz/mediated-modelling/>).

## **1.5. Future Phases of MTM**

The culmination of the above activities helped to inform the MTM research team about what knowledge gaps exist regarding the state of the coastal ecosystems and their services in each case study rohe, and what the most critical areas are for ongoing investigation. Based on the conclusions of these 'stocktake' exercises, in close collaboration with local tangata whenua, from mid-2011 MTM is undertaking detailed case study research in both Tauranga moana and the Horowhenua coast, as described in section 6. Further reports and tools will be produced outlining these case studies.

As the MTM research progresses, we will continue to utilise both western science and mātauranga Māori to assist iwi and hapū to evaluate and define preferred options for enhancing and restoring coastal ecosystems. This evaluation of options is also assisted by the development of innovative Information Technology (I.T.) and decision support tools (such as, for example, simulation modelling, interactive mapping, 3D depiction, real-time monitoring) by WakaDigital Ltd, and with the School of Architecture and Design at Victoria University in the Horowhenua case study. Action Plans will be produced for improving coastal ecosystems in each rohe (area).

The research team works as closely as possible with iwi and hapū in the case study regions to develop tools and approaches to facilitate the uptake of this knowledge and its practical implementation, including amongst other iwi throughout Aotearoa/New Zealand.



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The MTM research design includes the purposeful inclusion of both ‘western science’ and mātauranga Māori, albeit in varying concentrations throughout different phases of the research. There are phases during the 6-year MTM programme in which research is planned that could be classified as more ‘western science’ oriented, and at other times there is a greater focus on mātauranga Māori. However, as a whole, MTM is purposeful in its intent to conduct research that is meaningful to tangata whenua, and that will go some way towards restoring the health of coastal ecosystems in ways that the local communities have deemed to be important and appropriate.

## **2. INTRODUCTION TO THE STUDY OF COASTAL ECOSYSTEMS AND ECOSYSTEM SERVICES**

MTM aims to restore coastal ecosystems and ecosystem services that are important to iwi and hapū. ‘Ecosystem services’ are those things that the natural environment contributes to humans for our very survival and wellbeing. Ecosystem services include *products* like clean drinking water or wood products, and *processes* such as the filtering of waste, protection from floods, spiritual and recreational benefits. Academia typically groups ecosystem services into four categories:

- *provisioning*, such as the production of food and water;
- *regulating*, such as the control of climate and disease;
- *supporting*, such as nutrient cycles and crop pollination; and
- *cultural*, such as spiritual and recreational benefits.

Coastal environments provide critical ecosystem services (Wilson & Liu 2008) and can be a focus for people’s pride of place and for the identity of an area (Pedroli 2005; Sunde 2008). However, many ecosystem services are effectively ‘invisible’, and this makes them more likely to be taken for granted, ignored, or not known about at all by some people. This lack of understanding about ‘ecosystem services’ is quite widespread, including by people who have responsibility to make decisions about those very natural environments that provide such important ecosystem services.

Without an understanding of how changes to one part of the coastal environment will impact on the rest of the things in that system, decisions are often made in isolation that end up being harmful to the overall ‘system’ of the coastal environment. The result is that, increasingly in many coastal environments, ecosystems are being intensely modified and degraded as a result of urban growth and coastal tourism, flood control, agricultural and horticultural intensification, invasive species, and industrial development (Patterson & Hardy 2008). For this reason, the MTM research aims to be ‘integrated’ in its approach to coastal research, by considering the interactions between different aspects of the overall coastal environment. This also includes consideration of cultural, social and economic factors associated with the ‘ecology’ of the coastal environment.

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As mentioned earlier, coastal ecosystems are increasingly threatened with expanding urban settlement, pressures from port activities and marina developments, pressures from coastal tourism activities and, importantly in the New Zealand context, from the indirect and cumulative effects of rural land use (Briefing paper to Incoming Government 2008; Green & Clarkson 2006; Patterson & Hardy 2008). When measured in economic terms, the magnitude of this loss of coastal ecosystems is very clear. Estuarine ecosystems in New Zealand were broadly estimated to have a value of \$<sub>1994</sub> 3,927 million (per year) in terms of the ecosystem services that they deliver, and mangrove ecosystems were estimated at a comparable value of \$<sub>1994</sub> 67 million (Patterson & Cole 1999). The entire coastal zone may, in economic terms, provide ecosystem services much more than this, perhaps up to half the value of terrestrial ecosystem services (Patterson & Cole 1999).

The ecological impacts from these accelerating pressures on coastal ecosystems are of serious concern. When coastal areas are modified to make way for urban development, as one example of coastal degradation, this has a flow on impact on the plant and animal life that depend on that environment. For example, removing mangroves destroys the habitat that birds had used to nest their young; the draining of wetlands reduces the capacity for flood protection and filtering of waste that the wetland area once provided.

Likewise, the degradation of coastal resources has cultural implications, which is particularly alarming for Māori. The loss of cultural resources negatively impacts on local communities who are increasingly unable to access coastal ecosystem services that they have long relied upon for cultural traditions, sustenance and recreation. Things such as the provision of food, the culturally-relevant traditions associated with collecting kaimoana, and the spiritual benefits associated with a healthy coastal environment can also be thought of 'ecosystem services' that are provided by coastal ecosystems.

The customary collection of shellfish and other kaimoana from along the coast by tangata whenua for many generations is an important contributor to physical sustenance and wellbeing, but also cultural identity. Māori tribal identity and wellbeing are inextricably intertwined with place – the features and forms of the land that families and tribal groups are associated with, the natural resources and species of that land and its waterways, the cultural structures like communal centres, and all the histories and knowledge that are part of a place (Smith et al. 2011). This close association of Māori with the natural environment is explored more in section 3.

Mana (sense of pride) suffers when Māori are unable to demonstrate appropriate hospitality through the provision of kaimoana from their coastal area because of depleted or polluted fish stocks (e.g., see Hauraki Trust Māori Board 2003; van den Belt et al. in review). Māori are thus keen to stem the decline in availability of culturally-important seafood species, for example, and to effect change in the use and management of coastal resources to enhance the sustainability of coastal ecosystems, and in so doing to also enhance cultural sustainability (MfE 2005).

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When coastal environments are polluted, modified or destroyed, the ability for tangata whenua to interact with the coastal environment (as explored more fully in the next section) is also reduced, and thus the inherent connection between ‘people’ and ‘place’ is ‘disconnected’. As with coastal estuaries, whereas the river would once have been the social and economic focus of an area, and communities would have accustomed themselves to its vagaries, in many urbanised areas it has now virtually been forgotten (Selman et al. 2010). This displacement of local people from close associations they once had with their coastal environments is further exacerbated by the ‘disconnection’ many experience when excluded from decision-making processes through which ongoing degradation might be stemmed.

Successful coastal ecosystem restoration, such as that intended in the MTM research programme, ‘reconnects’ coastal ecosystems so that they are able to function effectively again, and continue to provide the ecosystem services that humans are so reliant upon. The process of ecological restoration can also help to restore the sense of pride and connection that local communities have with their natural environments and waterways, especially where stakeholders are engaged in processes of rehabilitation and restoration. In so doing, the people are also ‘reconnected’ to ‘place’.

Understanding and then bolstering the health of coastal ecosystems and their services requires research that goes beyond the ‘business-as-usual’ single-discipline, single-culture, single-organisation and reductionist approach to science. Fundamental to effective restoration of complex coastal and marine systems is research that is integrative, holistic, dynamic and incorporates cross-cultural dimensions in examination of the system. Participatory action research methods help accomplish research of this nature, especially in a cross-cultural context involving indigenous people, and in this case local tangata whenua for each case study region.

The participatory approach of MTM goes some way to facilitating the ‘reconnection’ of links between local communities and their coastal environments, through engagement in the research process itself, with researchers/scientists and local people working alongside each other in the research, and through our collective dialogue and actions to restore coastal ecosystems. Likewise, engagement of local communities in decision making around the selection of detailed case studies for research, and in coastal management policies, is encouraged through MTM. The MTM research approach has enabled Māori and non-Māori, public and professionals, academic researchers/scientists and local people with extensive local knowledge, to spend time sharing stories, local wisdom, hopes, and fears in a personally engaged manner.

The following sections introduce mātauranga Māori and the role of the natural environment for Māori. They go on to highlight the important contribution of mātauranga Māori to environmental restoration research, and discuss the importance of environmental research being conducted in ways that are appropriate and beneficial for Māori. The importance of tangata whenua involvement in the monitoring, management and restoration of environmental resources, including coastal ecosystems, is also discussed.

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### **3. CONDUCTING ENVIRONMENTAL RESTORATION RESEARCH OF IMPORTANCE TO LOCAL INDIGENOUS COMMUNITIES**

#### **3.1. Indigenous Knowledge of the Environment**

As a people group, indigenous people possess a rich knowledge of ecological systems and relationships within the natural world, accumulated through a long history of resource-use in specific locales. This indigenous knowledge is passed down through generations, combining practice, knowledge and belief systems (Berkes 2008).

Examples abound overseas where indigenous communities have detected long-term changes long before they were noticed by scientists (Berkes et al. 2000; Moller et al. 2009c); for example, climate change in the Arctic (Berkes et al. 2005). As with indigenous peoples around the world, tangata whenua have a distinct understanding of the natural world and their connection to it; a knowledge system about natural ecosystems and their interaction with human and other systems (Harmsworth 2005).

Māori knowledge (mātauranga Māori) is defined by FRST (2005) as knowledge that arises from, is based on, or contributes to the distinct culture, identity and collective experience of Māori including knowledge: 1) that reflects the range of values, concepts, principles, practices of world views that define Māori as a distinct social group; 2) related to technologies and practices that have developed from systemic and inter-generational observation and experience of New Zealand and its natural environment; and 3) that specifically addresses a resource of cultural importance to Māori.

It has been stated in the literature that 'mātauranga Māori' is probably the closest equivalent Māori term for 'Traditional Ecological Knowledge' (TEK) (Moller et al. 2009b), which the scientific literature often refers to when referencing knowledge from indigenous peoples about the environment. It is important to note, however, that 'indigenous knowledge' encompasses the many knowledge bases that contribute to the way that the world is understood. This distinction is more than semantics, because it is important to recognise that 'ecological knowledge' is just a fraction of the knowledge that is held by indigenous peoples. Indigenous knowledge is more than only the ancient understandings and practices from centuries ago, but is a continuum of knowledge including the sacred knowledge and traditions of ancient times as well as the lived experiences of people over time, and the more contemporary understandings of indigenous people who have built upon traditional knowledge by taking knowledge from other knowledge sources as well. This has been referred to as the 'mātauranga Māori continuum' in the New Zealand context (e.g., Royal 2006, 2009; Winiata 2006). This is similar to

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the way in which ‘science’ has adapted and developed over time (see Hardy & Patterson 2011).

The holistic, systems view of many indigenous groups actually reinforces the point that ‘ecological’ understandings – like ‘spiritual’ and ‘social’ and ‘economic’ and other subsets of understanding – need to be considered within the wider ‘systems’ view. A systems view takes into consideration the interactions between all aspects of the ‘system’, instead of a reductionist, compartmentalised approach as can be the case in western paradigms (Hardy and Patterson 2011). Mātauranga is an all embracing concept combining knowledge, identity, place and in the case of its application to mahinga kai in the past, the key to bioeconomic security of Māori (Moller et al. 2009c).

### **3.2. Indigenous Peoples’ Relationship with the Environment: the Aotearoa/New Zealand context**

Natural resources have multiple values to Māori, and play a critical role in their culture, people, land identity and spirituality. This relationship has formed over hundreds of years of continuous habitation and interaction where Māori have established and demonstrated environmental mātauranga and sustainability (capable of contributing to environmental research) (FRST 2009).

As part of their ancestry, which places Māori within an ecological sphere at the same level and linked to things in the natural world, a large number of responsibilities and obligations were conferred on Māori to sustain and maintain the well-being of people, communities and natural resources. Kaitiakitanga is the practice of spiritual and physical guardianship of the environment based on tikanga (traditional processes and protocols) and is therefore ‘active’ rather than ‘passive’ guardianship or custodianship (Harmsworth et al. 2002a, 2005). It includes aspects of guardianship, care, wise management, custodial responsibilities and stewardship. To most contemporary Māori, kaitiaki is not simply the exercise of traditional property rights, but entails an active exercise of power in a manner beneficial to the resource (Harmsworth et al. 2002a).

The exercise of kaitiakitanga arises from the Māori worldview where concepts concerning long-term occupation and authority over lands are regarded as expressions of rangatiratanga (exercise of authority, chieflihood, leadership) and mana whenua (authority over land). Spiritual beliefs appropriately honour a sense of sacredness, prohibition, and the protection of the energy or life-force within everything. Kaitiakitanga is expressed through everyday environmental activities from the most sacred or tapu aspects of Māori spirituality, to simple acknowledgement of codes of behaviour associated with manaaki, tuku and utu (respect, reciprocity and obligation to the natural world). Kaitiaki may be human but the term is also used for spiritual beings (including the higher deities) for tribal guardians or spiritual keepers (Ropiha 2005).

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According to Smith (2007), a cross-indigenous perspective would view the ultimate source of knowledge as the changing ecosystem itself. As peoples manifested relationships with resources, the environmental knowledge base expanded. Perhaps the closest concept that describes the unity and interrelationship that exists within indigenous knowledge systems is the knowledge that expressed vibrant relations between people, their ecosystems, and the other living beings and spirits that shared the lands. They remain multi-layered relationships that are relevant to the maintenance of social, economic and diplomatic relationships. In this way too, kaitiaki or taniwha (a spiritual entity, a force within nature - takes many guises) relevant to the Kuku coast, could not be separated from the territories in which they occurred. They required ongoing and utmost respect (Smith 2007).

A framework of inclusive environmental values reiterates how Māori whakapapa reference systems denote a shared genealogy between spiritual entities, animals, plants and human-kind (Durie 1996). This extended to whānaungatanga, the kinship ties between people and entities, and their sense of belonging and inter-relatedness. Wairuatanga is about the respect given to the spiritual aspects that existed within lands and waterways. Manaakitanga is the environmental value that protects and cares for resources for associated human sustenance and well-being. Rangatiratanga recognises how iwi and hapū authority leads the decision-making processes over tribal areas. Rangatiratanga is the value closely aligned to mana whenua, as authority over lands, and mana moana, as authority over waterways and sea. Mauri as the ultimate vitality of ecosystems and resources was ascertained by knowing the extent of pollution in an ecosystem, the levels of abundance present and its regenerative capacities. Whakakōtahitanga announces the coming together of people in respect of each other, as relations who recognise everyone's individual differences, and the desires of consensus, unity and solidarity as a collective. As the natural environment and associated knowledge systems had provided for people so well in the past, people expressed the value of tau utuutu or reciprocity, by giving back to the land in return (Durie 1996).

### **3.2.1. Tangata whenua relationship with the coastal environment: examples from the Horowhenua case study**

In prior times, secure occupation by peoples along the coast came about through collective usufructuary (use) rights. To protect the mauri (intrinsic life vitality / essence) in landscape, ancestors used certain forms of cultural marker as evidence of their kaitiaki rights in the interrelated regions along the coast. For example, historically, resource users erected pou or pou rāhui (pole or erected item that has cloth or hat or material on top of it to show someone is using resources in the area) at different stages to protect their harakeke supplies for flax dressing, oftentimes at areas within the Waitohu stream and wetland areas near Ōtaki.

In collating all relevant Māori Land Court Minutes for the Horowhenua case study region, for example, it is noted that in the Ōtaki, Foxton or

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Wellington Native Land Court, transactions or ancestral accounts over lands chronicled and recorded associated resource use rights as critical connections to lands and wetlands. Māori introduced the tikanga or custom of rāhui as a prohibition or ban to protect resources from overuse, to conserve and ensure the replenishment of mauri. Certain formalities or protocols, karakia or incantations around the practice of rāhui also demarcated areas and protected the resources within them from unsustainable use. Kaitiaki as resource guardians might erect a post as a pou rāhui with some fern fronds or a piece of clothing attached to it, to distinguish the site in use (Best 1898). Sometimes, rāhui involved placing a mauri stone or other object in order to aid the pro-life processes of recovery and regeneration by focusing the mauri of particular species within that area (Marsden 1988). Kaitiaki could also impose a rāhui if a location had become tapu or sacred due to a death or battle on the site (Marsden 1988).

As an example, localised practices of marking boundaries or erecting pou rāhui to sustain mauri and protect resources are described in a region of the south-west Horowhenua coast near the original Te Waitohu pā at the mouth of the Waitohu Stream that lay south of the Waikawa River. Simple wooden posts or pou rāhui were erected around resources like harakeke to indicate to others that the resources within the lakes and wetlands were being used in some way, often in the cutting or preparing of harakeke fibre. In evidence given in a Native Land Court sitting about an area identified within No. 229 Sub claim. Pukehou- 4C, a dispute arose about access to lands, lakes and use rights to the wetland's harakeke resources. In an excerpt from the protracted case over rights to occupy, use resources, set boundaries and succeed to areas, written evidence indicates how local acts of kaitiakitanga were performed (Smith 2007). According to Wehipeihana (1889-1890), recorded in Ōtaki Minute book:

‘...Wairaka<sup>1</sup> was the principle one and through him it [the land] descended to Hori... while Wairaka occupied he possessed the land with his son Hori. They belonged to Ngatikapu and Te Mateawa. When they first occupied they cultivated at Te Waitohu<sup>2</sup>. After they occupied near Rotokaio flax dressing... I saw a pa rāhui harakeke put up by Wairaka to preserve the flax at Ngoungou<sup>3</sup>. I saw the kainga haro muka o Hori that Hare Hemi stated was a kainga wakatete.’

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<sup>1</sup> Wairaka was directly related to the warrior ancestor, Kapumanawawhiti. He was father of Keremihana Wairaka, who in turn was father of Unaiki Keremihana (report co-author, Huhana Smith's great great grandmother). Hare Hemi (report co-author, Huhana Smith's great great great grandfather) was a brother of Koronīria [Te Whakawhiti or Koronīria Rangiwahakaripa]. With their sister Pirihira, Hare Hemi and Koronīria were the children of fighting chief and Te Rauparaha ally, Rangiwahakaripa (also known as Te Rangiwahakaripa) and Miraka Powhirihaui. The siblings of Rangiwahakaripa were his sister Waipare and brother, Poutama.

<sup>2</sup> An occupation area, near the mouth of the Waitohu stream north of Ōtaki.

<sup>3</sup> Ngoungou was a name given to a plough and a wetland region within the Pukehou block, north of the Waitohu stream. The plough had been purchased with the rent paid by a Pākehā farmer who grazed the area with his sheep.



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Additional local narratives for the Horowhenua case study have been sourced through New Zealand Historic Places Trust files and Māori Land Court minutes. They offer knowledge that provides a vital link between regions as related hapū (Ngāti Kapumanawawhiti, Te Mateawa to Ngāti Tukorehe) occupied areas that covered regions around Waitohu, Waitawa, Pukekaraka, and Mangapouri areas of Ōtaki. When Pukekaraka (the hill overlooking and including the present day Te Pou o Tainui marae) was occupied as part of the conquering expeditions of Te Rauparaha, other related tribes also settled in the region. Like their relations in adjoining northern coastal regions, the fertile grounds within forest cover were well under cultivation at Pukekaraka from the 1840s.

Ngāti Kapumanawawhiti readily adopted the new economies introduced by Europeans into the area. With rival missions operating in the Ōtaki district, British Anglicans founded their mission in 1839 and the French Catholics in 1844. The Mangapouri stream at the southern edge of Pukekaraka Block 5 became a form of boundary between these Christian spheres of influence.

Particular customary activities offered by Ngāti Tukorehe and Ngāti Wehiwehi were accorded to the Anglican mission and church Rangiatea, commissioned by Te Rauparaha, built and completed by 1849 at Ōtaki. Related hapū of Ngāti Tukorehe offered their allegiances to Christianity, initially through the Anglican Church.<sup>4</sup> Esteemed ancestor Koronīria Rangiwahakaripa was the tohunga (referred esoteric knowledge specialists) who presided over the felling of the tōtara trees sourced from Ngāti Tukorehe lands at Pukeatua, on Ōtararere ridgeline adjacent to the Ōhau River, Horowhenua. The logs were floated down the river with his wife Turuhira (according to accounts) assisting the process by urging the flotilla on, riding the logs, bearing a taiaha and performing haka.<sup>5</sup> The logs were floated across the wetlands of Waitohu to the present site of Rangiatea the rebuilt church. The logs were not rolled across ground as suggested by some other Ōtaki based hapū, but floated and pulled across more expansive wetland regions in pre-drainage times.

The French catholic missionary, Jean Baptiste Comte (Pa Kometa) arrived in 1844 at Pukekaraka to promote Christian religious instruction as the guide to material and spiritual change for iwi and hapū. By the time he left the district in 1854, Ngāti Kapumanawawhiti had substantial grain cultivations, a shop, a mill, flax ropewalks, orchards,<sup>6</sup> as well as a merchant schooner for transporting produce to the growing markets in Wellington. The wheat crops grown by a bend in the Ōhau River by Ngāti Tukorehe, Te Mateawa, Ngāti Kapumanawawhiti ki Kuku and at

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<sup>4</sup> Koronīria Rangiwahakaripa is referred to in Native Land Court minutes, No 8 page 10, Manawatu Kukutauaki 4F, 27 June 1889, 12. Koronīria is buried in the urupā opposite the original Ōhau pā, in dunes overlooking Kuku coastline.

<sup>5</sup> The Booklet Committee, 1964, *The Centenary of the Rowland Family in New Zealand 1864-1964*, 19.

<sup>6</sup> Notes from St Mary's Church Pukekaraka file no 12004-150 Vol 2, New Zealand Historic Places Trust, Wellington.

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Waikawa by hapū of Ngāti Wehiwehi were transported and milled in the Catholic Pukekaraka mill at Ōtaki.

It is surmised that the massive 1855 earthquake destroyed the grain mill,<sup>7</sup> and that the Ngāti Kapumanawawhiti schooner ran aground on the Ōtaki bar. The commercial ventures of Ngāti Kapumanawawhiti finally petered out when the market conditions for harakeke collapsed. With this downturn their ropewalk mill and shop went out of business. When Comte left the district a somewhat disillusioned Ngāti Kapumanawawhiti abandoned Catholic religious instruction.

From the 1860s, Pukekaraka became a stronghold for the Māori King movement, the important political interest group for Māori self-assertion, where 'Kingite flags were flown, armed men drilled and patrolled and large meetings debated options which alarmed Pākehā settlers... Māori too lived in constant tension from the threat of armed intervention by the government. Ngāti Raukawa Kingite gatherings at Katihiku and at Pukekaraka in Ōtaki from June to September 1863. At Pukekaraka the 'Kingite flag fluttered in defiance for the Queen's law' and Kingite's there 'made their own laws and drilled their own soldiers also in defiance of government authority.'<sup>8</sup>

In the mid 1860s other notable politico-religious ideas were introduced by preachers of the Paimarie (Hauhau) faith. Between the attractions of Pai Marire and lack of instruction in Catholicism, the flock built up by Comte had greatly diminished by the time the next resident priest Delphine Moreau S.M. arrived.<sup>9</sup>

### **3.3. The Importance of Indigenous Knowledge in Environmental Research**

Indigenous knowledge systems have an important place in research and policy efforts to monitor and restore degraded coastal ecosystems. According to Jollands & Harmsworth (2006), however, "the present level of engagement of indigenous groups and communities in New Zealand in sustainability monitoring remains low, under-resourced, and uncoordinated. To improve the worldwide quality of sustainability indicators there is an urgent need to address this poor participation" (p.716). Indigenous knowledge must be elevated into 'mainstream' environmental research, so that it can meaningfully contribute to exploration of the issues facing the world today (Hardy & Patterson 2011).

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<sup>7</sup> 78 *ibid.*

<sup>8</sup> This contextual information was sought from The Estate of W.W. Carkeek, 2004, *The Kapiti Coast: Maori History and Place Names of the Paekakariki-Otaki District*, Reed: Wellington, 134-144.

<sup>9</sup> Patricia Adams, 1987 'For the Salvation of the Māoris': The Catholic Mission of Pukekaraka, in J.Wilson (ed) *The Past Today*, New Zealand Historic Places Trust, 28-29.

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Citing examples of indigenous peoples having had their integrated and holistic development models largely overlooked by mainstream efforts to conceptualise and operationalise sustainable development, Loomis (2000) concludes that “more attention must be paid to indigenous initiatives if we are serious about finding viable approaches to sustainable development” (p. 893). Indigenous people’s philosophical thought should not be dismissed as “having too little analytical or scientific merit in confronting issues such as sustainable development”, or ignored because many groups see them as “obstructionist or idealistic” (p.896). Instead of trying to ‘harness’ practical indigenous knowledge to facilitate preconceived development models – an approach that is both derogatory and ineffective – there is growing recognition that indigenous epistemologies, science and ethics have much to offer the sustainability debate (Pieterse 1999 on the value of “critical holism”, cited in Loomis 2000, p.896).

The New Zealand Exclusive Economic Zone is so large that coastal-marine areas are by far the most extensive and least understood of all habitats in New Zealand (Moller 2009). Our knowledge of New Zealand’s complex and extensive marine system lags well behind that of terrestrial systems; the current knowledge gaps concerning marine processes and ecosystem functioning hamper development of sustainable resource management responses (Briefing paper to Incoming Government 2008; Green & Clarkson 2006). With such scarcity of knowledge and understanding about coastal issues, it seems sensible that all knowledge that is held about how to sustainably manage and live in such fragile ecosystems be harnessed, in order to effect positive change and restoration to treasured ecosystems, including knowledge from both ‘western’ and indigenous knowledge systems.

Partnership of science and mātauranga bridges a much more fundamental divide than simply the right to manage. Partnership of mātauranga and science could underpin shared or devolved power to manage New Zealand’s environment, but when set against a recent history of colonisation and assimilation, this requires acceptance of risk and development of innovation and trust rather than integration of knowledge systems” (Moller et al. 2009c, p. 236). Berkes (1994) poignantly refers to co-management as “bridging two solitudes”.

There appears to be widespread political will at the policy level for Māori and non-Māori to work together on restoring coastal ecosystems. For example, the *NZ Coastal Policy Statement* (DOC 2008) outlines how iwi and hapū can contribute to sustainable coastal management by exercising functions and powers within the Resource Management Act; the *NZ Biodiversity Strategy* (DOC 2000) emphasises ‘Partnerships in Biodiversity Management’, ‘Mātauranga Māori’, and ‘Customary Use of Biodiversity’. Furthermore, New Zealand’s *Environment Research Roadmap* (MORST 2007) particularly addresses the knowledge needs of understanding how can estuaries and coastal marine environments be protected from further degradation from land-based sources; and discovering distinctive and successful approaches to

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environmental sustainability by exploring iwi and hapū relationships with land, sea and kaitiakitanga.

Most importantly, in early July 2011 the WAI 262 deliberations resulted in the Waitangi Tribunal Report *Ko Aotearoa Tēnei*<sup>10</sup>. It recommends reform of laws, policies or practices relating to health, education, science, intellectual property, indigenous flora and fauna, resource management, conservation, the Māori language, arts and culture, heritage, and the involvement of Māori in the development of New Zealand's positions on international instruments affecting indigenous rights. These recommendations include law changes and the establishment of new partnership bodies in several of these areas. The Tribunal makes it clear that the Treaty envisages the Crown-Māori relationship as a partnership, in which the Crown is entitled to govern but Māori retain tino rangatiratanga (full authority) over their taonga (treasures). This partnership framework provides the way forward for the Crown-Māori relationship.

The WAI 262 report has relevance to the MTM research programme in a number of areas. One key area is in guiding how decisions are made about the flora, fauna and wider environment that created Māori culture. Additionally, WAI 262 has relevance for decision-making about how education, culture and heritage agencies can *actively* support the transmission and survival of Māori culture and identity. In MTM, iwi and hapū aspire to fulfil their obligations as kaitiaki (cultural guardians) towards their taonga in each case study region. Local kaitiaki obligations in the Tauranga and Horowhenua case studies are central to ensuring the enhancement of coastal fresh waterways and associated ecosystems into the marine. Such kaitiaki obligations are pivotal to the survival of Māori culture in these rohe. Therefore, being able to establish genuine partnerships, strong working relationships and participatory research in which Māori interests and those of other New Zealanders are fairly and transparently balanced, is vital. In conclusion, the Tribunal said:

*It is time to move forward.*

*As a nation we should shift our view of the Treaty from that of a breached contract, which can be repaired in the moment, to that of an exchange of solemn promises made about our ongoing relationships.*

*There is a growing community realisation that New Zealand wins when Māori culture is strong. We have an opportunity to take this a stage further through genuine commitment to the principles of the Treaty ...*

*Such a commitment will not only fulfill – at last – the promise that was made when the Crown and tangata whenua entered their partnership at Waitangi. It will also pave the way for a new approach to the Treaty relationship: as a relationship of equals, each looking not to the grievances of the past but with optimism to a shared future. It is, in other words, time to perfect the partnership.*

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<sup>10</sup> See: <http://www.waitangi-tribunal.govt.nz/news/media/wai262.asp>

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Therefore, the mandate and recommendations from entities such as the Waitangi Tribunal and research funding bodies means that a coastal restoration research design, such as for MTM, must be *at least* partially participatory, whereby tangata whenua and other local groups have direct involvement in the research. In this way, Treaty obligations are honoured. At the same time, local people are also more likely to take up and implement the findings of the research when they have actively involved in it from the outset. Local communities can also directly benefit from the knowledge and tools generated in the research and can use it to address real issues and concerns that matter to them. In this research, for example, the MTM team have attempted to make previous research more accessible to the non-academic/scientific community by developing the Digital Library (see section 5.2.1) as so that pertinent publications and information about coastal ecosystems in each case study area are centrally located for anyone to access. Additionally, a participatory research approach builds up capacity amongst local people in technical, science, research and other related skills, because local people are directly involved throughout the research process.

The next section describes the research design and methods appropriate for environmental restoration research with local communities in New Zealand, particularly with tangata whenua. It goes on to discuss the approach utilised in MTM to facilitate the inclusion of mātauranga Māori and western science knowledge about coastal ecosystems in the research design. The intent of MTM is to prioritise the needs of tangata whenua in the rohe of our case studies, including in the selection of research questions and detailed case study topics. While it is not possible to research *all* of the topics and questions that have been identified by iwi and hapū in Horowhenua and Tauranga moana, great effort is taken, firstly, to identify those issues of coastal health that are important to tangata whenua, and, secondly, to find ways to incorporate those issues into MTM research plans. For details about the ongoing detailed case studies of MTM that were prioritised by tangata whenua in each rohe in discussion with the MTM research team, see section 6.

## **4. CONDUCTING ENVIRONMENTAL RESEARCH WITH MĀORI IN NEW ZEALAND**

### **4.1 Participatory, Action-Oriented research Methodologies for Research with Indigenous Peoples**

A research methodology is “a theory and analysis of how research should proceed” (Harding 1987, p.3), and as such it sets the parameters for the kind of research questions asked and the kind of data obtained (Gibbs 2001). The methodology of any research is therefore closely linked to the kinds of epistemological claims able to be made in the research process (Usher 1997). Choosing a method congruent with the worldview of research participants allows the researchers to ask questions that are meaningful and informative

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from the perspective of the research participants (Bishop 1997, 2003; Smith 1992).

The MTM research aims and objectives necessitate the use of participatory research methods whereby tangata whenua are actively involved in guiding the development of research questions and the means by which those questions are researched. There are increasing examples of the use of participatory methods in environmental research with local communities. Various methods have been employed in an attempt to reconnect local communities with their natural environment; for example, Selman et al. (2010) utilised 'imaginative engagement' to re-imagine the restored state of degraded rivers as the first step in an ongoing process to engage in sustainable living and restore waterways. Imaginative engagement as a mode of citizen participation—the use of arts-based methods to involve people actively in shared learning experiences—holds promise as a means to increase awareness and understanding, and to build capacity, for sustainable use and management of natural resources" (Selman et al. 2010).

Other initiatives (Collins et al. 2007, Ison et al. 2007) have used systems thinking and systemic co-researching to change paradigms for floodplain management. However, effective community engagement in river basin futures has often failed to secure social outcomes either because involvement has been restricted to a small circle of influential stakeholder groups (Junker et al. 2007), or because of institutional barriers (Moss 2004, Wilkinson 2005), or because decision-makers presume a "deficit model" of public knowledge (Eden 1998, Eden & Tunstall 2006) and thus over-rely on the communication of scientific information" (Selman et al. 2010).

In Phase 1 of MTM, a number of different participatory action research methodologies were used as a way of facilitating 'end user' involvement and active engagement in our research, and as a way of encouraging social learning and understanding of complex sustainability problems. In MTM, iwi and hapū are engaged in research that aims to restore cultural, spiritual and interpersonal health and functioning for targeted fragmented ecosystems in the case study. The research activities also advance local peoples reconnecting with natural and cultural landscape. The concerted efforts thus far have brought people together in one accord to take on the challenges of environmental decline. When kaitiaki mobilise together to instigate positive change for coastal and cultural landscapes, they increase understanding that contemporary human relationships with the environment are a highly complex and diverse phenomenon. Re-enhanced iwi and hapū interaction within a wide range of social, cultural, economic, political and ecological variables (Oviedo et al. 1997) have made a difference in protecting their cultural landscapes.

The MTM research approach has enabled Māori and non-Māori, the public and professionals, academic researchers/scientists and local people with extensive local knowledge, to spend time sharing stories, local wisdom, hopes, and fears in a personally engaged manner. These are described in section 4.3 below. Discussion about research structures to facilitate the input of

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knowledge from both Pākehā and Māori knowledge systems is explored elsewhere (see Hardy 2010; Hardy & Patterson 2011).

## **4.2 Conducting Cross-Cultural Collaborative Environmental Research with Māori**

It has been suggested that for iwi and hapū Māori (as indigenous peoples of New Zealand), ecological sustainability cannot be separated from cultural survival (Smith 2007). Some coastal ecosystems in the MTM case study regions (Horowhenua and Tauranga moana) have been so modified and degraded over a period of decades, that local communities have effectively become 'disconnected' from them. The issues of coastal degradation are thus or such concern that it is imperative research conducted in these regions does address the concerns of tangata whenua.

A principal concern for many Māori is that historically some research has failed to benefit them, even when they have been included in the research, or were 'the researched' population. Instead much previous research has benefited the typically state-funded researchers doing the research, who often live outside the local community that the research is centred on, and often approach the investigation from a completely different world view (e.g., see Bishop 1996, 1997, 1998, 2003; Gibbs 2001; Smith 1999). Further, some criticism aimed at research programmes historically is due to the fact that the research often does not address priorities for Māori, with Māori often being invited to comment on the research only after the topic itself has already been determined by the non-Māori research leaders. Too often, this results in irrelevant research questions, from the perspective of those who live in the rohe that is being researched. Māori must experience beneficial research that they collaborate on, especially when that research is conducted in their rohe. Research must answer questions that tangata whenua need answered, to ensure their own sustainability and cultural survival.

When undertaking culturally-appropriate collaborative research, the researcher must respect the social and cultural institutions of the research participants (Gibbs 2001; Harmsworth 2001, 2005; Lyver 2005; Moller 2009; Moller et al. 2009a-c). There are many recent positive examples of research conducted with Māori in New Zealand (e.g., Gibbs 2001; Harmsworth et al. 2002a,b; Harmsworth et al. 2005; Lyver 2005; Moewaka Barnes et al. 2008; Moller et al. 2009a-c; Sunde et al. 1999; Taiepa et al. 1997; Taiepa 1997, 1999a-b; Wilcox et al. 2008). This growing body of literature guiding such researchers provides a very helpful basis for planning and conducting cross-cultural, collaborative research programmes with different cultural knowledge and value systems. The tītī example is one of a growing number of research projects that have tried to break down the traditional monocultural model of ecological scientists working on things Māori from outside Māori communities (Moller 2009). These projects, together with the findings of Bishop (1996), Smith (1995, 1999) and Harmsworth (2001, 2005) provide a meta-analysis of challenges and



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opportunities to building meaningful collaborative research models within Māori communities (Moller et al. 2009c).

Moller et al. (2009c, p. 235) provide an interesting description of the long-term nature of effective cross-cultural, participatory action research:

“The full trust and experience needed for harmonious research process were not fully established until 8–10 years into this project... If it takes nearly a decade to establish the trust and the experience needed to work fully effectively in this cross-cultural arena, there is little prospect that many of New Zealand’s 50+ iwi will have an opportunity to participate in long-term science projects directed at issues of substantive interest to their *whānui* (wider families)...”

They go on to provide an interesting description of the challenges they encountered as Pākehā researchers undertaking cross-cultural research with Māori, and the need for support mechanisms (which are often non-existent) and guidance that is required to facilitate effective and safe cross-cultural research:

“Effective research partnership with Māori requires personal adjustments, self reflection and unimagined challenges not yet encountered by most scientists. Formal mentorship and systems to support Pākehā science teams engaging in crosscultural research are not in place at the University of Otago, and probably not at other New Zealand universities. If Māori communities choose to engage research teams made up predominantly of Pākehā, it is a matter of professional best practice that educational institutes establish support systems for those Pākehā as they negotiate a cross-cultural minefield. Stronger institutional support for the research leaders is required to keep them safe, especially if they are Pākehā or inexperienced in the issues” (Moller et al. 2009c, p. 235).

Likewise, it is critical that systems are in place to ensure a ‘safe’ working environment for indigenous researchers working in cross-cultural research programmes. Research designs to create ‘spaces’ for various components of a cross-cultural research programme that includes knowledge from multiple knowledge sources and researchers from diverse cultural backgrounds has been discussed by, for example, Durie (2004a, 2004c, 2005), Yunkaporta and McGinty (2009).

Effective partnership in cross-cultural research requires respectful recognition of the strengths and complementary nature of each knowledge system (Moller et al. 2009c). Choosing a methodology congruent with the worldview of the research participants allows the researcher to ask questions that are meaningful and informative from the perspective of the research participants (Bishop 1997). MTM takes a *whole-of-systems approach* that recognises the inherent complexity and inter-connectedness of coastal ecological processes, and the myriad of socio-cultural drivers at play. MTM also aims to maximise the opportunity for hapū and iwi partners to build highly innovative Māori

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science and management capability with the aid of current and emerging technologies (e.g., web-based open-source coastal resource management tools, spatial geographic information systems, and mediated modelling) to maximise the potential knowledge transfer and uptake of knowledge and tools developed.

As in many indigenous cultures, certain Māori knowledge is *tapu* (sacred or restricted from common knowledge) and is only passed on in a cultural context (Gibbs 2001). An important element of collaborative research with Māori, or any cultural group whereby certain knowledge is protected, is that very early on in the relationship the research team must come to a clear agreement with the customary knowledge holders about how their knowledge will be used in the research, how the research results will be disseminated, including rights to publish. Intellectual property rights to traditional knowledge must remain with the indigenous research participants, and the use of any co-knowledge developed jointly in the cross-cultural research programme must also be negotiated carefully (Gibbs 2001; Harmsworth 2001, 2005).

One framework that allows for the deliberate intent and ‘space’ whereby researchers can study and further develop their understanding from distinctive ‘mātauranga Māori’ and ‘western science’ perspectives, as well as ‘at the interface between both knowledge systems’ is the ‘Treaty House’, or 3-house partnership model, based on the Raukawa Mihingare governance model (Royal 2001) adopted by the New Zealand Anglican church as the basis of its multi-house synod and Te Wānanga-o-Raukawa in its relationship with the Crown (Cole & Patterson 2008). This model provides for the existence of discrete Tikanga (i.e., ‘right’ ways of conducting research and operating) spaces for Māori and Pākehā team members. In a 3<sup>rd</sup> ‘Treaty House’ space, researchers from both Treaty partners work together around mutual respect for each other’s methodology, methods, mātauranga, values and goals. In this 3<sup>rd</sup> space, the focus is on mutually mana-enhancing/uplifting activities that produce mutually-beneficial outcomes (Cole & Patterson 2008).

While not formally adopted in the MTM programme, the underlying principle of the ‘Treaty House’ model, whereby the research is designed to ensure researchers have the ‘space’ to investigate and undertake research from their own cultural or disciplinary perspective, while at the same time ensuring there are stages whereby cross-cultural discussion and understanding ‘in the interface’ across cultural and disciplinary perspectives, is an important aspect of MTM. This is explored more fully in Hardy and Patterson (2011).

### **5.1.1 Kaupapa Māori Research, and Participatory Action Research**

*Kaupapa Māori* literally means the *Māori* way or agenda, a term used to describe traditional *Māori* ways of doing, being and thinking, encapsulated in a *Māori* world view or cosmology (Henry & Pene 2001, p.235). Traditional *Māori* society was underpinned by an ‘economy of

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affection', in opposition to the capitalist 'economy of exploitation' introduced as a result of colonization (Henare 1995).

Kaupapa Māori research as developed by Smith (1997), Bishop (1996, 2003), and Tuhiwai Smith (1999), among others, is "the philosophy and practice of being and acting Māori." It assumes the social, political, historical, intellectual and cultural legitimacy of Māori people, in that it is a position where "Māori language, culture, knowledge and values are accepted in their own right" (Smith, quoted in Bishop 1996, p. 12). Henry and Pene (2001) cite the following *Māori*-defined understandings related to *kaupapa Māori* research:

- Research which is 'culturally safe' which involves mentorship of *kaumatua* (elders) which is culturally relevant and appropriate while satisfying the rigour of research, and which is undertaken by a *Māori* researcher, not a researcher who happens to be *Māori* (Irwin 1994);
- A desire to recover and reinstate *mātauranga Māori* the indigenous system that was in place before colonisation (Glover 1997);
- Research by *Māori*, for *Māori* and with *Māori* (Smith 1995);
- *Kaupapa Māori* challenges a universal approach [it must be] able to address *Māori* needs or give full recognition of *Māori* culture and value systems (Reid 1998).

Tuhiwai Smith (1999) summarises some of kaupapa Māori research's key elements as: *Aroha ki te tangata* (respect for the people); *Kanohi kitea* (the face seen, i.e., you present yourself to the people face-to-face); *manaaki i te tangata* (share and host people, be generous); *titiro, whakarongo, kōrero* (look, listen, [then] speak); *kaua e māhaki* (don't flaunt your knowledge); *kia tūpato* (be cautious); *kaua e takahi i te mana o te tangata* (do not trample over the mana of the people) (cited in Moller et al. 2009c).

Exceptions notwithstanding, there are distinctions between what was typical historically in 'western' *Pākehā* (non-Māori) and *Māori* approaches to the acquisition and construction of knowledge. For instance, Cram (1993) argues that the purpose of *Māori* knowledge is to uphold the *mana* of the community, whereas *Pākehā* view knowledge as cumulative, whose component parts can be drawn together to discover universal laws. Thus, *kaupapa Māori* research embraces traditional beliefs and ethics, while incorporating contemporary resistance strategies that embody the drive for *tinio rangatiratanga* (self-determination and empowerment) for *Māori* people (Henry & Pene 2001).

Henry and Pene (2001) argue that *kaupapa Māori* is both a set of philosophical beliefs and a set of social practices (*tikanga*). These are

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founded on the collective (*whanaungatanga*) interdependence between and among humankind (*kotahitanga*), a sacred relationship to the 'gods' and the cosmos (*wairuatanga*), and acknowledgement that humans are guardians of the environment (*kaitiakitanga*), combining in the interconnection between mind, body and spirit. Taken together, these kaupapa (ethics) inform traditional *Māori* ontology and assumptions about human nature; that is, 'what is real' for *Māori*. Traditional *Māori* ethics and philosophy also drive *Māori* epistemology; that is, to live according to *tikanga Māori*, that which is *tika* and true (Henry & Pene 2001).

Bishop (1996) argues that relationships between the researcher and *Māori* research participants should be characterised by "connectedness, engagement and participatory consciousness" (p. 238). The goal is for an *equal* partnership between the researcher and research participants, where the researcher maintains the right to academic freedom, in the sense of providing critical opinion (Ollman 1993, p. 129).

As Bishop explains (1996, p. 239), "Whakawhanaungatanga as a research process uses methods and principles similar to those used to establish relationships among *Māori* people". These principles are invoked to initiate the research, establish research questions, facilitate participation in the work of the project, address issues of representation and accountability and to legitimate the ownership of knowledge defined and created in the project (Gibbs 2001). As such, Bishop's (1996) research strategy is a "culturally constituted metaphor for conducting Kaupapa *Māori* research" (p. 215). *Whanaungatanga* is also the *Māori* term for connectedness and engagement and is "one of the most fundamental concepts within *Māori* culture, both as a value and as a social process" (Bishop 1996, 215). In terms of a research process, it provides a metaphor for repositioning the researcher and the research participants as collaborative research partners. All those involved are considered as part of a "whanau of interest" or "research whanau" (Bishop 1996, 219).

"Whakawhānaungatanga demands participation of all members of a community, so there is a natural synergy between participatory action research (PAR) and Kaupapa *Māori* approaches. There is also natural resonance between the approaches because the *tangata whenua* (original people of a place) are intensely rooted in a locale, they are more committed to sustainable use of that place because there is no prospect that they will go elsewhere, and their knowledge is often "place dependent" (whereas science often portrays itself as place independent)... Community participation to define "the problem", design an inquiry, gather and interpret results means that "uptake" of the research is much more likely to become a seamless part of the overall project. PAR and the additional

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aspects of Kaupapa Māori research have therefore much to offer non-Māori research process” (Moller et al. 2009c, p. 234).

## **5. COASTAL RESTORATION RESEARCH WITH TANGATA WHENUA: MANAAKI TAHA MOANA PHASE 1**

### **5.1 Rationale for the Design and Methods Utilised in MTM**

As summarised in section 1, MTM aims to restore and enhance coastal ecosystems and their services of importance to iwi and hapū, through a better knowledge of these ecosystems and the degradation processes that affect them. Accordingly, MTM purposely researches issues of most importance to tangata whenua in our case study regions (Tauranga harbour, and the Horowhenua coast between Hokio and Waitohu Streams). MTM will also develop tools and systems to empower tangata whenua to engage more fully in decision making, management and restoration of coastal ecosystems. Māori and Pākehā involved in this research are passionate and committed to utilising and building upon mātauranga Māori and western ecological science in a mutually mana-enhancing respectful manner.

Thus, the MTM research aims and objectives necessitate including participatory research methods whereby tangata whenua, in particular but also other stakeholder groups, are actively involved in guiding the development of research questions and the means by which those questions are researched. Accordingly, MTM has 3 phases, all of which include participatory action research methods:

- i. An initial stocktake exercise to determine the extent of critical coastal ecosystem services in both of our case study regions and to prioritise coastal restoration issues of most importance to tangata whenua.
- ii. Detailed case studies to determine how to enhance and restore prioritised coastal ecosystems and their services in the case study regions.
- iii. Action plans for implementation and benefit transfer to other iwi throughout New Zealand, and the world.

Central to MTM is an exploration of both western science and kaupapa Māori approaches to defining and valuing coastal ecosystem services of importance to iwi and hapū, and for facilitating the appropriate uptake and communication of such knowledge so that it is ‘heard’ in decision making processes. This requires MTM to identify those coastal ecosystem services that are important to iwi and hapū and to explore ways of ‘measuring’ them alongside the traditional ‘western science’ indicators of ecological health; and to conduct research in such a way that tangata whenua can reunite with their natural and coastal environments. Through this research, it is hoped that hapū and individuals, as well as non-Māori stakeholders/end-users, will positively engage in the search for answers as to why coastal degradation is occurring,

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and thus in working on practical restoration initiatives to stem that degradation.

The methods employed during the team-building and associated networking phase to put together the MTM team and successfully gain the stakeholder support and funding for MTM are grounded in a kaupapa and tikanga Māori epistemology of knowledge development supported by cross-indigenous perspectives and international standards for ecological and human wellbeing. This research approach also utilised during Phase 1 of MTM, particularly by Smith et al. (2011) in the Horowhenua case study and in Phase 2 in the Tauranga moana case study. Such methodological considerations aim to achieve ecological and cultural restoration goals in a whole-of-person, whole-of-system context. The use of these methods suggest that restoration of fragmented ecological systems is interdependently related to the healing of coastal communities, by reconnecting them with their fresh waterways and resources into the marine, within their natural and cultural landscapes (Smith 2007).

“Despite modification and damage exacted over time, what emerges from action research grounded in a kaupapa and tikanga Māori epistemology of knowledge development is that the restoration of these fragmented ecological systems in a cultural landscape of narratives and significance, is interdependently related to the healing of a community. When local kaitiaki emphasised protective mechanisms based on former customary information and experience about cultural and spiritual areas in landscape at the coast, they forged necessary safeguards to protect against inappropriate use and development. Furthermore, these kaumātua accounts relayed a range of experiences with natural resources and the river and beach environs” (Smith et al. 2011, p. 14).

## **5.2 Phase 1: ‘Stocktake’ of Existing Knowledge**

We have largely completed Phase 1 of the MTM research programme (see <http://www.mtm.ac.nz/research.php#1>), which was a comprehensive stocktake of key information about the past and current states of important ecosystems in both Tauranga moana and the Horowhenua coast. This helped prioritise our ongoing research, and we hope will help to inform Council 10-year plans, and strategic planning for tangata whenua and other stakeholder groups in our case study regions.

### **5.2.1 Digital library**

Lack of access to information limits the ability of Māori, for example, to effectively engage in decision making. A ‘Digital Library’ was created to house the published information, data, maps, photographs, reports and articles of relevance to Tauranga Moana and the Horowhenua coast. This tool, which will be updated throughout the MTM programme,

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enables researchers, policy makers and local Māori alike to more easily access scientific, mātauranga and other pertinent information, much of which was previously difficult to locate. This greatly reduces the effort that was previously required to identify and then source information, both 'western science' and Māori knowledge, and research about coastal resources. This can greatly enhance effective decision making around coastal resource use and restoration research. It must be noted, however, that some knowledge, especially mātauranga, is not 'open access'. Thus, the Digital Library has specially-designed protocols and mechanisms in place to ensure that, while the existence of certain information is noted in the Digital Library, access to that information can be limited to only those people designed as being allowed such access by the owners of that knowledge. For example, the Digital Library may contain reference to a certain map or photograph, but might state that access to that item is via the kaumatua (elder) of certain hapū. Thus, protections are in place to ensure the culturally-appropriate use and access to information. The development of this and other Information Technology tools in the MTM programme is described in more detail elsewhere (see: [http://www.mtm.ac.nz/client/knowledge\\_centre-digital\\_library.php](http://www.mtm.ac.nz/client/knowledge_centre-digital_library.php); McCallion et al. in review).

### 5.2.2 Stocktake reports

An analysis of the published information about the state of coastal ecosystems in both case study regions was conducted, resulting in two peer-reviewed publications: *Health of Te Awanui Tauranga Harbour* (Sinner et al. 2011), and *State of Ecological/Cultural Landscape Decline of the Horowhenua Coastline Between Hokio and Waitohu Streams* (Smith et al. 2011).

For the *State of Te Awanui Tauranga Harbour* report (Sinner et al. 2011), the MTM team reviewed and summarised all key published and grey literature on the ecological condition of Tauranga Harbour, drawing upon over 200 separate sources, and published a report describing the harbour's current condition and priorities for further research. The report is already proving a valuable reference and basis for discussion with the regional council and other science providers on research collaborations in Tauranga Harbour. This will increase the contribution that MTM can make towards maintaining and enhancing coastal taonga (valued resources) for the iwi and hapū of Tauranga Moana. The report also summarised the main research gaps in relation to Tauranga harbour (see section 6.3). An additional report summarising the mātauranga Māori and understanding of the health of the moana is also being developed.

The "State of Ecological/Cultural Decline of Horowhenua Coastline between Hokio and Waitohu Streams" report (Smith et al. 2011) included mātauranga and western science knowledge about the

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coastline, and described how iwi and hapū have interacted with these valued ecosystems historically. The research investigated intricate and complex environmental problems, assessed the extent of ecological decline in the case study area, and considered how well kaitiaki (as caretakers of the natural environment and their cultural landscapes) are dealing with the impact of fragmented systems with associated effects on their human condition.

Various kaitiaki in the Horowhenua to northern Kapiti region have engaged in action (i.e., kaupapa Māori research and oral archiving) research to collate knowledge about the decline of species. They have also devised enhancement activities for ecosystems that are more meaningful and relevant to their local Māori communities. They have used tikanga-based approaches when exacting research such as karakia (incantation) or mihimihi (welcoming speeches) to open and close oral archiving sessions. They have also grounded the collaboration with other entities through the exercise of tikanga and powhiri protocols at marae within the case study (Smith et al. 2011), particularly before students or research collaborators ventured out into the field for hīkoi, or for noho marae (stay over at marae) at Te Pou o Tanui Marae in March 2011, or presented their projects at Tukorehe Marae in October 2011 (see sections 5.3.1 and 5.3.4).

The report also depicted the current state of decline of key ecosystems and ecosystem services, and summarised critical areas for ongoing research (see section 6.1).

## **5.3 Phase 1 Engagement with Local Communities**

Prior to and during the first phase of the MTM research programme (see <http://www.mtm.ac.nz/research.php#1>), significant emphasis was put on ground-roots liaison and consultation with local communities. This is described below.

### **5.3.1 Consultation hui and networking**

#### Establishment and Initial Stages of MTM:

Manaaki Taha Moana evolved from earlier work that Massey University conducted with Ngāti Raukawa and associated iwi and hapū that formally began in 2006, examining terrestrial ecosystems of importance to iwi. Dr Huhana Smith led one of those terrestrial case studies, and continues to lead the MTM Horowhenua case study. As such, the networking and consultation that occurred for the Horowhenua case study continued the substantive work that had taken place prior to MTM in that rohe, with the significant input and leadership of Dr Anthony Cole. Dr Huhana Smith and the Taiao Raukawa team continue to consult widely regarding the ongoing involvement of Taiao Raukawa in MTM and in the development and submission of the funding proposal.



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In the late 1990s, various groups in Tauranga moana were involved in the development of technology named *efish*, designed to assist tangata whenua in the monitoring of customary fisheries take. Through WakaDigital Ltd., support for this initiative increased with organisations such as Te Ohu Kaimoana coming on board, and ongoing liaison with the Ministry of Fisheries. Through these networks, it was suggested to WakaDigital that the *efish* tool would potentially capture a lot of useful data that could be explored in a research programme. After initial discussions in late 2007, a team from Tauranga moana made contact with the research team at Massey University in early 2008. After a series of hui throughout 2008 and 2009, including a powhiri and full day hui at Te Wananga o Raukawa in July 2008, a partnership was forged that resulted in the ‘consortium’ of partners joining up to form the Manaaki Taha Moana research team (made up of WakaDigital Ltd, Massey University, Cawthron Institute, Dr Huhana Smith, Taiao Raukawa, Waka Taiao and Manaaki Taiao / Manaaki Awanui (more recently)).

Multiple hui occurred during this time in Palmerston North, Tauranga, Nelson, and Horowhenua to both bring together a team of researchers, scientists, tangata whenua from both case study regions, and end user supporters to conduct the research itself. The hui were also held to gain as much kaitiaki and end user support as possible, for involvement in the research. The team was supported by kaumatua and kuia in Tauranga moana, and in Horowhenua, who were instrumental in ensuring the research went ahead.

Two ‘concept documents’ were submitted to the Foundation for Research Science and Technology (FRST) for funding: one for ongoing development of the *efish* tool, and another to look at restoring coastal ecosystems of importance to iwi. The research team was invited by FRST to submit a Full Proposal for the latter research, so extensive work then went into writing a Full Proposal and gaining multiple letters of support to co-fund or support the research (see list on our website: [www.mtm.ac.nz](http://www.mtm.ac.nz)). The Full Proposal was submitted in early 2009, and was successfully funded by FRST, subject to the MTM team setting up clear governance and operational structures to ensure effective communication and participation of ‘end users’ in both case study regions.

Thus, MTM has a “Research Management Group” (RMG) for each case study, which is made up of representatives from each of the contracting parties to MTM, as well as tangata whenua representation. For example, the Tauranga Moana Research Management Group includes members from Te Manaaki Awanui Trust (which itself has representation from iwi/hapū across Tauranga moana). These RMG groups aim to meet approximately three times a year. We intend to also meet with a National Advisory Group, made up of people who have access to wide networks, and who can help support the uptake of the research for the greatest potential benefit for iwi and other end user

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groups around New Zealand and internationally. Likewise, a charitable trust or other entity representing the interests of tangata whenua in each case study region is a part of the MTM team, and thus links and regular communication back to local tangata whenua groups are possible.

A powhiri and hui to 'launch' MTM, after the successful funding, was held in Tauranga moana in early 2010, with key representatives from Horowhenua iwi, Cawthron Institute, Massey University and FRST travelling to Tauranga where we were joined by our WakaDigital and Manaaki Taiao colleagues, kaumatua and kuia and a wide range of other people from across the moana. Each 'member organisation' of the MTM consortium did a presentation about their organisation and their likely contribution to MTM, and Prof Patterson, Science Leader of MTM, gave an overview of the MTM research objectives and design. This was followed by a time for people to ask questions and seek clarification about the research.

#### Tauranga case study:

In addition to that described in the previous section, additional consulting and liaison with tangata whenua and other 'stakeholders' in Tauranga moana has been undertaken by the MTM team. Multiple hui at various marae around the harbour have been organised; some of these hui have been supported by Bay of Plenty Regional Council (BOPRC), with other research providers conducting research in the harbour (such as, for example, NIWA, University of Waikato's Intercoast programme with Bremen University in Germany, BOPRC) also being invited to present their research and engage with the local community. These hui are a useful opportunity for tangata whenua and other stakeholder groups to hear directly from researchers about research plans and findings, and to seek clarification or suggest changes to proposed research to maximise its usefulness to the local community. This also helps to ensure research is not duplicated by different groups, and also facilitates collaborative efforts between the various research groups, such as is occurring in Phase 2 of MTM.

A series of cluster-hapū hui were also conducted to communicate research plans to tangata whenua, to engage hapū in the research inasmuch as they wished to be involved. These hui were also one way of including mātauranga Māori about the moana in MTM research, and hearing from tangata whenua directly about their greatest concerns and research priorities in relation to the health of the moana.

The mediated modelling research conducted by the MTM team was itself a crucial means of maximising the input and involvement of tangata whenua and other key 'end user' groups of Tauranga harbour, in the research process itself (see more detail in section 5.3.3).

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### Horowhenua case study:

Since February 2010 a series of consultation and information sharing hui have been held for the Horowhenua case study with a long list of participant Māori groups and authorities ranging from Treaty Claims teams, Marae committees, Farming Incorporations to Ahu Whenua Trusts. Key kaitiaki and other end users have come forward to assist the project and the MTM team, who try to meet at least 3 times per year. All participants are invited to take part in testing regimes, bird monitoring at Ōhau estuary and Te Hākari wetlands, or the practical work of planting trees over autumn and winter. All kaitiaki and end users were invited to associated hui of interest including the top ten Landscape Architecture students presentation hui on 15 October 2011 at Tukorehe Marae.

Kaitiaki are invited to contribute to the development of research plans. This has resulted in many key end users/kaitiaki/advisors being supportive of, or involved in MTM. Such people include: Tim Park (Biodiversity and Wetlands Manager) of Greater Wellington Regional Council, Pataka Moore for wāhi tapu project with Kapiti Coast District Council and Caleb Royal and their Hapai Whenua Consultants for Ōhau River testing and shellfish monitoring regimes, which are completed for local iwi and hapū and Horizons Regional Council. These people and groups willingly provided a range of helpful reports and latest important information that benefits the MTM project overall. The MTM team is building the confidence and capacity of its kaitiaki throughout the case study region. This has been particularly evident with the Waiwiri Stream water quality testing project with results being finalised in March 2012 and PhD studies underway with Aroha Spinks on behalf of and with Trustees for Lake Waiorongomai, Ōtaki.

The MTM team keeps the wider Māori communities informed through the quarterly and monthly reports tabled with Te Rūnanga o Raukawa and Komiti Whaiti and present at AGMs. This keeps people informed of progress, as does the hui schedule at different marae, email communications, and websites ([www.taiaoraukawa.co.nz](http://www.taiaoraukawa.co.nz) and [www.mtm.ac.nz](http://www.mtm.ac.nz)). The collaboration with the Landscape Architecture course at Victoria University (see section 5.3.4) also came about after collaboration and consultation over a number of years, again evidencing the fundamental feature that networking and end user engagement plays in the MTM programme.

### **5.3.2 Hīkoi**

The MTM team facilitated and participated in three major hīkoi during the initial start up and stocktake phase of MTM. Hīkoi (travelling workshops or walking/talking hui) have been used successfully in previous research conducted by Meurk et al. (2006) to promote and demonstrate ecological restoration in Canterbury and share knowledge,

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experience, inspiration and motivation amongst scientists, community groups and Māori who were involved in this area. The term hīkoi captures the concept of a travelling roadshow from which kotahitanga (unity), strength, mātauranga (knowledge), and whāinga matua (common purpose) are created through journeying and experiencing together (Meurk et al. 2006).

As in the Meurk et al. (2006) hīkoi, the main kaupapa (objective) of the MTM hīkoi along the Horowhenua case study rohe was whānaungatanga. That is, to facilitate relationship building and networking based on best practice from combining science and community approaches and mātauranga Māori. The hīkoi demonstrated in a practical way how partnerships between researchers/scientists, local communities and iwi are beneficial. Throughout the hīkoi, there were constant opportunities for reciprocal knowledge transfer of science-based ecological restoration principles and cultural values, approaches and practices associated with restoration involving the transfer of expert scientific knowledge from researchers to iwi participants, and the transfer of Māori cultural knowledge and values on the environment to researchers – and other non-Māori practitioners.

The MTM hīkoi included many decision makers and community ‘end users’ of coastal resources (including tangata whenua groupings; DOC; other academic/research providers from outside the MTM team; local care and community groups; Councils; Māori Councils, or Runanga) (Smith et al., 2011). During these multiple weekend hīkoi (12-14 November 2010, 19-20 February 2011 and 12-13 March 2011), participants (65+ individuals, representing 15+ different organisations/groupings) walked across the rohe (coastal area of our research), with many participants camping at various points each evening along the way. A series of colour image publications were produced as a record of these activities (see examples here: [http://www.mtm.ac.nz/project-case\\_study\\_regions-2.php](http://www.mtm.ac.nz/project-case_study_regions-2.php)).

The overwhelming conclusion expressed by MTM researchers who participated in the hīkoi was that it was a fantastic way for us as researchers to connect with the physical issues being researched, as well as connecting with local Māori and other interested ‘end users’. It helped us to develop an amazing network between our research team, key kaitiaki, local community and end user groups, which continues into ongoing phases of our research. Likewise feedback from iwi/hapū and other community groups who participated in the hīkoi showed great appreciation for the opportunity of having been involved in such an activity, that it was a valuable learning and relationship building experience.

One example of the success of this hīkoi was the collaboration with Landscape Architecture professionals and senior students, as described in section 5.3.4. In 2012, at least three Masters’ students will

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work on targeted areas within the MTM case study region. Further, the interaction between all groups on the coastline itself has greatly enhanced the ability of our research team to work with tangata whenua to catalyse, crystalise and prioritise of coastal restoration issues of most concern to them for ongoing research (see section 6).

### **5.3.3 Mediated modelling (MM)**

Our initial focus was working alongside end users and stakeholders, including tangata whenua, to develop a scoping model of Tauranga harbour, and as such was one of the first world-wide applications of the MM method in a cross-cultural research programme. The primary purpose of MM was to understand the dynamics of the harbour in a 'holistic' and 'integrated' way with an eye to assisting the selection of case studies for Phase 2 of MTM. A series of mediated modelling workshops were held in Tauranga from November 2010 to May 2011, through which the MTM team developed a systems dynamics scoping model of the inter-relationships in Tauranga moana that impact on the state of its ecosystems and ecosystem services (see <http://www.mtm.ac.nz/mediated-modelling/>).

The aim of the MM workshops was to help us gain a greater understanding of the key factors that are impacting on the state of the moana, and to identify the critical "leverage points" that are likely to have the greatest impact to restore things that are currently degraded. Participants from across Tauranga (including representatives from local and regional Councils; Department of Conservation; Royal Forest and Bird Society; industry representatives from the forestry, horticulture energy, and fertiliser sectors; Federated Farmers; other tertiary/research institutions; Chamber of Commerce; public health; Port of Tauranga; coastal care and other interest groups; tangata whenua groupings), provided a robust set of perspectives in the Mediated Modelling workshops, defining the ecological, economic, social and cultural impacts of the degradation of the health of Tauranga Harbour.

A scoping model was built, using the computer software STELLA, to show how all the individual aspects of the moana interact with each other, and impact on each other. This is called a "Systems Dynamics" model, and it is a powerful way of drawing together important information about the moana to get a better picture of what is causing the problems in the moana, how the moana will look in the future if certain conditions remain, and what improvements we could bring about in the future by making certain changes now to the way we do things. Participants also learned how to operate the model that they themselves helped to develop during workshops; and how to simulate future scenarios for "what-if my perspective and assumptions about the future are correct" versus "what if someone else's perspectives and assumptions about the future are correct". The group concluded with a

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list of key findings, recommendations and actions for decision makers and researchers regarding the state of Tauranga harbour and restoration initiatives (see van den Belt et al. in review).

The mediated modelling workshop participant group very favourably reviewed the 6-month mediated modelling process whereby the very disparate group of “end users” of the harbour were able to come together to examine issues about the state of the harbour in a “safe” space whereby all viewpoints could be considered, including cultural, economic, ecological and social issues that are relevant to the state of the harbour. Additionally, the group found great value in considering the systems of harbour interactions, and how coastal restoration issues need to be considered holistically for effective decision making and practical outcomes.

The process itself was highly informative and created a sense of community spirit and ownership over the harbour. This sense of goodwill was to the extent that the workshop group itself intends to continue beyond the mediated modelling research phase as a self-governing group, supported by the Regional Council, to further develop the ideas and strategies generated during the workshops. The group hopes to be an effective coordinated group where all parties can work together to achieve more than disparate groupings working independently at cross-purposes. This is a very significant outcome, as it is often extremely difficult to recruit “end user participants” from such a broad cross section of the community to engage in a research programme, let alone for that group to then want to continue on as a self-governing body, to engage with Councils, research groups and each other on coastal restoration. Further, the strong presence of tangata whenua in this group has been highly effective in ensuring that Māori values are considered in discussions about the harbour. Our MTM research team will continue to engage with this group throughout the remainder of our programme. The majority of the participants also stated that they intended to use the systems dynamics model of the harbour within their sector/industry to consider different future scenarios and how these might impact on coastal ecosystems (van den Belt et al. in review).

The Systems Dynamics scoping model of Tauranga harbour, developed through the Mediated Modelling research, integrates different perspectives and knowledge into one coherent framework, which is often lacking in policy decision-making. This is a significant development in terms of ‘integrated’ coastal management in New Zealand, where different knowledge bases often remain disparate and unconnected.

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### **5.3.4 Landscape Architecture Design course with Victoria University students**

In the Horowhenua case study, 4<sup>th</sup> year Landscape Architecture Design students from Victoria University focussed on practical design options to aid in the restoration of coastal ecosystems in that rohe. This included many interactions between the students and their lecturers with the MTM team and local tangata whenua, and will be continued for the duration of MTM.

The opportunity to collaborate with Penny Allen (Associate Professor in Landscape Architecture at Victoria University), and Megan Wraight (Director of Wraight & Associates, Wellington) came out of conversations that began in 2008 at Te Papa when Dr Huhana Smith (co-author of this report and Research Leader of the Horowhenua case study) was Senior Curator at Te Papa. (Dr Smith resigned from Te Papa in 2009 to take up the Research Leader's position in 2010.) Further conversations were had in 2009 when this group attended initial Kaitiakitanga training noho marae (overnight or extended stays at marae). Opportunities were discussed for mapping cultural landscape, the development of papa kainga (multi dwelling units on Māori land for extended family needs) and iwi resource management issues with those attending the monthly weekend course.

This development was enhanced by more informal conversations between key participants during our hīkoi of the Horowhenua coast. Collaboration was cemented with 4th Year Landscape Architecture Design students from Victoria University in Wellington, for the students to focus on our MTM research in Horowhenua to develop practical design solution options for the coastal area during their course. This innovative participatory action research and social learning design initiative has become an ongoing partnership for the next few years, with the students, their lecturers and our MTM research team working together with local hapū to design practical restoration options for the important coastal landscapes.

This initiative is also another use of innovative technologies such as illustrative software, theories and understanding human relationships to place. The collaboration works two ways: (i) it enhances the student knowledge base on Māori relationships to whenua (land) and resources; and (ii) it offers capacity raising opportunities for Māori to engage in technologies fashioned to suit Māori needs (Smith et al. 2011).

To explain in more detail the interface between students, staff, iwi and hapū, Ngāti Kapumanawawhiti of Pukekaraka in Ōtaki hosted an important weekend hui on 12–13 March 2011. This was the first hui in the MTM collaboration supported by research funds and manaakitanga (good care) afforded to manuwhiri (visitors). Before venturing out onto Māori land holdings and in keeping with tikanga (protocols) the final



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year Landscape Architecture students and staff from Victoria University's School of Architecture and Design Department and Wright & Associates were welcomed with a formal powhiri onto Te Pou of Tainui Marae. Their visit coincided with the hau kainga (home people) celebrating the 150<sup>th</sup> anniversary of the historic flagpole that was erected on their marae in 1861.

The students were treated to important local narratives and cultural histories of place, particularly those surrounding the flagpole at the 150<sup>th</sup> Celebration. King Tawhiao's tōtara tree (Waimarie) was also a special feature as Rupene Waaka transferred important understandings about kaitiaki or spiritual guardians. Rupene recounted the experiences of David Palmer an arborist, who had a very special encounter with Waimarie, the tōtara tree. "She is tapu... She has a special relationship with Tāwhirimātea and Tāne. It is a good relationship based on aroha and respect..." (Palmer 1994).

These shared narratives were critically important to the students developing a better understanding of Māori material, spiritual and political worldviews. These sensibilities of place and sacred areas are still maintained by people today to reiterate and emphasise ongoing relationships with marae, turangawāwae (place to stand), remaining landholdings and natural resources.

For the MTM project so far, the experience of student Landscape Architects coming together with Iwi and hapū to understand the intricacies of tangata whenua relationships to place has developed into a very positive working collaborative of innovative and complimentary expertise. The 15<sup>th</sup> October 2011 hui held at Tukorehe Marae completed the circle of enquiry for the students when they presented their visual ideas for areas within the MTM case study to some 55+ people ranging from members of Forest and Bird, local environmental groups, the Wellington Conservator, key DOC staff, Horizons Regional Councillors, kaitiaki from Waiorongomai and Katihiu, to list just a few of the attendees.

## **6. CASE STUDIES FOR ONGOING RESEARCH**

The findings and conclusions from the stocktake phase helped our MTM research team to identify most important areas for ongoing detailed investigation in the second phase of the research programme, which are briefly outlined below.

### **6.1 Horowhenua Coast (from Hokio to Waiwiri Streams)**

Iwi and hapū have evaluated and defined preferred options with their research collaborators for actively enhancing and restoring coastal and once culturally significant ecosystems in this distinct tribal area. Over time hands-on action



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research and rehabilitation programmes for valued ecosystems have taken place as kaitiaki respond to the severe environmental decline of ancestral lands and waterways in their areas of kaitiakitanga responsibility (Smith et al. 2011).

### **6.1.1 Factors influencing the health of Toheroa (and other shellfish)**

The aim of this case study is to identify the factors most likely to be impacting toheroa (and other shellfish) populations in the coastal zone of Ngāti Raukawa, in order to design targeted habitat quality investigations to identify sources and how to address them. The research questions are: What are the known stressors for toheroa/razor clam species? What are the habitat requirements of toheroa/razor clam? Of the stressors present on Horowhenua beaches, which are most likely to be impacting on toheroa populations?

A literature review will be conducted to inform the design of an investigation into habitat quality in the surf zone (see case study below) to identify sources of stressors on shellfish. Prior to undertaking that study, it is important to first identify what the most significant stressors are likely to be, so that the habitat quality sampling can target the most relevant parameters. Toheroa was selected because of its cultural significance as a delicacy species. Considered the ultimate expression of manaakitanga (akin to hospitality and care) to your visitors, it is regarded as kai o te rangatira: the food of chiefs. Like several other shellfish and fish species found in areas of mahinga mataitai (food gathering locations in coastal freshwater, brackish water and coastal foreshore areas) they are endangered species and/or under threat from a range of impacts. This work may be conducted collaboratively with other iwi groups around New Zealand who are also concerned about the decline of this important species.

### **6.1.2 Ghost shrimp and surf zone habitat quality**

Ngāti Raukawa and affiliated iwi are concerned at decline of toheroa and other taonga species along their coastline. Reasons for the possible decline of toheroa have been summarised in a report completed for MTM (Heasman 2011, in prep) and a possible survey design was initially proposed to assess shellfish abundance and habitat quality. During a field visit in November 2011, Cawthron staff discussed with local kaitiaki the decline of toheroa and other species and visited the mouth of the Waikawa River to look for toheroa and consider the feasibility of the proposed survey design.

In the course of the visit, it became apparent that the proposed survey design was unlikely to be practical due to low population densities of

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toheroa and the time-consuming methods required for sampling. The large number of factors potentially implicated in shellfish decline also meant it would be difficult to attribute the decline to a particular set of factors. For instance, sediment plumes from large floods on the Manawatu River could impact on shellfish, as could significant changes to local conditions of freshwater/surf zone interaction.

On the beach, kaitiaki showed the MTM team “worm holes”, large areas dominated by a burrowing animal known as ghost shrimp (*callinassa filholia*) that appears to have taken over areas where toheroa were once abundant. Although this could be either a cause or an effect of shellfish decline (or neither), it would be informative to compare the areas inhabited by ghost shrimp with those where toheroa are still found, and to document the extent of ghost shrimp beds along the coastline.

Therefore, this study will investigate how habitat previously occupied by culturally significant shellfish species has changed with the expansion of ghost shrimp colonies and look for clues as to whether this expansion might be a cause or effect of shellfish decline. This will involve mapping of ‘ghost shrimp’ along the rohe, oral interviews with kaitiaki about the abundance of this species over time and its relationship to other shellfish species, and other related Mātauranga, and some core sampling and analysis.

### 6.1.3 Water quality

Using the Waiwiri stream as a current research example, the aim of this case study is to identify sources of poor water quality and to rehabilitate habitat in the Waiwiri stream in areas that are considered to be of high cultural value for seasonal harvest of kai moana (specifically toheroa, tuatua and kahitua), and freshwater species such as tuna (eel). This research involves a review of historical water quality data; water quality monitoring: faecal indicating bacteria (FIB) and microbial source tracking (MST) on stream water and shellfish samples; and recommendations for stream restoration in conjunction with other work being conducted in the area by Muaūpoko Tribal Authority through another MSI-funded study led by Massey University called ‘Integrated Freshwater Solutions’<sup>11</sup>.

The Waiwiri Stream flows westward from Lake Papaitonga (Waiwiri) near Levin, for approximately 5-6km to its coastal outlet, just north of the Ōhau River mouth. There is anecdotal evidence that the stream has suffered ecological degradation in the past 35 years, with exacerbated decline noted by kaitiaki/resource gatherers in the last 8-10 years. The major source of pollutants is still being analysed but there are two potential contributors. One is the significant area of dairy pasture in the upper half of the relatively small catchment. The other is treated effluent

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<sup>11</sup> See: [www.ifs.org.nz](http://www.ifs.org.nz).

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runoff from part of Horowhenua District Council's Levin Wastewater Treatment Plant. The Levin plant uses primary sedimentation followed by secondary treatment, via a trickling filter, contact stabilisation and clarification (Wally Potts, pers. comm., 2011). Effluent is then pumped to a large unlined artificial pond, known as 'the 'Pot'', situated on dunes adjacent to the Waiwiri Stream. Effluent is then irrigated onto sand dunes planted with *pinus radiata* (approximately 1 km from the coast).

The study involves an assessment of the current and historical water quality between Lake Waiwiri (Papaitonga) and the stream's coastal outlet. The MTM team will utilise microbial source tracking (MST) technology to identify key pollutants and their likely source. With the help of local Iwi and Hapū, shellfish and water samples have been collected from selected sites. The methodology is similar to that used in a Northland oyster study<sup>12</sup>.

Since testing began in late June 2011, preliminary results for MST in the Waiwiri Stream are available for some parameters. They are very much early results and are therefore subject to change. They indicate that *E. coli* counts are generally lower in Lake Waiwiri (Papaitonga) than in the Waiwiri Stream. An open drain that enters the stream close to the Lake has some of the highest readings. MST faecal testing from the first sampling event indicates that the dominant faecal markers present are bovine in origin. Whilst samples from the lower Waiwiri Stream (downstream from the 'pot') contained trace amounts of human faecal markers, the strongest result throughout the stream implicates ruminant animals as the most dominant source of pollution. Results for the second and third sampling events are not yet back from the laboratory.

Riparian fencing and planting have been carried out in most of the lower Waiwiri Stream, but the upper reaches (approximately 2km downstream from the lake) remains unplanted and stock can access the water in some areas. Part of the Waiwiri Stream water quality report will include a map of water quality 'hotspots' and recommendations for prioritising riparian or lowland forest restoration efforts.

#### **6.1.4 Ōhau Loop restoration**

The aim of this case study is to restore aquatic ecosystem functions and services in the Ōhau 'loop', a coastal river remnant. This will involve: assessment of aquatic ecosystem functions and their significance to whanau, Hapū and Iwi and, as well as factors impairing these functions; making recommendations regarding the rehabilitation of the loop, including restoring part or all of the flow from the Ōhau River down through the loop, riparian planting, weed removal; and monitoring indicators of ecosystem health.

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<sup>12</sup> See: <http://www.envirolink.govt.nz/PageFiles/176/708-nlrc100.pdf>

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Flood protection works in the 1970s on the Ōhau River saw a 3.5km meandering stretch of the river, now known as the Ōhau 'Loop', removed from the main passage of flow. It still receives tidal flow via culverts from the main river, but this is insufficient to maintain healthy ecosystems. Intensive dairying in the immediate vicinity is likely to have contributed to the 'Loop's' current state, which is characterised by poor water quality, weed invasion and poor biodiversity. Local Iwi have made efforts to improve the state of waterways in the area, but it is thought that the best solution would be to reinstate the natural passage of flow through this section of the Ōhau River.

The *Ōhau Loop Phase 1: Existing Status and Recommendations for Improvement* report (Allen et al. 2011) involved the examination of existing aquatic ecosystems, cultural significance and constraints on the system. This involved fish surveys, invertebrate sampling, aquatic plant surveys, water quality analysis, and interviews on cultural aspects. Based on this information, the MTM team has recommended what could be done to restore the system<sup>13</sup>.

### **6.1.5 Coastal wetlands and lakes of cultural significance**

Coastal wetlands such as Te Hākari, Pekapeka Taratoa sand blow to wetland, Waikawa, Manga Pirau, Lakes Huritini, Waiorongomai and Kahuwera have been severely degraded in the past 100 years due largely to vegetation clearing and drainage, to make way for pastoral farming, as well as direct effects caused by grazing stock. The Manawatu/Wairarapa region is estimated to have lost 97.4% of its wetlands (since 1900), with just 1% of swamp areas still intact (Smith et al. 2011). The Waiorongomai dune lake and wetland area is historically significant, and hence is targeted for rehabilitation through a staged approach including initial study of existing aquatic ecosystem functions, cultural significance and constraints on the system. This would involve hydrological surveys, water quality analysis, and interviews with kaumatua and kaitiaki about cultural factors associated with this wetland. Geographical Information System (GIS) technologies may be used to determine the extent of wetland area and habitat given proposed increases in wetland water level at Lake Waiorongomai / Kahuwera wetland. The economic value of the wetland will be calculated and compared to the value of the land as dairy pasture, in line with similar studies undertaken in the Waikato region.

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<sup>13</sup> See:

[http://www.mtm.ac.nz/pdf/Ohau%20Loop%20Phase%201\\_Existing%20Status%20and%20Recommendations%20for%20Improvement\\_Final.pdf](http://www.mtm.ac.nz/pdf/Ohau%20Loop%20Phase%201_Existing%20Status%20and%20Recommendations%20for%20Improvement_Final.pdf)

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### **6.1.6 GIS and spatial modelling work**

The Victoria University Landscape Architecture students were issued spatial and mapping data sets collated from previous research derived from 'Ahi Kaa Roa: Mapping Cultural Landscape' within the Ecosystem Services Benefits in Terrestrial Ecosystems for Iwi (MAUX0502). They were able to thus develop some quite specific landscape design options to facilitate reconnection of people with the cultural landscape. Students will have access to the tools developed in subsequent stages of MTM, and this will enhance the landscape designs they develop in future years of the course. This includes cumulative mapping, spatial mapping and visualisation of action plans for iwi and hapū. WakaDigital are also leading additional substantive work in this area as detailed in the following section.

### **6.1.7 Information Technology developments**

In addition to the ongoing development and innovative updates to efish, the Digital Library and the MTM website (which acts as a communication forum for disseminating the research plans and outputs amongst the research team and with external stakeholders, researchers and tangata whenua), a number of other innovative developments are planned.

Technology will be tested on a degraded coastal ecosystem in the Horowhenua case study, which will allow visual tracking of the physical state of that ecosystem over time. This involves a video device 'flying' over the landscape capturing images over time, which is a powerful means of visualising the state of an ecosystem, when changes occur, and how quickly.

To ensure that the powerful 'story' told by the GIS information collected in the previous "Iwi Ecosystems" research is captured and can be 'told' in a meaningful way, a 'storyboard' will be created of the key features that incorporates images and text/description. Further, the GIS maps will be expanded upon to include more detail on the areas being studied in detail in MTM.

The academic literature on the use of information technology and communication tools to assist in coastal ecosystem service restoration, particularly with indigenous groups, will also be analysed and use to inform the development of I.T. tools in MTM.

### **6.1.8 Ecological economics research**

Ecological Economics is a rapidly developing branch of modern economics that attempts to understand, in a holistic way, just how the

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economy and biophysical environment depend upon each other. This involves using a whole battery of methods, approaches and theoretical perspectives drawn both from ecology and economics as well as other disciplines including the social sciences – this is often called a trans-disciplinary approach. In the Horowhenua case study region this has involved biophysically characterising and quantifying terrestrial ecosystem services in the coastal zone, as well as valuing them from a monetary perspective. This has involved drawing on and extending work from the previous project ‘Terrestrial Ecosystem Services Benefits’ FRST-funded programme, referred to previously. Particular focus is planned to provide more detail on the valuation of coastal ecosystems such as coastal lakes, wetlands, dune systems, beaches and foreshore, especially incorporating cultural values.

A particular case study valuation will be undertaken in early 2012 on the trade-offs between dairy farming economic returns and the degradation of ecosystem services from those activities. The interactions between dairy farming and wetland and other aquatic values will be particularly important in this valuation. It is hoped that this analysis will provide a more holistic appreciation of the ‘true’ value of dairy farming particularly as it impinges on both economic and cultural values that are important to Ngāti Raukawa and associated iwi and hapū of the case study region.

It is intended that this ecosystem services valuation work will not only provide iwi and planning authorities with important information on how to sustainably manage coastal land and the Horowhenua coastline, but it will also place some emphasis on developing new methods for valuing ecosystem services apart from the traditional monetary-based neoclassical methods – refer to section 6.2.8 (Tauranga Moana Case Study).

### **6.1.9 Oral archive of mātauranga**

A series of interviews will be conducted with tangata whenua to determine the way in which peoples’ relationships with coastal rivers, streams and lakes have changed over time. This will create an oral archive of the way that coastal ecosystems played in the lives of iwi, hapū and whanau, and the impact that the degradation of these places has had. Likewise, we aim to ascertain the impact on tangata whenua of efforts to re-engage with these places in an effort to restore them.

Tangata whenua will be shown aerial photos from 1942 to present. They will be asked about their knowledge of, and experience with, local streams, rivers and dune lakes depicted in the aerial photos; as well as water quality of these ecosystems. Examples of questions that may be asked to spark conversations include:

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*In your childhood:*

1. Did you and/or your family spend much time at the beach or rivers?
2. Did you and/or your family spend much time at the rivers, streams or lakes?
3. Where was the majority of your time spent?
4. What were some of the activities you would all engage in?
5. Were the elders of the day active in gathering food?
6. What part did they play? Did they observe protocols?
7. At the Beach, rivers, streams or lakes what was a usual past time for children in those days?
8. Was it usual to see rubbish or pollution in those areas when you were younger?
9. Is it considered usual to see rubbish or pollution in those areas now?
10. What was your favourite type of seafood? What was your favourite type of food from rivers, streams or lakes?
11. Was that type of food abundant when you were young?
12. At a Hākari; What types of seafood do you remember being served at local Marae?

*In your adulthood:*

1. Did you and/or your family spend much time at the beach?
2. Did you and/or your family spend much time at the rivers, streams or lakes?
3. Where was the majority of your time spent?
4. What were some of the activities you would all engage in?
5. Were the elders/parents of the day active in gathering food?
6. What part did they play? Did they observe protocols?
7. At the Beach, rivers, streams or lakes what was a usual past time for your children in those days?
8. Was it usual to see rubbish or pollution in those areas as you grew older?
9. Is it considered usual to see rubbish or pollution in those areas now?
10. What was your favourite type of seafood? What was your favourite type of food from rivers, streams or lakes?
11. Was that type of food abundant as you matured?
12. At a hākari what types of seafood do you remember being served at local Marae as you got older?

*Present day:*

1. Do you and your family spend time together at the beach, lakes or rivers?
2. What are some of the activities, as a family, which you all engage in?
3. Are you active in gathering kaimoana with your family?
4. What is a usual activity your grand children do when you all go to these areas?

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5. Are your favourite foods abundant nowadays?
  6. At a hākari; what types of seafood are served now?
  7. Are there any recommendations or thoughts you would like to pass on or share with future generations?

## **6.2 Tauranga Moana**

### **6.2.1 Broadscale survey of Tauranga harbour**

The aim of this case study is to understand the role of various anthropogenic stressors on biodiversity. This will be conducted by sampling flora and fauna over the spatial scale of the estuary and collection of associated sediment samples to quantify sedimentation, nutrients and pollutants at each site. Macroinvertebrates will be assessed at each site using benthic core samples and quadratic information collected to quantify the presence of flora including macroalgae, seagrasses and sea lettuce. Physical data will also be collected to quantify grain size, organic content, chlorophyll a and heavy metal sediment concentrations at each site. Sampling may be conducted over a range of habitats from intertidal sandflats (a key habitat for shellfish), mangrove habitats and seagrass areas.

### **6.2.2 Species and Community Health modelling**

The aim of this case study is to develop species distribution models and community health models for the harbor using the broad scale survey data. This will involve the development of models to map the distribution of key species and environmental variables using Species Distribution Modeling software (e.g. MaxEnt, GARP, ENFA). Species models can also be used for resource management applications such as predicting future species distribution under varying scenarios such as increases in sedimentation due to climate change or decreases in nutrient levels due to catchment practices. We will then develop community health models using multivariate ordination techniques to assess changes in benthic communities along the disturbance gradient of sediments, nutrients and contaminants. This approach assesses the current ecological health of the harbour and can be used for future monitoring to assess whether sites are improving or degrading over time.

### **6.2.3 Shellfish health assessment**

The aim of this case study is to determine the current extent of shellfish beds and identify the factors that affect intertidal, and possibly subtidal, species distribution. This may include investigation of the link between shellfish condition (measured by glycogen levels) and levels of sedimentation and contaminants within the harbour; assessment of whether existing levels of sedimentation or pollution limit the distribution



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of shellfish beds (as determined from transplant experiments) in Tauranga Harbour; assessment of how the loss of shellfish beds affects the ecological functioning of benthic communities (e.g. nutrient fluxes, biodiversity, sediment stability). Core samples are being taken to assess abundance of key shellfish species. This data will be linked in with the Broadscale survey data (see section 6.2.1) to generate species response curves to various physical variables.

#### **6.2.4 Coastal Cultural Health Index (CCHI)**

The aim of this case study is to develop a tool that can document the mātauranga Māori of the health of Tauranga harbour, and aligning this with western science measures of coastal ecosystem health. The method to be utilised for this tool development is still being finalised, but will likely involve adaptation of the 'State of the Takiwa' methodology developed for freshwater ecosystems, which is currently being adapted for estuarine environments in other research by other iwi in New Zealand (Ngai Tahu and Ngāti Kahungunu) with members of our MTM team. Building upon Bishop's (1996) approach, the steps utilised in that approach include: Whanaungatanga (enduring relationships) will underpin the basis of this research and ensure that the CCHI is embedded in the local community; relevant to the community's issues and capabilities; and designed to meet the shared aspirations and expectations of the participating parties.

To achieve this, our research design is likely to include the following steps, which will be adapted to suit local needs and requirements:

- a) Hold a workshop (hui whakawhanaunga) to establish a protocol of engagement between tangata whenua and the research team;
- b) Whakatuwheratanga (developing the CCHI) – a tangata whenua-led exploration of local mātauranga will be carried out to determine the appropriate aspects of knowledge that will be suitable for inclusion in a CCHI monitoring and assessment framework; a scoping exercise will be conducted of other Māori cultural estuarine and marine monitoring and assessment frameworks and/or tools developed externally to the Tauranga rohe (area) to determine the feasibility and appropriateness of inclusion of these in a CCHI to complement existing local Mātauranga;
- c) Mahere mahi (implementation of the workplan) – a joint plan will be developed to implement the CCHI to characterise anthropogenic impacts and biodiversity hotspot that aligns with tangata whenua aspirations.

The MTM team will attempt to create a plan where the different monitoring, e.g., Benthic Health Model and CCHI, will be undertaken

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concurrently to maximise opportunities for capability development and information sharing. We hope to develop a spatially detailed map showing the health of the harbour as assessed by mātauranga Māori, using “traffic lights” to show hot spots of impacts. A database will also be created, that integrates with data from other components of the Tauranga case study, to store data over time.

The CCHI is a tool that local iwi and hapū members would be trained to undertake the assessment at regular intervals into the future, thus empowering them to take an active ongoing role in the monitoring of self-determined critical ecosystems.

### **6.2.5 Other species-specific case studies**

Other critical areas for ongoing investigation that were identified during the stocktake exercise related to seagrass loss and mangrove expansion in Tauranga harbour. These focused investigations will likely follow on from the community health modelling work (described above), which will reveal those specific communities that are most threatened.

### **6.2.6 Mapping cumulative human impacts on coastal ecosystems in Tauranga harbour**

Adapting the method employed by Halpern et al. (2008, 2009), one potential model that the MTM hopes to develop is a model that maps the cumulative impact of various human activities on coastal ecosystems. This analysis allows us to identify areas where protection and mitigation measures are most needed, through the use of human impact scores. The data that is being gathered in other components of the Tauranga case study (e.g., 6.2.1-6.2.3 and 6.2.7) will go some way to providing the necessary information to help build this model.

### **6.2.7 Information Technology tool development**

In addition to the ongoing development and innovative updates detailed in section 6.1.7, similar I.T. tool development will be conducted for the Tauranga case study. The application of ‘drone technology’ will be tested in this rohe, and WakaDigital will liaise with Bay of Plenty Regional Council, and elsewhere, to build spatial models of the harbour that are more relevant to the needs of tangata whenua. Further, data collected in the research described in sections 6.2.1-6.2.6 will also be incorporated in the GIS spatial layers developed by WakaDigital.

## 6.2.8 Ecological economics work

Ecological Economics research for the Tauranga Moana will build on and be complementary to the research for the Horowhenua case study (refer to section 6.1.8).

First, a broad scale valuation of ecosystem services in the Tauranga harbour and its catchment will be undertaken. An initial analysis for the Tauranga Harbour demonstrates that ecosystem services of Tauranga harbour are worth \$464 million per year (refer to Table 1). Seagrass, for example, provides a number of ecosystem services including trapping and stabilising sediments, nutrient recycling, creation of high primary productivity and the provision of habitat for animal and plant species. By placing a monetary value on these ecosystem services, their value becomes 'visible' and decision makers can appreciate their worth in terms of market and non-market values. To put this figure of '\$464 million per year' into perspective, the Port of Tauranga had an annual turnover of \$143 million for the year ending June 2009, and made an after-tax profit of \$45 million. Clearly, on the face-of-it, the Port of Tauranga, although being a key driver of economic activity in Tauranga, provides a lower economic 'value' that is actually less than the value of the ecosystem services produced by the Harbour. The analysis of ecosystem services also points to the loss of value of ecosystem services due to ecosystem degradation. For example, seagrass in Tauranga Harbour declined from 44.4 square kilometres in 1959 to 29.3 square kilometres in 1996 (Elliot et al. 2010). This represents a \$54 million per year loss, co-incidentally about the same as the amount of profit from the Port of Tauranga.

**Table 1 Estimate of the Value (\$) Ecosystem Services  
Derived from the Tauranga Harbour**

<b>Ecosystem Type</b>	<b>Area (hectares)</b>	<b>\$/ha/yr</b>	<b>Total Value of Ecosystem Services (\$ million/year )</b>
Mangroves	92	23,893	2
Seagrass	4,440	45,451	202
Other	15,468	16,792	260
Total	20,000	23,187	464

Secondly, input-output analysis and modelling will be used to quantify the interactions between key sectors and the Tauranga economy and the natural capital (land, ecosystems, biodiversity of the harbour) upon which they depend. Particular focus will be given on the commercial activities associated with the harbour and the Port, as it is a common perception that these activities (particularly the Port) 'drive' the Tauranga economy and provide competitive advantages over other

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regional economies. Important research questions about the role of the Port in the regional economy will be therefore modelled and simulated using relatively straightforward input-output models.

Finally, it needs to be mentioned that in relation to the ecological economics valuation work of both the Tauranga and Horowhenua case studies, some emphasis has been placed on developing methodologies of valuation that complement the marketplace neoclassical methods. In this regard, some success has been achieved in further developing the emergy-based valuation method, which seeks to provide a more 'bio-centric' perspective on ecosystem values. In relation to this, a methodological paper has been produced by Patterson (2011) and accepted for publication in the journal *Ecological Modelling*. This paper demonstrates how non-equilibrium shadow prices can be determined by using empirical data for the Schlei Inlet ecosystem (Germany). It is hoped that, in subsequent years of Manaaki Taha Moana, this method can be applied to data for the coastal ecosystems in both of our case study regions.

## **7. OVERVIEW OF KEY FINDINGS AND CONCLUSIONS**

### **7.1 What has MTM achieved so far?**

Numerous hui, consultation and networking activities were undertaken in the initial development of the proposal that sought funding for MTM, and this level of engagement between the MTM team and local communities has continued during the Phase 1 of the research. This has been achieved through a variety of different means including powhiri and hui on marae, hīkoi, training workshops, mediated modelling, partnerships with tertiary students to design practical coastal restoration options, and meetings with numerous end user/kaitiaki (environmental guardian) groups to communicate research plans and findings as often as possible. The MTM research approach has enabled Māori and non-Māori, the public and professionals, academic researchers and scientists, environmentalists and local people with extensive regional knowledge, to spend time sharing stories, their wisdom, hopes and fears in a personally engaged manner.

The 'stocktake' in Phase 1 involved compiling and synthesising key published data, publications and knowledge about the health of the coastal environment in both case study regions, resulting in two reports in the MTM Monograph Series: *Health of Te Awanui Tauranga Harbour*, and *State of Ecological/Cultural Decline of Horowhenua Coastline between Hokio and Waitohu Streams*. During the stocktake a 'Digital Library' was developed to ensure this newly collected data could be easily accessed by researchers, tangata whenua and other decision makers in the future.

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In Tauranga, a systems dynamics scoping model of Tauranga Harbour was created through a series of 6 x full-day workshops with key representatives from diverse groups and sectors with an interest in, or impact on, the harbour. This model maps the inter-relationships between the various factors that contribute to the health of the harbour in a 'holistic' and 'integrated' way. The workshop participants very favourably reviewed the process as a forum in which conversations could be had between groups who would not normally feel 'safe' to share their perspectives and concerns about the state of the harbour and what could be done to improve it.

One of the key aspects of MTM is the development of IT tools to empower the research team to effectively conduct our research, to better communicate research plans and results, to support decision-making by iwi/hapū end-users and other stakeholders, and to facilitate the uptake of research results and tools developed in MTM more widely throughout New Zealand and overseas (see McCallion et al. in press). This IT development is being undertaken and led by Wakadigital Ltd, in conjunction with the other partners in MTM. The initial focus has been on developing the web-based communication portal/website ([www.mtm.ac.nz](http://www.mtm.ac.nz)); developing and populating the central information repository (see: [http://www.mtm.ac.nz/client/knowledge\\_centre-digital\\_library.php](http://www.mtm.ac.nz/client/knowledge_centre-digital_library.php)); and updating the WakaDigital *efish* database, in conjunction with Te Ohu Kaimoana and other cofunders (see: <http://www.efish.co.nz/>) to include new data and features.

Future IT development may involve spatial modelling, simulation modelling (what would happen in 20-30 years if we implemented 'xyz' management option), interactive mapping, 3D depiction (where are the problems occurring) and real time monitoring (e.g., water quality). Through the 4<sup>th</sup> year Landscape Design course at Victoria University, Landscape Architects also use innovative illustrative software such as Adobe Photoshop, Adobe Illustrator, Adobe InDesign, AutoCAD and Google Sketchup. One of the features of the application of these IT tools is to critically assess their efficacy and appropriateness in the context of Māori-focussed research.

## **7.2 Coastal ecosystem services research in New Zealand**

Typically, coastal research in New Zealand focuses on the species and process level, rather than on 'ecosystems' and their 'services'. MTM has begun to address this issue by explicitly considering coastal ecosystem services in terms of biophysical indicators and values, including mātauranga Māori indicators. Advancing understanding amongst local communities, Councils, and other kaitiaki and end user groups, as well as within the research community itself, about concepts and frameworks for understanding 'Coastal Ecosystem Services' requires significant advancement in the capability of communities to actually understand how human activity impacts on coastal resources. To assist this understanding, approaches to restoration efforts must include a multi-dimensional, integrative systems view of

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ecosystem services. Phase 1 of MTM has identified the need for much greater emphasis on ecosystem services research, as well as ‘education’ about such concepts within the community and within decision-making bodies who manage coastal ecosystems.

Further, we have begun the process of conceptualising and modelling coastal ecosystems and their services with our systems dynamics scoping model of Tauranga harbour, which utilised mediated modelling as a new ‘integrative’ coastal ecosystem management tool. This participatory approach to problem solving enabled a diversity of perspectives and cross-cutting ecological, economic, and cultural issues to be considered simultaneously. The result was an improved level of ‘knowledge integration’ within our MTM team and by the kaitiaki and end user group. Further enhancements to this model are planned as additional information comes to hand in Phase 2 of MTM. Additionally, MTM will examine coastal ecosystem services in greater detail, to increase the depth of understanding about the services provided by ecosystems in the coastal zone; currently, such knowledge is very limited, even within the academic literature.

### **7.3 Growing Māori capacity and capability in environmental restoration and research**

In our MTM research, of primary importance is capability development, particularly for tangata whenua. From a mātauranga Māori perspective, the MTM team understands kaitiakitanga as a socio-environmental ethic that acknowledges relationships between humans, spiritual and environmental properties.<sup>14</sup> Such thinking is central to a Māori environmental worldview (Smith 2007). This thinking requires greater emphasis at the community level to bolster the ‘cultural’ understanding of ecosystem services.

The MTM team understand that the responsibilities of kaitiakitanga and environmental kaupapa are passed down from ancestors where local whānau, hapū and iwi are charged with the care of their places, their natural resources and other taonga as valued assets in their regions. In working with active kaitiaki, the MTM team remains compelled to protect the mauri or vitality of places and resources as taonga<sup>15</sup> and bolster the health of waterways, dune wetland and surf zone systems. MTM research findings show that systems *are* in ecological decline with some waterways breaching national standards for water health. Whilst improving awareness amongst peoples of these decline issues through active kaitiaki engaging in field-work and other capacity raising activities, the means to actualise socio-environmental health for lands, waterways and peoples, must be edified by *more* local Māori in the wider

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<sup>14</sup> Merata Kawharu, 1999, Local Māori Development and Government Policies, Research Fellow, James Henare Māori Research Centre, University of Auckland, Auckland, 9.

<sup>15</sup> Parliamentary Commissioner for the Environment, 1998, *Kaitiakitanga and Local Government: Tangata Whenua Participation in Environmental Management*, Parliamentary Commissioner for the Environment Te Kaitiaki Taiao a Te Whare Pāremata: Wellington, ix.

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community. This is the vital message for 2012. The tenets of kaitiakitanga must also be translated well to all participants coming to assist, including the landscape architecture students. The MTM team is sharing research findings with Local and Regional Councils, local Ratepayers Associations and environmental groups. For example, Taiao Raukawa propose to run more communication hui, wānanga and workshops on MTM research outcomes to link local Māori with teams and the Landscape Architect students, whose work in 2012 with MTM teams will focus on specified projects within the case study.

### **7.2.1 Tauranga moana**

There has been Māori capability development and progress during Phase 1 of the Tauranga harbour case study. One significant development is that two Māori team members have learned the fundamentals of systems dynamics modelling through a mediated modelling process. They can now go on to use these tools with iwi and hapū in their rohe, and other groupings. There is also a desire for upskilling of undergraduate and high school students in knowledge about the holistic wellbeing of coastal ecosystems.

### **7.2.2 Horowhenua**

The current case studies in Horowhenua include: microbial tracking in the Waiwiri Stream catchment from lake to sea (report due in March 2012); the Ōhau River 'loop' project and the more recent shellfish monitoring project for toheroa vs ghost shrimp taking place between Waikawa and Waitohu (activated in October 2011). Each project has highlighted Māori capability development needs. Kaumatua hold significant knowledge that they have been imparting to the research team. However, only a few able-bodied, resident kaitiaki are readily acquainted with remaining natural resources, particularly as they are responsible for gathering these resources as kai for marae, including kaimoana or for customary occasions such as tangihanga (Māori funeral protocols). They have a strong sense of place and understanding of innate responsibilities to protect coastal regions and resources therein; however their numbers on the ground are few.

Taiao Raukawa and the MTM research team will strategise how to re-engage the role of human interdependencies and inter-relationships<sup>16</sup> to each other and to the natural, spiritual and cultural, in landscape. The MTM team acknowledges the coastal ecosystem decline evident from research results thus far. We will continue to engage with kaitiaki to determine clear planning strategies for positive action that can be taken over the unique environmental and spiritual values that once supported

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<sup>16</sup> Huhana Smith, 2007. *Hei Whenua Ora ki te Hākari: Reinstating the Mauri of Valued Ecosystems – history, lessons and experiences from the Te Hākari dune wetland restoration project*, Research report number: HSC 1007/01, for FRST-funded research project, *Ecosystem Services Benefits in Terrestrial Ecosystems for Iwi*, Unpublished Report.

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territories and peoples. The MTM team, and local kaitiaki active in MTM, aim to raise as much Māori capability training and development as possible for the sake of future generations' physical, economic and cultural welfare.

The emerging MTM reports clearly show that significant cultural landscapes along the coastlines are beset with water health issues. The ongoing Te Hākari dune wetland project, with training through Nga Whenua Rahui, has shown that there is considerable potential to expand into the neighbouring wetlands towards the Waikawa River and to hopefully increase the number of training opportunities in active kaitiakitanga, particularly for 18-25 year olds.

During 2011, local kaitiaki participated on hīkoi with the Landscape Architecture students, engaged with them on marae, met with them on the whenua for more site visits and assisted them with the development of their visual projects. This interaction culminated on 15 October 2011 with presentations at Tukorehe Marae, Kuku, Horowhenua. Kaitiaki who were present clearly signalled the importance of actively working with students to envisage well thought out action plans for each targeted ecosystem that is in decline. Additionally, such potential afforded by landscape architect students engaging more directly with iwi and hapū groups in 2012 to assist in visualising their rehabilitation projects, is exciting.

In 2012, it is also proposed that as part of the oral archive work, we communicate how tupuna (ancestors) of the region maintained their interdependencies and inter-relationships to their waterways and resources. With the wealth of historic information collated, communicating examples of such interdependences and sustainable use protocols is highly relevant for current generations.

It is vital to build better awareness amongst kaitiaki and other end users of the concepts of coastal ecosystems and coastal ecosystem services. Whilst addressing the needs of raising MORE capacity development, we are pleased with the engagement of local Māori from Ngāti Hikitanga, Muaūpoko, Tukorehe, Wehiwehi and Kikopiri in Waiwiri Stream testing regimes. They all enhanced their understanding of the issues facing this water catchment. With their knowledge of place, their mātauranga Māori of what indicators remain as far as natural resources along the waterway are concerned, and their sharing of information-these combined to further augment the water testing process. There is serious concern for local peoples' inability to customarily gather eel, rongoa Māori and kaimoana in this catchment and at the coast. There were raised eyebrows of surprise at the state of the Kuku Stream catchment to the Ōhau River, when the final Smith et al. (2011) report was presented to farm managers and directors. There are many associated impacts for local tangata whenua; however, being actively engaged in understanding decline issues for the region clearly sharpens



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the determination to see decline turned around.

The MTM collaborative team consulted well with Tahamata Farming Incorporation from November 2011 over the Ōhau River 'loop' project, for the case study field work, and in presenting the final report (Allen et al. 2011). It takes time for some farming boards to understand the philosophies inherent in an ecological economics and mātauranga Māori indicators perspective of coastal health. The information workshops planned for marae and farming incorporations of the region in 2012 will go some way to improving peoples' understanding of the decline along the coastline, which then helps underpin the action plan phases.

Māori research leadership is also being developed in Tauranga through MTM. It is the intention that by the end of this research programme, iwi in Tauranga can be supported to gain funding for, and to lead, major research programmes with research leaders from their own rohe.

### **7.2.3 General capability development**

Both research teams are continuing to support researchers to undertake tertiary studies. Efforts are ongoing to source scholarships for Māori to undertake postgraduate study in relation to MTM. As MTM progresses, we hope to increase the number of PhD and Masters qualified and experienced researchers within Tauranga moana iwi and Ngāti Raukawa, with knowledge of ecological economics, coastal ecosystem services, and importantly, mātauranga Māori knowledge of coastal health and wellbeing.

Despite these efforts there remains a large gap in Māori research capability (indeed in the wider research community) of 'integrated' modelling that can include socio-cultural, economic and ecological factors. Such dynamic and integrative modelling can include, but is not limited to, systems dynamics and mediated modelling.

## **7.4 Greater community awareness of coastal degradation**

We also need to bolster our collective understanding in New Zealand of coastal ecosystems and their services and functioning. Greater community awareness about the significant degradation of some critical coastal ecosystems in both case study areas has already had an empowering effect in targeting future research and restoration activity to stem such decline, and to consider the ecological and socio-cultural impacts of economic activity when making decisions about the use of coastal resources. Significant advances are required to develop capability in systems thinking, mediated modelling, understanding of coastal ecosystems and their services and functioning.

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To improve the socio-environmental health for lands, waterways and peoples, the holistic nature of a Māori environmental world view must also be bolstered and vocalised by more local tangata whenua.

## **7.5 Increased use of Participatory Action Research methods**

The approaches utilised in MTM Phase 1 to facilitate the involvement of local communities in the research process have been very effective. However, there are additional methods that could be employed to harness even greater support and participation more widely. One such method is ‘imaginative engagement’, which has wider relevance to other environmental issues that involve large-scale and difficult-to-comprehend systemic processes, such as climate change (Buckeley 2000; Few et al. 2007). It would seem to be pertinent to social and institutional learning for sustainable development (Schusler et al. 2003; Tilbury & Wortman 2004) where co-investigation of live issues can be made the subject of shared enquiry and creative involvement. Potentially, therefore, imaginative engagement approaches can complement other participatory methods, and may offer experiences which are enjoyable and rewarding. There is some evidence that capacity to engage in river restoration was increased by building knowledge about historical (and potentially recoverable) attributes, strengthening emotional ties to the river, demystifying river basin planning amongst non-professionals, and stimulating a deeper awareness of local meanings and appropriate modes of communication amongst scientists (Selman et al. 2010). Capacity was also built in terms of the art practice itself—the workshop leader noted marked development of writing skills and responded to requests for individual master classes, whilst one participant went on to contribute to a highly regarded local radio program” (Selman et al. 2010).

## **7.6 Challenges of Valuation of Ecosystem Services and Natural Capital**

The Ministry of Science and Innovation, in its latest “Request for Proposals: Environment”, has prioritised the critical importance of developing methods of environmental valuation to systematically account for natural resources as capital in the same way as we count nationally for economic and financial resources and “bridging this analysis into mainstream policy, planning processes and business decision-making”.

Phase 1 of MTM not only highlighted the challenges of achieving these types of valuations of ecosystem services and capital, but also highlighted the need to take more account of cultural and more biocentric values. Some useful case study examples of the valuation of coastal ecosystem services have begun and are planned to be completed in Phase 2. Furthermore, the development of the emergy-based methods for valuing coastal ecosystems has been demonstrated particularly in regard to how it highlights species and processes

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that may be overlooked by neoclassical methods of valuation such as contingent valuation. Despite the success we have had in developing and operationalising neoclassical and emergy-based methods, more important challenges lie ahead for MTM in terms of how the results of such valuations can be used in a practical sense by both iwi and non-iwi resource managers.

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