5. AQUACULTURE

AHUMOANA

The Stakeholder Working Group vision is that *prosperous aquaculture positively contributes to the health and wellbeing of the people and environment of the Hauraki Gulf Marine Park*.

Within the Hauraki Gulf Marine Park there are nearly 1500 hectares of consented mussel farm space, mainly within the Wilson Bay zone in the Firth of Thames, producing around 30,000 tonnes per year, accounting for over a quarter of national production. Production from the existing farms is predicted to double to 60,000 tonnes per year by 2025 based on improved productivity, development of consented farms within the Wilson Bay zone, and small extensions to existing farms outside the zone.

There are 210 hectares of consented oyster farm space in the Hauraki Gulf Marine Park, accounting for nearly half of national production. Two thirds of the Hauraki Gulf Marine Park's oyster production occurs in the Auckland region, with Mahurangi Harbour (108 ha of farms) being the centre of the industry. There are currently no finfish farms in the Hauraki Gulf Marine Park. However, there is 90 hectares of space in the Wilson Bay zone (of which 18 hectares is Treaty settlement space) and 300 hectares of space in the Coromandel Marine Farming Zone (of which 60 hectares is Treaty settlement space). The Waikato Regional Council will begin a tender process for the Coromandel Marine Farming Zone in late 2016.

Oysters are typically grown on wooden racks, trays and baskets fixed to structures on intertidal flats. In some areas, oysters that are ready for harvesting are transferred from the racks to long-line farms where they are suspended in baskets. This allows the oysters to flush themselves of any sediment or bacteria they may have ingested while in the intertidal zone. Mussels are grown on long lines in water depths of 10–45 m. Fish are held in pens or nets, which reach from the surface to depth, suspended under a surface structure, typically in water depths of 20–30 m.

Oyster farming and mussel farming (collectively known as shellfish farming) are examples of non-fed aquaculture, since oysters and mussels extract phytoplankton from the water by filter feeding and no additional feeding is required. Fish farming is an example of fed aquaculture where fish are fed manufactured feed pellets. This introduces additional product into the marine area with potentially greater environmental impacts.

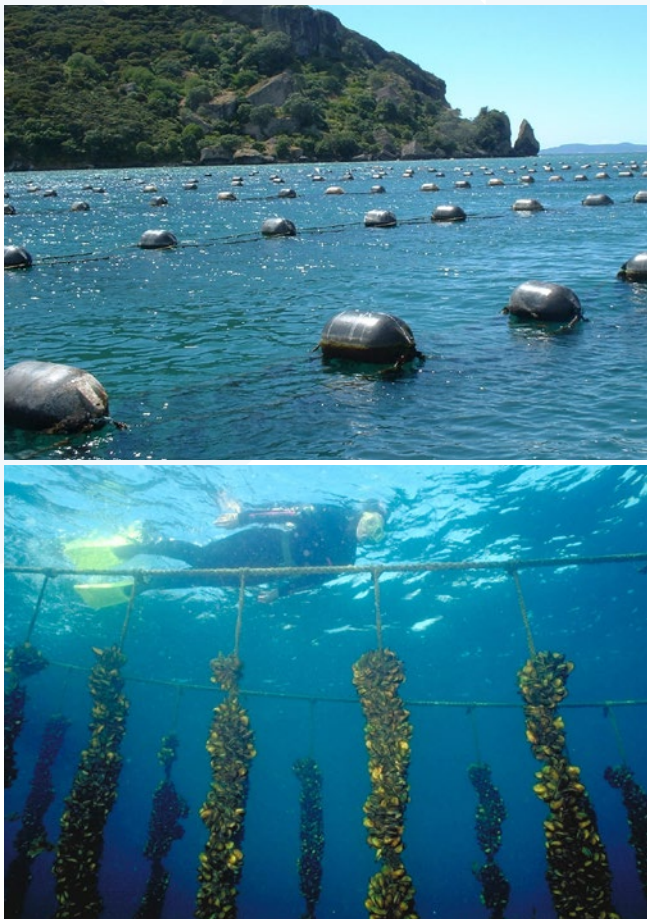


Figure 5.1 A mussel farm on the surface, and snorkelling underneath

A MANA WHENUA PERSPECTIVE

The Māori Commercial Aquaculture Claims Settlement Act 2004 addressed Māori rights relating to aquaculture. It consisted of three phases in which iwi received assets to settle commercial aquaculture obligations for a representative 20% of total approved aquaculture space. First iwi were compensated with cash for "pre-commencement space" (coastal space approved under the regime operating between 1992 and 2004), equivalent in value to 20% of allocated space. Second, where these were implemented, iwi received 20% of new aquaculture management areas

(AMAs) created between 2004 and 2011. Finally, iwi are entitled to 20% of new forecasted aquaculture space since 2011, but this may be paid in space, cash, or a combination of these.

To date some aquaculture settlements have been finalised for the Hauraki Gulf Marine Park; for the eastern Firth of Thames and Aotea/Great Barrier. These resulted in Hauraki iwi jointly establishing fisheries and aquaculture businesses, and becoming one of the major aquaculture participants within the Hauraki Gulf Marine Park. Their role in the sector is likely to increase as further settlement space is allocated.

Mana whenua tikanga and concerns relating to aquaculture

As well as being important aquaculture industry players as a result of Treaty settlements, Māori hold mana moana with associated inherited kaitiaki responsibilities. They therefore have dual roles in relation to aquaculture which require careful negotiation. As kaitiaki, local hapū and iwi are mindful of potential negative effects associated with aquaculture. Marine farms compete for traditional coastal marine space, and occupy areas in which mana whenua have traditional interests. This is further complicated by the fact that, in the Hauraki Gulf Marine Park, the extent of customary rights has not yet been tested or addressed.

Physical structures present potential impediments to iwi use of significant resources, such as kaimoana grounds, and create barriers to culturally important practices such as traditional waka routes and modern waka-ama. Of particular concern are the visual effects of marine farms on the experience and enjoyment of whānau that still reside on ancestral coastal lands, and for those reconnecting with lands returned via Treaty settlements. In the absence of iwi involvement over recent decades, Hauraki Gulf marine farms have been located inappropriately close to coastal wāhi tapu (sacred sites).

Marine farms are also a potential barrier to mana whenua environmental and kaimoana restoration goals, and bring a risk of entanglement and loss of territory for marine mammals. Coastal hapū are regular witnesses to paru, rubbish resulting from farms, including lost floats and lines. But they are also concerned with pollution that is unseen, the accumulation of detritus and waste on the seabed.

Tikanga Māori includes codes of conduct, based on centuries of living in a particular area, which may be offended by some activities associated with marine farming. For this reason, iwi seek involvement in any plans for new marine farms.

Despite significant shareholdings in commercial fishing and aquaculture companies, some individual iwi and hapū have experienced barriers to participation in aquaculture-related statutory processes. As a result, marine farms have been approved without consideration of effects on mana whenua values and interests. Barriers to participation limit the opportunity for farms to proactively address tikanga issues and mana whenua concerns, and places hapū and iwi in a reactive mode.

A community perspective

We found through our community engagement process that people have both positive and negative perspectives on aquaculture. In general, shellfish aquaculture is viewed positively. The overall sentiment clearly recognises the importance of the industry to local communities in the Hauraki Gulf Marine Park.

AQUACULTURE OBJECTIVES

We have identified a set of objectives that will collectively realise this vision and ensure that:

- There is a thriving aquaculture industry in the Hauraki Gulf Marine Park that supports local communities, including mana whenua.
- Marine farms are sentinels for a healthy environment and contribute to the restoration of the Hauraki Gulf Marine Park's mauri.
- Negative effects of aquaculture are avoided or managed so that a healthy environment is maintained.
- Environmental degradation which affects aquaculture is addressed so that the industry is not negatively impacted.
- Cultural, environmental and economic aspirations of mana whenua are supported and Treaty Settlement rights protected.
- The community has adequate certainty regarding the effects of aquaculture, while the industry has certainty for investment and sufficient flexibility to innovate,

diversify and adapt to changes in the business and natural environment.

- Well-targeted and sensible monitoring of aquaculture is carried out and is integrated with Gulf-wide state of the environment monitoring.
- Marine farms in the Hauraki Gulf Marine Park are part of the Aquaculture New Zealand's A+ Sustainable Aquaculture programme.
- Conflicts over the use of space are minimised.
- The regulatory framework is clear and consistent across the entire Hauraki Gulf.
- There are a variety of scales and types of aquaculture in the Hauraki Gulf Marine Park and innovation and research is actively promoted.
- Areas suitable for the various types of aquaculture currently undertaken are identified, and allowance is made for other types that are not currently found in the Hauraki Gulf Marine Park.

The Summary and Outcomes of Sea Change – Tai Timu Tai Pari Community Engagement (January 2014 – February 2015) noted the following:

- Aquaculture is valued for its economic and environmental benefits, but its impacts on natural character, water quality and other uses of the marine environment need to be closely managed.
- Many people think aquaculture enhances recreational fishing.
- Agencies need to provide more research opportunities to identify both the benefits and effects of aquaculture.
- Agencies need to support the aquaculture industry to be in the right place and doing the right thing by the environment.

A selection of quotes from members of the public at listening posts

Thames

Mussel farms are not a problem – you can go fishing in them, they're not a hazard to my interests.

Mussel farms have increased tourism in the Hauraki Gulf Marine Park because of the good fishing around the farms. Increased charter boat fishing.

Orewa

Mussel farms…affects sailing anchorages. In past, filtered the water but farms affect public ownership.

St Marys Bay

What about fish farms? They are just horrendous. I've dived under salmon farms in the Sounds.

Concern about the idea of salmon and fish farming with all the intensive feed that goes into the water but oysters and mussels are filtering.

Great Barrier Island

Mussel farms were a family thing – they were a community thing from here, and the people were from here. Two to three mussel farms are still locally owned but are leased out. Some of them are Sanford owned, and there are locals harvesting

Waiheke

Mussel farms attract giant snapper. They are like a supermarket – you go out and catch what you need for dinner

Kaiaua

I see people in this room who looked a lot younger and happier a few years ago, who have put years of energy into battling and worrying about the impact of extended aquaculture, their worry is returning.

Economic and social impacts of Aquaculture

Beneficial impacts

The Hauraki Gulf Marine Park's aquaculture industry provides a number of beneficial economic and social impacts including creating wealth and employment, supporting Māori development, providing for research and development and supporting other sectors such as charter fishing and tourism.

Value in the product that is produced

Aquaculture is a significant primary industry in the Hauraki Gulf Marine Park. Currently 27% of NZ's total Greenshell Mussel and 45% of Pacific Oyster production is grown in the Auckland and Waikato regions. This production is worth about $52m per year for mussels and $7.3 m for oysters in export revenue. It contributes about $31m to Waikato's GDP and $28m to Auckland's GDP[1].

Provides employment

The Hauraki Gulf Marine Park's aquaculture industry provides direct full-time employment for over 340 people in Auckland and 370 in Waikato. Indirect employment brings the total across both regions to over 900 people[2] . Employment on inter-tidal farms is usually located close to the farms, while employment on sub-tidal farms, such as mussel farms is centred around the landing facilities that service those farms. In the Firth of Thames, the main landing facility is the Sugarloaf Wharf at Te Kouma in the southern part of Coromandel Harbour. This brings employment to areas with fewer other opportunities.

Employment in processing is about 3-4 times higher than in the farm based operations and is located in towns and cities with sufficient population to provide a reliable source of employees and the necessary infrastructure (water supply, wastewater facilities and transport links). Mussels and oysters grown in the Hauraki Gulf Marine Park are processed in Whitianga, Tauranga, Warkworth and South Auckland. Oysters are also processed in Coromandel town.

Supports Māori development

Māori-owned farms in the Hauraki Gulf Marine Park have directly supported Māori development in Hauraki and allow Māori to express kaitiakitanga in practical ways. Returns from farms owned by Hauraki Māori have funded health, education and social services. For example, they contributed to funding the evolution of the Manaia Primary School (26 students and 2.5 staff) to a Kura ā Iwi with a roll of 130 students and 13 teachers. Māori businesses are a major part of the aquaculture sector and are expected to grow as a result of the delivery of the Crown's Aquaculture Treaty Settlement obligations in the coming twelve months.

Aquaculture supports research and innovation

Aquaculture in the Hauraki Gulf Marine Park already supports some educational and research activities and this opportunity can be leveraged further because of the proximity of the Hauraki Gulf Marine Park to a large highly skilled workforce, the proximity to a number of existing tertiary educational facilities, and the proximity and accessibility of the aquaculture activities within the Hauraki Gulf Marine Park. There is the potential for the Hauraki Gulf Marine Park to become a hub of aquaculture excellence, supported by research and innovation relating to all aspects of aquaculture activity including environmental enhancement projects.

Future growth of aquaculture can support increased benefits

There is growing demand for seafood, both domestically and internationally, so that the value derived from aquaculture production in the Hauraki Gulf Marine Park has the potential to significantly increase. To date, there are 1480 ha of consented space for mussel farms and 210 ha for intertidal oyster farms. National forecasts suggest that by 2035, mussel farming may seek to grow by an additional 920 ha and intertidal oyster farming by 145 ha. Growth in aquaculture will create additional employment opportunities and will lead to subsequent growth in associated sectors.

As a first step, support for increased productivity in the existing farms, and incremental increases in areas around existing farms, should occur where a net benefit is achieved. This will likely result in cost efficiencies and the minimisation of additional impacts on the Hauraki Gulf Marine Park's environment. However, in some existing locations, expansion may not be appropriate due

1&2 Figures combined from Murray and McDonald, 2010, and Wyatt, 2011.

to environmental constraints. Although these measures will provide some increased capacity, there will almost certainly be demand for new areas of marine space to be made available for aquaculture as markets expand and new marine farming technology develops. Aquaculture of new species, not currently farmed in the Hauraki Gulf Marine Park, could also play a role in increasing the value derived from aquaculture.

Figure 5.2 Oyster farm located at Clevedon

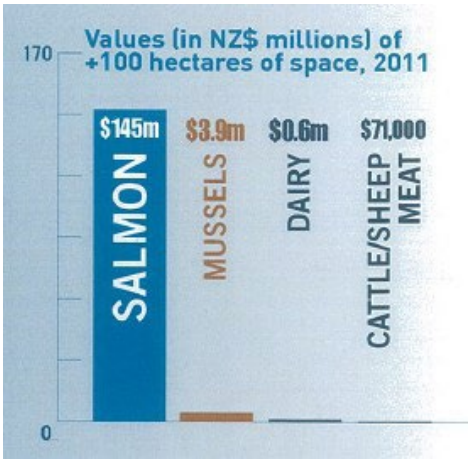


Figure 5.3 Value of salmon farming vs. other agriculture and aquaculture

Whilst growing finfish is an extremely efficient way of producing protein, there are ecological impacts including the amount of fish food needed which should be considered. Finfish farming returns more dollars per hectare than many other forms of agriculture and aquaculture. For example, the New Zealand salmon industry returns 2000 times as much money per hectare as beef and sheep meat[3] .

Aquaculture supports other sectors

The presence of marine farms can also support other sectors, in particular charter fishing boats and recreational fishing (as mussel farms attract snapper and other fish), and tourism and seafood restaurants. Aquaculture also makes seafood more available to everyday consumers.

Negative social impacts

Marine farms may exclude some human uses of the coastal marine area, including water sports, recreational boating and commercial fishing (although legally vessels are permitted to transit through marine farms and small powered vessels often do for recreational fishing purposes). The Hauraki Gulf Marine Park is the most highly utilised area for commercial and recreational boating in the country, with the number of yachts and launches predicted to increase significantly over the next 20-30 years.

Marine farms can be a navigational issue for vessels if located in popular cruising routes. They have the potential to be a navigational hazard during the day and night time if not well marked. Marine farms should not be located in areas suitable as safe anchorages for vessels as these are essential for safe boating and are becoming increasingly over-crowded with the growing number of vessels. There can be noise and disruption impacts on adjacent landowners, and the opportunity cost from using public space for aquaculture instead of for other purposes.

3 Industry investment opportunities in the New Zealand Salmon industry (2012), Coriolis Research, p15

Environmental impacts

As with the social effects descried above, aquaculture brings with it both positive and negative environmental effects. Both types are considered here.

Figure 5.4 Fishing over mussel farms

(Source. Top and bottom pictures supplied by Coromandel Marine Farmers Association, middle two supplied by Raewyn Peart)

Beneficial impacts

Restorative potential

There are ecological benefits that can be derived from aquaculture. Mussels and oysters feed on phytoplankton by filtering them out of the water as it flows past. In doing so they indirectly remove nutrients from the water and filter out other particulate matter such as sediment. They excrete the inedible material as 'pseudo faeces', which settle to the seafloor, removing them from the water column. A single mussel can filter up to 75 litres of seawater each day.

In this way, mussel farms can replicate some of the ecological functions of the natural sub-tidal mussel beds that were once widespread throughout the Hauraki Gulf Marine Park region, although currently on a much smaller scale. Historically mussel beds covered hundreds of square kilometres of the Hauraki Gulf Marine Park and made a major contribution to maintaining water quality. These beds have largely disappeared due to dredging in the 1950s and 60s, and subsequent high sediment loads, but were capable of filtering all of the water of the Firth of Thames every day. The development of additional shellfish farms will increase the filtering of water in the Hauraki Gulf Marine Park with resultant water quality benefits.

Shellfish restoration projects, which seek to restore rich benthic habitats in the Hauraki Gulf Marine Park for both ecological and water quality reasons, can benefit from the support of shellfish aquaculture (and other types of aquaculture which are valuable in this respect, e.g. seaweed, may develop in the future). For example the Revive our Gulf project, which aims to restore the mussel beds in the Hauraki Gulf Marine Park, has been supported by the aquaculture industry through the provision of live mussels that were unsuitable for the commercial market. These have been dropped to the sea floor in an attempt to recreate self-sustaining wild mussel beds.

It is important that restoration projects continue to benefit from support like this into the future. Other potential positive synergies may develop, such as through the provision of waste shell for deposition in the marine area or seaweeds for the collection of spat.

Creates habitat for other species

Marine farms create an 'artificial reef' effect through the physical structures of the farm and the crop on them providing shelter and food for other species. Small fish shelter among the crop lines, and this attracts bigger fish to prey on them. Snapper in particular are attracted to farms as they prey on mussels. Live mussels and shells accumulate on the seafloor under a farm. As farms are usually placed over soft sediments (rather than rocky reefs), this adds biogenic structure to the seafloor and may attract scavenging and predatory organisms such as starfish.

Accumulation of organic matter on the seafloor can provide hard substrate for other organisms to grow on, potentially increasing species abundance and diversity, including more predators (e.g., starfish), scavengers (e.g., sea cucumbers) and decomposing organisms (e.g., worms and bacteria).

Monitoring the environment

As marine farms require very high water quality they act as a sentinel in the environment. For example, seawater at shellfish farms is intensively monitored for bacterial contamination and harvesting is sometimes halted following any rainfall event due to the presence of E. coli in runoff from land.

Monitoring of the environment surrounding aquaculture farms, when targeted towards strategic issues, could assist in developing a better overall picture of the health of the Hauraki Gulf Marine Park, the impacts of aquaculture, including both positive and negative impacts as well as cumulative effects, and the influence of water quality (in particular sediments and nutrients).

Adverse ecological impacts

There are potential adverse ecological effects associated with aquaculture that need to be well managed. In general, fed aquaculture is intensive, has external inputs into the water column and has the potential for greater adverse effects than non-fed aquaculture, but it typically has a smaller physical footprint. Non-fed aquaculture is more extensive (requiring a larger area to be economically viable) and so typically affects a greater area, but the ecological effects are less intense.

Biosecurity

Aquaculture is unlikely to be the cause of a new pest incursion into New Zealand, but marine farm structures provide potential habitat for pest organisms to colonise, which become a reservoir for further spread. Movement of equipment, vessels and stock is a potential mechanism for the movement of pests (as are recreational and commercial vessels).

Biosecurity risks are not just non-native species arriving but include diseases, pathogens, parasites and other biological threats. The effect of diseases on farmed populations has raised concerns in New Zealand. For example, the effect of a herpes virus, especially between 2009 and 2011, on the introduced Pacific oysters.

Water-column effects – shellfish farming

The main effect on the water column from farming shellfish is the extraction of phytoplankton, zooplankton and organic particulates by the farmed shellfish. Phytoplankton forms the base of the marine food web; depletion therefore has the potential to impact on other species. Zooplankton includes fish eggs and larvae and its depletion therefore could potentially affect localised fish stock recruitment. The short-term composition of plankton communities can also be altered. The depletion zone usually only extends a short distance from the farm and is influenced by flushing rates, currents, depth, wind, etc. Depletion can be minimised by locating farms in areas with good flushing and/or high natural levels of phytoplankton. On the other hand, shellfish farms benefit from some land-sourced nutrients and can assist in mitigating negative effects of land sourced nutrients through extracting nitrogen.

Water-column effects – fin fish farming

Decomposition of fish faeces and uneaten food releases dissolved nutrients into the water column and can result in nutrient enrichment, impacting water quality. It may also change the species composition of phytoplankton with flow on effects in the food web. Potential problems can be minimised by good management, locating farms in areas that are deep and well-flushed, not overstocking them and avoiding areas which are nitrogen enriched.

Seabed effects

Both shellfish and finfish farming result in deposition of organic matter on the seabed. Negative impacts of accumulated organic matter include organic enrichment, reduced diversity and elevated levels of organic carbon. These impacts are much greater with fed-aquaculture, due to the deposition of high-nutrient faeces and uneaten feed on the seabed, which can transform well-aerated sediments into low-oxygen zones. In extreme cases the seafloor can become anoxic (lacking oxygen) as all the available oxygen is consumed in the decomposition of the organic matter. This eliminates all life except mats of bacteria. These conditions have been seen under salmon farms in New Zealand, but never under shellfish farms. Such effects can be reduced through good management, avoidance of overstocking and locating farms in deep, well-flushed areas and away from ecologically significant seabed areas.

Effects on wild stocks

When selective breeding is used for farmed species which are also present in the wild, the mixing of farmed and wild populations can potentially impact on the genetic structure of wild fish populations. There is also the risk of the transfer of diseases and parasites between farmed and wild stocks. This is mainly an issue for finfish farming where escapes can roam widely and mix with the wild population. This means that there needs to be tight control over finfish farm infrastructure to avoid the risk of escapees. On the other hand, released farm fish could be used to supplement wild stocks (for example, in Japan it is a part of the conditions of having a fish farm that stock is released to build up the wild stocks). These issues require ongoing research.

Effects on wildlife

Marine farms may exclude wildlife; either directly through displacing desired habitat, or indirectly through human presence or excessive noise. On the other hand, marine farms can attract fish, birds and marine mammals due to the increased availability of prey species that are attracted by the habitat provided by farm structures, as well as for artificial reefs.

Marine farms have the potential to exclude or modify how marine mammals use habitat when they impact on foraging, resting and nursery areas and migration routes. In addition, marine mammals can become entangled in structures, ropes and other non-biological waste material. Underwater noise associated with farm activities may also interfere with natural behaviours. The Hauraki Gulf Marine Park has several endangered marine mammal species, including Bryde's whales, bottlenose dolphins and orca, which need to be safeguarded from any adverse impacts from aquaculture. This can be achieved through careful siting of farms and good management of equipment to minimise any waste material entering the marine environment.

Areas with significant or outstanding conservation value for other wildlife may also demand additional safeguarding from impacts. The Firth of Thames intertidal-flat Ramsar site is an example. On the one hand, some overseas studies suggest that shorebirds may benefit from the establishment of marine farms through the provision of extra feed, so long as detritus from the farm does not smother the seabed. On the other hand, the disturbance of waders could increase with marine farms in the immediate vicinity (boat traffic, presence of farm workers, noise), and the cost to birds of disturbance may be high when they are putting on weight prior to their annual migration.

Effects on landscape and natural character

Marine farming on the sea surface, by its very nature, introduces human-made structures and activities into a natural environment. This can include buoys, racks, sea cages, supporting structures and vessel movements. Such structures and activities can adversely impact on natural landscape and natural character values of the Hauraki Gulf Marine Park.

The concepts of landscape and natural character encompass both the 'naturalness' of an area, which is the extent to which it is free from human-made structures and influences, and people's experience of that naturalness. Retaining the naturalness of high value coastal landscapes and seascapes is important to protect cultural values and the quality of life and economic prosperity of the Hauraki Gulf Marine Park. Because much of the Hauraki Gulf Marine Park has been heavily developed, particularly around Auckland and the Coromandel Peninsula, it is important that we protect remaining areas with high landscape and natural character values. This can be achieved through locating marine farms in appropriate areas that avoid adverse effects on these values.

Effect of additives and chemicals

Chemicals associated with marine farming may include feed additives, antifoulants, and treatments for bacterial diseases or parasites like sea lice. Currently no chemicals are used in shellfish farming, apart from treated timber for inter-tidal oyster farm racks, or in salmon farming apart from copper in antifoulants and zinc in feed. Antibiotics are not currently used in New Zealand. Good management practice minimises the use of additives and chemicals, and consent conditions can restrict their use.

Hydrodynamics

Structures in the water have an impact on currents and waves. This has the potential to reduce currents and wave energy. This may be positive by reducing the wave energy reaching the coasts, and hence reduce shoreline erosion, or could negatively affect surf breaks. Effects

can be reduced by locating farms in areas that are not a significant part of the swell corridor for popular surf breaks, by orienting infrastructure so it does cut across main current flows and by modelling the hydrodynamic effects, including cumulative effects of any proposed large scale aquaculture development.

Cumulative effects

Individual marine farms may be judged to have an acceptable ecological effect but they need to be considered in the context of both other marine farms and other human activities that are stressing the same ecosystem. This becomes particularly important as additional farms are proposed, existing activities increase in intensity and new activities appear.

WHAT DO WE WANT TO ACHIEVE?

By 2018, have a 'three tiered' regulatory regime in place for aquaculture that:

- Specifically enables aquaculture in identified areas where the overall social, economic and environmental benefits of aquaculture to the Hauraki Gulf Marine Park are maximised.
- Allows case-by-case consideration of aquaculture in areas which may be suitable but which have not been identified as an area where benefits will be maximised.
- Restricts aquaculture in areas which are not suitable for aquaculture.

There is potential for significant growth in the aquaculture sector. To determine where aquaculture should best be located and how it should be managed, there needs to first be consideration of the benefits of aquaculture and how these can be maximised, and then consideration of the matters that are important to ensure appropriate siting, scale and management of aquaculture as described above. Consideration also needs to be given to where aquaculture should not be located to provide some certainty for the community, industry and the environment.

By 2020 a robust and supportive regulatory framework (based on the above) provides clear and consistent policy, rules, monitoring and engagement requirements for the community, industry and mana whenua

A clear, robust and supportive regulatory framework, which clearly sets out where aquaculture is best located and where it should not go, will help to ensure a prosperous aquaculture industry which is strongly supported by the community. Central government and local authority policy and regulatory documents that provide certainty and consistency of regulation and monitoring requirements across jurisdictional boundaries will provide industry with the confidence for long term investment. The application of good practice industry guidelines, practises and standards is also very important as is the widespread adoption throughout the Hauraki Gulf Marine Park of Aquaculture New Zealand's A+ Sustainable Aquaculture programme.

In addition to the ecological and landscape/natural character issues set out above, Council decisions regarding aquaculture should avoid adversely impacting on culturally significant areas, in particular wāhi tapu (both terrestrial and marine). Allocations of new coastal marine space need to avoid pātaka kai, mahinga mātaitai and mana whenua food gathering areas. Councils also need to be mindful of community aspirations to participate in decision-making over the location of marine farms.

The regulatory approach should encourage increased production from existing space, where located in appropriate areas, as well as the reorientation or relocation of existing farms to other suitable areas where this has the potential to significantly increase productivity and reduce environmental impacts.

The regulatory framework should encourage a diversity of scale of aquaculture farms, scale of operator and type of operator. The allocation of marine farming space should prioritise operators with stronger links to the Hauraki Gulf Marine Park communities and whose operations will have greater positive socio-economic and environmental outcomes. Small-scale, marae-based marine farms should also be supported. This can be achieved through appropriately weighting the tendering process for space.

Restrictions should be placed on the circumstances in which consents can be transferred to others and should require that development is completed within 5 years of the consent being granted.

By 2020 mana whenua aspirations regarding aquaculture need to be provided for

Mana whenua are involved in aquaculture, are pragmatic, and many hapū and iwi[4] recognise potential benefits – economic, social and environmental – from marine farming done well. Where mana whenua have been applicants for marine farms, or have been meaningfully engaged by applicants, there have been positive results, as described in the Wharekawa kūtai place study. But there is clearly scope to better realise mana whenua aspirations for aquaculture. Local hapū and marae aspire to establish nearby small-scale marine farms, as pātaka kai, for their wellbeing and sustenance.

By 2020 iwi, the industry, government, universities and research institutes support research and innovation through the creation of a Hub for Aquaculture Excellence

There is potential for the Hauraki Gulf Marine Park to become a hub of aquaculture excellence, supported by research and innovation relating to all aspects of aquaculture activity including environmental enhancement projects, new species, new technologies, and climate change mitigation.

HOW WILL WE DO IT?

Identify preferred locations for aquaculture within the Hauraki Gulf Marine Park

We have undertaken a detailed assessment of possible locations for future aquaculture development. These have been identified with the expectation that further investigation will be undertaken on a place-by-place basis to identify potential benefits and effects and to further define the boundaries.

Many of the negative impacts discussed above can be avoided or managed by locating farms appropriately. Attention has been paid to biophysical factors, environmental factors, minimising adverse effects on sites of significance to mana whenua, natural character and landscape, and minimising exclusion of other users of coastal space. Different species and farming methods have different biophysical requirements. The spatial element of managing aquaculture is not simply about avoiding areas with environmental constraints, but also about identifying the water space that is well-suited to farming and areas where the benefits of aquaculture will be maximised.

Table 5.1 and Map 5.1 identify areas that are considered likely to be appropriate for future aquaculture development, and Appendix 2 provides a detailed map of the proposed locations and analysis that underpins the recommendations. The areas identified are a preliminary guide, based on our initial assessment which indicated that aquaculture is likely to be suitable in the vicinity of these locations. The analysis also identified the boundaries of areas within which we considered that some marine farming would be appropriate and these are shown in Appendix 2. The boundaries have been carefully drawn to exclude areas where farms would likely have negative locational effects. It is not envisaged that marine farming would occupy all or even the bulk of these areas.

These indicative sites do not override the regional coastal planning and resource consent application processes, and it is these which will ultimately decide the zoning for and authorisation of a marine farm. It is through these processes that the candidate areas will be subject to more detailed site investigation and assessment of environmental effects and more precise boundaries will be determined. These processes will also enable greater iwi, public and industry involvement in the decision-making process through the Resource Management Act 2001 consultation, submission and appeal rights. Early engagement with iwi by councils and applicants is essential.

Because commercial scale aquaculture of any finfish species likely to be grown in the Hauraki Gulf Marine Park has not taken place anywhere in New Zealand as yet, we recommend sufficient trialling of the species proposed and comprehensive monitoring to show that there are no significant environmental effects. This would provide more certainly for the industry and the community, before full scale farms are released.

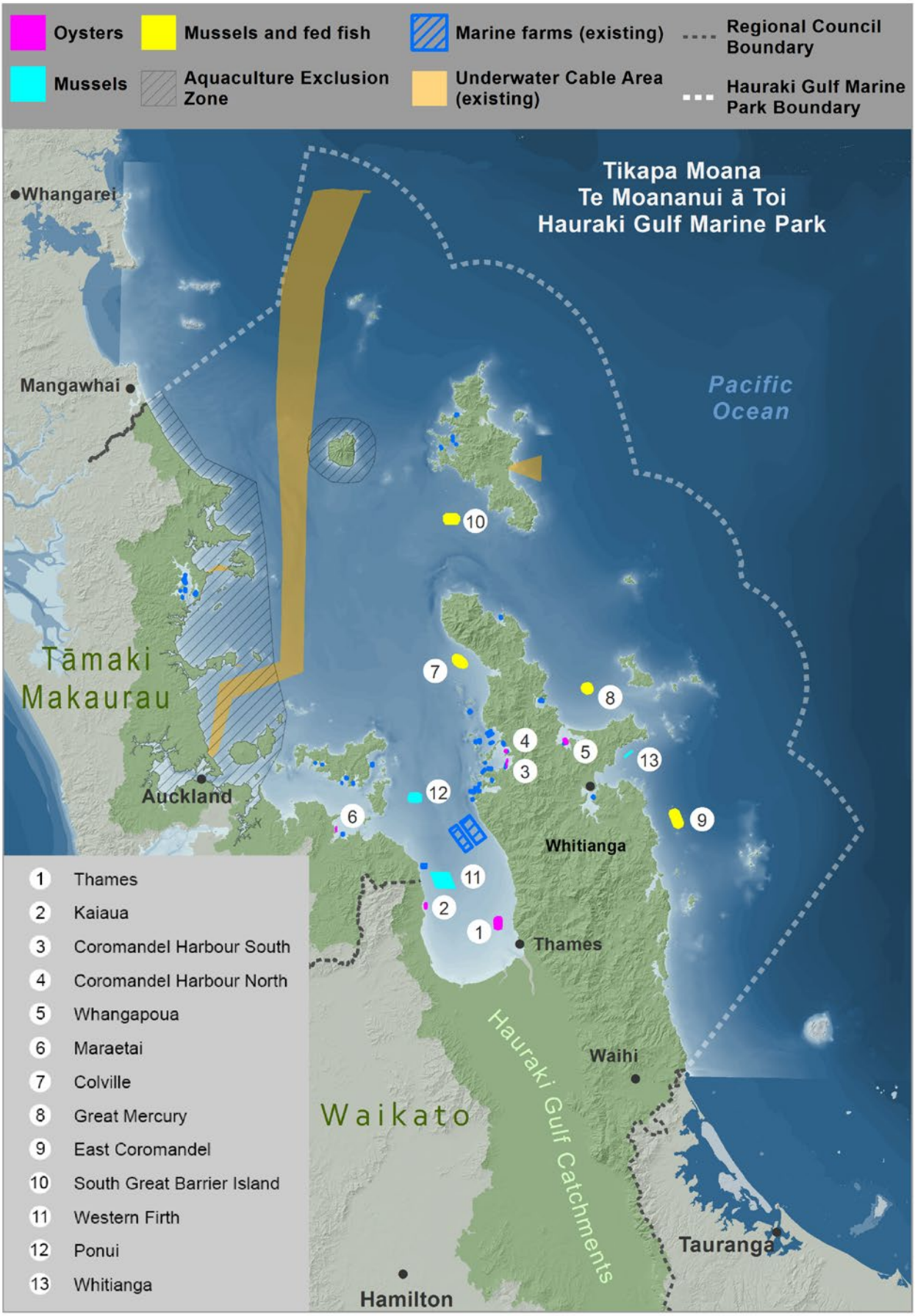
The sites identified in the Table are based on current knowledge of the industry and its growth aspirations, biophysical and natural character attributes of the areas, other uses of marine space, and mana whenua aspirations. We expect that new entrants to the sector, new types of aquaculture, or new technologies will almost certainly emerge in the future and further opportunities for these may need to be considered at that time.

4 Any reference to mana whenua is not the position of all iwi of the Hauraki Gulf Marine Park but reflects the opinion of those we discussed aquaculture with. Work is required with each iwi to determine their individual priorities and perspectives.

In addition, iwi and hapū should be supported to prepare plans identifying the potential location of future iwi/hapū operated commercial or customary marine farms to inform forward planning for aquaculture across the Hauraki Gulf Marine Park.

Table 5.1 Description of preferred indicative aquaculture areas

SITE	LOCATION	SPECIES
1	Thames	Inter-tidal shellfish (oysters)
2	Kaiaua	Inter-tidal shellfish (oysters)
3	Coromandel Harbour South	Inter-tidal shellfish (oysters)
4	Coromandel Harbour North	Inter-tidal shellfish (oysters)
5	Whangapoua	Inter-tidal shellfish (oysters)
6	Maraetai	Inter-tidal shellfish (oysters)
7	Colville	Subtidal shellfish (mussels and fish)
8	Great Mercury	Subtidal shellfish (mussels and fish)
9	East Coromandel	Subtidal shellfish (mussels and fish)
10	South Great Barrier Island	Subtidal shellfish (mussels and fish)
11	Western Firth	Subtidal shellfish (mussels)
12	Ponui	Subtidal shellfish (mussels)
13	Whitianga	Subtidal shellfish (mussels)



Map 5.1 Existing aquaculture sites, indicative areas preferred for future aquaculture development, and areas unsuitable for aquaculture.

See Appendix 2 for detailed locations and explanations of the numbered aquaculture sites.

Identify areas where aquaculture should be restricted

Areas which are unsuitable for aquaculture need to be identified in order to provide certainty for industry, the community and the environment. An initial identification of unsuitable areas is shown on map 5.1. There are other areas which are unsuitable and the full spatial range of these will need to be identified by councils.

A robust regulatory framework and monitoring regime that supports mana whenua, industry and local communities

The identification of preferred locations and inappropriate locations need to be supported by consistent policies, rules and other methods in order to provide industry with the clarity and certainty it needs to make large scale investment decisions and to deliver on mana whenua and local community expectations regarding protection of the environment and engagement with councils and industry. At present, inconsistent decision-making and monitoring requirements across council boundaries are an impediment to further growth of the sector. In many cases, mana whenua have been given insufficient input to aquaculture decision making and monitoring.

Planning framework

Regional Coastal Plan reviews should occur by 2018. The focus needs to be on the community providing input at the planning stage in terms of identifying suitable sites to zone as suitable for aquaculture and to zone as unsuitable. The reviews should address the following matters:

1. Provision of more permissive resource consenting for those areas identified as suitable in Table One (as further defined through the plan review process), than for aquaculture applications outside those areas (we suggest a restricted discretionary status for new farms). This will provide the industry with an incentive to grow in a planned manner, through reducing the significant costs, timeframes and uncertainty associated with a full discretionary resource consenting process. For those sites identified as unsuitable for aquaculture, non-complying activity status and associated policies and objectives should apply.
2. Provision for the re-consenting of existing farms as a controlled activity, where they are located in areas identified as suitable for aquaculture in the regional coastal plan, although retaining the requirement to undertake a site-based assessment of environmental effects.
3. Full-scale finfish farms are not to be released until there has been sufficient trialling of the species proposed and comprehensive monitoring has shown that there are no significant environmental effects.
4. Provision for small scale aquaculture (less than 5 hectares), in areas identified as suitable for aquaculture in the Regional Coastal Plan, as a limited notified restricted discretionary activity, to reduce the consenting barriers to establishment but still providing for a robust consenting process taking in to account cumulative effects.
5. Provision for experimental aquaculture sites of less than 3 hectares and of no more than five years duration, as a controlled activity, in areas identified as suitable for aquaculture in the regional coastal plan, to provide for the small scale piloting of new species and methods. Experimental aquaculture involving finfish species, which is located in areas outside those identified as suitable for finfish farming but within areas identified as suitable for other forms of aquaculture should be a restricted discretionary activity.
6. Provision for the expansion, readjustment and/or relocation of existing marine farms based on a robust set of criteria.
7. Recognition of mana whenua values and interests in any planning and resource consenting decision-making and providing for joint planning, learning and employment opportunities through such mechanisms as combined marine farmer and iwi forums.
8. Inclusion of criteria for tendering new aquaculture space which recognises the importance of providing for a range of operators and maximising the cultural, social economic and environmental benefits of marine farms to the Hauraki Gulf Marine Park.
9. Provision for imposing conditions of consent that require applicants to be certified by Aquaculture New Zealand's A+ Sustainable Aquaculture programme, and to incorporate technological and industry improvements.

Monitoring framework

Monitoring of marine farms should be designed, so that the information collected contributes to a wider understanding of the dynamics and state of the Hauraki Gulf Marine Park, as well as identifying any adverse environmental impacts of individual farms. This can be achieved through:

1. Providing consistent farm-by-farm monitoring and reporting requirements across the Hauraki Gulf Marine Park.
2. Carefully designing monitoring requirements so that the information generated can be utilised within the broader Park-wide monitoring programme.
3. Developing and using cultural indicators as part of the monitoring and restoration regime and involving mana whenua in the monitoring programme, particularly for measuring any cultural effects (discussed in more detail in the Implementation Chapter).
4. Ensuring that any data generated through farm monitoring programmes is freely available to councils, iwi, research institutions and the public.
5. Considering delegations of council monitoring functions to iwi.

Implementing an integrated marine monitoring system for the Park will require additional resources. The aquaculture industry can provide a valuable contribution to this. We recommend that any council and central government funds raised through tendering new aquaculture space within the Park be utilised to help fund an improved Park monitoring system including, in the first instance, the deployment of additional monitoring buoys.

Supporting research and innovation through the creation of a hub for aquaculture excellence

The benefits of the development of a hub jointly run by universities, industry, iwi and government for research and innovation for aquaculture in the Hauraki Gulf Marine Park could be valuable for both the industry, at a local, national and international scale, and for those that seek to better understand the state of the Hauraki Gulf Marine Park and the changes that are occurring. It would also provide opportunities for stewardship of the Hauraki Gulf Marine Park for larger parts of the community and provide greater opportunity for jobs in a highly productive and skilled research sector.

Aquaculture in the Hauraki Gulf Marine Park already supports some educational and research activities and this opportunity can be leveraged further because of the proximity of the Hauraki Gulf Marine Park to a large highly skilled workforce and a number of tertiary educational facilities, and the accessibility of the aquaculture activities within the Hauraki Gulf Marine Park.

The hub should be dually focused on environmental and commercial matters (as opposed to pure research) and could consider subjects such as:

- **Restoration benefits -** The development of additional shellfish farms has the potential to increase the filtering of water in the Hauraki Gulf Marine Park, as well as restoration of benthic mussel beds using unwanted mussel shells. While the extent of the potential positive impact of this is unknown, and will vary from species to species, it is important that this potential is maximised. The hub could lead research into the potential of aquaculture to contribute to the restoration effort for the Hauraki Gulf Marine Park and how such contributions could be enhanced.

- **New species -** The hub could coordinate and lead the investigation into species not currently farmed in the Hauraki Gulf Marine Park such as finfish, seaweeds, kina and sea cucumbers. These are experimental at this time and not commercially farmed in the Hauraki Gulf Marine Park, so more work is required before these become a commercial reality. For example, farming of sea cucumbers under farms may reduce the depositional and organic enrichment impacts. Other positive effects may be achieved such as farming seaweeds, which directly remove nutrients from the water, may increase localised oxygen content, and provide additional habitats for some fish and shellfish species
- **New technologies and modelling -** New technologies will continue to evolve, both in NZ and overseas, that could assist with aquaculture development, and monitoring. The hub could have a technology development and / or testing focus to ensure that as new technologies become available, they are tested and proven to be appropriate for deployment in the Hauraki Gulf Marine Park. Determining the aquaculture carrying capacity of potential farm sites requires sophisticated science, including modelling. For example, biophysical models have been used to understand the potential adverse effects due to phytoplankton depletion associated with mussel farms in the Wilson Bay zone.
- **Climate change -** As the global average temperature increases and CO2 within the ocean begins to reach saturation, the ability of the ocean to absorb carbon may alter significantly. At some point in the future removing carbon from the ocean may need to be considered. One method for achieving this could be through shellfish farming. Shellfish absorb carbon as they grow and convert it into calcium carbonate (CaCO3) to form their shell. The effectiveness of this method is still unknown and will vary significantly depending on species, stocking densities and a range of other variables – a research and innovation hub could lead this type of investigation.
- **Ocean acidification -** Increasing carbon dioxide in the atmosphere is causing the ocean to acidify. This changes the chemistry of the water, which in turn affects marine ecosystems and organisms including kai moana. Currently Ngāti Whātua and Ngāti Paoa are working alongside NIWA, the Universities of Auckland and Otago and the Cawthron Institute (including the aquaculture industry, MPI, regional councils, DOC and the Hauraki Gulf Forum) on the Coastal Acidification Rate, Impacts & Management Project. This 4-year project funded by the Ministry of Business, Innovation and Employment will monitor the rate that New Zealand coastal waters are acidifying. The project will also determine the effect of ocean acidification on important species like green shell mussel, pāua and snapper. The project will focus on three sites around New Zealand, one of which is the Firth of Thames Tīkapa Moana / Te Moananui-ā-Toi. We have data on water chemistry in the Firth that show it may be experiencing acidification – a research hub could also continue input into this research.

PLACE STUDY:
WHAREKAWA– MANA WHENUA AND AQUACULTURE IN THE FIRTH OF THAMES

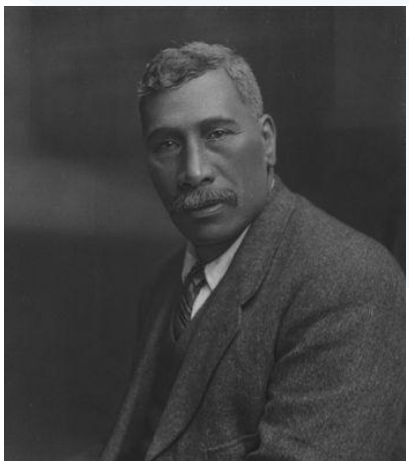


Figure 5.5 Tukumana Taiwiwi Te Taniwha – Ngāti Whanaunga /Ngāti Maru (1862 –1941)

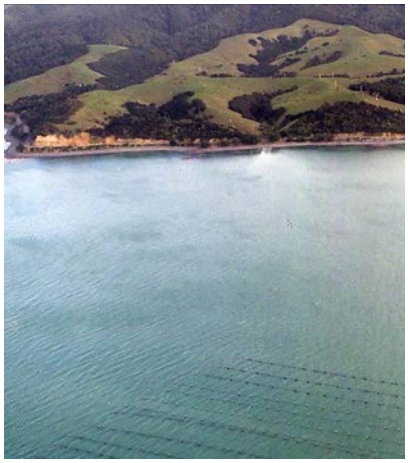


Figure 5.6 Existing mussel farms are within 800m of the shoreline at Wharekaw

The Kaiaua coastline, known as Wharekawa to mana whenua, is the rohe of Ngāti Paoa and Ngāti Whanaunga. Having once relied on the great mussel reefs within Tīkapa Moana, today most of the reefs have not recovered from the dredging of the mid-1900s. However, now as then, the coastline has ideal conditions for mussels. The coastline is subject to a tidal wave of mussel farming applications, almost all off-shore of the early land block Wharekawa number 4. This concentration of aquaculture activity is one of the pressures we are seeking to address in the Plan.

Mātauranga Māori – traditional fisheries knowledge

Wharekawa 4 was confirmed by the Native Land Court as the estate of four Ngāti Whanaunga hapū, Te Mateawa, Ngāti Puku, Ngāti Rangiaohia and Ngāti Kotinga. They had been the kaitiaki of this area since the coming of Marutuahu to Hauraki, probably in the 16th century.

Over this timespan iwi have built up a vast mātauranga, a body of traditional knowledge, about the coasts and harbours, and the kaimoana that lives there. This knowledge is key to understanding and managing local resources. Tukumana wrote down some of his knowledge of kūtai:

"If arose a wind from the North and if the wind blew towards that hill [Hauroa], or if the wind it blew down from it or lowered so that it drove (banked up) the sea land ward, then is seen the mussels (kuku and kūtai) – and they come ashore, not in the least were broken a single one of these mussels cast ashore – all were quite fresh though quite ashore. Nor was a single mussel to be seen outside the sea mark (below high tide mark). But if the wind is rising at the time it is flood tide – at dead low tide there will be no mussels cast up. If it should happen that the wind veers about to that mountain [Kohukohunui] when it is only half tide, those mussels will all be broken – and will be found also spread about all over the place".

Ngāti Whanaunga and Ngāti Paoa still live at Wharekawa, at their papakāinga at Kaiaua, Waihihi, and on the last remaining substantial piece of Māori land on the coastline at Waimango. While they have shares in aquaculture through the pan-tribal Hauraki fishing companies, they are not directly involved in mussel farming.

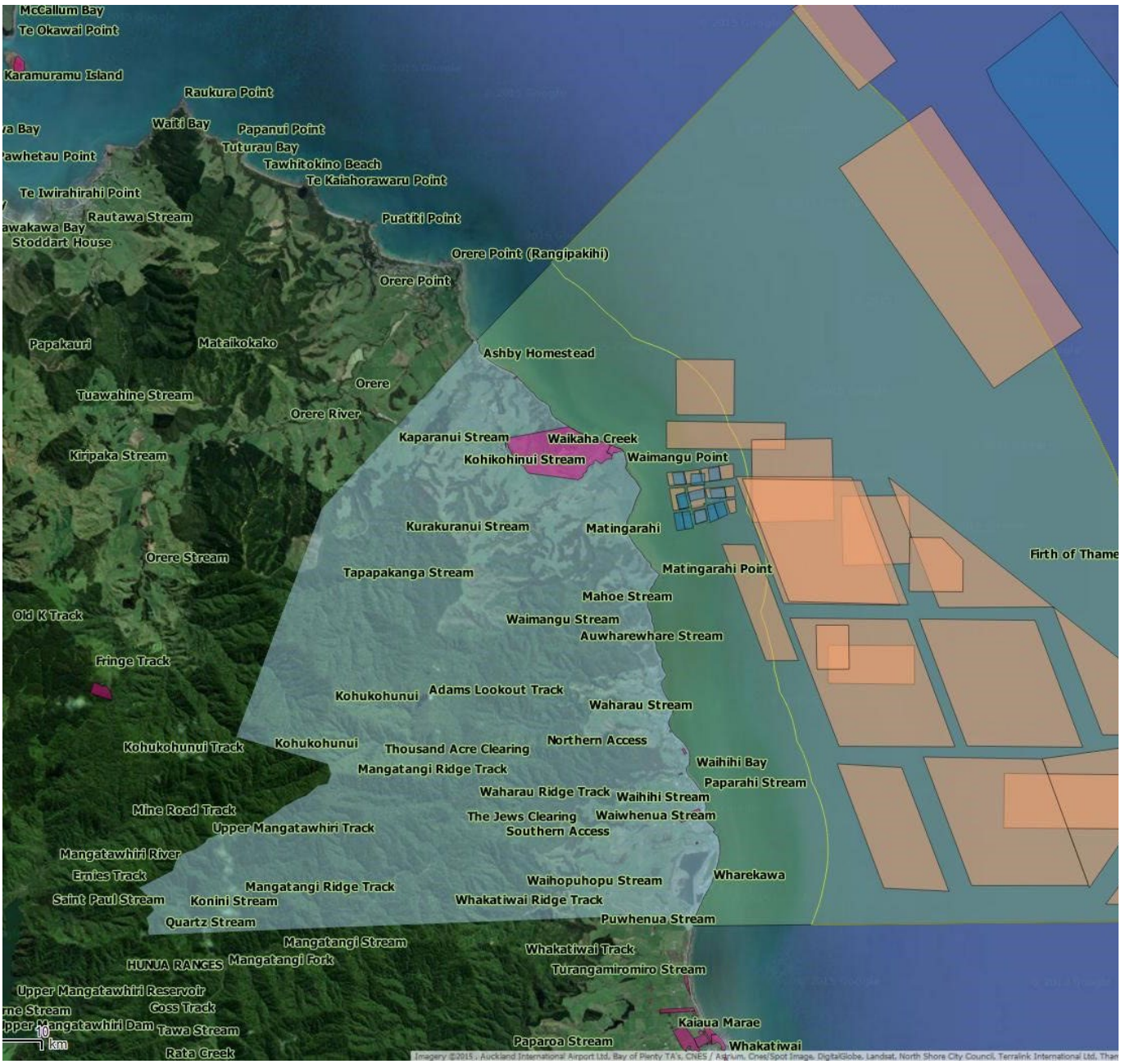


Figure 5.7 Wharekawa Māori owned land (purple), Iwi rohe boundary (white shading), regional boundary (yellow line), existing aquaculture (blue), and aquaculture applications (orange)

While there are currently only about 100 hectares of farms in the vicinity, applications are lodged for several thousand hectares. This Plan has recommended a range of alternative locations where aquaculture should be promoted.

The value of local relationships

Local hapū and whānau and the mussel farmers have established a group to oversee monitoring, develop a restoration plan, and undertake restoration initiatives in the vicinity. The Tūwhituaroa Aquaculture Steering Group was agreed between to the parties as a condition of consent. Called the Tūwhituaroa Aquaculture Steering Group provides a meaningful platform for the local hapū and whānau to exercise kaitiakitanga.

A critical aspect in the successful establishment of a kaitiaki steering group at Wharekawa is the long relationship between mana whenua and the local mussel farming families. Several of the owners have lived in the area for many generations, and the resulting relationship is cherished by local Māori and the farmers alike. It is hoped that this will provide a model for future marine farms.

Figure 5.8 The Wharenui.

Ancestral meeting house of Ngāti Paoa anad Ngāti Whanaunga at Wharekawa Marae, south of the mussel farms on the Wharekawa coastline (Source. Ngāti Paoa Iwi Trust)