10 RESTORING SUSTAINABLE USE OF FISH & INVERTEBRATE STOCKS

10.1 TABLE OF CONTENTS

10.2 LIST OF FIGURES

10.3 LIST OF TABLES

10.4 INTRODUCTION

The Kaipara Harbour is New Zealand's largest enclosed estuary and the second largest harbour in the world (Haggitt *et al*. 2008). It covers 743 km^2, and with over 3,000 km of coastline. The harbour mouth is 8 km across where a substantial amount of sand accumulates as an ebb tidal delta. It has long been recognised as an important nursery area for juvenile fish and sharks, particularly snapper, grey mullet, flounder and mako and great white sharks. It is also feeding ground for large mega fauna such as orcas and the critically endangered Maui dolphin. Kaipara hapū readily refer to the Kaipara as their 'food basket' and family member. The Kaipara holds tremendous cultural significance to Ngāti Whatua hapū Te Uri o Hau and Ngāti Whatua Ngā Rima o Kaipara.

The harbour constitutes a major inshore fishery, historically and currently, being exploited by Māori in pre-European times and today dominated by local commercial fishers targeting flounder, rig and mullet. Since the 1870's a variety of fish were caught by Pākehā for subsistence, for the local market, for canning, and ultimately for shipment by rail through Helensville to Auckland. In the latter part of the 20th century, a combination of increasing part-time fishers, the ability to work many areas of the Kaipara in various weather conditions, trawling and long-lining operating along and adjacent to the Kaipara entrance, and changing fishing rules, brought growing conflict on the harbour (KHSFMSG 2003).

The Kaipara fisheries have been subject to many attempts to manage the conflict and fishing pressure but all have failed and recent research on flounder, mullet and rig stocks has showed catch rates declining since the mid-1990s (Hartill 2004). A number of species that are harvested for commercial, recreational and cultural purposes have sustainability concerns but information which would assist management decisions is lacking (Haggit t *et al*. 2008)

A review of marine environment information identified a general lack of biological information on targeted species life histories, habitat utilisation and distribution patterns within the harbour; effects of non-fishing activities such as sandmining on fish; and effects of habitat loss or degradation particularly to juveniles.

This chapter reviews the three knowledge-bases and concludes with the identification of gaps in our knowledge which are barriers to restore the sustainable use of Kaipara fish and invertebrate stocks. This chapter will also identify possible remedies or solutions that will assist with achieving this long-term objective of restoring sustainable fisheries and moving towards the IKHMG vision of a healthy and productive Kaipara harbour. This chapter will compliment marine information reviewed by Haggitt *et al*. (2008), with information relevant to Mātauranga Māori and socioeconomic knowledge-bases.

10.5 HISTORICAL BACKGROUND ON KAIPARA FISHERIES

For the 25 years after the signing of the Treaty of Waitangi, fisheries and fishing was not an issue, as Europeans were primarily focused on land tenure and ownership. Māori were unrestricted in their fishing, access rights and trade (Waitangi Tribunal 1988). It is believed that roles reversed when access and limits changed somewhere around 1860s. During this time racial attitudes changed, land wars transpired, and European population numbers begun to outweigh those of Māori. Waitangi Tribunal (1988) states:

> *"In the wake of the wars came a series of laws destined to break the Māori control of the resources of the land and sea, and significantly, to put an end to their competitive trading habits".*

The *Oyster Fisheries Act 1866* was the first fish law in New Zealand. In 1865 it was reported to the House of Representatives that Auckland had literally received thousands of ketē (flax-made carrying bags) of oysters. The Act provided for the leasing of oyster beds for commercial purposes but made no specific provisions for Māori apart from not allowing them to sell oysters from their own reserves until 1913 (Waitangi Tribunal 1988). Then came the *Fish Protection Act 1877* the first comprehensive fisheries control measure that recognised the Treaty of Waitangi. It enabled the public to exploit fisheries and the rights of Māori would not encroach upon this (Durie 1998). And it was not until the *Fisheries Conservation Act 1884* that Māori customary fishing rights were defined as domestic, non-commercial rights only. It permitted the prescribing of the use for: closed seasons; minimum size or weight limits of fish, seals or oysters; mesh size; and use of fishing methods. The *Fisheries Encouragement Act 1885*, dealt entirely with encouraging commercial fishing and related industries, such as canning (Murton unpublished). These early pieces of legislation were intended to protect fish stocks from overfishing and depletion, and attention was particularly directed at oysters and seals, primarily because visual signs of depletion were evident as populations were highly abundant so close to shore.

Sea Fisheries Act 1894 and the *Fisheries Act 1908* were intended to prevent depletion, protect young fish and to prevent interference with reproduction and, thus seasonal closures, minimum fish sizes and mesh sizes and other input controls were utilised. General policies and processes were also introduced and affected fisheries of the Kaipara. Consolidation of fisheries law involving all existing legislation (freshwater and sea) occurred in 1908 and no new legislation was enacted until 1945 when licencing was introduced. But only in 1983 was the 1908 Act repealed and entirely new legislation was enacted to introduce the Quota Management System, more of which is discussed below.

Murton (unpublished) presents an overview of government fisheries management policy and legislation enacted to permit the management of fisheries of all types. The relationship to fisheries resources and the instruments used for control and management to conserve fisheries was also examined. Fisheries research was also examined from this period, to try and understand the reasoning behind the controls and management mechanisms placed on fisheries throughout the twentieth century. Most decisions were based upon hearsay and

economics, rather than on actual knowledge of fish biology, fish population dynamics, or foodweb biology for the various species of fish and shellfish.

Sea Commercialisation to 1987

With the advent of licencing fishers to sell fish in the 1940s, a large proportion of fishing boats that occasionally, casually or seasonally fished, left the industry. The system of restricted licencing sought the conservation of fish resources by controlling the number of licences, fishing method and areas open to fishing. The system also enforced a 'one port landing' rule. This required a fishing vessel to operate from, and to land fish only to, the port specified in the licence.

A review of the licencing regime was carried out in 1956, and again in1963, where recommendations were made on continuing the system of conservation of stocks, but the lack of knowledge regarding fish population dynamics was noted (Murton unpublished). During this period the New Zealand fishing industry shifted to meet the new economic direction of the country, which was towards export-oriented products, particularly for wool, meat and butter. The fishing industry encouraged expansion, and was supported by the New Zealand government where conservation was still considered to be necessary, but was taken to mean 'maximum yield on a continuing basis' (New Zealand Joint Working Group on Māori Fisheries Issues 1988). Government loans were made available for purchasing boats, equipment and other related items and entry into the fishery was made available. Subsidised licencing for fishing had not been allowed since 1937 (Murton Unpublished) and brought significant expansion into the inshore fishery which included the Kaipara Harbour.

The period through to the 1970s divulged an accelerating expansion of the fishing industry, including foreign vessels fishing around New Zealand, and the rapid growth of aquaculture industry. The United Nations Law of the Sea Convention 1982, which New Zealand signed, introduced the 200 nautical mile Economic Exclusive Zone, considered to be under Crown ownership for all New Zealanders. This also resulted in massive expansion and interest into deepwater trawl and longline fishing and increased pressure on fish stocks. This was soon to be hampered by the weakness of technology with respect to the suitability of gear and vessel ability to sustain long periods away from port, which included the need to store/freeze fish. This ultimately resulted in increasing inshore fishing and stocks continued to decline, placing many fishers, fishing companies and coastal communities heavily dependent on fishing, under strongly negative financial pressure.

In 1982, a moratorium on any new licences was imposed while the government evaluated the nature and extent of the inshore fishery problems (New Zealand Joint Working Group on Māori Fisheries 1988). This led to the introduction of an innovative fishery management system involving Individual Transferable Quotas (ITQ) and the Quota Management System in 1987. An ITQ essentially is a property right, not over the sea, but in the activity of fishing. It was the right to catch and sell. It was a right that could be bought, sold, gifted or willed, or used as a basis of partnership with others or to provide an income. A cost to government would be paid annually to allow this right.

Treaty of Waitangi and the Quota Management System

Many Māori, mostly part-time fishers, were not offered Quota which was of great concern to Māori and the Waitangi Tribunal, who believed the Quota Management System extinguished

rights, stipulated under the Article 2 of the Treaty of Waitangi. Negotiations between the Crown and Māori continued before the High Court and it was not until 1992 that an opportunity arose for settlement. Carter Holt Harvey proposed selling its 50% interest in Sealord Products Ltd., equivalent to 13% of commercial fishing quota.

The government provided Māori tribal authorities with capital to purchase a 50% shareholding of Sealord Products Ltd., in return for Māori withdrawing all existing litigation and supporting the repeal of all legislative references to Māori fishing rights and interests including, but not limited to, the repeal of section 88(2) of the Fisheries Act 1983 and an amendment to the Treaty of Waitangi Act 1975 to exclude from the Tribunal's jurisdiction claims related to commercial fishing.

On 23rd September 1992, a deed of agreement was signed, most of which is embodied in the *Treaty of Waitangi (Fisheries Claims) Settlement Act 1992*. Much was gained from the settlement for both present and future generations, benefiting from a package worth about $500 million; however, there were potential losses. This agreement involved Māori tribal authorities relinquishing all legal rights or interests in respect of commercial fishing, including commercial inland fisheries, and any commercial aspect of Māori customary fishing. There were to be no further negotiations or obligations to Māori regarding commercial fishing, and all claims before the courts or the Tribunal would be deemed discharged (Murton unpublished, New Zealand Joint Working Group on Māori Fisheries 1988).

Customary fishing rights also received protection through the *Fisheries (Kaimoana Customary Fishing) Regulations 1998* which provided for the establishment of Mātaitai reserves (see Appendix 5 for details) adjacent to marae which offered exclusive control with benefits to community and iwi/hapū to manage traditional fisheries. It also sought to give effect to kaitiakitanga through the appointment of kaitiaki whom control the customary take for particular purposes such as hui and tangi.

Under the Settlement, quota totaling 20% of the Total Allowable Commercial Catch (TACC) for all species was transferred per annum to the constituted Treaty of Waitangi Fisheries Commission. This organisation was comprised essentially of representatives of iwi that had been defined in the nineteenth century, including many with large coastlines. The distribution arrangements were passed to the Commission and the Crown stepped away. A fair and equitable distribution framework was not agreed upon until 2004 under the *Māori Fisheries Act 2004*, which established Te Ohu Kaimoana and Aōtearoa Fisheries Limited, and outlined the criteria to be met before iwi could receive assets derived from the Settlement. These included: iwi organisations needing to meet governance requirements, including having a representative structure and an appropriate constitution; having an asset holding company to receive fisheries assets; and have a minimum number of affiliates on their iwi's register which for Ngāti Whatua is 3,000, compared to Ngāpuhi which is 21,400.

Ngāti Whatua and its mandated iwi organisation will receive through the settlement: (a) quota (composed of inshore and deepwater quota dependent on iwi coastline), (b) income shares in Aōtearoa Fisheries Ltd. (AFL), in proportion to iwi population, and AFL are expected to pay at least 40% of its net profit after tax to its shareholders; and (c) cash, will be allocated in proportion of each iwi population with a minimum being $1 million. The two key factors used in estimating how much each iwi will receive are: (a) length of coastline and

(b) the size of their population relative to the total Māori population as per the Māori Fisheries Act 2004. Ngāpuhi are likely to receive the largest asset package in the Taitokerau as they have a large coastline and higher population as compared to Ngāti Whatua.

Quota Management System and Stock Status

The Quota Management System (QMS) and Individual Transferable Quota have been in place for 23 years in the Kaipara Harbour. The QMS was introduced as an innovative system to achieve sustainable utilisation of fisheries resources. Similar quota systems have subsequently been implemented in 18 countries managing several hundred stocks (Chu 2008). Since its introduction, the QMS has allowed particular stocks to recover and improve, and ITQs have proven to be an effective component of fisheries management in New Zealand. However, despite its introduction, some stocks have continued to decline in the Kaipara Harbour, including snapper, rig, flatfish and grey mullet stocks (Hartill 2004, Haggitt *et al*. 2008). The benefits and drawbacks of ITQs and the property-right and access privilege are hotly debated in New Zealand and globally (Chu 2008, Pauly & Maclean 2003; Yandle & Dewees 2008). The benefits of the QMS and ITQs include the efficacy with which they can end the 'race for fish', reduce over-fishing and stock depletion and overcapitalisation in the fishery, provide economic stimulation, and increased fleet efficiency. The disadvantages of ITQs are believed to be around the initial allocation of quotas, the concentration of quota and the socio-economic consequences to those participating in the fishery. ITQs do not translate into consistent changes in stock biomass (Chu 2008) and can be allocated using historical landings data and vessel characteristics. The concentration of quota to fewer fishers has seen (in New Zealand) smaller owner-operators leave the industry, and larger fishing companies dominating, which has led in turn to social conflict between local fishers and non-local fishers, and seasoned and new fishers.

Scientific literature and debate regarding ITQ recognises that ITQs alone can not conserve stocks (Chu 2008, Griffith 2008). The ITQ and a combination of other measures are needed, such as compliance monitoring, research, observer programs, and no-take marine protected areas to allow fish to stay in the water longer to grow older and larger. Sectors of the community also wish to see stock assessment modeling avoiding B_{MSY}, to set TAC, rather than B_{MSY} being the target (Rea 2009), particularly with high uncertainty surrounding the biomass levels in the short and long-term. The decline of snapper and other stocks in the Kaipara despite having ITQs (perhaps in part due to overly high TAC, or low levels of harvest compliance), also demonstrates the complexity of managing dynamic resources in a changing environment. Climate change, inter-specific and intra-specific dynamics and relationships within the food web (Pauly et al. 2002, 1998; Myers & Worm 2003) and habitat availability throughout the species life-cycle also affect stock biomass (Dayton *et al*. 1995), and also can affect stock status.

Impact of Global Fishing Pressure on New Zealand Fisheries Management

With increasing pressure on fisheries resources occurring across the globe and in New Zealand, particularly inshore in the 20th century, it was recognised that fish resources were finite (Beverton & Holt 1957) and fishing could cause the collapse of fish populations, and generate significant damage to the marine ecosystem. This resulted in significant policy and legal responses at both international and national levels around the globe. These were

aimed at balancing the right to exploit these resources with an obligation to conserve them for present and future generations.

Some important international steps that led to multilateral environmental agreements that affected New Zealand's fisheries management approach were:

- *International Convention for the Regulation of Whaling 1946*
- *Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) 1973*
- *UN Convention on the Law of the Sea (1982)* (UNCLOS) established 200nm Exclusive Economic Zone (EEZ) and the right to exploit resources sustainably and an obligation to protect the marine environment
- *Convention on the Conservation of Migratory Species of Wild Animals – Bonn Convention (CMS) 1983*
- *Agenda 21, UN Conference on the Environment and Development (1992)* defined sustainable development and introduced the precautionary principle.
- *Convention on Biological Diversity (CBD) 1992,* strengthened the principles of integrated ecosystem management; called for conservation of genetic, species and ecosystem biodiversity; and recognised MPAs as a key measure for conservation of marine biodiversity.
- *Convention for the Conservation of Southern Bluefin Tuna 1993*, and
- *United Nations Agreement on Straddling Fish Stocks and Highly Migratory Fish Stocks Agreement 1995*[1]

Since then several countries have developed national Acts of legislation, multilateral agreements, and policies have been developed to give effect to these international agreements and ecosystem management approaches. Some recent examples are the Australian Oceans Policy, Canadian Oceans Act and the United States of America Magnuson-Stevens Act. New Zealand began the development of an Oceans Policy in 2000, which was to ensure integrated and consistent management of the ocean, but was delayed in 2003 while attention shifted to the development of the Foreshore and Seabed Act for public access and customary rights.

The United Nations Millennium Ecosystem Assessment assessed the consequences of ecosystem change for human well-being and involved the work of more than 1,300 experts worldwide. Their findings provide a state-of-the-art scientific appraisal of the condition and trends of the world's ecosystems and services they provide to humanity. The marine environment was assessed (Pauly & al 2005) and the report recommended scientifically based actions to conserve and use the marine resources sustainably, such as:

- *Implement an ecosystem-based approach to fisheries management*
- *Global fisheries authorities must agree to eliminate bottom trawling on the high seas by 2006….to eliminate globally by 2010*

[1] Provisions of UNCLOS Relating Conservation of Management of Straddling Fish Stocks and Highly Migratory Fish Stocks

- *Having in place a network of representative, fully protected marine reserves that covers 10 percent of the oceans, with a longterm goal of 30 percent…*

These international developments to address the global concern of overfishing and fisheries habitat destruction, allowed New Zealand to step up and become a signatory of many of the above multilateral environmental agreements. On the international stage New Zealand was promoting sustainable fisheries, and at home maximising the benefits from the use of fisheries resources using the internationally successful Quota Management System.

Paradigm Shift – The Rise of Ecosystem-Based Fisheries Management

The development of the ecosystem approach can be traced to the 1972 UN Conference on Human Environment, but international institutional development has been slow. While there was some progress in the 1980s, notably with the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) and the 1982 Law of the Sea Convention, development accelerated in the 1990s, and in particular the 1992 Rio Declaration and Agenda 21, along with the FAO Code of Conduct and the 1995 UN Fish Stocks Agreement were important cornerstones in the development of the approach.

Ecosystem-based management, ecosystem management, ecosystem approach, ecosystem approach to fisheries, ecosystem-based fisheries management are all terms readily used in the literature to describe an approach to management of natural resources that is ecosystem focused. There is no definitive term commonly accepted across the planet, but there is consensus that the terms “ecosystem”, “based”, “approach” and “management” must be used to imply that management is focused from an ecosystem perspective rather than from a single-species perspective. Just using the term “ecosystem management” will not do as it implies that it is possible to control and manage an entire ecosystem; it is scientifically more accurate to use the term “ecosystem-based management” or “ecosystem approach to management”.

The other term commonly used in the literature is ecosystem-based fishery management. How Does ‘Ecosystem-Based Management’ (EBM) differ from ‘Ecosystem-Based Fishery Management’ (EBFM)?

EBM and EBFM are different, but complementary. Managing individual sectors, such as fishing, in an ecosystem context is necessary but not sufficient to ensure the continued productivity and resilience of an ecosystem. Individual human activities should be managed in a fashion that considers the impacts of the sector on the entire ecosystem as well as on other sectors. The longer-term, integrated, cumulative impacts of all relevant sectors on an ecosystem must be evaluated, with a mechanism for adjusting impacts of individual sectors (Ward *et al*. 2002).

EBM in fisheries is a new direction for fishery management (Pikitch *et al*. 2004), where priorities start with the ecosystem rather than a target species. EBFM aims to sustain healthy marine ecosystems and the fisheries they support. EBFM has been readily taken up in international forums such as the UN Convention on the Law of the Sea and FAO Responsible Fisheries Code of Conduct, the US Magnusons-Stevens Act and Australian Oceans Policy. More recently EBM experienced a significant boost in Johannesburg in 2002, where the World Summit on Sustainable Development’s Johannesburg Plan of

Implementation (JPOI) endorsed the ecosystem approach for fisheries, biodiversity protection and sustainable development and called for its implementation by 2010.

The 2002 World Summit noted that:

> "*Oceans, seas, islands and coastal areas form an integrated and essential component of the Earth's ecosystem and are critical for global food security and for sustaining economic prosperity and the well-being of many national economies, particularly in developing countries*," and therefore stated that "*Ensuring the sustainable development of the oceans requires effective coordination and co-operation, including at the global and regional levels, between relevant bodies, and actions at all levels to: (d) Encourage the application by 2010 of the ecosystem approach, noting the Reykjavik Declaration on Responsible Fisheries in the Marine Ecosystem and decision 5/6 of the Conference of Parties to the Convention on Biological Diversity*."

The 2002 World Summit called on States to:

> "*In accordance with chapter 17 of Agenda 21, promote the conservation and management of the oceans through actions at all levels, giving due regard to the relevant international instruments to:(c) Develop and facilitate the use of diverse approaches and tools, including the ecosystem approach, the elimination of destructive fishing practices, the establishment of marine protected areas consistent with international law and based on scientific information, including representative networks by 2012 and time/area closures for the protection of nursery grounds and periods, proper coastal land use; and watershed planning and the integration of marine and coastal areas management into key sectors*."[2]

The ecosystem approach has been involved in a number of parallel but related institutional streams: in the law of the sea, through the UN Law of the Sea Convention, the UN Fish Stocks Agreement, ICP (Open-ended Informal Consultative Process on Oceans and the Law of the Sea) and the General Assembly; in the FAO, through the Code of Conduct, COFI, expert consultations and the Reykjavik Declaration; in the Convention of Biological Diversity (CBD); and from the Stockholm Declaration through the United Nations Conference on Environment and Development (UNCED)'s Agenda 21 and the Rio Declaration and the JPOI. However, although ecologically sustainable development is now a goal of fisheries statutes and there has been progress in sustainable fisheries assessment, fisheries legislation in general, retains barriers to ecosystem-based management and multiple-user management − and the number of overfished species is growing (ACF and NELA 2006, Pauly *et al* 2005, Currie 2007, FAO 2007).

Maximising the Use of Fisheries

Identified in the 2005-2008 Statement of Intent (Ministry of Fisheries 2005), the Ministry of Fisheries introduced the term "objective-based approach to fisheries management". This

[2] World Summit on Sustainable Development, Johannesburg Plan of Implementation, A/Conf.199/20, (JPOI), paras. 29, 31, and 64.

approach introduced standards (e.g. consultation, harvesting), and defined outcomes to deliver on the goal of the *Fisheries Act 1996* s8, and fisheries plans. Implementing fisheries plans would be the main tool to deliver objectives-based management for specific fisheries. The Kaipara Harbour was included in the North Island West Coast Fish Plan (Ministry of Fisheries 2009a) which was developed by an Advisory Group assisted by the Ministry of Fisheries. Other Stakeholder-driven fisheries plan development was also implemented elsewhere in New Zealand, which allowed the Stakeholders to lead and implement the Plan. While fisheries plans have been mandated under s11A of the Fisheries Act 1996 since 1999, action to deliver on species-specific and area-based fisheries plans did not start until February 2008. Consultation on the draft North Island West Coast Fish Plan started in September 2009.

With a change in government in November 2008 after nine years and a global economic recession with associated credit crunch, the 2009 Strategic Direction for the Ministry of Fisheries (Ministry of Fisheries 2010) embraced economic drivers to rebuild New Zealand's economy and deliver better more efficient fisheries returns. The Government's priority is to:

> *"Grow the New Zealand economy in order to deliver greater prosperity, security and opportunities for all New Zealanders".*

This includes particular focus on reforming the performance of aquaculture and commercial fisheries, frontline compliance by increasing the number of fishery officers; research on fish stock status and addressing information gaps particularly addressing amateur fisher interests; as well as implementing the Treaty of Waitangi Deed of Settlement. This led to the organisational restructure of the Ministry with a more centralised operations focus and a view to deliver on a strategic document: 'Vision 2030' along with maintaining an objectives-based fisheries management approach and standards.

Vision 2030 sought to develop new institutional arrangements and tools to unlock the potential of the New Zealand fisheries sector and generate a significantly greater contribution to the economy. An independent review of the fisheries sector was carried out by PriceWaterHouseCoopers New Zealand. The Ministry of Fisheries worked with non-commercial fishing interests and Māori to develop a shared vision to achieve goal of Vision 2030. Input of all stakeholders and tangata whenua were sought in response to firstly, the independent review of the Ministry of Fisheries and New Zealand's fisheries management regime (PriceWaterHouseCoopers 2008) which informed the 2030 Strategy; and secondly the draft 2030 Strategy itself. PriceWaterHouseCoopers (2008) noted the complexity in balancing and managing multiple and conflicting sector issues, regarding a highly complex ecosystem with tremendous uncertainty regarding its status and use. Without any some form of Government intervention, in their mind, a number of issues would continue: (a) depletion of the resource, (b) inability to receive benefits as a user (c) over-investment in utilization, (d) under-investment in management; and (e) a lack of confidence by the wider community.

Then Minister of Fisheries, the Hon. Phil Heatley, released the Fisheries 2030 Strategy in September 2009 (Ministry of Fisheries 2009) with the overarching goal of "*New Zealanders maximising benefits from the use of fisheries resources within environmental limits"*. This strategic document was developed to:

> *"….assist with guiding approaches to fisheries management, provide more certainty to tangata whenua and stakeholders as they make decisions about investments and activities"*

Of note, were the principles of ecosystem-based management, conservation of biodiversity and environmental bottom-lines. Together with eight values and ten other principles these are applied across three broad outcomes: Use, Environmental and Governance. The Minister of Fisheries Cabinet Paper (Office of the Minister of Fisheries 2009) to the Cabinet Economic Growth and Infrastructure Committee reports that the 2030 Strategy:

> *"..sets out a strategy and recommended actions to enable the [fisheries] sector to make a significantly greater sustainable contribution to the New Zealand economy".*

The Minister identified a Plan of Action to be developed as stipulated in the 2030 Strategy; a short-term objective which will still maintain an objective-based fisheries management planning approach, government-set standards and sector responsibilities.

Evolution rather than Revolution – an Alliance is Formed

Māori, environmental and non-commercial fishing interests were initially supportive and hopeful of the shared fisheries direction and Vision 2030 project and believed it to be an opportunity to deliver their vision of *"more fish in the water - kia maha atu nga ika ki roto i te wai"* (Rea 2009). However, concerns arose when the Ministry of Fisheries adopted in September 2009 a more economic-outcome approach (Rea 2009a) for the final Ministry of Fisheries 2030 Strategy (Ministry of Fisheries 2009) which is believed to be at the detriment to social, cultural, environmental and economic well-being. Arising from this concern was an unprecedented alliance was established between Māori non-commercial fishing interests: the Hokianga Accord, amateur or recreational fishing groups such as the New Zealand Big Game Fishing Council, Recreational Fishing New Zealand, Option4[3]; and environmental groups Greenpeace New Zealand Aōtearoa, Environment and Conservation Organisations of Aōtearoa New Zealand (ECO) and Royal Forest & Bird Protection Society. Together they complied and presented joint submissions, requested an audience with the then Minister of Fisheries and CEO of the Ministry of Fisheries to voice their shared issues and concerns.

A particularly concerning aspect of the 2030 Strategy to stakeholders and Māori was the change from *Vision 2030* to a goal orientated strategy (Rea 2009a), which was identified in the Minister of Fisheries cabinet paper as a terminology issue (Office of the Minister of Fisheries 2009). However, when PriceWaterHouseCoopers (2008) consulted with the sectors, including Māori, during the drafting of the Vision 2030 project, a vision rather than a Goal was discussed and recommended.

This historical synopsis and the outline of the current situation of the broader New Zealand fisheries management sets the stage for understanding the direct and indirect impacts of fishing on the Kaipara harbour fisheries, fisher community and Kaipara Māori. The following section reviews the development of Kaipara fisheries and considers the difficulties faced in

[3] www.option4.co.nz

fisheries management as a manifestation of many of the management issues occurring not only nationally but globally.

10.5.1 DEVELOPMENT OF KAIPARA FISHERIES

Among the fish originally targeted by commercial fishers were grey mullet, flounder and snapper and it was not until the 1950s that school shark became important. Small amounts of trevally, gurnard and some other species were also caught, mainly as bycatch. The first weight estimates of fish catches from the Kaipara date back to 1931−1932 (Marine Department 1932) (Figure 1) with descriptions of catch being first reported by the government from 1915−16 (Marine Department 1916). However, European anecdotal descriptions go far back as Barlow (1888):

> "*Snapper can be caught by line fishing in the Kaipara, at the rate of 60 or 70 an hour per line of two hooks, and of an average weight of about 9 lbs each…..Mullet average about 2 lbs each in weight, and I have known 120 dozen of them to be netted by two men in a day up here. Patiki, a fish shaped exactly as the English flounder, but resembling more nearly in flavor the sole, are here in great numbers, and can be caught with a net in boatloads"*.

Pākehā and Māori fishing methods used up to the 1890s for commercial fishing included line fishing, nets, traps and weirs, and hand gathering.

The historical record describes various Māori fishing expeditions that took place on the Kaipara Harbour in the late nineteenth century. On December 18th 1840, Buller (1878) recorded that chief Tirarau and his people had gone down river to Ōtamatea to catch young sharks. Likewise, on January 22nd, 1843, Buller noted that many Māori in the vicinity had gone to Ōtamatea for shark fishing. Such shark fishing expeditions were also described in an address given to the Auckland Institute in 1910 by R. H. Matthews who described in detail the tradition, rules and methods used to capture shark (Waitangi Tribunal 1988). The Helensville Heritage Study (Fletcher 1994) also provides some evidence concerning shark fishing in the southern Kaipara, describing shark fishing as occurring mainly in the summer, but also throughout the year. Mataia Stream which enters the Kaipara Harbour near Glorit, was a popular base for shark fishing expeditions in the southern Kaipara. Large numbers of shark were caught, dressed, sun-dried on frames made of Manuka poles and stored for winter consumption.

Polack (1838 (1974)), whom travelled down the Wairoa River in 1831−32 noted "*one hundred lbs of snapper fish, and the kahawai*" were caught in just under an hour at Tokatoka.

Handlining for snapper, usually 40−50 kg in total catch weight, was believed to occur commercially and for subsistence purposes by Māori and early European settlers around the Kaipara, until steam trawling was introduced in the late 1890s.

Mullet and flounder were netted by Māori, and Barlow (1888) describes the practice in the Arapaoa River where "….*in a couple of hours had captured over a hundred fine mullet…*".

This same technique was used commercially well into the early 20th century, where stakes were driven into the mud with nets attached to capture the flounder; whereas the nets were shot out round the school of mullet, sometimes referred to as 'seining'.

Set netting or stalling for flounder was a technique that was first described in 1896, with nets made of flax (Murton unpublished). Stalling was deemed 'harmful and wasteful' by the Marine Department because of the large capture of small fish, and the practice was prohibited in the Kaipara Harbour by 1906. But the practice still continued, as it was less work compared to picking up nets before they dried and were saturated with weed and grass. Enforcing such laws were also difficult on the Kaipara due to its enormous expanse and the only Harbour Master was then located in Te Kopuru, up the Wairoa River towards Dargaville. Stalling was again prohibited under the *Fisheries Act 1986* on 1 April 2008 (Anderton 2007).

Commercial Fishing on the Kaipara

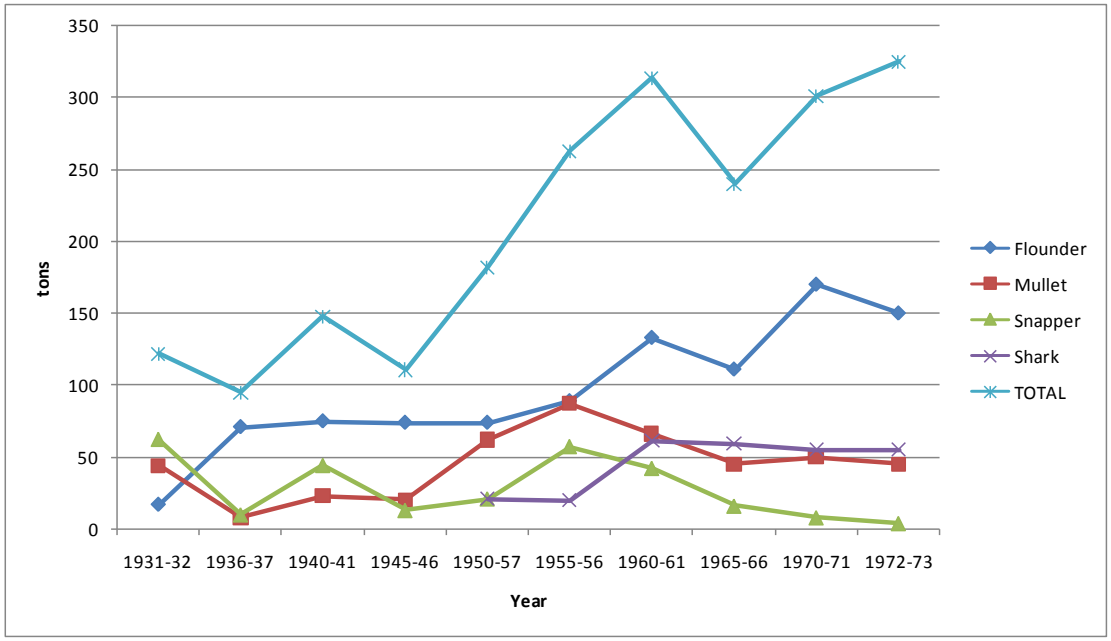
Commercial fishing began in the late 1870s when mullet began to be caught for sale to the canneries, and following the completion of the direct rail link from Helensville to Auckland in 1881. Mullet were the most commonly caught fish by Māori, due to their high abundances close to shore and thus, dominated the Auckland food market.

The first cannery located on the Kaipara Harbour was established at Kauramuramu, near the mission station at Rangiora, in 1874−75. At about the same time, a smaller cannery for preserving fish, mainly mullet, began lower down the Ōtamatea. Sherrin (1886 (2000)) noted that it was Māori who supplied these factories initially. When the cannery in Helensville opened in 1882, Pākehā started it and processed all kinds of fish, mostly for export to Australia. Another opened at Batley on the Ōtamatea River, where processing of fish, meat, jam and fruit was carried out. The Helensville cannery closed in about 1890, but another re-opened in 1913. At this time, there was only one other cannery: on the Ōtamatea, which operated until 1922−23. The Helensville operation closed down permanently in 1921.

Commercial flounder fishing was a distant second to mullet during the late nineteenth century and prior to 1915, there was no consistent catch data from the Kaipara. The Marine Department annual report for 1914−15 stated that 55,000 dozen (660,000) mullet were reported caught, 20,000 dozen flounder, 13,000 dozen snapper, 1,000 dozen trevally and 200 dozen gurnard (Marine Department 1915). However, the Kaipara Harbour's contribution to New Zealand's total fish catch has never been large, and the industry was relatively small in scale, with a dependence on close inshore estuarine fish species.

Records from the 1930s to 1970s started to show a different dominance in the composition of fish caught (Figure 1). Snapper comprised about half of the catch, followed by mullet and flounder. By 1936−37, flounder dominated, and continued to do so until the early 1950s. From 1961, the contribution made by snapper declined radically, while flounder increased considerably, and mullet steadied. During the 1950's, school shark also became an important part of the catch.

Figure 1. Major fish landed in the Kaipara Harbour, 1931-1973 (Source: Murton Unpublished, Marine Department 1972).



With the introduction in 1899 of steam trawler technology to New Zealand, which allowed large single or paired nets to be hauled, a new era of fishing began. There were up to five screw steamers and one paddle steam trawler operating in the harbour targeting snapper (Murton, unpublished) before being banned from the Kaipara Harbour in 1908. Trawl fishers could land fish at a cheaper price in Auckland than if railed from Helensville, and for commercial set net and line and recreational fishers this introduced new concerns.

Danish seining and trawl fishing catches increased exponentially and were concentrated in harbours and inshore shallow waters, such as the Kaipara Harbour. Impacts on fish stocks were immediate and the first major enquiry into the state of New Zealand fisheries and fishing industry took place in 1937 (Murton unpublished). Commercial fishers consistently broke the fishing regulations, with ongoing debate regarding depletion taking place up until restricted fishing was introduced between 1945 and 1963.

The Sea Fisheries Investigation Committee produced a report, which led to the reshaping of the management of the fishery for the next 25 years. The enquiry led to the introduction of one new and innovative principle which restricted and limited licencing. This meant from 1940 on, a licence was necessary to take out a fishing boat licence and to catch fish for sale (New Zealand Joint Working Group on Māori Fisheries 1988). This resulted in many part-time boats ceasing fishing, which heavily impacted on Māori.

Perhaps the most significant aspect about the development of commercial fishing in the harbour was the absence of a Māori presence from the 1870s in fisheries management development and negotiations with the Crown. Māori were heavily involved in commercial fishing for the canneries up to the mid 1880's, but thereafter, disappeared from the industry, except to sell fish casually and part-time. Murton (unpublished) records that only one

fulltime commercial Māori fishermen continued up to the 1960's (the Rapana family of Haranui). Murton (unpublished) stated that nothing obvious about the industry precluded Kaipara Māori from participating fully; however, capital was required to adequately compete in the industry, which most Kaipara Māori did not possess. Loans were very rarely given to Māori at that time, even if they possessed land as collateral, so that the financial and social structure of industry and markets made it almost impossible for Kaipara Māori to become commercial fishers'.

By the 1950s, Kaipara Harbour landings of flounder usually ranked in the top three in the country, only challenged by landings from Thames, Manukau Harbour and Nelson. Also, by the late 1960s, school shark landings were either first or second by weight in the country (Murton unpublished).

Issues of stock depletion have been a constant complaint over the last 150 years, while management tools such as, closed seasons, restricted licences to open entry and net restrictions have been applied to conserve stocks and enhance economic returns to the greater New Zealand economy, such issues persist. Māori had been significantly involved in fisheries for subsistence and trade between whanau/hapū prior to European settlement, and also up until the establishment of canneries in the 1880s. But after this period commercial Māori fishers were limited to casual and part-timer fishers (with the exception of one family). However, when it came to oysters and toheroa the situation was very different.

Oysters

The native rock oyster (*Saccostrea cucullata*) historically occurred abundantly throughout the Kaipara Harbour in natural beds, forming a conspicuous zone at mid-tidal level on rocky shores. Wild, natural oyster beds were recorded in the Arapaoa, Whakaki, Ōruawharo, and Ōtamatea Rivers, and along the Hukatere peninsula. Though considered inferior to the quality of oysters found in the Hauraki Gulf, they were cultivated, harvested and considered of fair quality. The Kaipara Harbour is still recognised today as the most important spat catching area for New Zealand's Pacific Oyster farming industry, although spat collection can be abundant but inconsistent. Throughout the development of oyster farming in the Kaipara Harbour, growing oysters to suitable market size was difficult, and it was recognised that native rock oyster growth was a lot slower compared to other areas.

Oysters were the first fishery to become regulated in New Zealand under the *Oyster Fisheries Act 1866*, which established closed seasons, minimum sizes, and licensing for pickers of wild oysters. The legislation was enacted because oyster beds near Auckland, where the biggest market occurred, were showing signs of depletion. Between June 1883 and June 1894, Kaipara oyster beds were declared closed, as they too were showing obvious signs of depletion due to the increasing demand of the Auckland market (Marine Department 1894).

Oysters were a notable delicacy for early settlers, particularly at saloon bars where they were served in a bottle, but were also harvested to make shell lime (Murton unpublished). Oyster beds continued to show signs of depletion, with the closed season and a dedicated inspector from the Marine Department provided to oversee the protection of oyster cultivation in the Kaipara throughout the late 1890s and into the twentieth century.

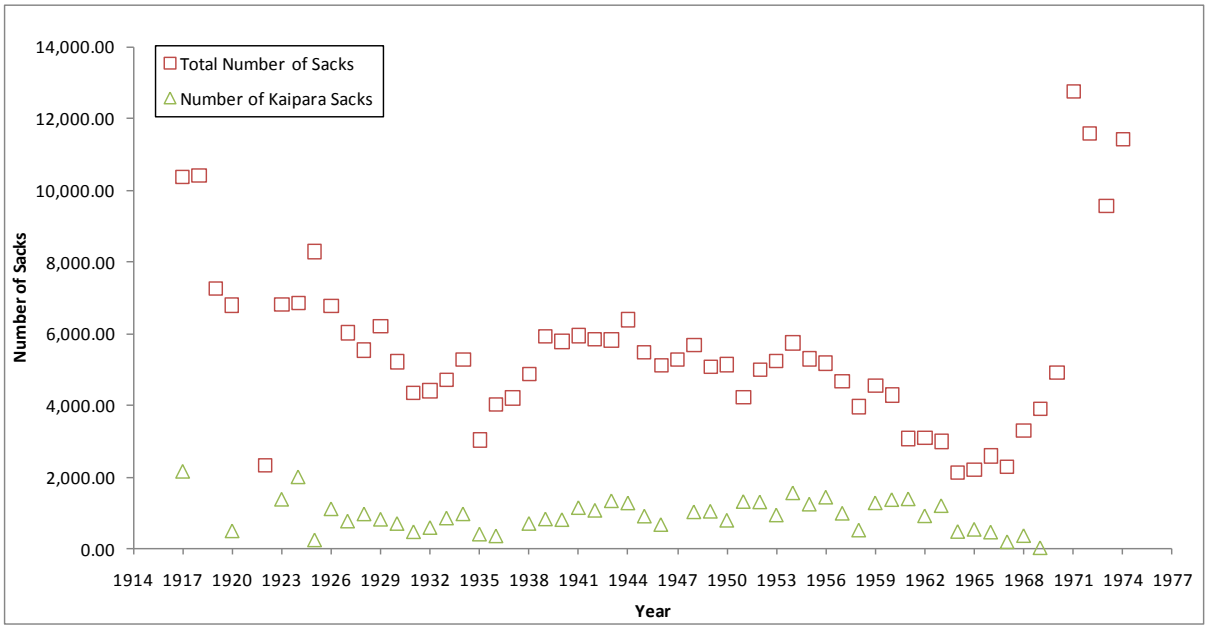
Because of native rock oyster's high abundance and widespread distribution in the Kaipara and being a significant oyster spat area for New Zealand, serious oyster cultivation began in 1928. Quarried stones and rocks, and old ballast heaps were transferred to the lower intertidal edge and high level oyster rocks were moved down the shore. Between November 6th and 24th 1928, 3,548 yards of rock were moved, with six men and a dedicated supervisor from the Marine Department employed (Murton unpublished). By 1929, 12,244 yards of rock had been moved, along with 1,892,000 oyster borers and 5,110 pupu (a marine snail), being destroyed as pests. The last significant amount of stone placement took place between September 1946 and February 1947 in the Ōruawharo River.

Oyster cultivation progressed rapidly through the aid and support of the New Zealand Marine Department, which invested resources, labour and technical expertise. Scientific research also was initiated, with the first water temperature recordings being taken in 1927 from all oyster areas, and an expansion to include additional environmental factors affecting oysters in 1929, including the oyster borer gastropod (*Lepsiella scobina*). Spat and growth studies were undertaken by Marine Department scientists until the 1930s, when attention shifted to toheroa and marine fish (Marine Department 1929, 1940). Spat experiments and collections were especially concentrated in Hargreaves Basin at Oneriri and Schoolhouse Bay in the Ōruawharo River.

Profits had been made from oyster cultivation throughout the late 1920s and into the early 1930s. It was noted, that in particular cultivating areas in the Ōtamatea, Arapaoa, and Ōruawharo Rivers, oyster growth was rapid and there was no signs of silting (Murton unpublished). However, oyster cultivation areas established near the Ruawai stopbanks proved unsuccessful, due to numerous floods and bad weather affecting oyster growth and quality. These areas were abandoned in the 1920s.

It was not until the late 1950s that the Kaipara was deemed to have an 'oyster crisis'. The cultivation approach was still using stone as the growing surface, and turning stone was not producing economically successful results. The number of sacks produced dropped from over 2,000 sacks in 1924 to only 514 sacks in 1958 (Figure 2). At its height, the Kaipara Harbour oyster industry contributed up to 29% (in 1924) to the overall New Zealand total of wild harvested oysters.

Figure 2. Sacks of Oysters Picked by the Marine Department, 1917-1974.



In 1963 the total government monopoly of oyster production shifted to private production through oyster farming (Murton unpublished) throughout New Zealand. With the accidental introduction of the Pacific Rock Oyster (*Cassostrea gigas*) in the 1970s, saw wild native rock oyster cultivation was replaced with farming of the faster growing and better quality Pacific Rock Oyster. Spat collection, science, and technology development continued on Marine Department farms, with subsequent grow out activities being privatised under the *Rock Oyster Farming Act 1964* (and subsequent Acts, the *Marine Farming Act 1968* and *Marine Farming Act 1971*). Under the Act, permission from the Crown was granted to individuals to lease portions of the foreshore, where oysters grew, to farm oysters. The Marine Department believed this to be the most profitable, economical and permanent way to protect and extend the beds (Murton unpublished). Oyster production nearly doubled with this change in direction and support from the government, with the annual production of sacks of oysters rising to well over 12,000 (Figure 2) in 1971, up from 4,912 sacks in 1970. The Kaipara's role in this production shifted from on-growing cultivation, to that of spat collecting, with the majority of the New Zealand oyster industry relied heavily on Kaipara Harbour spat production (Murton unpublished).

This shift to using the Kaipara for spat collection was because of the low quality of adult Pacific Oysters, with oysters containing less flesh and more shell, and tasting muddy. Oysters were washed prior to selling as they were covered with a slimy mud. A large proportion of oysters were reported to be killed by this mud. Even when different types of technology such as trays or stones were used for cultivation, mud was smothering the oysters and reducing water flow accumulating around the stone work. By 1960, even the youngest beds created in 1946 were reported to be silting up.

Commercial oyster farming in the Kaipara Harbour currently occurs in isolated spots in the Arapaoa River, particularly at Kirikiri Inlet (or Deep Creek), and Whakapirau Creek. More recently, a new oyster farm is being established adjacent to the Hoteo River in the southern

Kaipara, but out in the open harbour using new technologies, in an area not previously considered suitable for oyster farming. Spat collecting still continues, mainly at Batley Point, in the Ōtamatea River.

Six oyster reserves returned under the Te Uri o Hau (Treaty of Waitangi) Settlement Claim Act 2002 occur throughout the Arapaoa, Ōtamatea and Ōruawharo Rivers; and also from Pouto Point north to Sail Point. The location and condition of remaining oyster beds have been recently described in Haggitt *et al*. (2008) and Kelly (2009).

Toheroa

Commercial harvesting of toheroa (*Paphies ventricora*), (a surf clam), ceased on beaches adjacent to the Kaipara Harbour in 1969, in response to declining population abundances. Recreational harvesting ended on Muriwai Beach in 1976, and for Dargaville Ripiro Beach in 1980 (Stace 1991; Akroyd *et al.* 2008), although customary harvesting continued. For Kaipara Māori, including Te Roroa of the Kaihu Valley, Te Uri o Hau, Te Pōpoto O Ngāpuhi O Kaipara and Ngāti Whatua o Kaipara, living in areas adjacent to the coast, toheroa was a traditional staple food (Murton 2006), and collected and dried for long journeys (Stace 1991). Toheroa were also prestigious kaimoana for hui and tangi for Kaipara Māori. Toheroa composed nearly half of their food supply and numerous trails existed between the beach and Nohoanga settlements. From the 1900s, both Māori and Pākehā began to dig toheroa for sale, 'hawking' them in the small townships emerging along the Wairoa River (Murton 2006).

Before depletions, toheroa populations were found along the exposed beaches of the Kaipara peninsulas, and into the Kaipara entrance. Exactly how many toheroa were in the beds at the beginning of the 20th century is unknown, but numbers showed enormous fluctuations in abundance (Murton 2006). First estimates of abundance were collected around 1929 by the Chief Inspector of the Marine Department. The Kaipara Harbour Master at Te Kopuru carried out a detailed inspection in 1937, when he dug sample plots and concluded that the beds were partially depleted in the vicinity of the beach access areas along the north Kaipara (Ripiro Beach to Mahuta Gap) beaches. Similar surveys were also carried out at Muriwai and up towards Rangitira Beach (northern Muriwai) in the mid-1930s where it was noted that the beds closest to the beach entrance had been heavily exploited and would probably not recover. Pre- and post-closed season surveys were carried out starting in 1961 so the Marine Department could understand the issues of depletion and variable toheroa numbers (Table 1). From the early 1960s, toheroa numbers begun to fall at both Muriwai and the north Kaipara beaches, from an estimated 8 million and 5 million, respectively. However, in 1972 the total number of toheroa on the north Kaipara was estimated to be 30 million, of which over 29 million were of legal size (that is, 3" or greater), the outcome of massive juvenile recruitment in the years 1970 to 1972.

In the early 20th century toheroa began to be canned, firstly at Mahuta Gap, either whole or as soup (Stallworthy 1916), which occurred on a diminishing basis until the 1960s. With the introduction of the *Sea Fisheries Act 1908* the collection of toheroa became regulated. The initial request for regulation came from canning interests. They wanted the north Kaipara beaches to be divided into leased areas for exclusive rights to dig toheroa. Murton (2006) comments that these early regulations had little to do with the conservation of the toheroa,

but with the protection of specific interests. Campers, being very popular along Kaipara peninsula beaches visiting from larger cities such as Whangarei and Auckland, were not prohibited from digging in the leased areas, and in some locations particular 'camper reserves' were set aside for that interest group. Māori found the restrictions restrictive to their daily subsistence and 'ordinary food consumption' (Murton unpublished).

Murton (2006) described the increasing popularity of collecting toheroa by Pākehā visiting from nearby urban areas, as they could make trips to the beaches and take their quota of toheroa at any time during the open season (December-September). Up to 3,000 cars were recorded at Glinks Gully during 1957, carrying recreational harvesters of the toheroa beds. The number of vehicles continued to climb, and in 1966 it was estimated that about 12,000 vehicles (carrying 50,000 people) visited the north Kaipara peninsula beaches on one weekend alone.

Table 1. Toheroa Population,1962−1968. (Source: Secretary for Marine 1969)

Beach	Survey	Total Population (million)	Total 3" or greater (million)	% of Total 3" or greater (Legal size)
Muriwai	Nov 1937	8.6	4.1	47
	Sept 1962	5.2	1.4	27
	July 1963	4.7	1.5	32
	Sept 1963	8.3	2.0	24
	Oct 1964			
	March 1965	1.5	0.5	33
	Oct 1965	3.3	1.5	45
	May 1966	5.3	2.8	53
	Oct 1966	3.3	1.3	43
	May 1967	2.3	0.6	26
	Oct 1967	3.8	0.6	16
	May 1968	6.6	1.4	21
	Oct 1968	2.2	1.1	50
North Kaipara	Nov 1937		heavy mortality event	
	Sept 1962	20.5	9.0	44
	July 1963			
	Sept 1963	18.1	12.8	71
	Oct 1964	14.6	11.4	78
	March 1965			
	Oct 1965	15.4	5.3	34
	May 1966	12.1	3.0	25
	Oct 1966	16.1	6.3	39
	May 1967	3.3	1.9	58
	Oct 1967	5.0	3.3	66
	May 1968	6.3	4.2	67
	Oct 1968	3.4	1.1	32

Other non-fishing stressors are also suspected to have caused the depletion of, and the subsequent failure to recover, of toheroa populations (Murton 2006, Morrison *et al*. 2009). Time series data from toheroa populations along Kaipara peninsula beaches and Ninety Mile Beach suggest that these beaches receive erratic and variable juvenile recruitment, followed by large-scale mortalities that prevent increases in the abundance of large toheroa (Morrison & Parkinson 2008). Vehicle traffic can crush juvenile toheroa beds (Brunton 1978; Hooker & Redfearn 1998; Auckland Regional Council 2009), while adverse weather conditions, lack of freshwater seepage due to dune pine plantations, and other changing landuses (Murton Unpublished, Stace 1991, Auckland Regional Authority 1976; Kokich 1991), are believed to cause additional stress and mortality to toheroa populations (Morrison *et al*. 2009).

10.6 CURRENT MANAGEMENT REGIME

In the 2008 fishing year, the main commercially targeted species within the Kaipara were rig (*Mustelus lenticulatus*) commonly known as spotted dogfish, pioke (Māori name) or lemonfish in supermarkets; flatfish (mostly yellow-belly (*Rhombosolea leporine*) and sand flounder (*Rhombosolea plebeian*)), grey mullet (*Mugil cephalus*) and shortfin eel (Tuna) (*Anguilla australis*). Individually, these species have quite different life history characteristics as was identified by Haggitt *et al*. (2008) and Ministry of Fisheries (2008a, b, c, d, e). Rig can live to more than 20 years in age, and like other sharks, bear live young. Flounder live for only 3 to 5 years, and are very localised in their habitat use; while grey mullet can live up to 14 years, with sexual maturity occurring around 3 years of age.

In New Zealand, commercial fishing is governed by a quota management system (QMS), the background to its introduction was described above, and was introduced in 1986. Every year a Total Allowable Catch (TAC) is set by the Minister of Fisheries. The TAC takes account of recreational and non-commercial customary fishing mortality and other types of mortality possibly derived from other types of fishing like illegal fishing, unreported or unregulated fishing. This is to ensure that all fishing occurs sustainably. Fishing companies or independent owner-operators buy an annual catch entitlement (ACE), which determines the amount, usually tonnes, of fish they may catch per annum. If quota owners catch more than their ACE they will be issued with a deemed value invoice and will have to pay a particular amount to the Ministry of Fisheries.

The commercial component of the TAC is the Total Allowable Commercial Catch (TACC). This is divided into Individual Transferable Quota (ITQ), allocated to New Zealand commercial fishers. Having an ITQ allows a fisher or company to catch that specific proportion of the TACC for a particular species stock. Table 2 summarises the TAC, TACC and stock status of the various species targeted in the Kaipara Harbour. The average quota share price ($ per ton) for GMU1 was $3,435.98 in 2005/06 and for FLA1 $2,509.90, compared to a SNA8 value of $41,753.85 (Ministry of Fisheries 2009a). If quota owners choose not to fish their quota directly, they can generate value from selling ACE. Quota is the long-term asset while ACE is the annual return realised from this asset. Snapper ($2,674 per ton in 2005/06) and school shark ($1,406 per ton in 2005/06) have the highest ACE values of the West Coast North Island fisheries species, compared to flatfish ($374 per

ton in 2005/06) and grey mullet ($487 per ton in 2005/06). These latter two species are the most heavily targeted in the Kaipara Harbour. Most of the higher value fish is exported, with up to 60% of snapper exported to the USA and Australia as chilled whole fish; and up to 30% of flatfish exported mainly to Australia and China, also as chilled whole fish; but only 1% of grey mullet is exported, as chilled whole fish, to the USA.

Reporting of catch and effort information is mandatory for commercial fishers. In the 2005/06 fishing year, 86% of fishing vessels reporting commercial catch were less than 10 metres in length, with the remaining 13% between 10 and 14 metres in length.

Area Based Restrictions

Under the *Fisheries Act 1996* and its regulations, the Kaipara Harbour currently has several area-based restrictions (Table 3), as does the adjacent West Coast (Table 4). There are also general non-spatial restrictions applying to the Kaipara Harbour and the West Coast (Table 4). No restrictions currently exist for the Kaipara Harbour under the *Submarine Cables and Pipeline Protection Act 1996*, areas gazetted or established by Order in Council under the *Conservation Act 1987*, *Marine Reserves Act 1971*, *Marine Mammals Protection Act 1978*, *Reserves Act 1977*, and *Wildlife Act 1953.*

A West Coast North Island Marine Mammal Sanctuary was notified for intention on 26 June 2008 by the Minister of Conservation, including the Kaipara Harbour (Minister of Conservation 2008). The proposed regulations, outlined in the *Marine Mammals Protection (West Coast North Island Sanctuary) Notice 2008*, prohibit seismic testing and mining. However, in June 2009 a judicial review in the High Court started between the Federation of Commercial Fishermen, and the Minister and Ministry of Fisheries, regarding the new fishing measures to protect Maui Dolphin. In February 2010, a judgement from the Wellington High Court on the legal challenge was issued. The Court upheld four out of the six restrictions that were subject of the legal challenge and referred two back to the Minister of Fisheries for reconsideration. One measures included the West Coast North Island: (1)The extension of the set net closure for commercial fishers on the West Coast North Island to include area between 4 and 7 nm from shore. Interim relief fishing measures were granted to commercial fishers relating to the West Coast North Island:

- Interim relief includes set netting (for rig and school shark) by commercial fishers during 1 October to 24 December (inclusive) in waters lying between 4 and 7 nm from mean high water mark that extends from Maunganui Bluff to Pariokariwa Point, Taranaki.

Table 2. Summary fishing information of common fish species targeted in the Kaipara Harbour.

(Source: Haggitt et al. (2008), (Weeber et al. 2007a, 2007b; Ministry of Fisheries 2008, 2008a, 2008b, 2008c, 2008d, 2008e, 2009). Kaipara Landings 2007/08 were provided from the Catch, Effort, Landings, & Return Database.)

Name	Stock	TAC	TACC	2007/08 Landings	Kaipara 2007/08 Landings	Kaipara % of landings (Haggitt et al. 2008)	Customary Non-Commercial Allowance	Non-Commercial Allowance	Other Fishing-Related Mortality Allowance	TAC Set, Last Reviewed	TACC Sustainable	Biomass Estimate
Tamure **Snapper**	SNA8	1785	1300	1327 (2006/07)	-	-	43	312	130	1986, 2005	Depleted Rebuild in place	8−12%
Kanae **Grey Mullet**	GMU1	1125	926	848	227	25−50%	100	100	-	1986, 2001	Unknown	Unknown
Patiki **Flatfish**	FLA1	1762	1187	704	73.7	30−40%	270	270	35	1986, 2001	Unknown	Unknown
Pioke **Rig Shark**	SPO1	752	692	399 (2006/07)	48.8 (2006/07)	10−20%	20	25	15	1986, 2005	Unknown	Unknown
Makohaurau **School Shark**	SCH1	893	689	661	6 (2005/06)	1%	102	68	34	1986, 2007	Unknown	Unknown
Tuna **Shortfin Eel**	SFE20	146	86	76	-	-	30	28	2	1986, 2007	Unknown	Unknown
Tuna **Longfin Eel**	LFE20	39	19	17	-	-	10	8	2	1986, 2007	No	Unknown
Tuatua	TUA9	102	43	0	0	0	-	-	-	2005	Unknown	Unknown

Table 3. Area-based restrictions for the Kaipara Harbour.

Location	Fisher Type	Description of restriction
Parts of Kaipara Harbour	Amateur non-commercial	No person who is not Māori shall take oysters
Kaipara Harbour	Commercial	No commercial fisher shall use any trawl or Danish seine net
Kaipara Harbour	Commercial	No commercial fisher shall use for taking fish: a box or teichi net, purse seine, Dutch seine, trawl net, lampara net, or set nets >1000m total length
Kaipara Harbour	Commercial	No commercial fisher shall use a drag net
Kaipara Harbour	Commercial	No commercial fisher shall use a set net with the total length >1000m to take fish
Kaipara Harbour	Commercial	No commercial fisher shall take any scallops
Kaipara Harbour	Commercial	No commercial fisher shall use stalling.

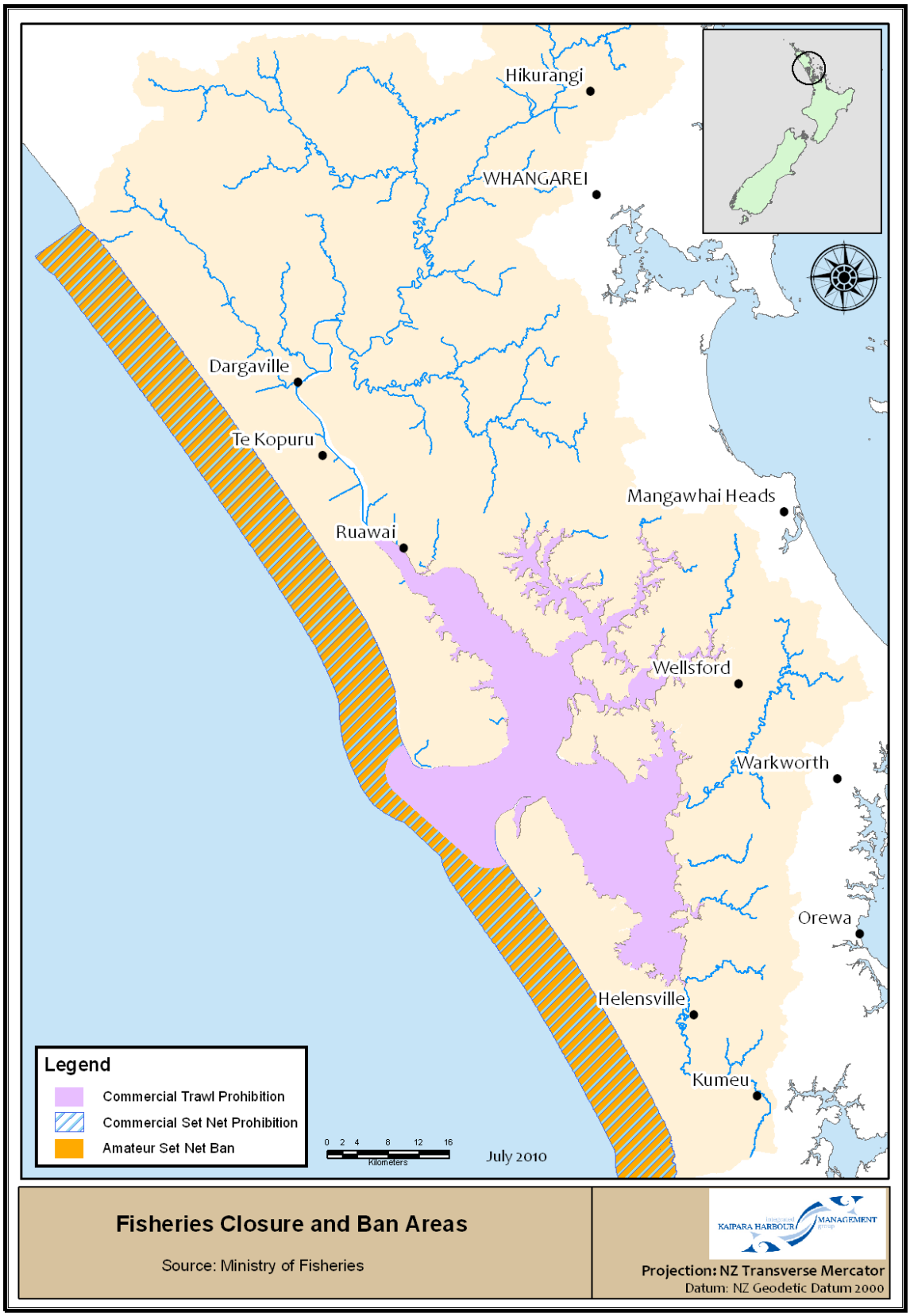
Table 4. Area-based restrictions for the adjacent west coast of the Kaipara Harbour.

Location	Fisher Type	Description of restriction
West Auckland	Commercial	No commercial fisher shall use any trawl or Danish seine net
Maunganui Bluff to Tirau Point	Commercial	No commercial fisher shall use any set net within 7nm (**interim relief measure**: 1 Oct to 24 Dec can fish between 4-7nm)
Maunganui Bluff to Tirau Point	Amateur non-commercial	No person shall use any set net (amateur)
Maunganui Bluff to Tirau Point	Commercial	No commercial fisher shall use any trawl within 2nm of the coastline

Table 5. Restrictions that apply generally.

Fisher Type	Description of Restriction
Amateur non-commercial	1. Amateur maximum daily number of fish by species that can be taken or possessed by one person in any day
Amateur non-commercial	2. Amateur minimum mesh size for catching different species of fish
Amateur non-commercial	3. No person can take or possess snapper <27 cm length
Amateur non-commercial	4. No person shall take or possess spotted black grouper
Commercial	5. No commercial fisher shall take any tuatua
Commercial	6. No commercial fisher shall take any green-lipped mussls
Commercial	7. No commercial fisher shall take any cockle
Commercial	8. No commercial fisher shall take any pipis
Commercial	9. No commercial fisher shall use any set, trawl, Danish seine purse, lampara or drag net or dredge to take fish or aquatic life unless authorized in a fishing permit
Commercial	10. No commercial fisher shall take paddle crabs, octopus or hagfish other than by a pot unless the method is authorized by a fishing permits. If authorized to take paddle crabs by set net the mesh is to be at least 200mm
Commercial	11. No commercial fisher shall take green-lipped mussel spat
Commercial	12. Commercial fishing minimum mesh size by species fished
Commercial	13. No commercial fisher shall use a drag net with a mesh <125mm to take snapper
Commercial	14. No commercial fisher shall use a set net with a mesh <125mm to take snapper, trevally or rig
Commercial	15. No commercial fisher shall take anchovies, pilchards, or sury by a net with a mesh at least 25mm. No lampara or seine nets may be used.
Commercial	16. No commercial fisher shall take or possess any spotted black grouper
Commercial	17. No commercial fisher shall take any shortbill spearfish or sailfish
Commercial	18. No person shall sell or possess the following fish species taken from the Auckland FMA: banded wrasse, black angelfish, butterfly perch, giant boarfish; green wrasse; kelpfish; long finned boarfish; marble fish; notch headed marble fish; painted moki; red moki; red mullet; red pigfish; rock cod; Sandaggers wrasse; scarlet wrasse; silver drummer; splendid perch; toadstool grouper
Commercial	19. No commercial fisher shall take kina for sale except by hand harvest.

Figure 3. Area-based restrictions for the Kaipara Harbour and the adjacent West Coast. Note: there is no longer a scallop fishing closure under s186A of the Fisheries Act.



10.7 MĀTAURANGA MĀORI

From a Mātauranga Māori perspective, natural resources such as fish and shellfish are imbued with mauri, an intangible and intrinsic value. In the Māori worldview (tikanga Māori) the land, sea, sky, and waters are seen as indivisible, and Māori do not see the land above the high water mark, tidal land, and the sea bed as distinct entities, although being dominated by different energies (Waitangi Tribunal 2004). The natural world is indivisible, one with the spiritual world, with all things having mauri and wairua. Ensuring the mauri of natural resources are maintained is an integral part in defining who Kaitiaki of natural resources are (Awatere 2009). Kaitiaki are people with an active role in the management of natural resources based on Mātauranga Māori values and perspectives. Whanau/hapū of the Kaipara living amongst natural resources had an obligation to care for resources such as toheroa, both physically and spiritually.

Mātauranga Māori

A body of knowledge that was first brought to New Zealand by Polynesian ancestors of present-day Maori. It changed and grew with the experience of living in these islands. Following encounters with Europeans in the late 1700s and early 1800s, it grew and changed again before becoming endangered in many substantial ways in the 19th and 20th centuries. The elements that remain today – including the Māori language – have catalysed a renewed interest in this body of knowledge.

Kaipara Māori have been utilising fishery resources for many hundreds of years. The waters of the harbour and its rivers were 'roads' and 'gardens' for Kaipara Māori, as were the ocean beaches. They were connected to the foreshore, seas and waterways and their resources through genealogy (whakapapa), narratives (korero), and naming. Māori were a maritime fishing people, living as much off the seas and inland waters as off the land. A large part of the identity of Kaipara Māori was bound up with the bountiful natural resources of the Harbour – fish, eel and shellfish.

The harbour constituted a major inshore fishery of the type mainly exploited by Māori in pre-European times. However, the harbour soon became a transport network for Pākehā enterprise and settlement, and from the late 1860s Pākehā began to exploit the fish of the harbour as well.

This section seeks to:

1. Understand the cultural and spiritual aspect of Kaipara fisheries (customary fishing and practices, fish stories)
2. Review the traditional relationship with Kaipara fisheries, including shellfish and freshwater (fishing grounds and species)
3. Understand the extent to which kaitiaki have been involved in traditional and modern commercial fishing (traditional use and rights)
4. Understand the current role of kaitiaki in customary management
5. Outline gaps (e.g. status of native oyster) that will assist in restoring the fisheries of the Kaipara that include Mātauranga Māori.

10.7.1 STATUS OF INFORMATION

There is very little written information about the fishing life of Kaipara Māori in pre-European times. What is known was recorded from a Pākehā perspective particularly in the first journals of early European explorers and settlers in the Kaipara, and eventually in government department reports. But there is a wealth of whaikorero (oratory) knowledge and whakapapa describing the cultural and spiritual relationships Kaipara Māori had with fisheries resources. The main sources of information reviewed included:

- Waitangi Tribunal Casebooks. Kaipara Claims. Volume 2. Wiremu Wright, Te Uri o Hau o te Wahapū o Kaipara: Manawhenua Report, December 1996, Wai 271 Record of Documents (ROD), document A1, (Wai 674, A1) (Wright 1996). Written for the purposes of Te Uri o Hau Settlement Claim process with the Crown.
- Brain Murton (Unpublished). Kaipara Harbour Report. Chapters 18−21. An extensive review and analysis of the historical record regarding fisheries in the Kaipara Harbour particularly grey mullet, snapper, school shark, flounder, oysters and toheroa.
- Waitangi Tribunal (2002, 2006). Kaipara Report. Wai 674. Waitangi Tribunal Interim Report 2002 and Report 2006. An interim report produced in 2002 which summarises the Wai 674 claim that excludes the claim of Te Uri o Hau; and the final report in 2006.
- Jackson (1997) Pouto Peninsula: An Archaeological Perspective. Written for Te Uri o Hau settlement claim.
- Environs Holdings Ltd (2007) Cultural Impact Assessment of a Proposal by Crest Energy Ltd to construct and operate a tidal powerstation in the Kaipara Harbour.
- Discussions and Hui with Kaipara Kaumauta, Kuia and Kaitiaki carried out during 2007 to 2009.

Other information that provided insight into Māori fishing techniques, relationship and customs was the Muriwhenua Fishing Claims report (Waitangi Tribunal 1988), and a report on the Crowns Seabed and Foreshore Policy (Waitangi Tribunal 2004).

10.7.2 MANA WHENUA & MANA MOANA

Ngāti Whatua has held mana over both the land and sea resources and other taonga through numerous generations of occupation following their conquest of Ngāti Awa. With its long shoreline, ocean beaches, and many peninsulas, the harbour provided a very attractive environment for Māori. Just like the land, the harbour was fertile with fish and shellfish, and the many streams and swamps provided eel and wild fowl. The natural resources of the Kaipara were sufficient to support a larger number of Māori inhabitants than the few hundred estimated to have lived there in the early eighteenth century. The harbour and its tributary rivers provided the main access routes, and there were several important portages for canoes.

The Legend

Aōtearoa was born through fishing as the north and south islands are believed to represent a fish *Te Ika a Maui* (fish of Maui, North Island) and a boat, *Te Waka a Maui* (a canoe of Maui,

South Island). *Te Ika a Maui* represents the great fish hauled up from the deep sea by Maui the Atua (demi-god/ancestor), and the South Island represents the waka on which he and his brothers used to go out fishing. In Māori tradition, the fish are the children of Tangaroa, the god and father of the sea and it is only by respecting Tangaroa and his ocean-home, that anyone may take of his treasures.

Kaipara Māori are a maritime culture, peopled from the Polynesian Pacific, and since Kupe's discovery of Aōtearoa, the land of the long white cloud, have had distinct involvement with the sea.

Species, Customs and Techniques

Māori had strict laws and sea knowledge to preserve the *rawa moana* (the bounty of the sea) over many generations. *Tapu*, *makutu* and *rahui* were applied to control human behavior and protect natural resources. *Tapu* and *makutu* protected fish resources by restraining the manner of use and extent of the user. *Rahui* was applied to prohibit the use of fishing grounds under pressure or to prevent fish being taken out of season. Tangata whenua knew the seasons of spawning and maturity for the various fish and shellfish species they ate. For example, toheroa between 60-90mm were collected, allowing the larger toheroa to breed and spawn (evidence from midden collections - M. Miru and B. Searle, pers. comm., 2009).

Species habits and movements were well understood and particular large-scale fishing expeditions were organised around such information. Particular fishing areas in the Kaipara, including lakes, were visited and fished at appropriate times according to periods of seasonal abundance or when fish and shellfish condition was at its best. Specific karakia were conducted prior to, during, and after expeditions (Waitangi Tribunal 1988).

Te Iwi o Ngāti Whatua considers the harbour, rivers, streams and lakes within their rohe to have a mauri. The literal translation is "life-force" or "life-energy", although admittedly such Māori concepts are often unable to be adequately translated to English. Te Iwi o Ngāti Whatua are the Kaitiaki of that mauri whereby they have a cultural and spiritual responsibility to ensure it is maintained, protected and enhanced. Mauri, as defined by Environs Holdings Ltd (2007), is:

> *"…intimately connected to the interrelationship and intertwining of all forces that make up an ecosystem – the physical and spiritual, the tangible and intangible, the past, present and future, human and non-human, individual components and interconnected wholes."*

A variety of techniques and gear were utilised by Kaipara Māori to capture the targeted species. Flax woven nets, seine nets, hook and line, bag net (korohe); puhoro, a large net; tarawa, a conical net; horapa, a small hand net and the atata, toemi (used to take lobster) and pouraka were hoop nets or traps. The hinaki (still utilised today – woven baskets held down by stones), was used for capturing eel/Tuna as they moved through a Pa tuna (eel weirs). The kaha was a net for whitebait and the tata a small bag net. All fish nets and traps which were set, and not handled, were termed kawau moe roa (Waitangi Tribunal 1988). It is unknown if Kaipara Māori used seine nets, as described in the Muriwhenua report, to herd large schooling fishes such as kahawai into shallow water. But the historical records do state that large expeditions were organised for capturing school shark (Murton Unpublished).

The archaeological record has revealed a number of different hooks and fragments throughout the Kaipara (Jackson 1997).

Today, those whom hold traditional ways still say karakia before entering the water to begin harvest and collecting. Rāhui are still also practiced however, the implementation and technique to put in place the Rāhui is disappearing as the kaumatua find it difficult to pass on the tradition to future leaders present around the marae (M. Miru, pers. comm.. July 2010).

Traditional Relationship – Kaipara Māori Identity

The iwi of Ngāti Whatua claim a long traditional relationship with the Kaipara Harbour and the catchments of the rivers that make up the harbour ecosystem. Fishing has been and will continue to be, a traditional occupation for Kaipara Māori; they were fine fishermen and were capable of operating on a very large scale, with seine and trap nets. This traditional spiritual relationship with the Kaipara harbour and its treasures is evident today in Ngāti Whatua tribal whakataukī, and in the naming of water systems and land features. The Kaipara Harbour, its tributaries and ranges and peaks that surround the harbour are named by resident hapū in pepeha (whakapapa); as they were by their tupuna and, as the current generations intend they will be referred to by their mokopuna for all time to come. These practices maintain identity and links to ancestors and their family member – the Kaipara Harbour.

The wellbeing of the Kaipara is paramount to Ngāti Whatua; kuia and kaumatua often mention during hui on marae: "*it is our family member. We are of the same*" (Environs Holdings Ltd., 2007).

There are specific examples within the historical records used in the Te Uri o Hau O Te Wahapū O Kaipara settlement claim and Waitangi Tribunal hearings (Environs Holdings Ltd., 2007), such as:

> *"Taporapora is the name of the sand island in the centre of the harbour entrance. Much of it is now underwater or eroded. Taporapora is the birthplace of Te Uri o Hau. Manukapua was the tauranga waka there, the ancestral landing site of the Mahuhu kit e Rangi waka of Ngāti Whatua. The first wharekarakia was established at Taporapora, and the raNgātira Rongomai drowned when his waka capsized crossing the bar – his body washed ashore at Pouto (hence the whakatauki Kaipara whakarere wahine…Kaipara that overturns ships and makes women widows)*
>
> *There are many stories of dolphins in the Ōruawharo River. At Atiu Creek, (Mullet Creek) dolphins were seen in historical and recent times rounding up the mullet. Ōwekatapu is a wahi tapu, it is the burial ground of dolphins. The Tupuna Horomoana Te Arai was the RaNgātira in that area. Kuia spoke of special dolphins coming up the Ōtamatea River when certain RaNgātira died. To nga tupuna dolphins were Ariki that visit occasionally bringing a tohu (sign) of important event/messengers. Individual dolphins were known and named.*
>
> *The historical record speaks of three channels going out of the Kaipara, but nowadays it is believed there is only one remaining. Rengarenga is the name of the channel, it has the same name as the urupa at Ōruawharo – Te Rengarenga. There is a well known Ngāti Whatua legend of the maiden Te Hana that swam across to Ōkahukura (Tapora) from Pouto to meet her lover. She rested on the sandbank of the Rengarenga channel during her journey.*

The traditional relationship held between Kaipara Māori and natural resources such as fisheries and shellfish, was regulated by tikanga. This involved both spiritual and physical dimensions. There are elements of authority (mana) and law, ritual and use, which are rooted in the spirit world and the concepts of tapu (sacred) and noa (ordinary and free from restrictions). Rangātira and tohunga used to perform karakia and rituals that invoked the protection of the atua of the sea and governed the use of its bounty. They ensured this relationship existed between the Atua and tangata whenua (Waitangi Tribunal 2004). The names and dwellings of the various taniwha that still protect the harbour today are still held by the kaumatua (Environs Holdings Ltd 2007). Pokopoko, is the name of the taniwha that watches the harbour entrance.

Traditional Fishing Areas

Te Ripo o Te Awa, kei runga o Kaipara, e tohu aroha mo nga tupuna
The ripples on the rivers of the Kaipara show the love of our ancestors

The location of traditional fishing areas are known by Kaipara Māori today and has been commented on in early European historical records (Polack 1838 (1974)). According to Waata Richards, of Haranui marae:

> *"…catching mullet at Whakahura beach, hard sand beach, not mud, was an adventure for the whole community…whanau. The children collected mullet into kete and run them upto the shore…We would share everything, to all homes which were delivered by horses. We salted and smoked the mullet. We did not have freezer or fridge so we had to eat it and use it in one to two days.."*

Waata Richards also spoke about fishing for tuna and pioke (school shark):

> *"Eel was collected in muddy mangrove channels and pioke, small sand shark, was a delicacy and was dried. Shark were caught by line or net mainly by adults."*

According to Willie Wright, of Te Uri o Hau, remembers his childhood fishing at Taporapora Te Ngaio Point:

> *" …scallops, used to live on seagrass, worms, cockle beds and big flounder we used to catch and drag the flounder on to the beach. At low tides we could get a feed of scallops on the Te Ngaio Point banks. Flounder were fished for at night with no moon and other tohu were used to catch fish. We became aware of how to read channels and currents….used flowers as tohu, for example, kowhai, pohutakawa and types of grasses to catch snapper. Also, when we could hear mullet jumping we did catch them because they were spawning and releasing eggs."*

Māori fishing embraces not only the physical but also the spiritual, social, and cultural dimensions. Elders had extensive knowledge of fishing grounds, knew the proper seasons, the best places, and the best manner in which to take fish and shellfish, and the best way to sustain them. Māori fishers knew the spawning seasons and maturity of species. They knew their habits and movements, and visited appropriate fishing grounds according to a species seasonal abundance.

Middens occur frequently throughout the Kaipara landscape (Figure 4), with fish bones, shells and even whale bone recorded from them. Jackson (1997) records a long and rich history of Māori occupation and use of resources in the Kaipara dating far back as 1546 AD, for a pa site located on Pouto Peninsula, Tauhara Pa.

Although there were no permanent Māori communities living on beaches, archaeological research suggests that people periodically used trails from Nohoanga (temporary) settlements and large pa and kainga (Jackson 1997) to visit beaches to collect shellfish, particularly toheroa, eel and waterfowl. The cultural landscape for Pouto peninsula was described by Jackson (1997) using the archaeological record, geological maps (Ferrar 1934) and botantical records (Ingeborg 1981) (Figure 5).

Almost all of the archaeological sites on the Pouto Peninsula are found in the eastern and central regions rather than the Ripiro Beach-West Coast region. The eastern region was rich, not only for its natural resources such as freshwater lakes, swamps and the Kaipara Harbour but also the high quality land available for cultivation. The land was utilised for cultivation and gardening, especially of kumara, for several hundred years (Jackson 1997). Over 100 food storage 'pits' have been recorded and described as archaeological sites on the southeastern side of the Pouto Peninsula. Land Court minutes (Stirling 1998) also confirm the archaeological research regarding the large defended pa sites with associated kainga in the southeastern part of the peninsula.

The western region of the Peninsula along Ripiro Beach has fewer sites than the east coast region, but still holds a rich archaeological record of human activity in this region. Most evidence from archaeological sites in this area suggests that people were only passing through periodically and were mainly camping (as part of seasonal harvesting expeditions) not settling for any large periods of time. The west coast was rich in raw materials like flax, raupo, shell and whale bone, used in the manufacture of nets, mats, kete, fish hooks and other commodities for trade. Toheroa, eels and birds were collected. The peninsula was once covered with native forest, remnants of which can be seen today behind the lighthouse at North Head and at Tapu Bush (Whakapaingarara).

Urupa and wahi tapu are abundant throughout the Pouto Peninsula (Jackson 1997) several of which have been desecrated due to changing landuse from sand dune and native bush to pine plantations and pastoral farming.

Similar patterns of occupation occurred throughout the southern Kaipara Peninsula sand dune country within the fertile eastern valleys (Figure 6). Archaeologist Wynne Spring-Rice documented that the peninsula was once covered in a predominantly coastal broadleaf forest (Spring-Rice 1996). Māori practiced a form of swidden agriculture, whereby an area of land would be cleared by burning the vegetation, with the resulting ash providing a source of fertiliser. The ground would be cultivated for a few seasons and, when crop production dwindled, a new planting area would be cleared and the old one left to regenerate (Spring-Rice 1996; Wright 1996). Usually manuka and bracken would be the first colonising plants of the regenerated area, subsequently replaced by kanuka stands.

Middens found in the 1970s, and were later described in 2006 from Woodhill Forest near Lake Ototoa, as consisting of a light, sandy-brown soil matrix with fragments of paua (*Haliotis iris*), tuatua (*Paphies subtriangulata*), toheroa (*Paphies ventriocosa*), scallop

(*Pecten novaezelandiae*), kuhakuha oval trough shells (*Mactra (Cyclomactra ovate)*), tio rock oysters (*Saccostrea glometrata*), kawari whelks (*Cominella* species), and tuangi New Zealand cockle (*Austrovenus stutchburyi*) (Coster & Johnston 1976; Mallows & Barr 2006). One midden was estimated to be 62 m long by 4.4 m wide. Ngāti Whatua of the southern Kaipara enjoyed a 'rich and varied environment' (Spring-Rice 1996) and its bounty provided from the land and sea. However, representatives of such a cultural landscape have virtually disappeared, being replaced through various landuse and associated development (Waitangi Tribunal 2006).

Figure 4. Midden sites found in the Kaipara Harbour gained from archaeological survey sites.

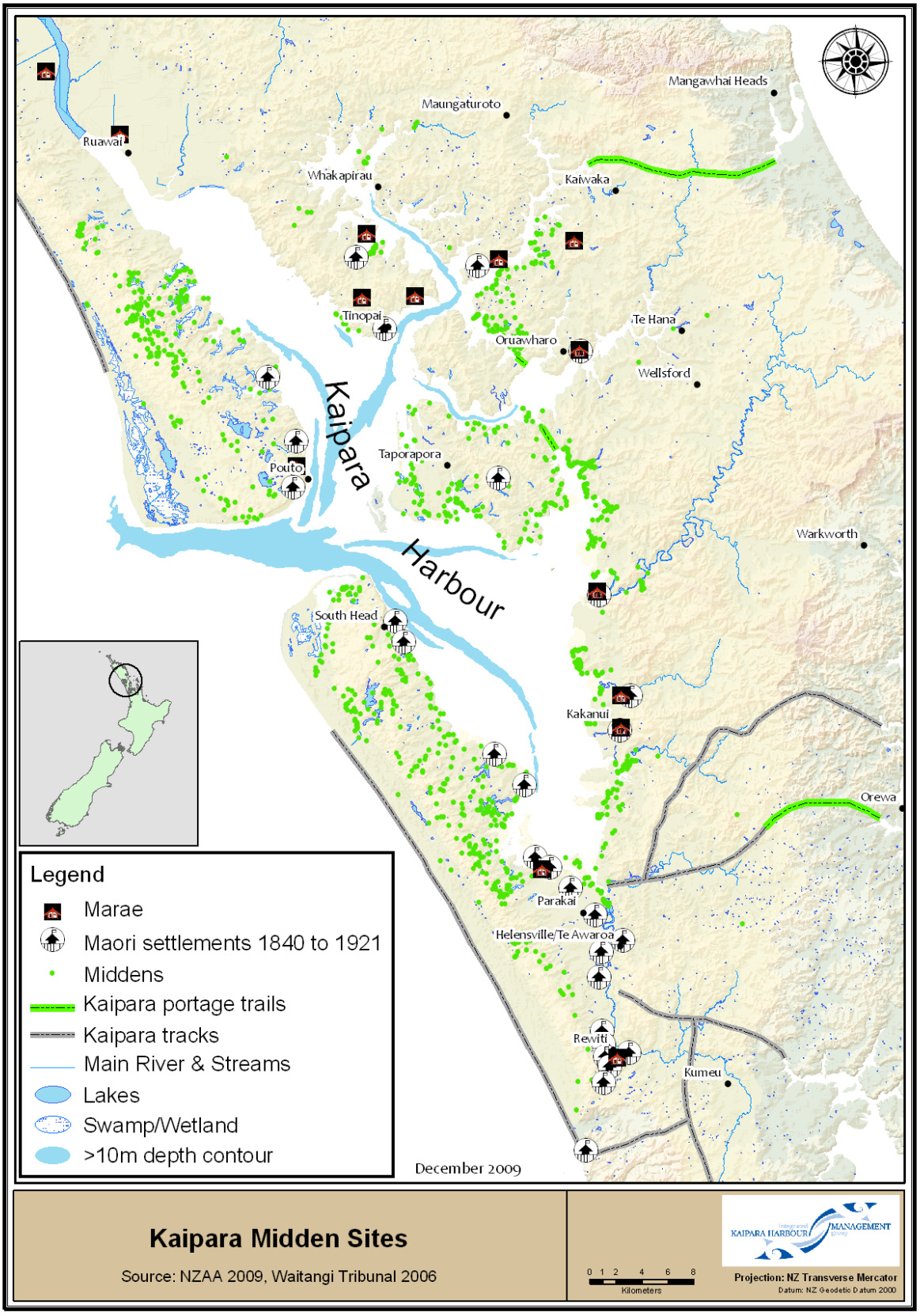


Figure 5. The cultural landscape of Pouto Peninsula describing Kaipara Māori occupation within the natural ecosystem.

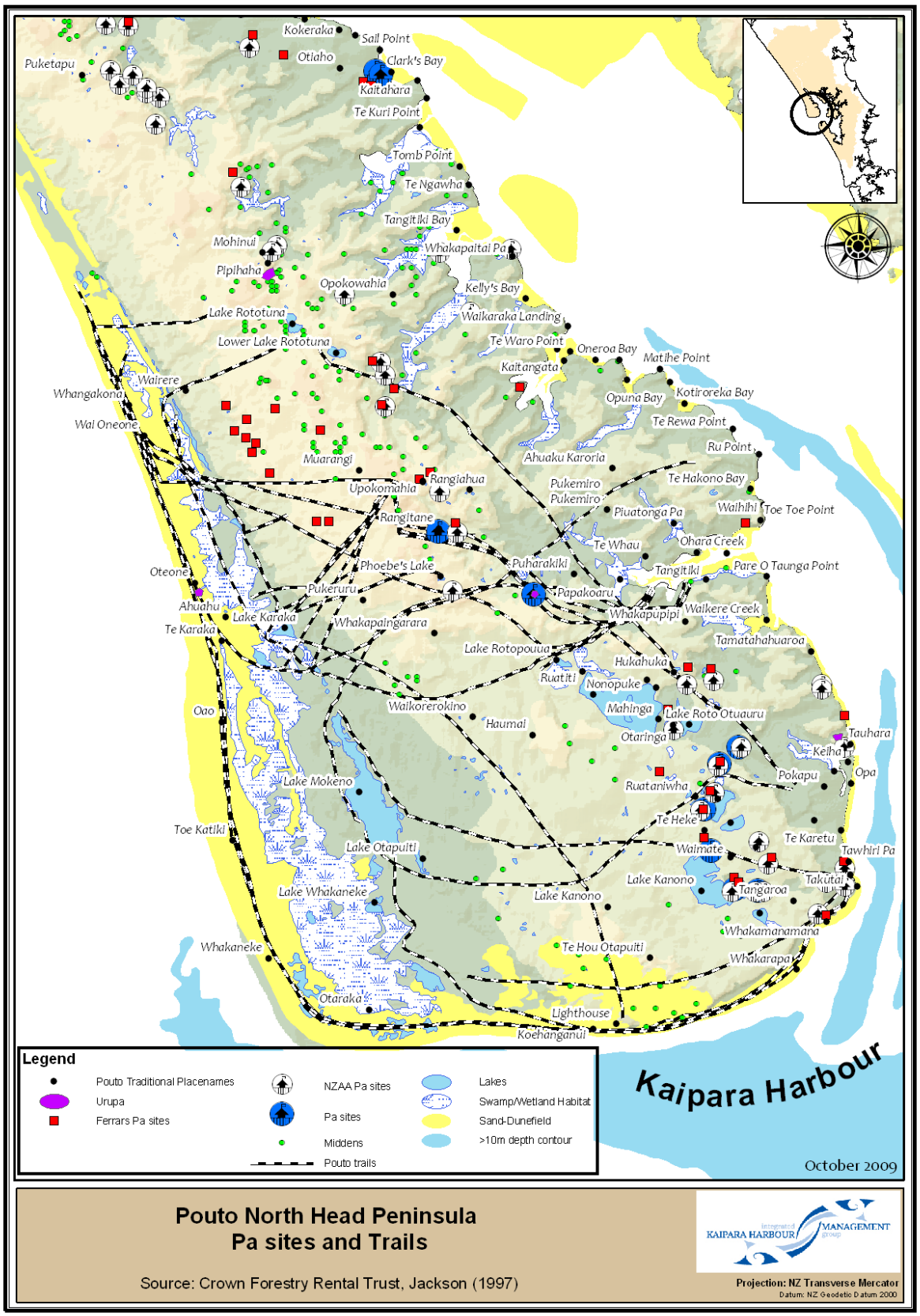
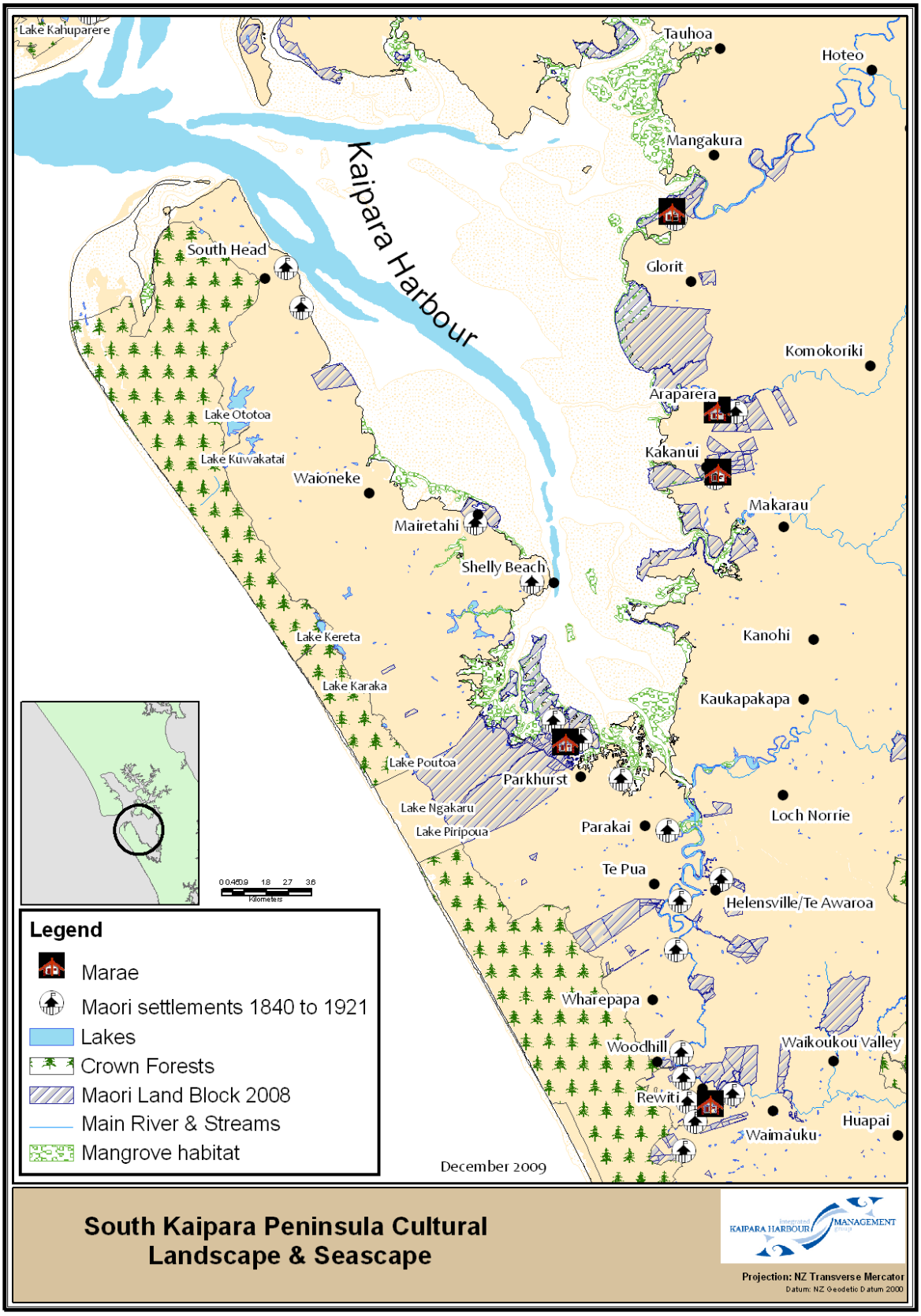


Figure 6. South Kaipara Peninsula cultural landscape and seascape.



10.7.2.1 TE URI O HAU CLAIMS SETTLEMENT ACT 2002

The *Te Uri o Hau Claims Settlement Act 2002* records an agreement reached by the Crown and Te Uri o Hau Governance Entity. The purpose of the Settlement Act is to give effect to certain provisions of the Te Uri o Hau Deed of Settlement 2000, being a deed that settles the historical claims of Te Uri o Hau. Under the Act, the Crown agreed to restore Te Uri o Hau's access to traditional foods and food gathering areas.

10.7.2.2 KAITIAKI & ROHE MOANA REGISTRATION

Kaitiaki of Te Uri o Hau engage daily in the natural resource management of the Kaipara Harbour. However, current harvesting restrictions for customary purposes such as hui or tangi, require a registered Kaitiaki under the *Fisheries (Kaimoana Customary Fishing) Regulations 1998*, to provide a permit to harvest particular taonga, such as toheroa.

Also, to apply for Mataitai, an iwi or hapū rohe moana is required to be registered under the *Fisheries (Kaimoana Customary Fishing) Regulations 1998*. Te Uri o Hau Settlement Trust rohe moana was confirmed and gazetted by the Minister of Fisheries in 2008.

Toheroa Rahui - Customary Measures

Te Uri o Hau has had a rahui in place for several years from Mahuta Gap to Pouto Point, whereby Te Uri o Hau do not collect for customary purposes. Although some permits still being issued under customary fishing regulations (section 27a of Fisheries Act) to the north of the beach from other hapū.

10.8 STATUS OF INFORMATION

10.8.1 FISH & SHELLFISH

Information about Kaipara fish and shellfish stocks includes:

- FRST funded research on juvenile fish in estuarine and coastal habitats including the Kaipara Harbour and other west coast harbours such as Hokianga, Whangapae, Manukau, Aotea, Kawhia and Whaingaroa/Raglan (Morrison *et al*. 2009). Morrison *et* al. (2009) summarises some of the results of this research, which demonstrated the central importance of the Kaipara Harbour to the wider West Coast North Island ecosystem in terms of juvenile snapper recruitment. Sampling found high abundances of juvenile snapper (30–100mm length, 0+ age class) in West Coast North Island harbours, which were rare or absent from the adjacent coast. Using otolith chemistry, this same 2003 year class was sampled as 4 year old fish from the coastal commercial fishery, and using estuary specific elemental signatures, the majority of fish were linked back to the Kaipara Harbour. Essentially, the Kaipara Harbour now appears to sustain most of the adult coastal snapper populations on the west coast of the north island. Within the harbour, horse mussel beds and subtidal seagrass meadows are major juvenile snapper habitats.

  Juvenile yellow-eyed mullet and grey mullet are common throughout the Kaipara with a strong association of juvenile grey mullet and anchovy (*Engraullis australis*) with mangrove habitats and intertidal seagrass meadows. However, juvenile snapper was absent from mangrove habitats in the Kaipara Harbour.

- Ministry of Fisheries catch, licenced fish receivers, effort, and landings data (*Comm_fish* database) from commercial fishing activities, usually reported to a Statistical Area (i.e. 044 Kaipara Harbour) (Figure 7) scale. Information on what species are targeted, using what fishing method and statistical area over time can be understood (Figure 8) using this database.

  Since 2007, set netters with boats greater than 6 m in length must report their latitude and longitude information in their catch returns; a legal requirement as a quota holder. Electronic returns have just been introduced from 1 October 2009 to streamline the process and drastically reduce data input errors. This information assists with stock assessments, stock biomass status, effort distribution (Figure 9) and setting Total Allowable Catches.

Figure 7. Statistical Area 044 Kaipara Harbour.

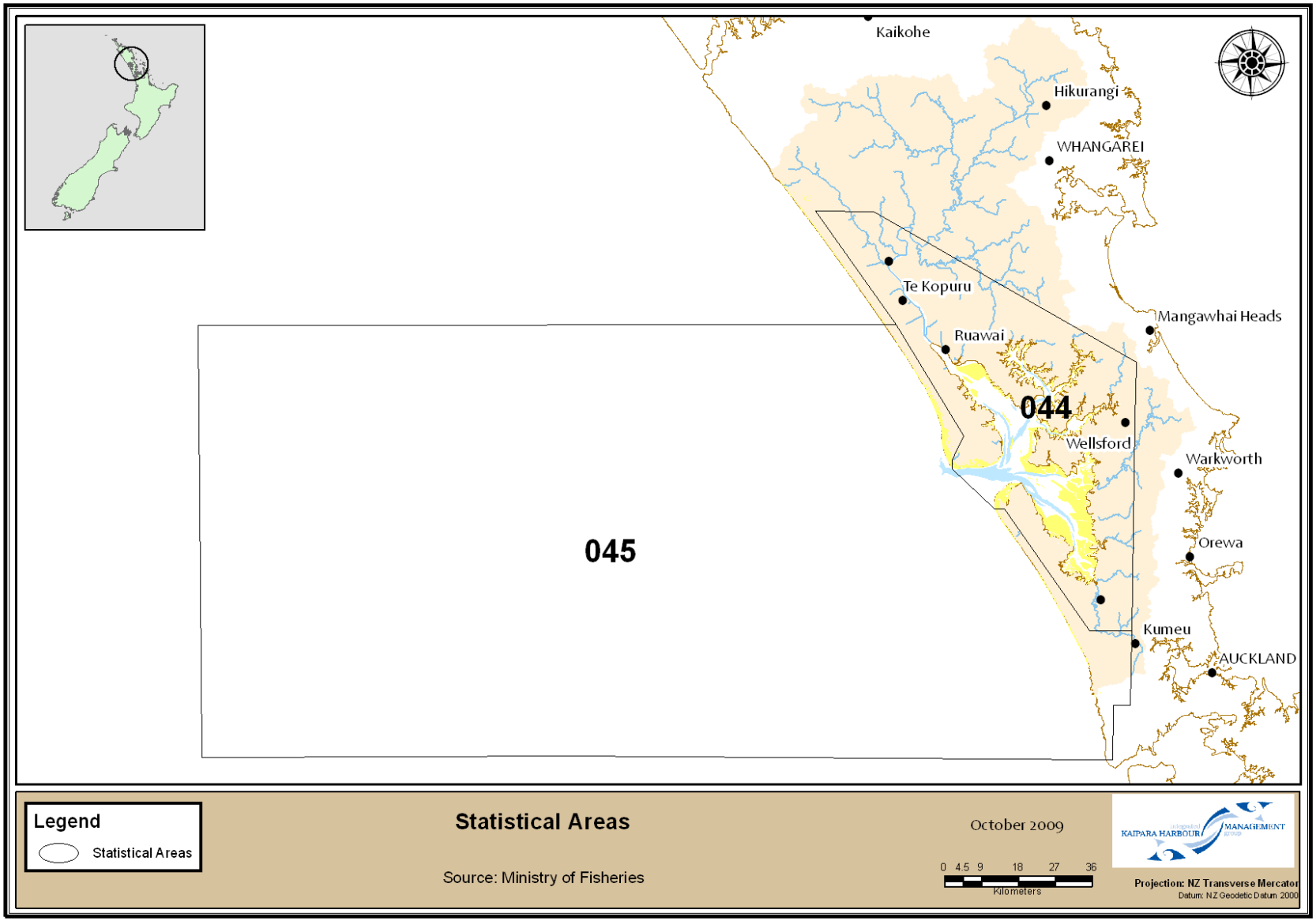


Figure 8. Top ten fish species targeted by commercial using all fishing methods, set nets, dredge, longlining and trawling. (Source: Ministry of Fisheries).

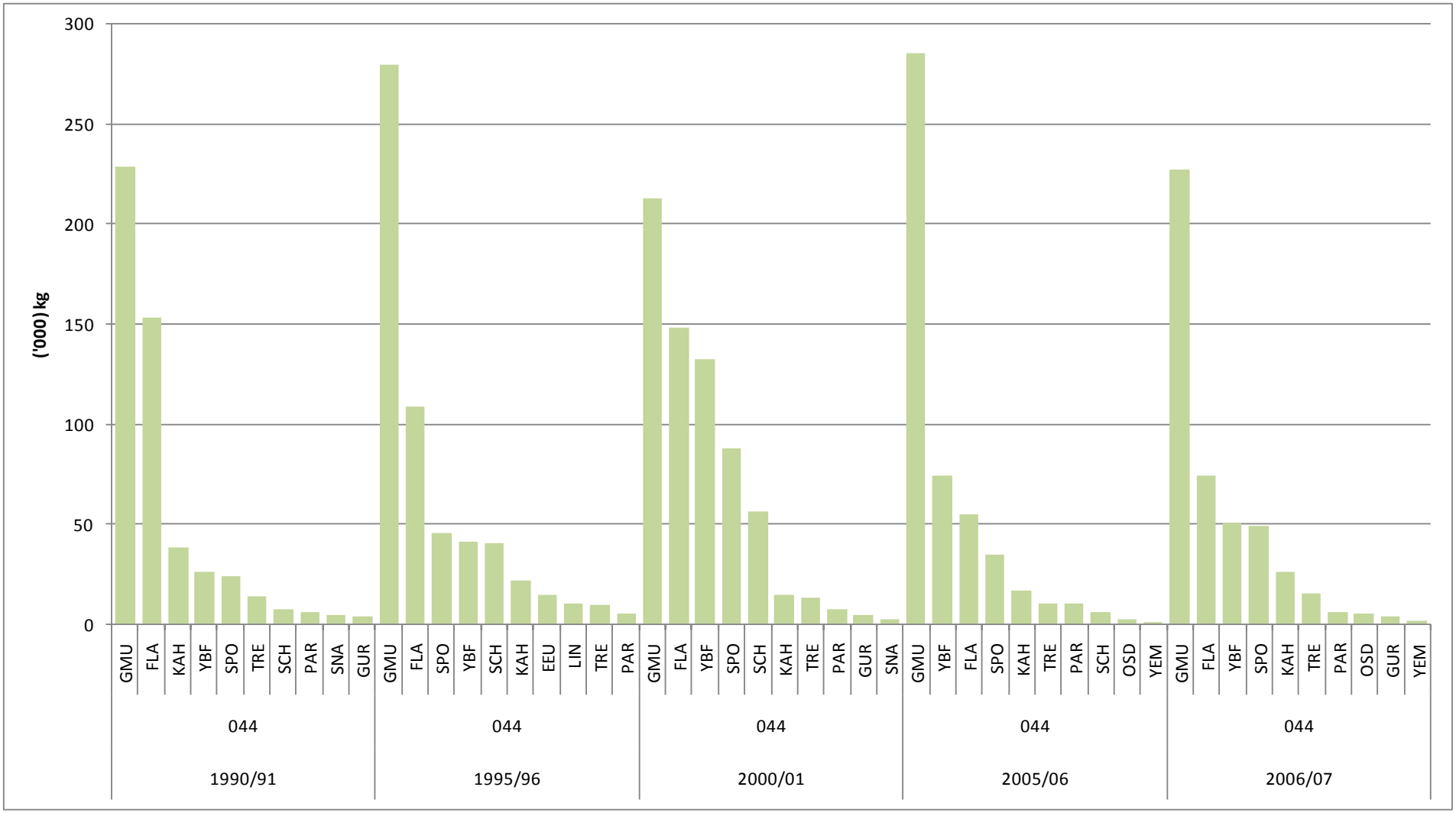
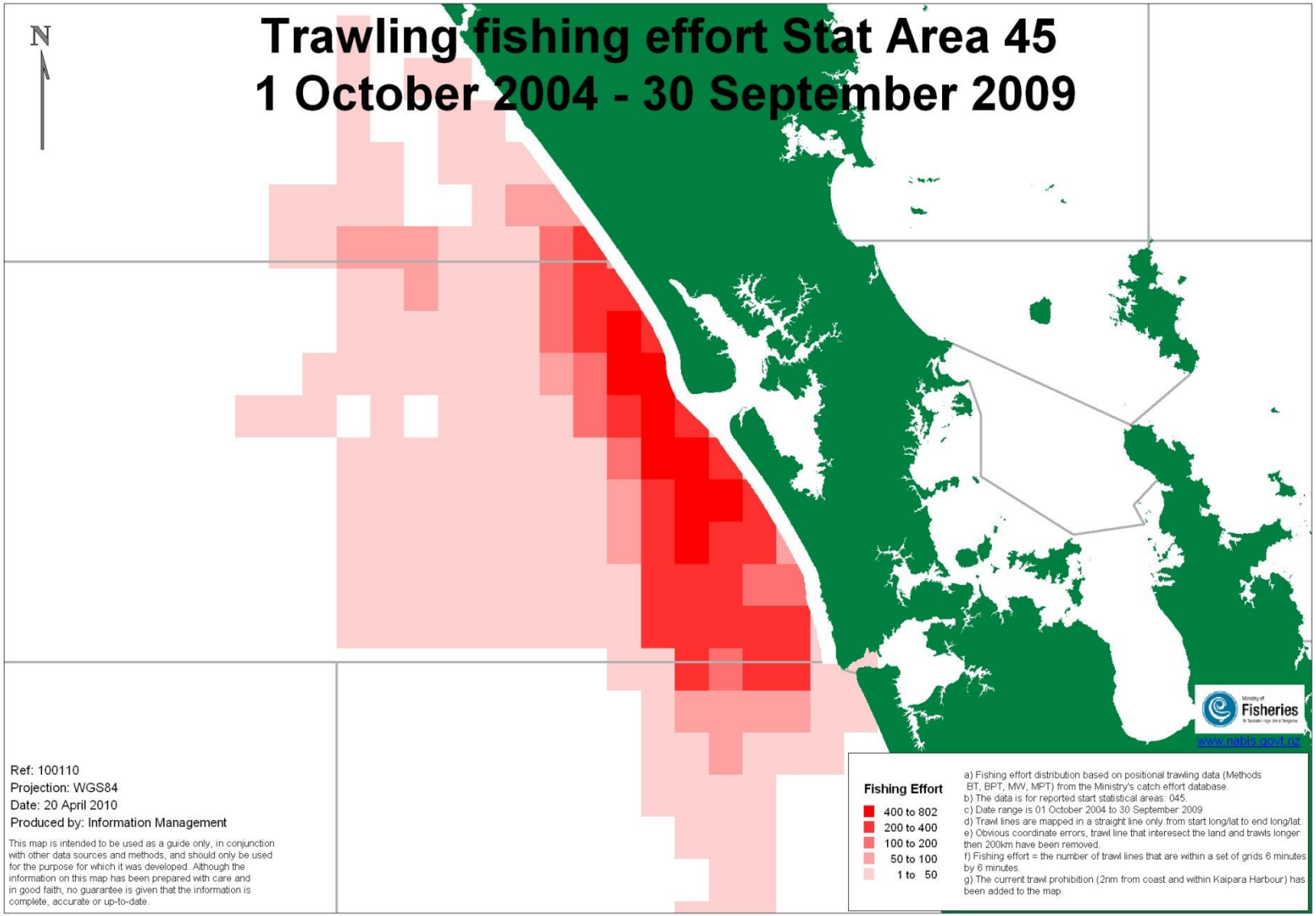


Figure 9. Trawling fishing effort for Statistical Area 45 (adjacent to Kaipara Harbour) during 1 October 2004 to 30 September 2009.



- Review of Kaipara Harbour fisheries stocks; Haggitt *et* al. (2008) undertook a literature review of the Kaipara Harbour and its different biophysical components, including fisheries; Hartill (2004) characterised the commercial flatfish, grey mullet, and rig fisheries; Paulin & Paul (2006) described both the historical and current state of grey mullet pollutions and their associated fisheries.

- Site assessment sampling associated with an Assessment of Environmental Effects (AEE) report for an oyster farm in the southern Kaipara Harbour (Kelly *et al*. 2001).

- Wider ranging studies of fisheries where the Kaipara Harbour was part of a fisheries assessment include: **(1)** Watson *et al*. (2005) undertook a Catch Per Unit Effort (CPUE) analysis of the Northern (GMU 1) grey mullet (*Mugil cephalus*) setnet fishery, covering the period1989–2002. Evidence of annual CPUE declines was found in the Kaipara Harbour. **(2)** McKenzie & Vaughan (2008) found the Kaipara Harbour to have a distinct population within the larger GMU 1 stock, and that utilising a northern TACC is not optimal, as mortality rates differ markedly within the northern TACC between sub-populations (e.g. Kaipara, Manukau, northwest coast, Lower Waikato) within the northern TACC. The Kaipara harbour, Manukau Harbour, and East Northland accounted for over 80% of the GMU 1 catch. **(3)** Blackwell *et al*. (2006) undertook CPUE analysis of the rig setnet fishery in northern New Zealand. The Kaipara Harbour was considered to be a separate substock of SPO 1 based on reported greenweight and CPUE models for harbours of northern New Zealand, including the Kaipara Harbour. **(4)** Paul & Saunders (2001) and Paul (2003), both reported on the catch rates and describe the school shark within the Kaipara since 1989. **(5)** Coburn & Beentjes (2005) reported on the first standardised CPUE estimates for flatfish (FLA 1) between 1989 and 2004, including the Kaipara Harbour.

- Kaipara Harbour Te Uri o Hau Oyster Reserves. Kelly (2009) quantified the distribution and relative abundance of Pacific oyster (*Crassostrea* gigas) cover in five of the six Te Uri o Hau oyster reserves in the Kaipara Harbour. Large numbers of dead oysters were observed. Oysters were observed growing on a variety of substrates; include reef, mangroves, boulders, oysters, and mud. Notes were taken on the presence of the native rock oyster (*Saccostrea cucullata*).

- Tuatua (*Paphies subtriangulata*) were introduced to the Quota Management System (QMS) on 1 October 2005, but information regarding tuatua population dynamics within the Kaipara Harbour remains scant. Haggitt *et al*. (2008) reported that no estimates of fishery parameters such as mortality or growth rates exist. Also, there are no biomass time series information to help estimate the best sustainability harvest level. Tuatua were found to occur prolifically in subtidal areas within the Harbour mouth, particularly between Pouto Point and North Head; and in the intertidal areas of Taporapora and Manukapua Island, during biological monitoring between 2000–03 but have not been seen in more recent samples at this site (R. Grace, pers. comm., August 2009).

Eels

- Eels of Pouto Lakes Ministry of Fisheries and Te Uri o Hau project (EEL2007/04A). This included an assessment of the eel fishery in the Pouto Lakes and their present status. Distribution, relative abundance, species composition, age structure, growth rates and sex ratio were reported. The New Zealand eel catch has been reported to be in a state of decline (Figure 10), a view also shared by local Kaipara Harbour residents and hapū.

  Eel are highly valued by Māori and historically constituted a very important food source. There is no quantitative assessment of the current level of harvest for customary Māori purposes or recreational/sustenance use at the stock level. North Island eel stocks were introduced to the QMS in October 2004 and the allowance to Māori purposes, such as tangi and hui, was estimated at 40 tons; the allowance for recreational/sustenance use was estimated at 36 tons, for the entire QMA. Under the *Te Uri o Hau Claims Settlement Act 2002* the Crown agreed to restore Te Uri o Hau access to traditional foods and food gathering areas, and give effect to certain provisions of the Deed.

Figure 10. Total eel landings from 1965-2007/08, as well as for shortfin and longfin landings from 1989-90 to 2007-08 fishing year. Source: Ministry of Fishery (2008d)

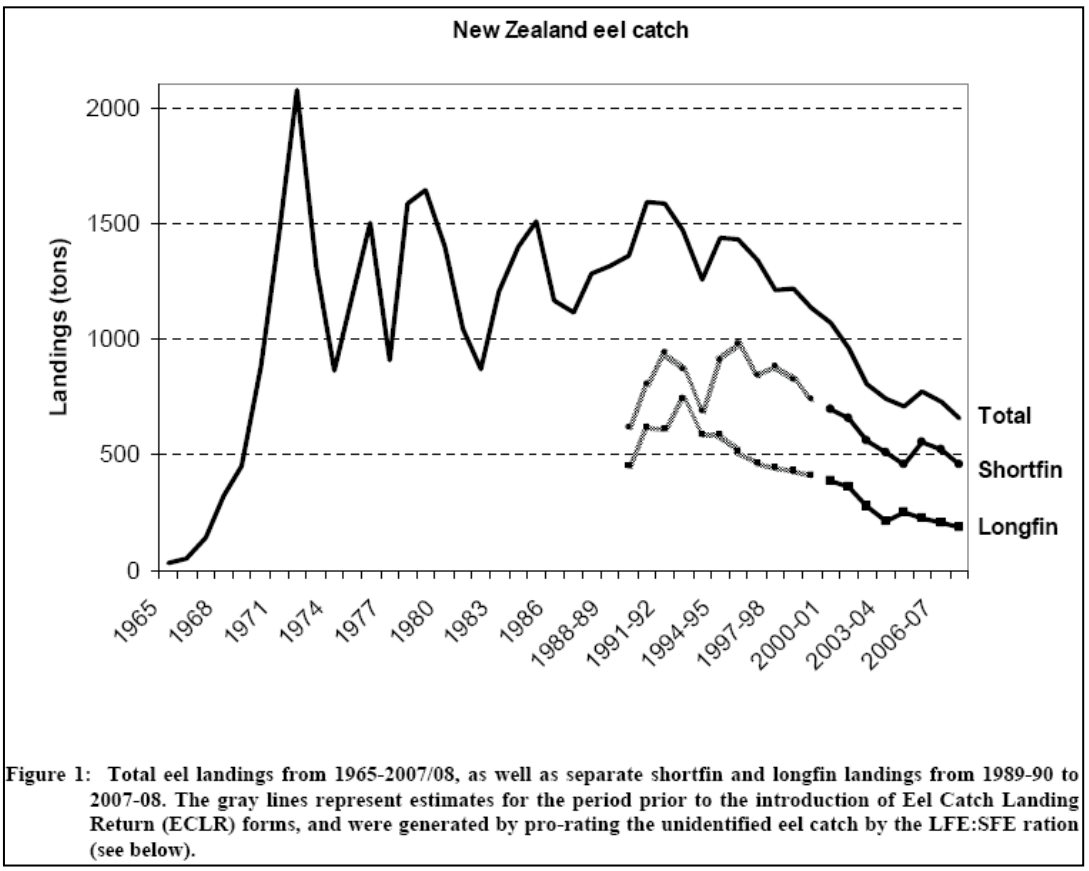


Figure 1: Total eel landings from 1965-2007/08, as well as separate shortfin and longfin landings from 1989-90 to 2007-08. The gray lines represent estimates for the period prior to the introduction of Eel Catch Landing Return (ECLR) forms, and were generated by pro-rating the unidentified eel catch by the LFE:SFE ration (see below).

Scallops

- The scallop populations of the Kaipara Harbour were assessed while a s186a closure was in place (Walsh & Holdsworth 2007). Scallop distribution, size, and relative abundance were reported. A second survey has just been completed in November 2009 (Kelly/Ministry of Fisheries, unpubl. Data).

- The closure was put in place 2006, and reopened on the 30th November 2009. Te Uri o Hau are currently investigating appropriate measures to promote ongoing restoration of the Kaipara scallop beds, such as the establishment of a Mataitai reserve.

Toheroa

- Occurring along the long exposed west coast beaches of the Kaipara Peninsulas, this endemic surf clam (*Paphies ventricosa*), was historically very abundant. A regionally and locally important fishery, abundances are now greatly reduced (Morrison 2005; Murton 2006).

- All toheroa beds are now closed to recreational and commercial fishing (Morrison & Parkinson 2008).

- A customary rahui set down by Te Uri o Hau marae (Waikaretu, Ripia and Oturei) has been in place for several years form Pouto Point to Mahuta Gap. This is not a s186a closure under the Fisheries Act, so is difficult to police.

- Toheroa populations of the Kaipara Peninsulas are part of a series of beach populations that stretch from Ninety Mile Beach, Whangapae, Mitimiti, Mahuta Gap, Rangitira Beach, and Muriwai (Morrison 2005). Knowledge of the connectivity, sink/source relationships, spawning, settlement and movement between this spatially disperse toheroa beds, is poor. Particular beds may act as sources for spawning populations and others may act as sinks or settlement populations. Such population dynamics are unclear.

Recreational Fishing Catch and Effort

- Recreational fishing surveys have been conducted using various methodologies since the 1990s, to characterise New Zealand recreational fisheries, and to estimate catch and effort levels.

- The Kaipara Harbour recreational fishery was recently surveyed in more detail, as part of a larger West Coast North Island (2006–07 winter and summer season) aerial and boat ramp survey (Hartill 2008). Earlier national estimates from 1996 were considered to be unreliable (Bradford *et al*. 1998; Hartill *et al*. 1998), as well as from 2000 and 2001 (Hartill et al. 2005).

- For 2006-07, the top number of species caught for the Kaipara and Hokianga Harbours were snapper (51%), gurnard (20%) and kahawai (20%).

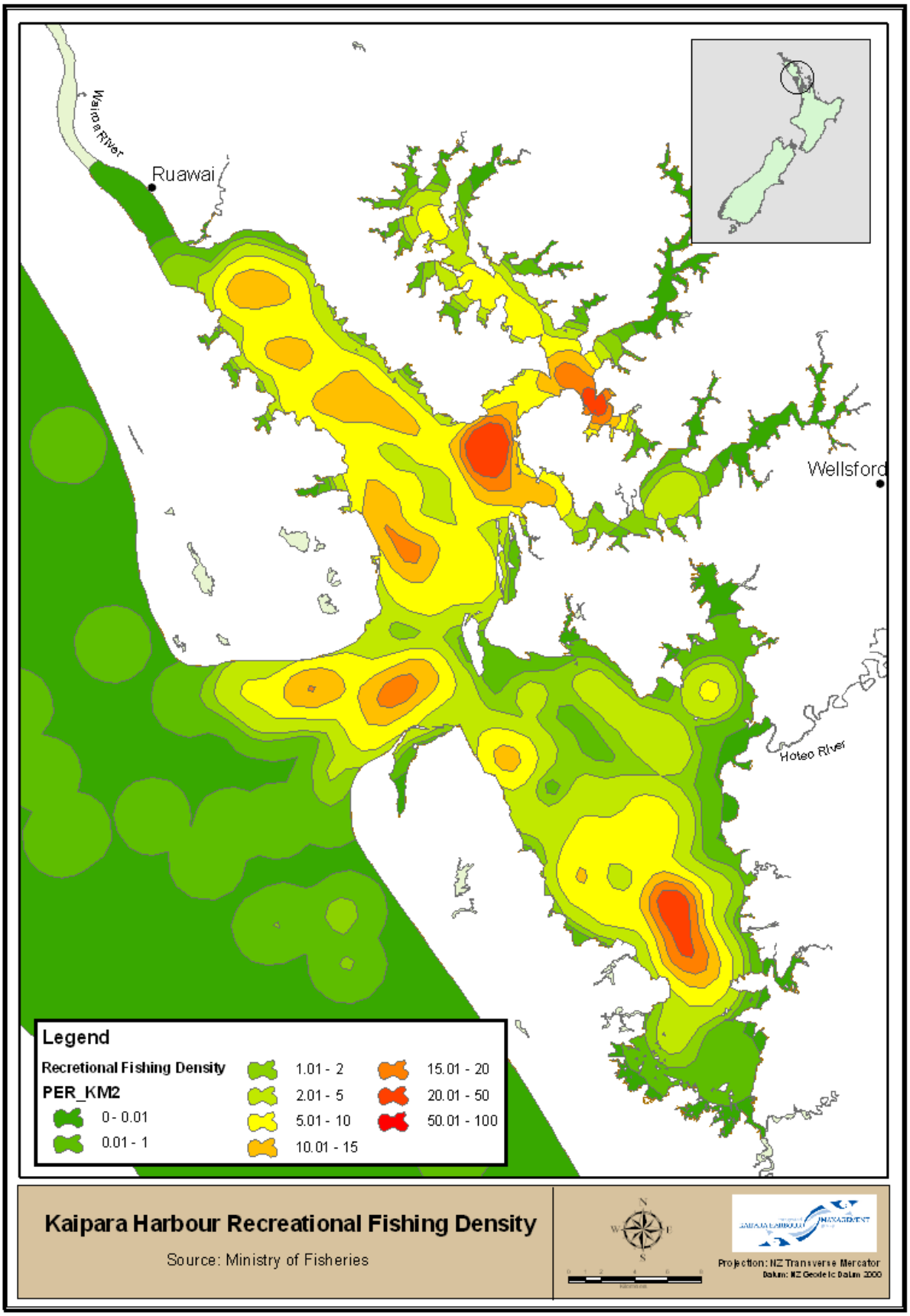
- The number of fishers varied between the winter and summer seasons, with more fishers interviewed in summer than winter.

- Fishing effort was much higher during weekends and public holidays than on weekdays (Mondays to Fridays).

- Over 89% of fishers used trailer boats, rather than launches or charter boats.

- Higher densities fishing boats were found near to major boat ramps or townships; for the Kaipara Harbour, such areas included Shelley Beach, Tinopai and to a slight lesser extent the Funnel (near Tinopai) and Graveyard (entrance to Kaipara harbour) (Figure 11).

Figure 11. Kaipara Harbour recreational fishing density (number of fishers per km^2).



10.8.2 SOCIO-ECONOMIC INFORMATION

Comprehensive and quantitative socio-economic information regarding fishing and fisheries is an information gap. The best information to date that describes the socio-economic value of fishing was carried out for the Maui and Hectors Dolphin Threat Management Plan (Department of Conservation & Ministry of Fisheries 2007). Other socio-economic information available includes the Ministry of Fisheries recreational survey of FMA 9 in 2006 (discussed above), and national surveys carried out since 1996.

Hector's and Maui Dolphin Threat Management Plan

This plan included a rapid socio-economic impact assessment of commercial trawl, set net and recreational set net fishers to the proposed options to mitigate fishing threats to Hector's (*Cephalorhynchus hectori hectori*) and Maui dolphins (*Cephalorhynchus hectori maui*).

Maui Dolphin Facts:

- World's smallest dolphin - full grown adults are size of a small child, about 1.4m.
- Internationally (IUCN) classified as 'critically endangered', meaning high risk of it becoming extinct in the near future.
- New Zealand's rarest dolphin
- Found only on the North Island West Coast
- Cousin to the Hector Dolphin in the South Island
- Believed to be about 100 individuals
- Live about 20 years and females begin to breed when aged 7-9 years and have one calf every 2-3 years. This equates to a very low growth rate – 2%.
- Live in shallow coastal waters up to 100m deep – this includes harbours, river mouths, estuaries and shallow bays
- Most sightings are between Manukau Harbour and Raglan Harbour
- At risk from fishing nets used for trawling and set netting. Other threats include their habitat being affected by pollution, struck by boats, coastal development and seabed mining.
- Believed that the death rate is 110-115 per year for Hector's and Maui dolphins
- Feed on fish and squid

(*Source: http://www.doc.govt.nz/conservation/native-animals/marine-mammals/dolphins/mauis-dolphin/ which refers to: 77 peer reviewed published papers in scientific journals, 13 Masters theses, 9 Doctorate theses, 42 departmental reports, 8 unpublished papers and 7 sections in books*)

Four management options were proposed for set netters and recreational set netters: (1) Status quo, which involved no change to management; (2) Partial area prohibitions; (3) Mandatory net attendance and no overnight setting in harbours; (4) Full prohibition in West Coast North Island harbours and extension of closure out to 12 nm and down to Mount

Egmont/Taranaki. For inshore trawlers, management options were slightly different but were presented with four options also: (1) Status quo; (2) Additional monitoring operating in within 4 nm; (3) Seasonal area prohibition between Manukau Harbour and Port Waikato and Maunganui Bluff to Taranaki; (4) Full trawl prohibition out to 4 nm. The assessment was undertaken between August and October 2007 (Penny *et al*. 2007). The Kaipara Harbour, (statistical area 044) and its adjacent coastline (statistical area 045) was assessed.

Focus groups, interviews and questionnaires were the main methodology used. There was a poor participation rate for the West Coast North Island inshore trawl fishery and set netters, especially Manukau Harbour, and with only 2 commercial inshore trawlers participating in the questionnaire and focus groups. In 2007 there were six exclusively inshore bottom trawl fishers (>80% of all catch taken from inshore bottom trawling) operating in the West Coast North Island region. Licensed Fish Receivers (LFRs), processors, fishing service industry participants, and retailers were also sampled. Sanfords Ltd own or contracts the majority of the inshore bottom trawl fleet on the West Coast North Island. Māori participation was very low, primarily due to the process taken. Hapū representatives from the Kaipara did participate in one-to-one interviews.

The report states, that those most affected by the proposed Hector's and Maui dolphin protection mechanisms would be the inshore trawl vessels. This would be particularly felt through the additional monitoring costs, ranging between $800–$1,000 per day, and voluntary codes of practice if they had to fish from 4 nm from shore. It was estimated for the 2005/06 fishing year that the West Coast North Island value of inshore trawling based on the main species caught was $6.4 million, compared to East Coast South Island region at $8.7 million, West Coast South Island region at $5.24 million and the South Island South Coast at $1.0 million (Penny *et al*. 2007). For Option 2, there would be a 10% loss of economic value to trawl fishers, rising to 73% under Option 3, which would lead to most of the 22 West Coast North Island bottom trawlers exiting the industry.

The financial profile of an inshore bottom trawling fisher using data collected from the questionnaires (e.g. fishing turnover, gross annual household incomes, dependents, debt levels and asset value) and a Agribusiness Group Model revealing that business would run at a $15,000 loss, when depreciation, management costs and increasing/changing fuel costs are taken into account. This profile is particularly relevant to an owner-operator business rather than a corporate business such as Sanford or Talleys.

For Kaipara commercial set netters, defined as gill and ring netting, analysis found that 80% (about 79 fishers) of West Coast North Island set netters relied on this method to catch fish, and would be significantly affected by the proposed protection mechanisms. Penny *et al*. (2007) received 28 questionnaires from set netters in this region, with a total of 39 participating in assessment.

Little impact was found to occur under Option 2 for Kaipara Harbour commercial set netters. Under Option 3 up to 75% of set netters would be out of business immediately, while Option 4 would mean 100% of set netters would be significantly affected and immediately lose their livelihoods.

The financial profile developed for the commercial set netter using the questionnaire results, focus groups, and interviews cross-referencing for the 2005/06 fishing year, provides some

independent measure of economic sensitivity or resilience to changes in income or costs, given the protection mechanisms proposed. Fishing turnover was valued at between $10,000 and $533,000, with a median of $122,000. Seventy-five percent of participants reported fishing accounted for more than 90% of gross household income. Forty percent reported they owned all their fishing assets, valued between $12,000 and $2.5 million; whereas 60% indicated they were carrying debt for their fishing assets between $27,000 and $900,000.

The loss of economic value was calculated for each option for the West Coast North Island set netters. Penny *et al*. (2007) estimated that 13% loss would occur for Option 2, 55% for Option 3 and 104% for Option 4

Recreational set netters were categorised into three groups: 'regulars' (locals), 'semi-regulars' (locals and holidaymakers), and 'opportunists' (holidaymakers). Penny *et al*. (2007) describes the 'value' of set netting to recreational fishers surveyed and concluded that such an activity holds significant cultural value, where most regular and semi-regulars relied heavily on this activity for food and leisure. Option 4 would pose the most significant effect to the recreational fisher.

10.9 ISSUES

Fishing has direct and indirect effects on target species, bycatch species, and habitat (Myers & Worm 2003, Pauly *et al* 2002, Dayton *et al* 1995); and on the diversity, structure and productivity of benthic communities (Jennings & Kaiser 1998, Kenchington 2002), including deepwater benthic environments (Cryer *et al* 2002, Morato et al 2006). Because of our imperfect understanding of ecosystem structure and function, and the difficulty in distinguishing between human and natural-induced changes, the former are not always perfectly predictable and/or reversible (Christensen *et al* 1996).

10.9.1 DIRECT FISHING IMPACTS

Declining Biomass

- Localised depletion of grey mullet, flatfish, rig, (Hartill 2004, Paulin & Paul 2006), scallop, snapper, school shark and fish stocks within the harbour have been documented (KHSFMSG 2003; reviewed in Haggitt *et al*. 2008).
- Little scientific information is available on the status of stocks, especially stock sizes or biomass. It is unknown whether they are at a sustainable level of commercial fishing, as well supporting recreational and customary fishing extractions. Assessments are undertaken mainly using measures of Catch Per Unit Effort (CPUE). The assumption of this measure is that, if fishers are, through time, able to catch the same amount of fish over a given time period (usually annual) using the same effort, the stock size is likely to be stable. However, one of several problems with CPUE measures is that they do not take into account changes in equipment technology (e.g. use of GPS, sounders) and fishing methods (sometimes referred to as "technology creep"). If fishing becomes more efficient, the stock could be in decline, but show a stable CPUE.
- This is of particular concern to Māori, who have indicated that they do not feel able to exercise their customary fishing rights. Under the Te Uri O Hau Deed of Settlement the Ministry of Fisheries is required to consult with the hapū and iwi of the harbour. In a low income area such as the Kaipara, the state of the local fisheries is of significant concern to the community.
- Reporting of the status of commercial fishing of flatfish, grey mullet and rig in the Kaipara found that catch rates have declined in recent years. However, an increasing proportion of landings of each species originate from the Kaipara Harbour.
- Increased fishing effort is being applied in the harbour to maintain catch levels (as shown by decline in CPUE) (KHSFMSG 2003).

Demographic Changes

- Demographic changes, or changes in target or non-target fish population characteristics, are the most obvious effects of fishing, especially for an overexploited population. While direct demographic changes have not been quantified for many targeted fish stocks in the Kaipara, it is generally accepted that fishing: reduces the abundance of target species; changes the size and age structure of the populations through selective removal of larger, older individuals; and affects the spawning biomass and, with over-fishing, recruitment to the population (Botsford *et al*. 1997; Pitcher *et al*.2000; Pitcher 2001; Pauly *et al*.2002; Polunin 2002). Historical and current evidence of this occurring has been observed for example, for the West Coast North Island SNA 8 stock in fish size and age compositions (Morrison et al. Unpubl. data). Commercial catches in the 1974–76 were composed of broad ranges in sizes of snapper, with 20–40% being over 20 years old and greater than 50% being between sizes of 40–60cm. Catches from 1988–90 contained few of these larger and older snapper, with the population now dominated by younger (4–8 years) and smaller (25–35 cm) fish, with no evidence of population recovery as of the most recent comparable sampling in 2003–04.

Bycatch

- Bycatch is the catching of organisms that are not the primary fishing target. In most fisheries there is bycatch; including small individuals of the target species, or other species with little or no commercial value. The problem is widespread, and exaggerated by inefficient fishing practices, which may lead to high juvenile mortalities, and losses of non-commercial species. Additional issues can include reductions in fish quality (and hence economic returns), as from damage to target species in trawls with high levels of bycatch, and set netting when nets are left unattended and left to soak and fish overnight, or greater than 6 hours (the average netting time as tides turn) (KHSFMSG 2003).

10.9.2 UNHEALTHY MAURI

- Te Iwi o Ngāti Whatua are the Kaitiaki of the Mauri and have been witness to the diminishing of the mauri (Environs Holdings Ltd. 2007) of the Kaipara. Increased siltation and narrowing of waterways, reduced waterflow, native habitat and associated biodiversity are all believed to be impacting on the health of the mauri and wairua of the Kaipara Harbour ecosystems and the different domains of Papatuanuku and Ranginui.

- Examples of this have been cited in particular evidence (Wright 1996, Environs Holdings Ltd 2007, Waitangi Tribunal 2006) and also discussions with Kaipara Kaumatua, Kuia and Kaitiaki. It should be noted that there is a paucity of Māori perceptions of the environmental degradation within the written historical record, and similar scarcity of information on Māori views of Crown actions. Ngāti Whatua o Kaipara believe the mauri has been affected by continuing anthropogenic impacts over the past 200 years, such as ongoing resource extraction and use, landuse

changes, deforestation and sandmining (Environs Holdings Ltd 2007). As a result, significant adverse cultural effects on Ngāti Whatua o Kaipara, notably Te Uri o Hau and Ngāti Whatua Ngā Rima o Kaipara, have occurred. At its worst this has been a core factor in the physical alienation of the people from their whenua and moana.

- Ngāti Whatua o Kaipara Kaitiaki believe any further effects that contribute to the cumulative stress on the ecosystems of the Kaipara, in particular fisheries and kaimoana beds, will have an adverse effect on the ability of haukainga to feed their families and manaaki their manuhiri (Environs Holdings Ltd 2007).

- More discussion on the status and health of the mauri is composed within Chapter 11 'Restoring the Mauri of the Kaipara'.

10.9.3 EFFECTS OF LANDUSE ACTIVITES

- The impacts of run-off (usually composed of sediments, nutrients and other pollutants such as resides of pesticides like dioxin) from the land can have a significant influence on fish stocks, particularly on coastal and estuarine species. For example, in the Kaipara estuarine environment it is suspected that sedimentation has affected flatfish and shellfish stocks. Managing these impacts on fish stocks is currently outside the mandate of the Ministry of Fisheries but within the jurisdiction of regional councils (Peart 2007). As a result, Ministry of Fisheries essentially treats them as uncontrollable and external to the fisheries management system. In the past it has not researched such impacts, as the findings of the research would not directly link to a management action. However, this situation is now changing, which is described below.

- Important and vulnerable habitats are found in the Kaipara Harbour that support commercial and recreationally important fish species. Juvenile fish and seagrass research carried out in the southern Kaipara harbour revealed high densities of 0+ snapper. The seagrass meadows support high abundances of juvenile snapper and trevally, with trevally being an order of magnitude more abundant than at any location previously surveyed in New Zealand. Also, intertidal seagrass meadows where found to support juvenile grey mullet. Such habitats are especially vulnerable to degradation in environmental conditions.

10.9.4 CLIMATE CHANGE

- Understanding climate change impacts on fish stocks of the Kaipara is an important issue, particularly as information surrounding this is relevantly unknown, not only for the Kaipara Harbour, but also at other scales. A synthesis of climate change information concerning impacts to the marine environment stated that our understanding is very limited as a result of three major gaps in knowledge: (1) the lack of long–term time series of data to establish correlations with past environmental

fluctuations; (2) little information on the resilience of habitat-forming species to variability in the environmental factors that will be affected by climate change (e.g. temperature, rainfall, sea level); and (3) a limited understanding of ecosystem structure and function and the relationships between the species and the environment (Willis *et al*. 2007).

- We do know that estuarine and wetland habitats are particularly vulnerable to climate change impacts. Both habitats are of particular significance to fisheries in the Kaipara Harbour as juvenile and adult fish feeding and spawning grounds. Kaipara Harbour seagrass meadows form an important component to the entire Kaipara estuarine ecosystem, as they have been shown to provide valuable community functions including food and nursery habitat for commercially and recreationally important fish, such as snapper and grey mullet, invertebrate habitat and food to waterfowl and other wading birds.

- Seagrass meadows may adjust their pattern of distribution and relocate to areas they can tolerate, depending on salinity changes, growth, photosynthesis and propagule formation. Seagrass meadows are expected to be exposed to increasing stress from disease and fouling by epiphytes (Willis 2007).

10.9.5 DECLINING BIODIVERSITY

As fishing can affect so many species and linkages in ecosystems, it must also threaten marine biodiversity in general. Biodiversity is declining and is a worldwide trend due to the destruction of habitat, harvesting and introduction of exotic pests, diseases and plants (Worm *et al*. 2006).

Biodiversity, or biological diversity, refers to the number and variety of living organisms. It includes diversity of species, between species and of ecosystems and the processes that maintain them. It also refers to genetic diversity, which is about the varied genetic make-up among individuals of a single species.

Most of New Zealand's biodiversity is in the sea (MacDiarmid 2007). Diversity within marine ecosystems is important for stable function and productivity (Kenchington 2003). When a species of commercial importance becomes extinct, or are reduced to low levels, harvest pressure is often transferred to others with similar traits, and reverberates through the levels of species assemblages and ecosystems.

Diversity is hypothesised to buffer ecosystems from the impacts of large-scale environmental changes. Thus, any reduction in diversity could affect an ecosystem's ability to withstand change, and may instead see it undergo a major shift in trophic structure, composition and function. Worm *et al*. (2006) conducted a meta-analysis of published data over the past 35 years, across varying scales and ecosystems (coastal, estuarine, large marine ecosystems) and up to 80 economically and ecologically important species. The analysis examined the effects of variation in marine biodiversity (genetic and species richness) on primary and secondary producers, resource use,

nutrient cycling and ecosystem stability. Across regional scales, it was found that with declining diversity, rates of resource collapse increased and recovery potential, stability, and water quality decreased exponentially. The analysis suggested that substantial loss of biodiversity is closely associated with regional loss of ecosystem services, notably filtering and detoxification services provided by suspension feeders, marine vegetation (seagrass) and wetlands.

As part of the analysis Worm *et al*. (2006) reported on the ability to reverse the trend of declining biodiversity. 44 fully protected no-take areas and four large-scale fisheries closures from across the World, showed a general trend of increased biodiversity and ecosystem services. Fisheries productivity (measured in CPUE) increased fourfold in fished areas around the no-take area.

Biodiversity is important from an ecosystem-based management point of view because it is related to "resilience" or capacity to resist an impact or return to original conditions after the impact is removed. As a consequence, it is of interest to fisheries that the diversity of exploited habitats and the diversity of habitats and species in them is maintained and possibly enhanced as an "insurance" against negative consequences of future changes.

Loss of genetic diversity

By selectively removing older and larger individuals, fishing potentially alters the genetic structure of the exploited populations (Smith *et al*. 1991; Goni 1998; Hauser *et al*. 2002). Very few studies have been carried out on the loss of genetic diversity. A study of a population of orange roughy (*Hoplostethus atlanticus*) off New Zealand, revealed that after a 70% reduction in the virgin biomass after 6 years of intense fishing, a positive correlation was observed between heterozygosity, growth rate, and size of individuals, suggesting that in virgin populations, the oldest and largest individuals are the most genetically diverse.

With the removal of larger and older individuals, reproductive output is reduced because age-at-first and size-at-first maturity is smaller. Even though spawning stock biomass remains in its thousands, the effective genetic population size is only hundreds. To study and demonstrate the changes in genetic diversity of overexploited or collapsed stocks in wild populations is often complicated by the lack of suitable populations for comparison (Hauser *et al*. 2002). Most commercially exploited species are fished wherever they occur, and thus comparisons between exploited and unexploited stocks are not possible. For the New Zealand snapper fishery there is evidence of a loss of genetic diversity. The northern North Island stock of snapper was compared with the more natural stock of Tasman Bay in the South Island (was not exploited and heavily fished at the same time as the northern stock) (Hauser *et al* 2002). It was found that commercial fishing had selective genetic changes in exploited stocks and also caused reduced genetic diversity by genetic drift. Thus very few individuals contribute successfully to the next generation, possibly in part explaining the often poor relationship between the size of the spawning stock and recruitment. This is an area of new research. Collaboration between fisheries biologists and molecular geneticists is needed to protect individuals that are most likely to reproduce successfully from overexploitation.

Reducing genetic diversity can affect a species ability to cope with environmental changes (e.g. climate change) and anthropogenic impacts. Genetic diversity is partitioned among and within populations. Genetic diversity provides the variation which is the raw material of evolution and thus has become an important element of conservation (Kenchington 2003).

10.9.6 LACK OF LOCAL MANAGEMENT & KAITIAKITANGA

The QMS is criticized for its inability to address local fisheries management issues. Processes to address such issues including the Ministry of Fisheries conflict resolution process can be costly and time consuming, and the inability to meaningfully control local fisheries has long been a point of frustration for the Kaipara Harbour community.

A point of discontent from local fishers has been the ability for non-local fleets to fish within the harbour. Because the FMA (Figure 7) cover large areas, fishers with access to quota can trail their boats across to the west coast harbours and concentrate their fishing effort. This can severely impact on localised fishing operations, especially when fish stocks become depleted from extra effort from non-local fishing operators. This situation acts as a strong disincentive for any local efforts to manage the health of the harbour and fisheries.

Spatial Conflict

The decline in abundance of some fish species has resulted in ongoing conflict amongst local commercial fishers themselves (KHSFMSG 2003, Peart 2007), and between recreational and customary fishers, and also with fishers from other harbours and other harbour users. Conflict exists over fishing method used and species targeted, such as trawlers operating outside the harbour along the coast applying heavy fishing effort to catch adult snapper. Harbour fishers have always believed trawling and Danish seining have significantly jeopardised the snapper population inside the harbour (Murton unpublished). By targeting adult populations outside the harbour and subsequently damaging and modifying habitats, fishers believe trawlers affect the yield of other fishers who do not use such destructive gear.

Three different categories of relationship exist for fisheries in the Kaipara Harbour:

- Competition within the fishing industry
- Relationships between fisheries and other coastal industries, such as aquaculture, sand mining, energy and coastal development
- Relationships between fisheries and charismatic megafauna (e.g. dolphins, orca, seals)

These relationships characterise the fisheries communities in the Kaipara Harbour and need to be considered in management decisions. Any decisions for the coastal and marine management of the Kaipara Harbour will involve trade-offs between scarce resources and constantly increasing demands for use and allocation rights. Under the current fisheries management regime the allocation of fish is not carried out holistically

with respect to other non-fishing users. Unlike resource management decisions under the RMA which require an assessment of the environmental, economic, cultural and social impacts of resource use, fisheries allocation models are premised on maintaining sustainable levels of fish stocks for future use. This does not consider local values or ecosystem principles. Kaipara Harbour communities have therefore long advocated for management regimes which are better able to recognise local values.

Essentially, the approach taken to address the spatial trade-offs between benefits will dictate the outcomes: "the devil is in the detail" (van Roon & Knight 2004). For example, while land activities influence water quality, coastal and marine environments, these issues come under a variety of jurisdictions', legislation and regulations. An approach to achieve sustainable fishing in the Kaipara Harbour could utilise holistic indicators such as: increased income, access to education and health, longer lives, cleaner water and various aspects of measures of improved quality of life may assist with addressing the spatial conflict. A journey to achieve a more 'equitable' sustainable model was started in 1992 when the conflict between fishers and non-fishers reached the attention of the nation.

10.10 LOCAL & INTEGRATED MANAGEMENT INITIATIVES: PAST & CURRENT

Tinopai Fisheries Management Committee

In early 1997, growing concern escalated over the depletion and degradation of Kaipara fishstocks. Local fishers had observed this to be due to four factors: (1) Scale of Management (e.g. FMA 1) was unable to prevent overfishing and subsequent localised depletion of stocks; (2) Catch information returned to the Ministry of Fisheries is volume only not size or quantity of fish caught, thus disguising any recruitment overfishing or demographic changes in the stock; (3) TAC is not being achieved thus, indicating possible underfished stock or stock no longer exists at the estimated level at which the TAC was set; and (4) Set netting methodology under the current legislation allows large wastage of fish due to long and unattended soakage of nets; and the disregard for 1000m net length limits; and general bad practice and lack of respect for local fishers (i.e. commercial, customary and recreational) needs.

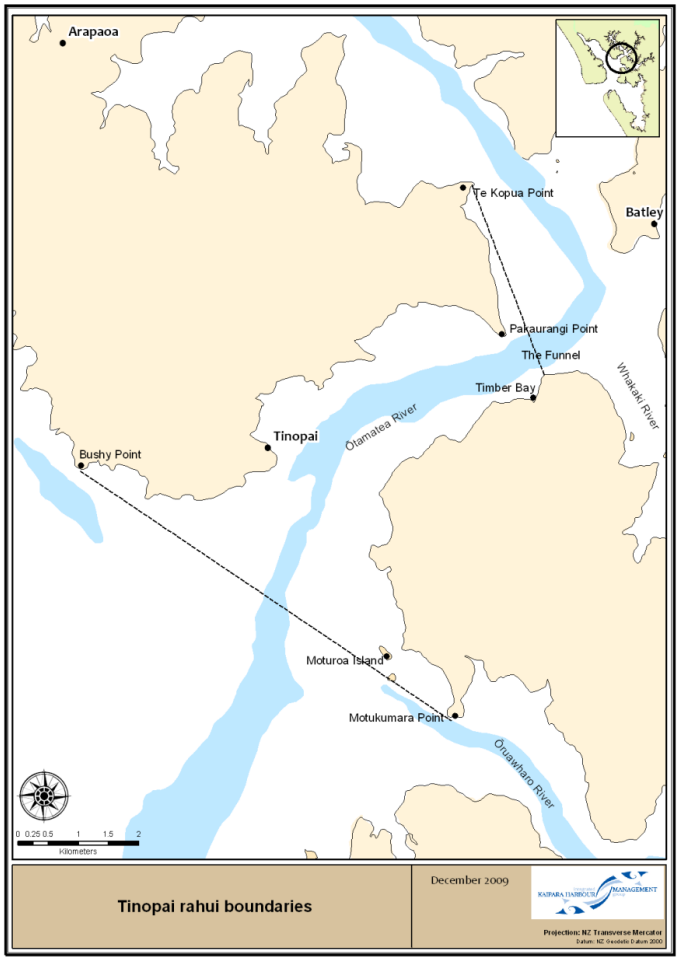
A public meeting was held at Tinopai Hall, called by local kaumatua, where 175 people attended to discuss these issues and concerns. The Tinopai Fisheries Management Committee, with the assistance of the Ministry of Fisheries, was formed to identify solutions and rebuild a sustainable fishery. A traditional Māori Rahui was identified as the best solution to address the depleting fish stocks. The Rahui area would offer a safe migration passage for fish moving in and out of the Kaipara Harbour to their respective breeding grounds and juvenile habitat.

Rahui is a Māori custom to conserve resources and ensure their replenishment and sustenance. It is a form of prohibition or ban instituted to protect resources. Within tribal territories a certain area would be placed under Rahui and posted as being 'out-of-bounds' to those wishing to harvest those resources within. Other areas would remain open for use, as a form of rotation farming. When the resources had regenerated itself, then the tapu

would be lifted and the resource would be restored to general use. This rotation method would ensure a constant and stable source of supply to the tribes.

The placing of the Rahui was carried out by the late kaumatua Bill Tito of Nga Tai Whakarongorua marae, Tinopai, on 15th November 1997 prohibiting commercial fishing only. The Rahui was placed over an area between Te Kopua Point in the Arapaoa River across to Timber Bay in the Ōtamatea River through the funnel, with the western boundary ending north at Bushy Point and west to Motukumara Point in the Ōruawharo River (Figure 12).

Figure 12. The Tinopai Rahui boundaries, 1997-2002.



The move was not supported by Auckland Inshore Fishermen's Association which represented commercial fishers not only from the Kaipara but from the wider Auckland (FMA 1) area. They did not support the Māori Rahui as they believed it was not recognised under any statute of New Zealand law and they had no intention of changing the way they operated when they had the legal right to fish in the Rahui area.

The Committee did not police the Rahui but did advocate and communicate the Rahui with the local Kaipara community. They also called for the Ministry of Fisheries to support their local initiative and give the Rahui legal status.

On 22nd June 2000 the Minister of Fisheries Pete Hodgson closed the Tinopai Rahui area to commercial fishing for two years under section 5 of the Fisheries Act 1996. The closure was for two years, an interim measure, pending the development of a broader strategy for the Kaipara harbour. This option was considered the best to address the local conflict, the Crown's obligations to act in accordance with the principles of the Treaty of Waitangi and the adverse effect at Tinopai by commercial fishing particularly to Māori and the exercise of customary fishing rights.

Kaipara Harbour Sustainable Fisheries Management Study Group (KHSFMSG)
At the direction of Minister Hodgson the Kaipara Harbour Sustainable Fisheries Management Group (KHSFMSG) was formed in 2000 to develop an overall fishing management plan for the Kaipara Harbour. The KHSFMSG was composed of

representatives from the Tinopai Fisheries Management Committee, commercial, recreational and customary fishers from other parts of the Kaipara harbour. The KHSFMSG had an independent facilitator/chair, the Mayor of Kaipara District, Graeme Ramsey.

The Group produced a strategy called *Fishing for the Future* (KHSFMSG 2003) and identified a range of options to improve the management of the Kaipara fishery. Included in this strategy is a proposal to establish the Kaipara as its own QMA with a separate licensing regime. However, to date, liaison with the Ministry of Fisheries has mainly been focused on voluntary mechanisms rather than using regulation. Progress has been made (through community and iwi/hapū support) with the temporary closure of the scallop grounds. This is only a recreationally targeted fishery so does not have the same high level conflict as the other proposals. The scallop grounds have been closed for another 4 years, but as of December 2009 are reopened. Other progress has also made on the use of stalling nets. The ability to use stalling has been revoked from the Fisheries Act 1996.

The s186A temporary closure ended in June 2002. The Rahui was lifted by Tinopai kaumatua in the same year.

Integrated Kaipara Harbour Management Group (IKHMG)

Formed in 2005, the Integrated Kaipara Harbour Management Group (IKHMG) was initiated by Te Uri o Hau Settlement Trust, through its mandated Kaitiaki Unit, Environs Holdings Ltd. The impetus for action on harbour management was driven by the settlement of Te Uri o Hau (TUOH) treaty claim in 2002. Under section 59 of the TUOH Claims Settlement Act 2002 the Crown acknowledged the cultural, spiritual, historic and traditional association of TUOH with the Kaipara Harbour. The statutory acknowledgement and set of MOU's and Protocol Agreements entered into with TLA's and key crown agencies involved in the management of the Kaipara harbour reaffirms the obligations TUOH have in relation to the restoration of this Taonga.

As described in Chapter 5 'Purpose and Vision' the IKHMG is composed of several parties from regional councils, district councils, crown departments, community groups, research organisations, and hapū/iwi with a shared vision for a 'Healthy and Productive Kaipara Harbour'.

10.11 MONITORING

Regular State of Environment Monitoring of fish stocks, fisheries habitats and their associated biodiversity is a gap. Annual Plenary Reports produced by the Ministry of Fisheries provide information on commercial fishing landings against the TACC and TAC, any new information surrounding the recreational and customary non-commercial fishing of the target species (over 250 species in QMS); any new information on illegal, unregulated and unreported catch and effort; biology of the species; stock assessment particularly CPUE analyses if possible and abundance/biomass estimates; and status of stocks against relative sustainability measures such as B_{MSY}. Current and/or sufficient information on mortality rates and current biomass to, revise or estimate, yields can be insufficient and understand the risk of fishing to the stock.

Status of fisheries habitat and biodiversity is not reported on for grey mullet, eels or flatfish in the recent 2008 Plenary Reports.

10.12 CURRENT & PROPOSED RESEARCH

Habitats of significance for fisheries: Kaipara Harbour
The overall objective of this research program, scheduled to begin in December 2009 to September 2011, will identify and map areas and habitats of particular significance that support fisheries in the Kaipara and assess potential fishing and land-based stressors to their function. A desktop study of previous fisheries habitat role and spatial distribution information will be collated and reviewed. Historical, current and possible anthropogenic impacts to these habitats that could affect fisheries values, including fishing and land-based threats will be assessed. Habitat mapping of particular fisheries habitats will be undertaken using various methodology, which may include aerial photography, underwater video and camera approaches and/or acoustic and spectral methods.

This research program is a result of recent work that suggests biogenic habitat structure can be extremely important for coastal fisheries production. There is an urgency to identify such habitats because they seem to be disproportionately both important and vulnerable (Morrison *et al*. 2009). The Kaipara harbour is emerging as a vital component to the wider West Coast North Island ecosystem with recent work suggesting the Kaipara Harbour is the predominant natal nursery ground for the west coast North Island snapper stock (SNA8). West coast harbours are also known to support important nursery habitats for trevally, school shark, rig, grey mullet, kahawai, yellow-belly and sand flounders.

With increasing usage of the Kaipara harbour and its river catchments, pressure on both structured and unstructured habitats and their associated fisheries and biodiversity, are thought to be increasing. In particular, these include sedimentation, eutrophication and cascades of effects generated by their combination (e.g. suspended sediment loads leading to smothering of benthic plants and shellfish, and increased turbidity). These stressors and their associated impacts cannot be considered in isolation from other stressors, such as fishing.

Fish-habitat classification scheme for the Kaipara Harbour
This project has linkages with the new FRST program “Coastal Conservation Management”, in developing a fish-habitat classification scheme, but with a specific Kaipara Harbour focus. This is a NIWA CapFund project involving a desktop review of different approaches to fish classification and integration of all available biological and physical datasets, including a stressors framework (M. Morrison, NIWA, pers. comm., Nov 2009). Fine-mesh beam trawls for small juvenile fish, including snapper and trevally; and dropped underwater video (DUV) for fish assemblages greater than 5cm and associated quantified habitat structure, will be collected (e.g. Morrison & Carbines 2006; Carbines & Cole 2009).

This fish-habitat classification will support and assist with the development of the regional and national scale fish-habitat classification being undertaken for the “Coastal Conservation Management” program and will support the interpretation of results obtained for the ‘Habitats of Significance for Fisheries: Kaipara Harbour” program.

Larval settlement of snapper

This post-doctoral research program started in August 2009 will be specifically aimed at understanding the breeding behaviour of adult snapper. It will also examine the larval processes bringing larvae into the harbour, and identify the settlement cues of habitats most attractive to snapper larvae (C. Radford, University of Auckland, pers. comm., Aug 2009). This information regarding the snapper life cycle is vital to understanding how spawning snapper and larvae make use of the harbour and how these processes can be impacted by environmental stressors.

Spatial mixing of grey mullet GMU1 using otolith microchemistry

Grey mullet (kanae, *Mugil cephalus*) are predominantly found in harbours and these environments have undergone significant changes as a direct result of anthropogenic impacts. The impacts of these changes on the population dynamics of grey mullet are not well understood but are believed to have had a potential impact on sustainable yields of grey mullet.

About 75% of grey mullet are landed in GMU1 and come from the West Coast of the North Island. As grey mullet are often harbour based, several geographically distinct fisheries have been found to exist. The Kaipara Harbour is recognised as a potentially distinct population. CPUE estimates using from 2001/02 in Kaipara Harbour appear to have declined but have since increased when 2005/06 data was included (Ministry of Fisheries 2009). The status of GMU1 biomass relative to Maximum Sustainable Yield is unknown.

This Ministry of Fisheries project (being conducted by NIWA) involves assessing whether distinctly different otolith chemistry signatures exist between different grey mullet nursery grounds. If so, in future years such signatures will be used to determine the rates of spatial mixing and connectivity between grey mullet populations in GMU1, using otolith microchemistry. This methodology has recently been used for identifying the Kaipara Harbour as the natal nursery for West Coast North Island adult snapper populations. Grey mullet are a good example to replicate such successful methodologies, as they are known to be heavily reliant on estuarine environments during early juvenile life-stages. They also have strong associations with specific habitat types, such as mangrove forests and tidal mudflats so they can feed on small invertebrates. It is expected that juvenile grey mullet are very likely to have distinct chemical signatures and the Kaipara Harbour is one of several being sampled.

10.13 GAPS & OPPORTUNITIES FOR RESTORING SUSTAINABLE USE OF FISH & SHELLFISH

Early European explorers and settlers to the Kaipara commented on the bounty of the harbour ecosystem. Evidence of this is described from explorers' journals, ship's logs, and settler narratives. The record shows that Kaipara Māori were indeed fine fishermen and were capable of operating on large-scales, with enormous nets, to capture schools of fish.

A strong and significant historical social connection occurs with the fisheries of Kaipara. Fisheries have always held, and continue to hold, an important social and economic value, particularly for local commercial fishers and customary fishers.

There exists a significant traditional Māori, cultural, spiritual relationship and value to Kaipara fisheries across the landscape and seascape.

The Kaipara estuarine ecosystem has a significant role in the wider West Coast North Island ecosystem particularly as a natal nursery ground for snapper (SNA8), and most likely grey mullet (GMU1) and school shark (SCH1) stocks.

The Kaipara marine estuarine ecosystem contributes an outstanding example of intact seagrass meadows to the entire West Coast North Island ecosystem.

Declining fish stocks, particularly snapper, grey mullet, eel, toheroa, flounder and rig are a concern to the sustainability of commercial fishing in the harbour. The unknown status of their relative biomass is of particular concern, which provides tremendous uncertainty to the future of these stocks.

A high proportion of non-commercial recreational fishers' fish on weekends compared to weekdays, use a boat, use a hook and line, and target snapper. Fishers also travel between 5-10km to suitable fishing grounds.

The use of Mātauranga Māori (traditional knowledge) in the current management regime and policy framework is very limited. Avenues for this to exist are possible but have yet to be taken on.

There is a strong desire within Ngāti Whatua ki Kaipara (Hapū) and local community for a local, co-managed fishery. Currently there is no room for local management or co-management arrangements to exist under the New Zealand fisheries legislation.

Little information exists on fisheries habitat within the Kaipara especially the relationship with fish habitat connectivity throughout the life-cycle of species.

10.13.1 PRIORITY GAPS & OPPORTUNITIES

Lack of Local Management Arrangements

Local fisheries management arrangements have been advocated for the Kaipara since the mid-1990s when the Tinopai community gathered and placed a Rahui across the Ōtamatea

River and The Funnel to address overfishing and stock depletion. A substantial amount of effort, time and resources went into the development of a fisheries management strategy, *Fishing for the Future* (KHSFMSG 2003). Several recommendations were outlined for the Minister of Fisheries with some being implemented and some not. Specific fisheries legislation has been utilised, such as the section 186A closure on scallops and the revoking of the use of stalling nets; but the recommendation to establish the Kaipara Harbour as a separate QMA and a code of practice has not; or the implementation of other long-term local management arrangements that incorporate both western ecosystem-based management knowledge and Māori knowledge or Mātauranga Māori.

Scientific research has found that the Kaipara Harbour is a discrete spatial entity that significantly contributes to the wider west coast North Island fishery. This has recently been documented for snapper, but is believed to also be true for grey mullet, school shark and rig. Anecdotal evidence and traditional knowledge reveals that the Kaipara is also the nursery ground for snapper, grey mullet, flounder, school shark, rig/spotted dogfish, mullet, hammerhead sharks, and great white sharks. With a wide range of habitats and associated species, and a range of human activities associated with it, the Kaipara Harbour is an ideal place in which to advance and demonstrate the use of local management arrangements founded a paradigm of ecosystem-based management and Mātauranga Māori.

Particular attention should be given to the following opportunities when developing local management arrangements:

- **Ecosystem-based management approach**. Some of the principles of EBM have been discussed in earlier chapters however, with respect to fisheries, very few examples (Burges 2004)[4] exist where EBM has been operationalised on a day-to-day basis. Table 6 describes the key components of EBM and provides examples/mechanisms to move towards EBM approach (also see Butterworth & Punt 2001, Sainsbury & Sumaila 2001).

- Before much more is lost and superseded by other kinds of knowledge, **build a body of knowledge** - *Mātauranga Māori* – that brings together the two different approaches to fisheries management, giving effect to kaitiakitanga across all levels of fisheries management. A great deal of work is needed to organise this and bring about relevance and utility within this body of knowledge in our present-day circumstances. Mātauranga Māori, traditional Māori knowledge, is distinct from other knowledge bases such as science, mathematics or psychology. Mātauranga Māori is not a science (Durie 1998; Williams 2001). Mātauranga Māori is a taonga (Williams 2001). Incorporating particular tikanga, values and principles into fisheries management, planning, science and research, will not induce change immediately, but may occur in the medium to long-term. There are broad gaps that are barriers to move towards the objective of restoring fish and shellfish stocks of the Kaipara Harbour, which require addressing where the use of Mātauranga Māori is part of the package.

[4] Burges (2004). The Potential for Ecosystem-Based Management of New Zealand's Fisheries: A Dissertation. BSc(Hons), 121p, School of Environmental Science & Geography, University of Auckland.

- Giving effect to **kaitiakitanga** is provided for under the *Fisheries Act 1996* (section 12) (see Appendix 10). However, opportunities to adequately define the exact role and function of Kaitiaki within the hapū rohe have not arisen. As Kaitiaki today, it is an integral part of their mana, their relationship with their taonga, and the rights and obligations imposed by tikanga to practice kaitiakitanga over natural resources, such as fish and shellfish, using the combined power of wairua, Mātauranga Māori, whakapapa and Te Reo Māori.

  Concerns have been raised by Kaipara Māori non-commercial customary fishers that the new amendment to section 13 of the *Fisheries Act 1996* (Moana Consultants Ltd 2008), known as subsection 13(2A), allows the Minister of Fisheries to sidestep this obligation under section 12, when establishing the new fishing year Total Allowable Catch (TAC). An amendment was urgently developed and passed on the 28th September 2008 after the High Court ruled the Minister of Fisheries could not use section 13(2) of the *Fisheries Act 1996* to reduce the TAC for a fish stock without an estimate of both current biomass and the biomass that can produce the maximum sustainable yield (MSY).

  Satisfying customary interests in fisheries and enabling the meaningful exercise of these traditional rights requires diversity, abundance, the ability to exercise authority over human activity and balance in nature. The concept of MSY is in conflict with these values from a Māori non-commercial customary, traditional and environmental perspective.

  Acknowledgement, acceptance, understanding and incorporation of kaitiakitanga is necessary to achieve a truly holistic approach to achieving sustainable fisheries management within the Kaipara.

- **Management Strategy Evaluation (MSE) for Kaipara sub-stocks of flounder, grey mullet snapper, and rig**. The evaluation will assess the consequences and trade-offs of management scenarios of harvest strategies, performance indicators and objectives.

  The MSE approach involves evaluating the entire management system (ie. research programs, stock assessment methods, performance indices and harvest strategies). This approach to evaluation has a long history in quantitative fisheries science (e.g. Southward 1968; Hilborn 1979; Donovan 1989). The full MSE approach has been applied to certain Australian fish stocks: orange roughy, blue grenadier and eastern gemfish stock (Punt *et al* 2001).

  A key feature of the MSE approach is that it can explicitly take account of uncertainty (in the data available, the values for the parameters of models, the structure of the models upon which advice is based, and the ability to implement management actions - quite different from conventional approaches to fisheries stock assessment). Also, the method has to involve stakeholders for the MSE approach to work, as it usually involves changes to TACs and research programs (Punt *et al* 2001).

  This approach provides a set of tools that allow four key scientific questions to be addressed:

- Evaluation of the extent to which alternative rules for setting future TACs (referred to as harvest strategies 2) can satisfy the management objectives and hence identify the trade-offs among the objectives corresponding to different harvest strategies;

- Evaluation of which methods of stock assessment are able to provide sufficiently reliable estimates of quantities of interest to management (such as current biomass and MSY);

- Evaluation of whether proposed performance indices are able to detect the events that they were designed to identify. These events might include those in which the fishery is close to (but not yet in) an undesirable state;

- Evaluation of the (management) benefits of research programs.

Benefits:

Evaluating harvest strategies by means of simulation is often supported by both industry and conservation groups. A broader range of hypotheses is usually considered when conducting MSE than would be normal when conducting a stock assessment. The strength of the approach is that it allows evaluations without their direct application to the real system being managed

- **Understanding human uses and intrinsic values** of Kaipara Harbour resources and ecosystem services. Our knowledge of the social benefits of Kaipara Harbour resources and ecosystem services is a gap. Our knowledge of the intrinsic life-supporting value of Kaipara resources and ecosystem services is a gap.

  With scarce natural resources and the constant increasing demand for use and allocation a spatial and temporal understanding of human uses and values of these natural resources and ecosystem services would assist with moving towards restoring sustainable fisheries of the Kaipara Harbour. Rapid assessment methodology designed to understand these two knowledge gaps may be appropriate (e.g. Breen 2006).

  This type of information greatly assisted the multiple-use planning of the Great Barrier Reef Marine Park and Channel Islands Marine Park (California) when making trade-offs between resource use and environmental, cultural and social benefits.

  Involving local stakeholders in the ongoing monitoring and management of the Kaipara harbour can result in a more transparent and supported decision-making process for use allocation. Active participation in management leads to a well developed sense of ownership and knowledge of the local environment

Spatial Management & Planning

Pro-active spatial management and planning that will benefit local fish populations (or sub-stocks), fisheries habitats and shellfish is recognised as an essential tool to understand various fisheries management arrangements/scenarios for the Kaipara.

The Kaipara Harbour is no longer a wide-open frontier, and its spaces are broadly allocated and with extensive overlap by many regulatory agencies. For example, a zoning approach is being taken on the land within the Rodney District, southern Kaipara, to address growth and development pressures spilling out from Auckland. Pressure for foreshore and seabed occupancy through aquaculture, sandmining and a proposed marine turbine project is increasing conflict with other extractive users, particularly fishers, and non-extractive users and iwi/hapū, as they advocate for the protection of their values and right to use Kaipara resources and ecosystems.

The IKHMG has recognised the need for a more pro-active strategic and systematic approach to manage human wants and needs and the services the Kaipara fisheries provide, rather than a piece-meal or un-integrated conflicting approach. Multiple objectives occur across statutory obligations and regulatory agencies with conflicting approaches.

Exploration into marine spatial planning framework and scenarios should form a cornerstone to delivering the principles, objectives and vision of the IKHM project. Marine spatial planning has been proved in many international examples as an important tool, within an systematic planning approach, to achieve ecosystem-based management (Ward et al. 2002, Babcock et al. 2005; Ehler 2007).

Spatial planning should be comprehensive, adaptive, and participatory, and resolve conflicts among multiple uses and the ecosystem. Spatial planning also recognises the inter-connectivity of the marine environment and its interface with the terrestrial environment. Ecosystems are spatially heterogeneous, and spatial patterns and processes are important to ecosystem structure and function. Ecologically, it recognises the temporal and spatial scales at which marine systems operate and the connectivity that is fundamental in marine ecosystems, while helping to ensure the health and integrity of the ecosystem as a whole. Socially, it helps to resolve and manage conflicts in the use of marine resources and ensures that reasonable uses can occur in various areas while minimizing conflicts. Administratively, it can facilitate more effective use of resources, rather than each small, isolated marine protected area (MPA) having to maintain its own set of duplicate resources.

Land-based Stressors and impacts

Understanding spatial patterns of land-based stress, level (measured from frequency or intensity) of stress and scale (metres to kilometers) of stress is a knowledge gap when managing Kaipara Harbour fisheries. Our understanding of what type of land-based stressors and impacts are beginning (e.g. Morrison *et al*. 2009), and for the Kaipara Harbour, the stress of sedimentation and eutrophication from run-off is considered to be having a detrimental effect on the Kaipara ecosystems.

10.13.2 OTHER GAPS & OPPORTUNITIES IDENTIFIED

Science & Research

- **Kaipara Harbour ecosystem modeling**. Descriptions are required regarding food web and trophic relationships; and the flow of energy or carbon through the various levels and relationships within the food web. Haggitt *et al*. (2008)

discussed the information missing on target species and how they are affected when removed from the entire ecosystem. Understanding these interactions between, species, communities and predator-prey relationships and also how they function with fishing removal and mortality across space and time (e.g. juvenile, adult life stages) would assist with moving towards an ecosystem-based fisheries management approach. Various models, such as Ecopath[5] (Christensen & Pauly 1993) and Ecopath with Ecosim[6], do exist and have been utilised in fisheries management (Walters *et al.* 1999; Pauly *et al.* 2000; Gribble 2001). Such models are considered to represent the only tool currently available to fisheries managers for even beginning to contemplate the consequences of harvest on the rest of the ecosystem.

- **See Haggitt *et al*. (2008) (pg 171)** made several suggestions regarding information gaps. Recommended knowledge gaps to address the sustainability concerns of the targeted species included:
    - Understanding fish-habitat associations across time and space, between the harbour and coast, and between the harbour and rivers/streams. This would involve creating an inventory of information of what fish species and shellfish are associated with what habitats (and habitat elements) across different life stages (Morrison *et al*. 2009). Aspects of this knowledge gap are being addressed by the proposed fish-habitat classification scheme for the Kaipara Harbour.
- **Effects of freshwater (river) plumes**. Understanding of how river plumes influence Kaipara Harbour fisheries and shellfish populations both positively and negatively (Morrison *et al*. 2009).

Traditional, Spiritual & Cultural Relationship

- **Understanding and defining iwi/hapū significant sites, cultural land-seascapes.** By giving effect through identification, description, plans of management, suitable rules of use; identifying the status of the cultural landscape or seascape within the mauri and wairua. Ensuring that the linkage with cultural landscapes and seascapes is maintained will provide opportunities to enhance and/or restore them within the wider ecosystem.

  This knowledge of Mātauranga Māori relating to the landscape and the seascape is of tribal origin and ownership lies with tribes, sometimes iwi, hapū or marae and or whānau. Continuing efforts are required to recognise and understand this knowledge spatially within Kaipara estuarine and catchment ecosystems, and subsequently incorporate into policy and management.

[5] See www.ecopath.org

[6] Ecopath with Ecosim (EwE) is a free ecological/ecosystem modeling software suite. EwE has three main components: *Ecopath* – a static, mass-balanced snapshot of the system; *Ecosim* – a time dynamic simulation module for policy exploration; and *Ecospace* – a spatial and temporal dynamic module primarily designed for exploring impact and placement of protected areas.

The Crown has a role as a protector of Māori people and Māori property rights to achieve the continuing ownership of physical and cultural property.

- **Acknowledging iwi/hapū significant sites and cultural land-seascapes in planning**: identifying, understanding and giving effect to this in planning and policy. With multiple planning and policy situations occurring in the Kaipara Harbour and catchment, Te Uri o Hau wish to see recording and mapping of cultural information. This is seen by tangata whenua as means to giving effect to their contemporary responsibilities as tangata whenua, ahi kaa and kaitiaki that will have a positive impact on the mana of generations to come.

  Tangata whenua consider the information gathered will be able to be utilised either in their own environmental management plans, and/or to inform the plans and policies of agencies such as Councils and Department of Conservation. An example of where Councils have used cultural landscapes in policy and planning strategies is the protection of "view shafts" from marae in the Tauranga District and the protection of volcanic cones in the Auckland District.

Table 6. Adapted from Ward et al. (2002) shows the key components of EBM, how to 'involve' them in fisheries management and to define 'intended outcomes'.

COMPONENT	INVOLVING	INTENDED OUTCOMES
1. Identify stakeholder community.	• Fishery management agencies, conservation agencies, conservation NGOs, local community groups, scientific/academic research community, fisher associations or cooperatives, higher and lower levels of government, fish processing / distribution groups, indigenous representatives.	• A formal network of interested parties with whom the fishery representatives will participate to prepare and review the management of the fishery. • A transparent and fully accountable process enabling the participation of all interested parties in the process of managing the fishery.
2. Prepare a map of ecoregions and habitats.	• Conducted by the fishers, research community, fishery managers, stakeholders and partners. • Covers the full area of fishery operations. • The focus is on areas where the fish are, where they are fished, and any specific spawning, nursery or similar obligate habitats or locations. • High resolution is needed in benthic primary producer habitats (such as algal beds, seagrasses, mangroves, coral reefs).	• Maps of the ecosystems throughout the fishery at scales of resolution consistent with the scale of the fishery. • Resolved habitats at a scale consistent with the potential impacts of the fishery. • Coherent with other ecosystem classification initiatives (at both larger and smaller scales). • Major features and exceptions documented (e.g. highly migratory species, oceanographic currents or features, boundary mismatches between taxa). • Major uncertainties identified and documented as guidance for research and investigation programs.
3. Identify partners and their interests / responsibilities.	• Conservation, environment protection, and coastal planning agencies from all levels of government. • Major users and managers of other, possibly co-located, resources (e.g. tourism, mining, oil/gas, transport, and communications). • Directly affected local communities.	• Clarify specific roles and responsibilities for management in the marine environment. • Engage with other supportive interests. • Promote the opportunity for coordination and integration, improved efficiency across government and better outcomes for marine management, better agency outcomes for lower cost, more accountability in government, more effective long-term solutions to marine ecological problems, and shared approaches to problems held in common.
4. Establish ecosystem values.	• Fishers, research community, fishery managers, stakeholders, partners and the public; designed to identify all major uses and all major natural and ecosystem values throughout the area where the fishery operates.	• A detailed distributional analysis of the main attributes of the ecosystem where the fishery operates. • A clear and agreed expression of the natural and use values, which could include: - highly valued habitats;

COMPONENT	INVOLVING	INTENDED OUTCOMES
		- representative areas dedicated as reserves; - protected species feeding, breeding, or resting grounds; - fishing, spawning grounds, recruitment areas and migration paths for commercial species; - highly productive areas such as upwellings; - areas popular for recreational fishing or diving; - areas used for ports and harbours; - areas of high scenic and wilderness amenity; - high cultural and historic value; - traditional hunting grounds for Indigenous peoples; - areas of high tourism value; - areas used for dumping of dredge wastes, defence training etc.
5. Determine major factors influencing ecosystem values.	• Establishing cause-effect relationships; consider factors both internal and external to the fishery management system. • Conducted by the fishers, research community, fishery managers, stakeholders and partners.	• Identified hazards to marine ecosystems and their values from the full range of actual and potential human impacts that occur in the fishery region. These could include: - extent of loss/damage of marine habitats; - effects of specific fishing gear on benthic habitats; - effects of pollution from coastal rivers on inshore habitats; - risk of marine pest invasion and disruption to critical habitat or fishing operations; - effects of the removal of the biomass of harvested species (in all fisheries) on trophically dependent species.
6. Conduct Ecological Risk Assessment (ERA).	• ERA conducted with participation of all stakeholders and partners, fishers, research community and the fishery manager: • uses broad multi-disciplinary knowledge base; • identifies key areas of uncertainty; • open for public scrutiny and review; • fully peer reviewed by independent authorities.	• Agreed estimates of high, medium and low risks of the fishery to the ecosystem values identified in step 5, such as the risk of the fishery to protected species, and to the ecosystem, habitats, species and genetic diversity.
7. Establish objectives and targets.	• Fishers, research community, fishery managers, stakeholders and partners. • Performance objectives and targets established for:	• Agreed and shared goals for specific elements of ecosystems. • Specific performance objectives and targets for important elements of the ecosystem.

COMPONENT	INVOLVING	INTENDED OUTCOMES
	- high and medium priority risks from the ERA; - important aspects of the ecosystems (including protected species, critical habitat); - stocks.	• Objectives and targets that are comprehensive and precautionary in terms of valued aspects of the ecosystems. • Could include: - maintaining or recovering population sizes of protected species; - maintaining the distribution, area, species diversity and trophic structure of important habitats; - reducing fishing effort in specific areas to help protect populations of benthic fauna; - increasing the distribution and diversity of benthic fauna considered to be affected by fishing; - rehabilitating marine ecosystems to a past (healthier) condition.
8. Establish strategies for achieving targets.	• Fishers, research community, fishery managers, stakeholders and partners. • Focus is on identifying appropriate and workable strategies to achieve objectives and targets, and on specific capacity matched to responsibilities for implementing strategies. • Strategies designed based on best understanding of the cause-effect relationships developed in Step 5, and matched to highest priority needs for corrective actions identified in Step 6 (ERA). • Use of incremental strategies where necessary and unavoidable.	• Series of prioritised strategies that define workable activities and responses to achieve specific objectives and targets identified in Step 7. Includes who is responsible, what funds and time frames are involved, what controls are needed and where data/outcomes are reported and assessed. • Strategies could include: - declaring a network of sanctuary protected zones; - establishing buffer zones where only specific uses, or types of fishing, are permitted - research on improving gear design to reduce impacts on a sensitive habitat, or reduce the bycatch of an important species; - improved fishery-independent monitoring of catch, or bycatch; - reducing pollution from coastal rivers; - constructing fish escapement panels in trawl nets to avoid catch of a certain type and size of fish, or to reduce overall fish bycatch; - implementing an industry code of practice to reduce risks of bait discards to bird populations.
9. Design information system, including monitoring.	• Fishers, research community, fishery managers, stakeholders and partners. • Focus is on capture of appropriate data/information to determine if strategies are working as expected; objectives and targets are being achieved; cause-effect models are correct; fishery impacts are being reduced.	• Efficient and effective fishery information system that provides data and information on stock and ecosystem performance (additional to information needed for stock management); identifies specific effects of fishery strategies on ecosystem values. Could include: - Periodic mapping of important habitat distributions;

COMPONENT	INVOLVING	INTENDED OUTCOMES
	• Collaboration and contributions from partners identified.	- Population census of important protected species; - Species diversity in fished habitats; - Distribution of fishing effort by gear types and fine spatial scale; - Size/age classes in harvested species; - Species diversity in closed areas.
10. Establish research and information needs and priorities.	• Fishers, research community, fishery managers, stakeholders and partners. • Focus is on identifying specific high priority areas of uncertainty, and on quality science outcomes, for both stock and ecosystem issues. • Collaboration and contributions from partners identified. • Research strategies are fully peer reviewed or independently audited.	• Comprehensive research programs targeted at resolving key ecosystem and stock issues in the fishery. Could include: - habitat mapping; - impact of fishing on specific habitat types; - effects of coastal development on recruitment of harvested species; - design of monitoring programs to resolve important changes in habitats; - biological data of key species (both utilised and non-utilised); - determining the dietary preferences of harvested species and their major predators; - species composition of bycatch with different gear types used in the fishery.
11. Design performance assessment and review processes.	• Fishers, research community, fishery managers, stakeholders and partners. • Focus is on a process that is participatory and inclusive. • The locations, timing and resourcing enables partner and stakeholder participation in reviews of performance of the fishery in relation to stock and ecosystem values. • Performance outcomes peer reviewed by independent authorities.	• Periodic (but regular) forum for discussion, review and assessment of fishery performance by partners, stakeholders and the public. • Periodic (but regular) forum for review, assessment and revision of monitoring data, objectives and targets by stakeholders and partners.
12. Prepare education and training package for fishers.	• Fishers, fishery managers, extension experts and stakeholders and partners.	• Outreach program to provide training and support for fishers about new fishery management, ecosystem or other EBM initiatives, and provide local technical support for assessment and resolution of ecosystem issues; to commence at the time of Step 1

10.14 BIBLIOGRAPHY

Akroyd, J., K. Walshe, B. Manly, J. Te Tuhi, B. Searle & R. Searle (2008) Distribution and abundance of toheroa (*Paphies ventricosa*) on Dargaville and Muriwai Beaches, 2006-07. 28.

Anderton, H. J. (2007). Review of Regulatory Measures and other Management Controls for 1 April 2008. M. o. A. Office of Hon Jim Anderton, Minister for Biosecurity, Minister of Fisheries, Minister of Forestry**:** 2.

Auckland Regional Authority (1976). Report on a coastal resource area: Kaipara South Peninsula.

Auckland Regional Council (2009) Off Road Motorised Recreation in the Auckland Region. Impacts Paper. Prepared by the Auckland Regional Council. 25.

Babcock, E. A., E. K. Pikitch, M. K. McAllister, P. Apostolaki & C. Santora (2005). "A perspective on the use of spatialized indicators for ecosystem-based fishery management through spatial zoning." ICES J. Mar. Sci. **62**(3): 469-476.

Barlow, P. W. (1888). Kaipara, or, Experiences of a settler in north New Zealand. London, S. Low Marston.

Beverton, R. J. H. & S. J. Holt (1957). On the dynamics of exploited fish populations. London, Chapman and Hall.

Blackwell, R. G., M. J. Manning, D. J. Gilbert & S. J. Baird (2006) Standardised CPUE analysis of the target rig (Mustelus lenticulatus) setnet fishery in northern New Zealand (SPO 1 and 8). 56.

Botsford, L. W., J. C. Castilla & C. H. Peterson (1997). "The management of fisheries and marine ecosystems." Science **277**: 509-514.

Bradford, E., D. Fisher & J. Bell (1998) National marine recreational fishing survey 1996: overview of catch and effort results. 55.

Breen, B. (2006). Integrating social and biophysical data to develop and evaluate marine protected area planning at a local scale: the 1998 Cairns Area Plan of Management as a case study. Department of Tropical Environment Studies, Townsville, Australia, James Cook University of North Queensland**:** 293.

Brunton, P. M. (1978). "Toheroa predation by Black-Backed Gulls on Dargaville Beach, North Auckland, New Zealand." Notornis **25**: 128-140.

Buller, J. (1878). Forty Years in New Zealand: Including a personal narrative, An Account of Maoridom, and of the Christianization and Colonisation of the Country. London, Hoddes and Stoughton.

Carbines, G. & R. G. Cole (2009). "Using a remote drift underwater video (DUV) to examine dredge impacts on demersal fishes and benthic habitat complexity in Foveaux Strait, southern New Zealand." Fisheries Research **96**: 230-237.

Christensen, V. & D. Pauly (1993). Trophic models of aquatic ecosystems. ICLARM Conf. Proc. 26.

Chu, C. (2008). "Thirty years later: the global growth of ITQs and their influence on stock status in marine fisheries." Fish and Fisheries **10**: 1-14.

Coburn, R. P. & M. P. Beentjes (2005) Abundance estimates for FLA 1 from standardised catch per unit effort analysis of the set net fisheries, 1989–90 to 2003–04. 46.

Coster, J. & G. Johnston (1976) Pouto State Forest Archealogical site survey, May 1976. Unpublished site survey report, NZ Forest Service, Auckland 1976. Auckland. NZ Forest Service.

Dayton, P. K., S. F. Thrush, M. T. Agardy & R. J. Hofman (1995). "Environmental effects of marine fishing." Aquatic Conservation: Marine and Freshwater Ecosystems **5**: 205-232.

Department of Conservation & Ministry of Fisheries (2007) Hector's and Maui's Dolphin Threat Management Plan. Draft for public consultation. 298.

Durie, M. (1998). Te mana, te kāwanatanga: the politics of Māori self-determination. Auckland, NZ, Oxford University Press.

Ehler, C. (2007). WCPA – Marine Plan of Action Summit. Priority 5: MPAs, Ecosystem-based Management and Marine Spatial Planning or 'Putting MPAs in their (Right) Place through Marine Spatial Planning' . IUCN/WCPA.

Environs Holdings Ltd (2007) Te Uri o Hau effects Assessment Report of a Proposal by CREST Energy Ltd to Construct and Operate a Tidal Powerstation in the Kaipara Harbour. Whangarei, NZ. Environs Holdings Ltd. 64.

Ferrar, H. T. (1934). The Geology of the Dargaville-Rodney Subdivision, Hokianga and Kaipara Divisions. Wellington, New Zealand Dept. of Scientific and Industrial Research.

Fletcher, M. (1994). Helensville Heritage Study. Produced for the Rodney District Council by Marina Fletcher & Di Stewart & Associates. D. S. Associates. Orewa, NZ, Rodney District Council. **vI - The Study - vII The register**.

Goni, R. (1998). "Ecosystem effects of marine fisheries: an overview." Ocean & Coastal Management **40**(1): 37-64.

Gribble, N. (2001). A model of the ecosystem, and associated penaeid prawn community, in the far northern Great Barrier Reef. Oceanographic processes of Coral Reefs. Physical and Biological Links in the Great Barrier Reef. E. Wolanski, CRC Press. **1:** 189-207.

Griffith, D. R. (2008). "The ecological implications of individual fishing quotas and harvest cooperatives." Frontiers in Ecology and the Environment **6**: 1-10.

Haggitt, T., S. Mead & M. Bellingham (2008) Review of environmental information on the Kaipara Harbour marine environment. Prepared for Auckland Regional Council by ASR Ltd and Coastal & Aquatic Systems Ltd. Auckland, NZ. 200.

Hartill, B. (2004) Characterisation of the commercial flatfish, grey mullet, and rig fisheries in the Kaipara Harbour. 23.

Hartill, B. (2008). Estimating Recreational Harvests. Presentation to the National Meeting of Regional Recreational Fishing Forums, Auckland, Nov. 2008.

Hartill, B., R. Blackwell & E. Bradford (1998) Estimation of mean fish weights from the recreational catch landed at boat ramps in 1996. 40.

Hartill, B., H. Cadenhead, R. Tasker, C. Middleton & D. Fisher (2005) Monitoring the length and age composition of recreational landings of kahawai in KAH1 in 2000-2001, 2001-02 and 2002-03. Final Research Report for Ministry of Fisheries Research Project KAH2000/1: Objective 1. 36.

Hauser, L., G. J. Adcock, P. J. Smith, J. H. B. Ramirez & G. R. Carvalho (2002). "Loss of microsatellite diversity and low effective population size in an overexploited population of New Zealand snapper (Pagrus auratus)." PNAS **99**(18): 11742-11747.

Hooker, S. & P. Redfearn (1998) Preliminary survey of toheroa (*Paphies ventriocosa*) populations on Ninety Mile Beach and possible impacts of vehicle traffic. NIWA Client Report AK98042. 37.

Ingeborg, P. C. (1981). Vegetation of the North Kaipara Barrier. Department of Geology. Auckland, University of Auckland.

Jackson, M. A. (1997). Pouto Peninsula: An Archaeological Perspective. The evidence of Moria Annette Jackson. Amended 10th April 1997. In the Matter of the Treaty of Waitangi Act 1975 and in the

matter of the Statement of Claim by Te Uri O Hau O Te Wahapu O Kaipara (Wai 271, A13). Waitangi Tribunal.

Kelly, S. (2009) Kaipara Harbour Oyster Reserves. Final Research Report for Ministry of Fisheries project OYS2008/02. Ministry of Fisheries. 31.

Kelly, S., S Handley, M Morrison, M Smith & M. Wilkinson. (2001) Environmental Impact Assessment for proposed oyster farm, Kaipara Harbour. NIWA Client Report AKA01171. 16.

Kenchington, E. L. (2003). The Effects of Fishing on Species and Genetic Diversity. Responsible Fisheries in teh Marine Ecosystem. M. Sinclair & G. Valdimarsson. Rome, Italy, Wallingford, UK, FAO and CABI Publishing. **1:** 235-253.

KHSFMSG (2003). Fishing for the future – a strategy for the fisheries of the Kaipara Harbour. Prepared by Kaipara Harbour Sustainable Fisheries Management Study Group. (Unpublished report, held by the Ministry of Fisheries, Auckland).

Kokich, D. C. (1991). Kai Iwi - Pouto Dune lakes water resources. Whangarei, Northland Regional Council 1991.

MacDiarmid, A., Ed. (2007). The Treasures of the Sea: Ngā Taonga a Tangaro. A Summary of the Biodiversity in the New Zealand Marine Ecoregion., WWF NZ.

Mallows, C. & C. Barr (2006) Post Harvest Assessment of Archaeological Sites Q9/103, Q9/104 and Q9/1025 in Woodhill Forest. Report Prepared by Opus International Consultants Ltd. for Carter Holt Harvey Ltd. Hamilton, NZ. Opus International Consultants Ltd. 29.

Marine Department (1894). Annual Report for 1893-94, Appendices to the Journal, House of Representatives (AJHR), H-18.

Marine Department (1915). Annual Report for 1914-1915, Appendices to the Journal, House of Representatives (AJHR), H-15.

Marine Department (1916). Annual Report for 1915-1916, AJHR, H-15.

Marine Department (1929). Annual Report for 1928-1929, Appendices to the Journal, House of Representatives (AJHR), H-15.

Marine Department (1932). Annual Report for 1931-1932, AJHR, H-15.

Marine Department (1940). Annual Report for 1939-1940, Appendices to the Journal, House of Representatives (AJHR), H-15.

Marine Department (1972). Annual Reports, Annual Journals of the House of Representatives, 1932-1972.

McKenzie, J. R. & M. Vaughan (2008). CPUE analysis and characterisation of grey mullet (*Mugil cephalus*) setnet fisheries in Fishstock GMU 1 between 1989 and 2006. New Zealand Fisheries Assessment Report 2008/57. 36.

Minister of Conservation (2008). Notice of Intention to Declare Four Marine Mammal Sanctuaries. M. o. Conservation, New Zealand Gazette. **104**.

Ministry of Fisheries (2005). Statement of Intent 2005-2008. 34.

Ministry of Fisheries (2008). Grey Mullet (GMU). Plenary Report 2008. Final. 7.

Ministry of Fisheries (2008a). Flatfish (FLA). Plenary Report 2008. Final. 7.

Ministry of Fisheries (2008b). Snapper (SNA). Plenary Report 2008. Final. 7.

Ministry of Fisheries (2008c). School Shark (SCH). Plenary Report 2008. Final. 7.

Ministry of Fisheries (2008d). Eel (SFE & LFE). Plenary Report 2008. Final. 7.

Ministry of Fisheries (2008e). Rig (SPO). Plenary Report 2008. Final. 7.

Ministry of Fisheries (2009). Fisheries 2030. New Zealanders maximising benefits from the use of fisheries within environmental limits. 15.

Ministry of Fisheries (2009a). Draft North Island West Coast Finfish Fisheries Plan. Summary Document. 16.

Ministry of Fisheries (2010). Statement of Intent. For the period 1 July 2010 to 30 June 2015. Presented to the House of Representatives pursuant to section 39 of the Public Finance Act 1989. Wellington, NZ. 20.

Moana Consultants Ltd (2008) Ministry process to amend section 13 of the Fisheries Act 1996 including an outline of Māori customary interests' involvement. Prepared for the Hokianga Accord. 17.

Morrison, M. (2005) An information review of the natural marine features and ecology of Northland. National Institute of Water & Atmospheric Research Ltd. 174.

Morrison, M. & G. Carbines (2006). "Estimating the abundance and size structure of an estuarine population of the sparid *Pagrus auratus*, using a towed camera during nocturnal periods of inactivity, and comparisons with conventional sampling techniques." Fisheries Research **82**: 150-161.

Morrison, M. A., B. M. Gillanders, C. Walsh, K. W. Webster, M. Lowe & M. P. Francis (Unpubl. data). "Linking juvenile fish nurseries in estuaries to coastal adult populations: why environmental degradation in estuaries matters.": 33.

Morrison, M. A. & D. M. Parkinson (2008) Distribution and abundance of toheroa (*Paphies ventricosa*) on Ninety Mile Beach, March 2006. 27.

Murton, B. (2006). "'Toheroa Wars': Cultural politics and everyday resistance on a northern New Zealand beach." New Zealand Geographer **62**(1): 25-38.

Murton, B. (unpublished). Kaipara Harbour Report (Draft). Chapters I-VII.

Myers, R. A. & B. Worm (2003). "Rapid worldwide depletion of predatory fsih communities." Nature **423**: 28083.

New Zealand Joint Working Group on Māori Fisheries (1988). Māori fisheries issues: guide to sources in government archives since 1840: draft. Wellington, NZ, The Working Group?

Office of the Minister of Fisheries (2009). Increasing the Contribution of the Fisheries Sector to The New Zealand Economy. Presented to Cabinet Economic Growth and Infrastructure Committee. 7.

Paul, L. J. (2003) Characterisation of the commercial and recreational fisheries for rig (*Mustelus lenticulatus*) in northern New Zealand (SPO 1 and SPO 8), and unstandardised CPUE analyses of the targeted setnet fisheries. Wellington. Ministry of Fisheries. 69.

Paul, L. J. & B. M. Sanders (2001) A description of the commercial fishery for school shark, *Galeorhinus galeus* in New Zealand, 1945 to 1999. New Zealand Fisheries Assessment Report 2001/32. Wellington. Ministry of Fisheries. 63.

Paulin, C. D. & L. J. Paul (2006). "The Kaipara mullet fishery: nineteenth-century management issues revisited." Tuhinga **17**: 1-26.

Pauly, D. & e. al (2005) Millenium Ecosystem Assessment. Chapter 18. Marine Fisheries Systems. 477-511.

Pauly, D., V. Christensen, J. Dalsgaard, R. Froese & F. T. Jr (1998). "Fishing Down Marine Food Webs." Science **279**: 860-863.

Pauly, D., V. Christensen, S. Guenette, T. J. Pitcher, U. R. Sumaila, C. J. Walters, R. Watson & D. Zeller (2002). "Towards sustainaility in world fisheries." Nature **418**: 689-695.

Pauly, D., V. Christensen & C. Walters (2000). "Ecopath, Ecosim, and Ecospace as tools for evaluating ecosystem impact on fisheries." ICES J. Mar. Sci. **57**: 697-706.

Pauly, D. & J. Maclean (2003). In A Perfect Ocean. The State of Fisheries and Ecosystems in the North Atlantic Ocean. Washington, , Island Press.

Peart, R. (2007). Beyond the Tide. Integrating the management of New Zealand's coasts. Auckland, NZ, Environmental Defence Society.

Penny, G., G. Dumbell, P. Vincent & S. McEntee (2007) A socio-econonomic impact assessment of fishers: proposed options to mitigate fishing threats to Hector's and Maui's dolphins. Volume 1: Final Report. 125.

Pikitch, E. K., C. Santora, E. A. Babcock, A. Bakun, R. Bonfil, D. O. Conover, P. K. Dayton, P. Doukakis, D. Fluharty, B. Heneman, E. D. Houde, J. Link, P. A. Livingston, M. Mangel, M. K. McAllister, J. G. Pope & K. J. Sainsbury (2004). "Ecosystem-Based Fishery Management." Science **305**: 346-47.

Pitcher, T. J. (2001). "Fisheries managed to rebuild ecosystems: reconstructing the past to salvage the future." Ecological Applications **11**: 601–617.

Pitcher, T. J., R. Watson, N. Haggan, S. Guenette, R. Kennish, U. R. Sumaila, D. Cook, K. Wilson & A. Leung (2000). "Marine reserves and the restoration of fisheries and marine ecosystems in teh south China Sea." Bulletin of Marine Science **66**(3): 543-66.

Polack, J. S. (1838 (1974)). New Zealand: being a narrative of travels and adventures during a residence in that country between the years 1831 and 1837. Christchurch, Capper Press.

Polunin, N. V. C. (2002). Marine Protected Areas, Fish and Fisheries. Handbook of Fish Biology and Fisheries, Volume 2 Fisheries. P. J. B. Hart & J. D. Reynolds, Blackwell Publishing. **2:** 293-318.

PriceWaterHouseCoopers (2008) Fisheries 2030 - Vision, result areas and action plan. Unlocking the potential of the New Zealand Fisheries Sector. November 2008. Wellington, NZ. 20.

Rea, T. (2009). Combined Non-commercial Ministerial *Fisheries 2030* Meeting Phil Heatley's Office, Wellington, 3 August 2009. A report for non-commercial fishing and environmental interests. Auckland, New Zealand, Option4**:** 5.

Rea, T. (2009a) Summary of Final Ministry of Fisheries 2030 Proposals. For the non-commercial environmental and fishing interest Alliance. Auckland, NZ. Option4 & Co. 4.

Secretary for Marine (1969). Memorandum and Attachments, Secretary for Marine to the Minister of Marine, February 18, 1969. MI 42/12/5. DV. I, p. 129-131.

Sherrin, R. A. A. (1886 (2000)). Handbook of the Fishes of New Zealand. Prepared under the instructions of the Commissioner of Trade and Customs By R A A Sherrin. Auckland, NZ, Wilsons & Horton (original publisher); Kiwi Publishers.

Smith, P. J., R. I. C. C. Francis & M. McVeagh (1991). "Loss of genetic diversity due to fishing pressure." Fisheries Research **10**: 309-316.

Spring-Rice, W. (1996). Maori settlement on South Kaipara Peninsula, University of Auckland**:** 525.

Stace, G. (1991). "The elusive toheroa." New Zealand Geographic **9**: 18-34.

Stallworthy, J. (1916). Early Northern Wairoa. Wairoa, Dargaville (N.Z.), Wairoa Bell and Northern Advocate.

Stirling, B. (1998). Ngāti Whatua Native Land Court block histories, 1864-1900: the evidence. [New Zealand], B. Stirling.

van Roon, M. & S. Knight (2004). Ecological Context of Development. New Zealand Perspectives., Oxford University Press.

Waitangi Tribunal (1988) Report of the Waitangi Tribunal on the Muriwhenua Fishing Claim. Wai 22. Wellington, NZ. Waitangi Tribunal. 354.

Waitangi Tribunal (2002). The Kaipara interim report (Wai 674). Wellington, Legislation Direct.

Waitangi Tribunal (2004) Report on the Crown's Foreshore and Seabed Policy (Wai 1071). 224.

Waitangi Tribunal (2006) The Kaipara Report. Wai 674. Waitangi Tribunal. 420.

Waitangi Tribunal (2006) The Kaipara Report. Wai 674. Chapter 3. Waitangi Tribunal. 420.

Walsh, K. & H. Holdsworth (2007) Monitoring s186A closures Kaipara Harbour Scallop Survey. 14.

Walters, C., D. Pauly & C. V (1999). "Ecospace: prediction of mesoscale spatial patterns in trophic relationships of exploited ecosystems, with emphasis on the impacts of marine protected areas." Ecosystems **2**: 539-54.

Ward, T., D. Tarte, E. Hegerl & K. Short (2002). Policy Proposals and Operational Guidance for Ecosystem-Based Management of Marine Capture Fisheries, WWF.

Watson, T., J. McKenzie & B. Hartill (2005) Catch per unit effort analysis of the northern (GMU 1) grey mullet (*Mugil cephalus*) setnet fishery, 1989–2002. Wellington. Ministry of Fisheries. 36.

Weeber, B., K. Knowles, H. Bain & S. Yates (2007a) Best Fish Guide 07-08. Part One. Ecological Rankings for New Zealand Commercial Fisheries. Wellington, New Zealand. Royal Forest & Bird Protection Society of New Zealand, Inc. 105.

Weeber, B., K. Knowles, H. Bain & S. Yates (2007b) Best Fish Guide 07-08. Part Two. Criteria for Ecological Rankings for New Zealand Commercial Fisheries. Wellington, New Zealand. Royal Forest & Bird Protection Society of New Zealand, Inc. 105.

Williams, D. (2001) Mātauranga Māori and Taonga. The nature and extent of treaty rights held by iwi and hapū in Indigenous flora and fauna, cultural heritage objects, valued traditional knowledge. 600.

Willis, T. J., S.J. Handley, F.H. Chang, C.S. Law, D.J. Morrisey, A.B. Mullan, M. Pinkerton, K.L. Rodgers, P.J.H. Sutton, and A. Tait (2007) Climate change and the New Zealand marine environment. 88pp.

Worm, B., E. B. Barbier, N. Beaumont, J. E. Duffy, C. Folke, B. S. Halpern, J. B. C. Jackson, H. K. Lotze, F. Micheli, S. R. Palumbi, E. Sala, K. A. Selkoe, J. J. Stachowicz & R. Watson (2006). "Impacts of biodiversity loss on ocean ecosystem services." Science **314**: 787-791.

Wright, W. (1996). Manawhenua Report, Te Uri O Hau O Te Whahapu O Kaipara. The evidence of Wiremu Wright. Unpublished statement of evidence.**:** 114.

Yandle, T. & C. M. Dewees (2008). "Consolidation in an Individual Transferable Quota Regime: Lessons from New Zealand, 1986-1999." Environmental Management **41**: 915-928.