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Aquaculture

Economic Impact in the Auckland Region

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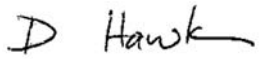

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Aquaculture: Economic impact in the Auckland region

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Contents

Executive Summary

The aquaculture industry has been identified as one with growth potential, both from within the New Zealand industry itself and worldwide. The opportunity for export development, employment and innovation has been highlighted – with the aspiration for the sector to achieve output of $1billion nationally by 2025. This report addresses the regional impact of the aquaculture industry in the Auckland region. It also provides an insight into the economic impact of growth within the sector, by modelling a scenario using economic input-output tables.

In the 2008-2009 year, the Auckland region harvested 2,648 tonnes of mussels and 890 tonnes of oysters. This equates with 3 per cent of national mussel production and 26 per cent of oyster production. For that period, the region processed nearly seven times the amount of mussels harvested (17,426 tonnes). It processed (853 tonnes) slightly less than that harvested in the region, indicating that this is done in other regions or oysters are exported live. The food processing facilities in Auckland are very important for the industry, and also service contiguous regions. Aquaculture contributed an estimated $\$_{2004}$72 million of output to Auckland's economy in 2009. This corresponds to $\$_{2004}$28.2 million of value added, or regional gross domestic product (GDP), or 0.06per cent of Auckland's total regional GDP. The contribution to GDP is comprised of aquaculture farming impacts (approximately 20 percent of total) and aquaculture processing impacts (approximately 80 percent of GDP impact). Thus, for the region, aquaculture processing is highly significant. The processing facilities are not just important for the Auckland region, but also for adjoining regions' harvests.

Economic impacts of the aquaculture industry 2008-2009 year

	Aquaculture Farming Impacts[1]	Aquaculture Processing Impacts[2]	Total Economic Impact
*Output ($\$_{2004}$mil)**			
Direct	6.6	42.2	48.7
Indirect	4.5	14.2	18.7
Induced	0.8	4.1	5.0
Total	**11.9**	**60.5**	**72.4**
Value Added ($\$_{2004}$mil)			
Direct	3.1	13.7	16.8
Indirect	2.2	6.7	8.9
Induced	0.4	2.0	2.5
Total	**5.7**	**22.4**	**28.2**
Employment (FTEs)			
Direct	66	275	341
Indirect	37	104	141
Induced	4	21	25
Total	**107**	**400**	**507**

*prices are given in 2004 dollar terms, which is the base year for the input-output table (See section 3.3 for details).

Economic impact assessment recognises that one form of economic activity almost always leads to others. Direct impacts are the initial immediate economic activities resulting within the target industry from an investment. These are the first round of expenditure in an economy. Indirect impacts are the changes that occur in other businesses or industries that supply inputs

into the industry where the investment has taken place. Induced impacts are those which occur due to increased total household expenditure, as a result of an investment. The sum of the direct indirect and induced effects is the total effect on the economy – the effects of an initial investment is compounded or multiplied throughout the economy.

In terms of employment, there are an estimated 507 full time equivalents (FTEs) resulting from aquaculture in the region. These are comprised of 341 in direct farming and processing jobs, 141 indirect jobs as a result of activity in other industries, and 25 induced jobs in the region. Again, 80 percent of these are in the processing industry, reinforcing its relative importance within the industry.

1 Introduction

1.1 Background

Auckland has a 1.1 million hectare coastal marine area, extending from the 1,800 km coastline of the region. Within this marine area, many economic activities concur. Aquaculture is one such activity. Aquaculture includes both marine farming and land based activities. Marine farming is the practice of cultivating marine organisms for harvesting and sale. Land based aquaculture activities involve fish and mollusc farming in tanks or ponds onshore. This report looks exclusively at marine aquaculture, while acknowledging that land based aquaculture is in operation within the region, and is a component of the fish farming industry. There was insufficient economic data from land based activities, for it to be included in this analysis at the present time.

New Zealand's aquaculture industry was first established in the 1960s and comprises approximately 6,250 hectares of farmed space. Predominately this is taken up by mussel farms, with a significant oyster farming industry (particularly in Northland and Auckland), some areas for scallop growing and a small number of salmon farms. Research is underway by the industry and research institutions to explore options for farming new species, for example kingfish and hapuka, and to increase the quality and quantity of yields of existing farmed species. The aquaculture industry is recognised as a growth industry with aspirations for the New Zealand aquaculture sector to have sales of $1 billion per annum by 2025[1].

One quarter of the farmed seafood produced globally is mainly in the form of bivalve shellfish. Aquaculture is the fastest growing food production system in the world. For the past 20 years, global production from aquaculture has steadily increased. This trend is projected to continue, especially for low energy intensive farming. Aquaculture is, for the first time, set to comprise half of the (humanly) consumed fish worldwide[2].

The strategic question arises as to how New Zealand's aquaculture industry fits into the mosaic of world fish and shellfish production, given New Zealand's current penetration of niche export markets based on quality food products. This situation contrasts with aquaculture production in many countries, where it is considered a relatively low cost policy instrument for increasing protein in the diets of subsistence farm families - and therefore more domestic and locally focused.[3] To understand the role of the aquaculture industry, one needs to understand the dynamics of how it functions within the local economy. This report attempts to do this for the Auckland region – to cast light on the economic impact of the aquaculture industry.

[1] New Zealand Aquaculture Council (2006) The New Zealand Aquaculture Strategy. Written by Mike Burrell and Lisa Meehan of LECG Ltd for the New Zealand Aquaculture Council, the New Zealand Seafood Industry Council and the Ministry of Economic Development.
[2] FAO (2009) State of World Fisheries and Aquaculture. Rome: United Nations, Food and Agriculture Organisation. See Appendix 1 for recent trends in world fishery and aquaculture production.
[3] See for example the UN FAO's programme for sustainable aquaculture development at ftp://ftp.fao.org/docrep/fao/012/x4208e/x4208e00.pdf

1.2 Rationale for this analysis

The Auckland Regional Council identified a gap in information on the economic contribution of aquaculture in the region. Little was known about the combined economic effect of harvesting and processing and the economic effects of expansion in the sector. This is the first attempt to integrate both aquaculture farming and processing, and measure their combined impact for the Auckland region. The approach is to apply regional input-output economic modeling to generate regional multipliers for Auckland's aquaculture industry, as in 2008-2009. Input-output analysis is highly relevant to supply chain analysis, and its use for tracing the value added through supply chains in regional economies is internationally well documented[4].

An economic impact assessment traces spending through an economy and measures the overall effect of that spending on the local economy. Estimating the economic impact of an activity is instrumental in the planning cycle, as it leads to an understanding of potential benefits of growth. It is one component of estimating the consequences of a particular project or expansion of an industry on the economy, and should be used systemically in conjunction with broader social, environmental, ecological and cultural considerations.

1.3 Aquaculture in the Auckland region

Currently green lipped mussel and pacific oyster farming prevail in the Auckland region. Oyster farming occurs on intertidal racks in the Mahurangi Harbour, Waiheke Island and Wairoa Bay and mussel farming occurs on long lines around Great Barrier Island, Waiheke Island and the Firth of Thames. The Auckland region is not the largest regional aquaculture producer in New Zealand, but does have some significant farms and produces around 26 per cent of the total production of New Zealand Pacific Oysters and around 3 per cent of the total production of New Zealand Greenshell™ mussels[5]. Nationally, the aquaculture industry sees the north east of the country as vitally important in meeting its growth target, especially in the development of higher value added species and processes. Provision for the farming of new species and the introduction of innovative technologies is recognised as an important component of providing for aquaculture in the Auckland region in the future. Nevertheless the economic impact of the industry in the region and the inter-linkages with other sectors of the economy was unclear, and this report aims to rectify this. Of particular importance for the Auckland region is the extent of secondary industries using aquaculture produce. Auckland is important not only for what is farmed within the region, but also what is processed in the region from contiguous areas. Additionally the proximity to local and international distribution points and infrastructure (including transport, marketing and research services) provide critical resources for the industry. The Auckland region contains the largest local market for aquaculture products, plus the Ports of Auckland and the airport also provide critical export infrastructure.

[4] See for example Albino *et al* (2002) and McDonald and Patterson (2008).
[5] Aquaculture New Zealand (2009) New Zealand Aquaculture Farm Facts. 2nd Edition. June 2009.

2 Current Industry Structure

2.1 Activity

Marine farms in the Auckland region harvest two species – oysters and mussels. The temperate environment and sheltered and shallow bays of Auckland's intertidal areas are well suited to the cultivation and grow-out of Pacific oysters. Pacific oysters are grown on racks or in baskets in the intertidal area. Green lipped mussels are grown in deep water, on lines suspended from surface floats and prefer a cooler water regime such as in the Marlborough Sounds. Consequently, mussel production in Auckland is relatively limited.

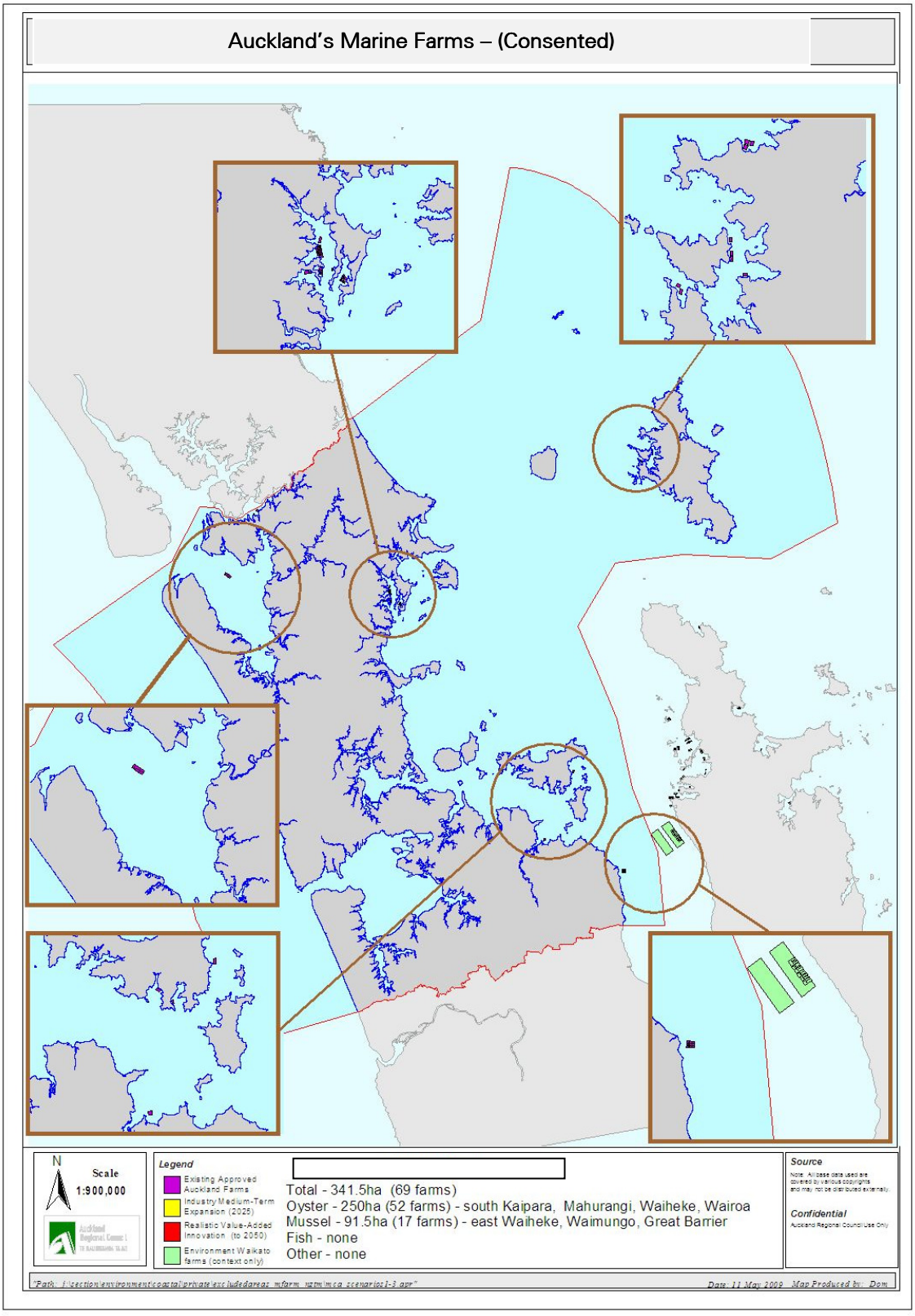
Auckland's aquaculture industry consists of 70 existing marine farms, covering an area of 341 hectares. The number of marine farms corresponds to the number of consented marine aquaculture areas within the region, and not necessarily to the number of businesses or operators. There are 22 oyster businesses and 11 mussel operators. Nearly three quarters of Auckland's marine aquaculture area is consented for oyster farming (250ha) – although not all of this area is fully farmed as yet - while the remaining quarter is consented for mussel farms (91.5ha). At any one time, the area under production may be less than that consented for, given preferences at the farm business level with regard to harvesting and fallowing.

Table 1. Consented aquaculture areas in the Auckland Region

	Aquaculture Farms (ha)	Main Activity
Mahurangi Harbour	122	Oysters
Kaipara Harbour	94	Oysters
Firth of Thames	59 *	Oysters and Mussels
Waiheke Island	34	Oysters and Mussels
Great Barrier Island	32.5 *	Mussels

The marine farms grow and harvest both oysters and mussels. Some farms also process their harvest themselves, while other farms do not have that facility and send their produce to processing centres. In the Auckland region, there are at least seven processing facilities for oysters and mussels – although not exclusively for these two shellfish, as some process other fish species. Auckland has significant processing facilities, handling 17,426 tonnes of mussels and 853 tonnes of oysters in the year ending March 2009 (Aquaculture New Zealand database, June 2009). Most notable from these figures is the extent to which mussels from other regions are processed in the Auckland region. This is an example of centralisation of processing activities. There is also consolidation within the industry, with examples of economies of scale in processing and shared marketing of aquaculture produce amongst businesses.

Figure 1: Location of Auckland's aquaculture industry



2.1.1 New Zealand Greenshell Mussels™

'The green-lipped mussel is one of several species of mussel (bivalves, family *Mytilidae*) that occur naturally in New Zealand. Green-lipped mussels are found in a variety of coastal habitats throughout the country, but are most common in central and northern regions. The species is sometimes found in the inter-tidal zone, but is predominantly sub-tidal, occurring most commonly from below low tide level to a depth of about 50m. It lives in a variety of habitats, anchored either to solid substrates, such as rocky faces or algal holdfasts, or forming clusters on sandy and muddy bottoms in sheltered embayments. The species frequently forms dense beds of up to 100m^2. Green-lipped mussels feed on phytoplankton and other organic particles, which they filter from water as it circulates through sieve-like gills' (Lloyd, 2003).

To farm the species, mussel spat are placed on cotton stockings and attached to longlines. Longlines consist of ropes attached to anchors and floats. Once the spat has attached itself to the rope, the stockings are no longer required and biodegrade, leaving the mussels attached to the longlines. After a process of thinning out to ensure enough space, the mussels are left to grow until they reach between 8 to 11cm. This entire process takes between 12 to 18 months.

Harvesting barges are used to lift the longlines from the water, strip the mussels from the rope and then take them to the shore for processing. Depending on the end product, and for what market, processing may involve cleaning the outside of the shell, minced and/or heat shocked and finally packaging for sale (Environment Waikato, 2007).

2.1.2 New Zealand Pacific Oysters

New Zealand Pacific Oysters (*Crassostrea gigas*) were first discovered from an oyster farm in the Mahurangi Harbour in 1971, but its origin, method and time of arrival to New Zealand is not clear – possibly arriving to New Zealand's shores in the 1950s. In the late 1970s they became the only farmed oyster species, and thrive in intertidal inlets, generally where water temperatures range from 14˚c to 22˚c (AquaBio Consultants, 2004). Oysters are filter feeders, and are able to survive periods of exposure or reduced salinity (freshwater inflows). Pacific oysters have a high growth rate, approximately 25mm per year, but can grow to over 75mm in their first 18 months.

The farming of oysters involves attaching spat to fixed frames/racks that are below sea level at high tide, but exposed at low tide. Spat is normally sourced from the wild, during summer time, but also can be sourced from hatcheries, where it is selectively bred for desirable characteristics. Spat is collected by placing bundles of spat sticks in areas where the spat naturally congregate. The spat are placed on the intertidal racks for between 12 to 18 months prior to harvesting, during the Autumn/Winter months (April to December).

2.2 Auckland in a national context

The New Zealand aquaculture industry had a harvest of 65,600 tonnes of mussels, 3,700 tonnes of oysters and 7,000 of finfish in the year to March 2009 (Aquaculture New Zealand database, June 2009).

Of this, Auckland had a harvest of 2,650 tonnes of mussels and 890 tonnes of oysters – equating to approximately 3 per cent of the national mussel harvest and 26 per cent of oysters, with no finfish production (Table 2) in the 2008 production year (noting that these proportions change, as not all farms harvest each year, and the amount of water space used for farming may be less than the total allocated or consented space).

Table 2. Aquaculture harvest data for New Zealand's regions (tonnes)

	Auckland	Northland	Coromandel	Marlborough	Canterbury	Southland	Other
Mussels	3%	-	22%	68%	1%	3%	3%
Oysters	26%	47%	21%	5%	-	-	1%
Salmon	-	-	-	75%	6%	19%	

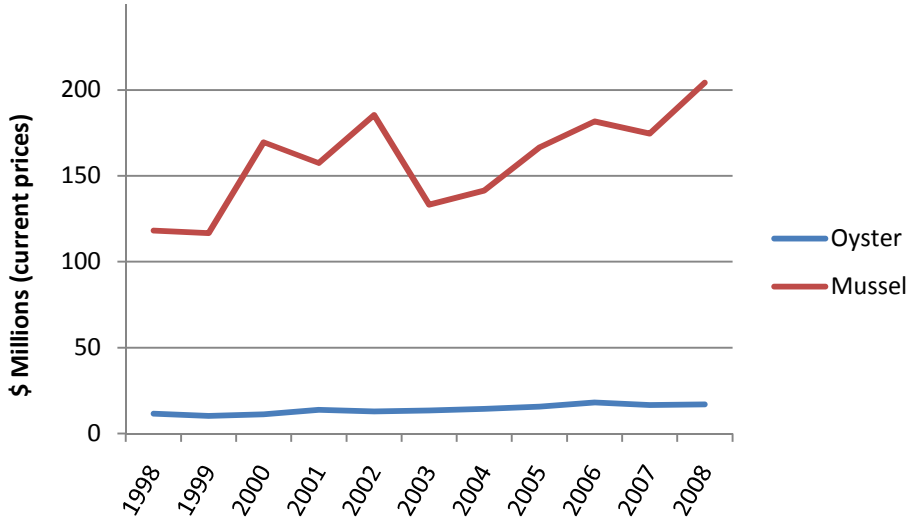
Source: Aquaculture New Zealand Levy Production data 2009

2.3 Exports

It is estimated that 80 per cent of New Zealand's mussel harvest is exported, 57 per cent of oyster harvest and 36 per cent of salmon harvest (Aquaculture New Zealand, 2009). There is no evidence that this export ratio differs for the regions. In terms of overall exports from commercial fishery and aquaculture activities, aquaculture made up 18 per cent of the total export value, while wild caught fish, the remaining 82 per cent in 2006[6]. Given the growth of the aquaculture sector worldwide, with significant increase in consumer demand for seafood, coupled with the fact that half the fish consumed worldwide is farmed rather than caught from the wild, there is considerable potential for growth in aquaculture exports for New Zealand. This is premised on the niche markets that the local industry could penetrate globally, based on high quality produce with environmental integrity and quality. The global aquaculture industry is estimated as one of the world's fastest growing primary industries, with recognition that catching and harvesting seafood needs to be managed to avoid the collapse of wild fish stocks. The total receipts from the export of mussels dwarves that of oysters, in dollar terms (Figure 2). However, the export value of oysters per kilogram is greater than that of mussels (Figure 3). There was an exception in 2001, when there was a significant increase in the amount of freeze dried mussel powder exported, raising the value of exports by weight for mussels. Processed mussel powder has a significantly higher export price than unprocessed mussel product.

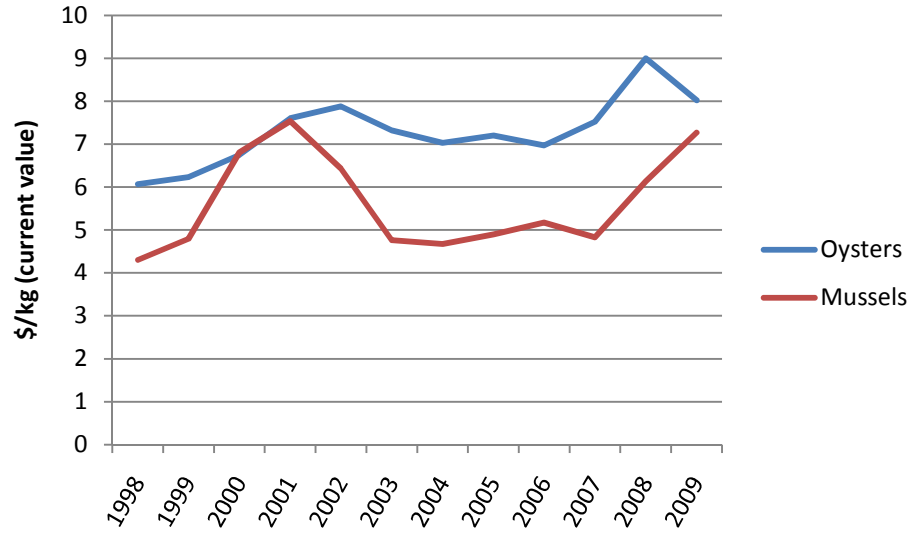
[6] Ministry of Fisheries. Retrieved from http://www.fish.govt.nz/en-nz/Fisheries+at+a+glance/default.htm

Figure 2: Value of New Zealand's mussel and oyster exports (current prices)



Source: Statistics New Zealand 'Harmonised System Classification' database.

Figure 3: Value per kilogram of New Zealand's oyster and mussel exports



Source: Statistics New Zealand 'Harmonised System Classification' database.

There is a range of the type of product that is exported, both for mussels and oysters (over 20 in total[7]), and it is clear that the type of processing determines the output value (sales) and value added to the product. However, the majority of shellfish exported are on the half shell and frozen (80 per cent of the value of all exported bivalves), while 11 per cent of the value of oyster exports is in live form, and 10 per cent of the value of mussel exports is as frozen meat (Table 3).

[7] Aquaculture New Zealand (2009) New Zealand Aquaculture Farm Facts.

Table 3.New Zealand's main shellfish products export (value)

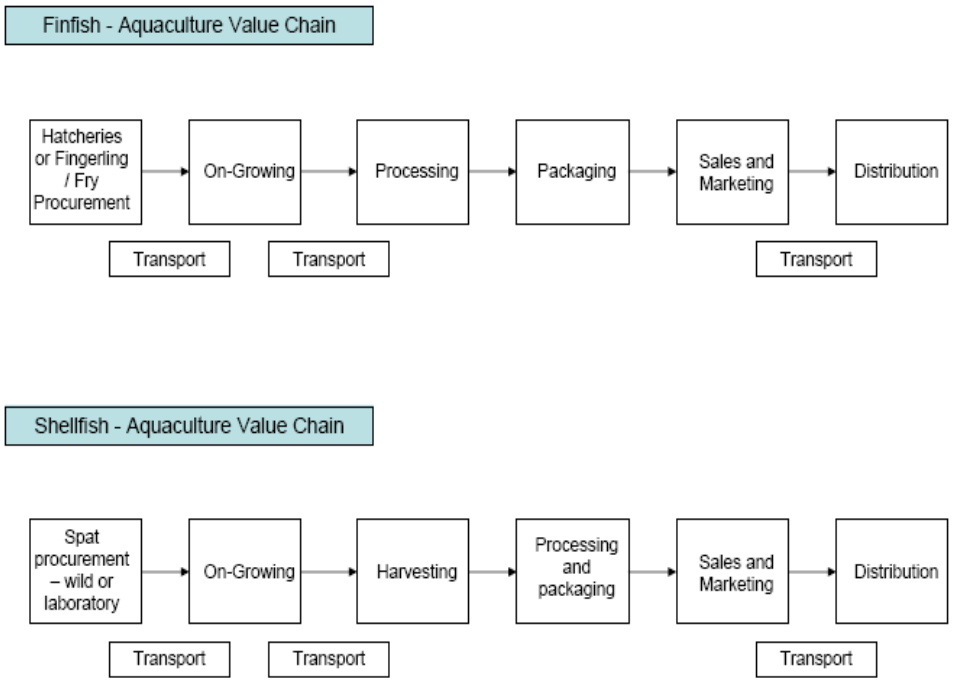
Main Products - Mussel Exports 2008			Main Products - Oyster Exports 2008		
	$ current prices (million)	%		$ current prices (million)	%
Half Shell Frozen	160.5	79%	Half Shell Frozen	13.4	80%
Meat Frozen	21.0	10%	Live	1.8	11%
Freeze-dried powder	13.0	6%	Half Shell Chilled	.9	5.5%
Whole Frozen	4.4	2.1%	Whole Frozen	.3	1.8%
Preserved/Marinated	3.3	1.7%	Meat Frozen	.08	0.5%
Live	1.2	0.6%	Other	.01	1%
Other	.6	0.3%			

Source: Statistics New Zealand 'Harmonised System Classification' database.

2.4 Extended industry

The aquaculture industry has an extended value chain, ranging from suppliers of materials used within the marine farms, to industries which use aquaculture produce in their manufacturing processes (for example neutraceuticals, cafes and restaurants), distributors and exporters. The aquaculture industry value chain was summarised by PricewaterhouseCooper (2006) and was described as covering the key functions in getting the aquaculture product from 'seabed to plate'. These functions are illustrated in Figure 4 below. Another regional study noted that Auckland is important for aquaculture retailing of equipment for that other region (Environment Waikato, 2007). Thus the inter-regional linkages are also important.

Figure 4: Aquaculture Value Chain



Source: PricewaterhouseCoopers (2006) p.10

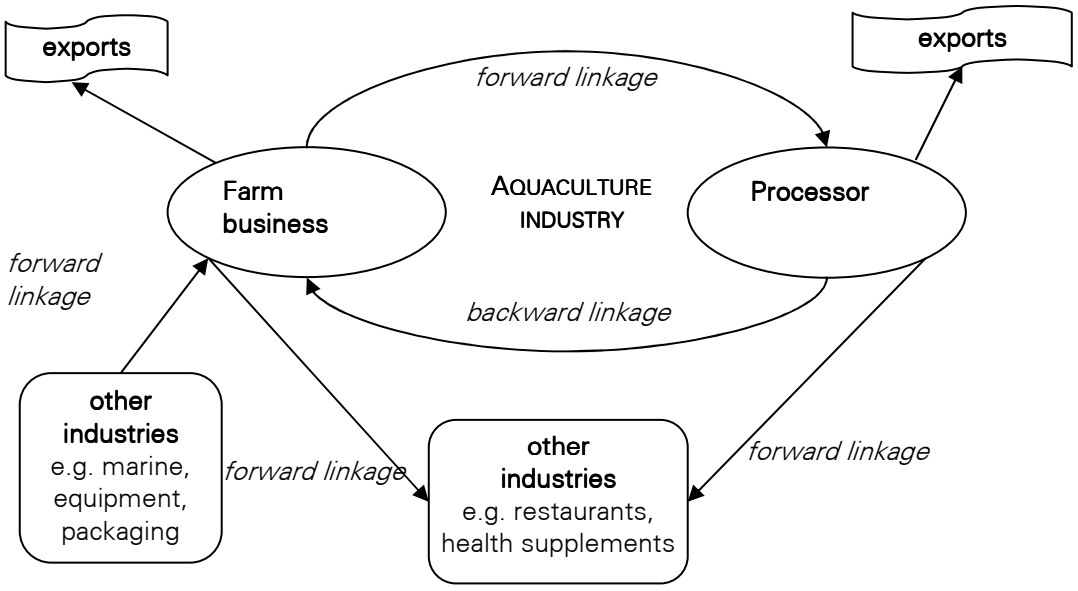
The economic activity from other regions (mainly retailing) is not integrated into this study, but it is noted that Auckland is important for the aquaculture industry nationally, given its size and specialised retailers. Furthermore, there are ancillary industries in operation in Auckland, based on marine farming whose economic activity are also not encapsulated into this study, due to lack of consistent data. These include scientific research in aquaculture, aquaculture consultancy and specialist legal practitioners. Their activities constitute the broader aquaculture industry. There are also considerable synergies and shared resources with the land based aquaculture industry in the region – increasingly through emerging governance structures such as AquA™[8], which views a potential for a successful aquaculture (land and marine) based business cluster in the Auckland region. This is due to the significant resources and competences within the (broad) aquaculture sector in Auckland.

[8] AquA™ (2009) Regional Aquaculture Cluster Business Case Assessment.

3 Methodology

In 2006, a review of different methodologies for measuring the economic effects of aquaculture, at a regional level in New Zealand, was undertaken[9]. The report endorsed an "Economic Analysis Framework" as a planning tool for aquaculture development, and identified economic impact assessment (EIA) as a critical component of that framework. EIA clarifies how expenditure in one industry impacts and flows onto other industries. This report applies the EIA method to the aquaculture industry (farming and processing) in the Auckland region. Economic impacts in this report are the changes generated by the aquaculture industry on the various other sectors that make up the Auckland economy. This occurs when businesses within the aquaculture industry purchase goods and services from other suppliers in the course of producing aquaculture products, and also include the effects of processing and exporting these products. The basic inter-linkages are set out in Figure 5.

Figure 5: Tracing linkages between industries



3.1 Economic Impact Assessment

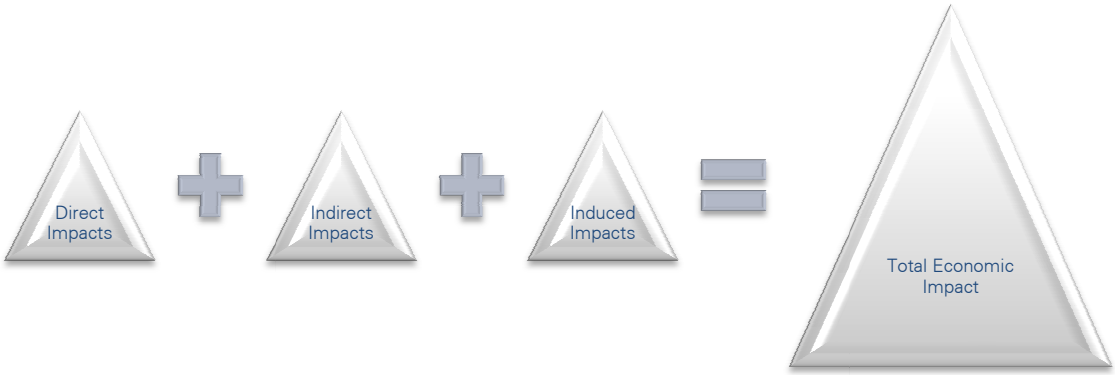
Three types of economic impacts are considered, based on the input-output model. They are:

- Direct impacts which relate to the injections of revenue and expenditure that can be specifically attributed to the aquaculture industry;
- Indirect impacts which arise as a consequence of changes in the level and value of sales for suppliers of goods and services to the aquaculture industry; and

[9] The report was written by PricewaterhouseCoopers in collaboration with New Zealand Trade and Enterprise, the Auckland Regional Council and Environment Waikato.

- Induced impacts which arise as a consequence of increases in the level and value of expenditure on goods and services, due to increased household incomes in the study area.

Figure 6: Total Economic Impact



The core of an economic impact assessment rests on an economic input-output model which documents the purchases between industry sectors, showing the inter-relationships between sectors. These input-output tables are published intermittently at a national level in New Zealand by Statistics New Zealand. The most recent input-output table was developed from a full inter-industry study in 1996, so show purchases between sectors at that time. Due to a lack of information indicating otherwise, an assumption that these patterns of purchase prevails in this study. A regional input-output table generated by Market Economics Ltd., using the Generation of Regional Input-Output Tables (GRIT) method was used.[10] The limitations of using this approach are acknowledged[11], but without having access to a regionalised census of production, this approach is the most appropriate to obtain regional input-output tables[12].

3.1.1 Regional Input-Output Tables

This regional table for Auckland has 123 industry sectors, and seven components of 'final demand' including household expenditure, private non-profit organisations serving households, the consumption of services provided by local and central government, changes in inventory (stocks), gross fixed capital formation and exports. In this table, aquaculture is a component of fishing, and aquaculture processing a component of seafood processing, which both also include marine (wild stock) fishing and processing. Therefore the aquaculture industry had to be separated into its farming (oyster and mussel) and processing components, measuring their inter-linkages with the other industries and final demand. This required building up a complete profile of aquaculture farming and processing in the region, creating two new industry sectors in the regional input-output table, while correcting the table by taking out these components

[10] Statistics New Zealand (2003) Regional Input-Output Study. Retrieved from; see also Jensen *et al*, (1980)
[11] Kronenberg (2009)
[12] Market Economics (2008) The Economic Impacts of the Seafood Sector in New Zealand.

from where they were embedded within the original table. The inter-linkages (as in Figure 5) between the aquaculture component and other industries could then be traced.

3.1.2 Economic Multipliers

A major extension of EIA and input-output analysis is the derivation of multipliers. The concept of a multiplier is that it is possible to effectively measure how a particular sector or industry is integrated with the rest of the economy. Multipliers can be seen as a set of simple mathematical relationships between one industry and the rest of the economy, and are used to measure the effects of a change in one industry on the overall economy. Multipliers are based on coefficients derived from the input-output transactions table.

An increase in final demand for any sector has repercussions throughout the whole economy, not just for that one sector. For example, if the demand for aquaculture products increases significantly, the sector (when unconstrained) will respond to this demand, by increasing production. This will require an increase in the inputs to that sector – perhaps more boats, racks, labour inputs. It may also require an increasing capacity in processing of the product, or in ancillary downstream industries such as pharmaceuticals if it is not sold directly. Also, if the increased production leads to higher profits and income, this will be saved, reinvested into the business or spent on consumer goods. These are different types of impacts making up the multiplier effects, and are categorised into three different types – direct, indirect and induced.

- Aquaculture farmers buy inputs required for production from suppliers and other industries. Increasing aquaculture output has a *direct* impact on the aquaculture industry by increasing employment, value added and expenditure. In this analysis the processing functions are also considered a part of the aquaculture sector, although technically they are two separate sub industries.[13]
- If aquaculture production increases, there is an *indirect* impact in industries such as those who supply to the (farming and processing) industry shown by the forward linkages and those industries that use aquaculture products, such as cafes and restaurants. Indirect impacts get smaller and smaller as you move out to other industries.
- An *induced* impact is brought about by the effects of increased expenditure on consumer goods, given that there is more money in the economy – through wages and salaries - brought about by the increase in economic activity.

Conceptually there are forward linkages to other industries which are not captured in this analysis, but where spin-offs of the aquaculture industry exist. It was not possible to gather information on the magnitude of various expenditures and where they occur. However, such spin-offs are acknowledged and noted as important, especially for an emergent industry, whose product has a potential range of uses in other industries. These impact effects are converted into 'multipliers', and two types are classified.

Type I multiplier captures direct and indirect backward linkage effects associated with direct expenditures. A type I multiplier measures interdependencies and is calculated according to:

[13] An adjustment needs to be taken to eliminate the backward linkages between farming and processing here, to avoid double counting the impacts.

$$\frac{\text{Direct Effect + Indirect Effect}}{\text{Direct Effect}}$$

In this study, the Type I multiplier can be interpreted as the net effects of an increase in investment in the aquaculture sector – for example a $100,000 investment on an existing farm impacts the aquaculture sector itself and other industries which supply to the aquaculture sector (an increase in the sale of equipment), along with the effects of increased activity in the sectors that use the product (an increase in oysters and mussels in the restaurant industry).

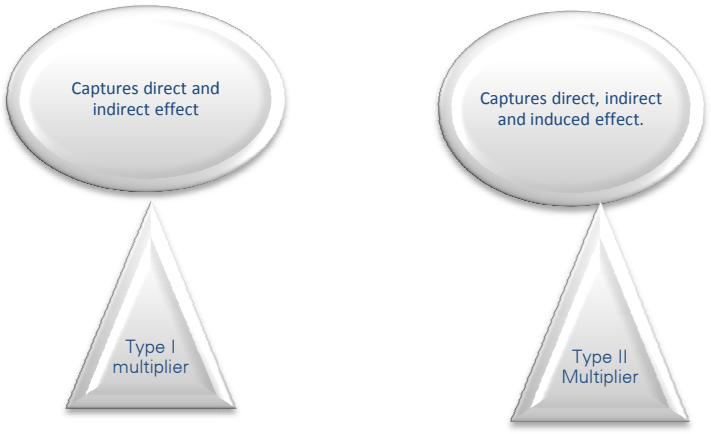
Type II multiplier measures the direct, indirect and *induced* effects, taking into account consumer expenditure in the economy stimulated by the increase in activity in the particular sector in question. It is calculated according to:

$$\frac{\text{Direct Effect + Indirect Effect + Induced effect}}{\text{Direct Effect}}$$

In this study, the Type II multiplier includes Type I plus the impact on the economy from an increase in consumer expenditure, brought about by the wages and salaries paid to the workers in the aquaculture sector.

Input-output analysis is based on average impacts. It maintains a set of assumptions about constant and uniform proportions of expenditure in the different sectors, and these are reflected in the multipliers.

Figure 7: Multipliers: Type I and Type II



3.2 Data Sources

In order to analyse the economic impact of the aquaculture industry, five main data sources were used:

- an industry survey of Auckland's aquaculture farmers, processors and ancillary aquaculture service providers;
- the Environment Waikato economic impact study of mussel farms;
- Aquaculture New Zealand's databases;
- Statistics New Zealand's *Annual Enterprise Survey*, and
- Statistics New Zealand's *Harmonised System Classification*.

In addition secondary data sources and published reports were used to check and triangulate all data used.

3.2.1 Primary data collection

Profiles of Auckland's oyster and mussel farms were created using a survey of aquaculture farms. The survey was developed to gauge the inter-industry linkages of aquaculture farms and aquaculture processors[14]. The data collection process for the survey was undertaken by an independent consultant (Enveco Ltd.), due to the sensitivities for the aquaculture farmers in divulging commercial financial information to the Auckland Regional Council, who is also the regulating (consenting) agency for the industry in the region. The survey was sent to all farmers and processors in the region. The response to the survey was low - only four responses aquaculture farmers were returned from a total of 20. However, this did not constrain the analysis, as it was still possible to construct a 'prototype' oyster farm for the region from the responses, and a 'prototype' mussel farm using the Environment Waikato study. It was assumed that the Environment Waikato study of mussel farms would be applicable to the Auckland region, given the shared location of mussel farms in the Firth of Thames for both regions.

There were three responses from a total of seven aquaculture processing businesses in the region.

In addition qualitative interviews with industry players (key informants) were conducted, using a 'snowball' process of sampling. The aim of this inquiry was to gauge the ancillary aquaculture services that are provided by individuals and businesses in the region. These ranged from legal services, consultancy, equipment manufacture and retailing, scientific research and education.

3.2.2 Secondary data collection

Aquaculture New Zealand, the industry body covering marine based aquaculture provided harvesting data for each region of the country. This is based on their levy data and was essential to get accurate figures for production in the region. It also enabled a vital calculation of tonnage per hectare farmed in the region, and was used in the triangulation of the survey data in generating regional figures.

[14] The survey was based on the questionnaire developed by Environment Waikato (2007). See Appendix 2.

The Annual Enterprise Survey (AES) is New Zealand's most comprehensive source of financial statistics and provides annual financial performance and financial position information about industry groups operating within New Zealand. From the AES, it was possible to extrapolate the ratio of purchases to total income for the fish industry, and establish the average mark up on aquaculture products. The key purpose of the AES data was to cross-check the survey results in terms of ratio of gross output to profit margins and mark-ups. The survey results were within 10% of the same ratios for their AES parent industries (fishing and seafood processing), which was considered within a satisfactory margin of error for use.

The New Zealand Harmonised system classification is published annually by Statistics New Zealand. It provides the data for international trade, and provides accurate data on aquaculture exports from the country. Given the harvest data, this dataset enabled a cross check of the amount of domestic consumption of aquaculture produce. It was found that the domestic price for aquaculture produce is the same as the export price, and it was found that the mark up on fresh mussel and oyster produce was 14 per cent, and on processed food 5 per cent.

3.3 Economic impact modeling

Within the regional input-output table developed by Market Economics Ltd, there are 123 industry sectors, concording to the 1996 ANZSIC industry classification. The latest national level input-output table (published by Statistics New Zealand) is for the 1996 year. When the regional input-output table was generated from this data, prices were updated to 2004 – which became the base year for the table.

Aquaculture farming is a component of the fishing industry, while aquaculture processing is contained within the seafood processing industry. The first step was to build an autonomous aquaculture industry into the regional table, by decomposing its constituent parts and subtracting them correctly from the fishing and seafood processing components of the original 123 industries. To do this, a profile of the aquaculture industry was constructed, using survey data, triangulated with existing reports and data sources.

'Model' oyster and mussel farms were developed, showing their inter-linkages with the other industries. Similarly a model aquaculture processing plant was constructed, based on survey data. These three models were scaled up to the regional level, based on the tonnage farmed and processed in the region, total weights as provided from Aquaculture New Zealand's database. Thus they formed the aquaculture component or sector within the input-output table.

Once this aquaculture profile was built, they were subtracted from their parent fishing and seafood processing industries in the original input-output table to avoid double counting, and entered as two separate industries, to calculate the economic impact of aquaculture farming and processing separately. A further adjustment was made to analyse the overall impact of the combined farming and processing (creating one aquaculture sector), as the forward linkages from farming into the processing industries would be double counted, if the two industries were simply added together. Dollar values of the aquaculture component were adjusted to 2004 levels, to be compatible with the input-output table. As stated above, all monetary values reported are not in current prices, but reported in 2004 dollar value terms for production in the 2009 year.

3.4 Scenario Development

The use of scenarios is increasingly common for comparing the status quo with a hypothesised situation. In this case, assessing the currently existing farms in the Auckland region represents the status quo. In 2007 three scenarios were modeled as part of a quadruple bottom line analysis which included the existing farms in the region, a moderate medium term expansion scenario and a larger value added innovation long term expansion scenario of the industry out to 2025. All scenarios were developed in consultation with the industry. This analysis took into account the modelling applied to the medium term expansion scenario. The locations of the localised expansions of existing farms were mapped as indicative, but provided a reasonably accurate proposition of the size and location of medium term industry expansion interest. The location of a 1,000ha block of mussel farm in the Firth of Thames was only approximate, but the size was guided by detailed numeric modeling of potential phytoplankton effects, and the location was selected to reduce potential impacts upon navigation, safety and visual amenity. For this exercise, no transaction costs of setting up the new space were included. Rather, the scenario was intended to answer, '*what* would like likely impact be *if*' questions, rather than determining the actual location of new space, and the associated opposition or disagreement which this might engender.

4 Results

Aquaculture's contribution to the regional economy is dominated by processing of aquaculture products, which is reflected in the three impacts reported here – output, gross domestic product (GDP) and employment. The results are given for aquaculture farming impacts, aquaculture processing impacts and the total of both. The impacts are further broken down into direct, indirect and induced impacts (Table 4). An adjustment has been made for the existence of forward and backward linkages between farming and processing. The figures reported here exclude this double counting, and farming impacts exclude those already captured in processing, and vice versa. Intuitively then the indirect value of output for processing is proportionately lower for processing than that for farming – the reason is due to the exclusion of these linkages and given the dependence in processing on output from the farming sector.

The results presented are a static analysis for aquaculture farming and processing for the 2008-09 year. The lack of survey data for preceding years/time periods restricts an analysis of effects brought about by price changes for aquaculture products or for commodity prices.

4.1 Economic Impacts

Aquaculture contributed $\$_{2004}$72 million of output to Auckland's economy. This equated with $\$_{2004}$28.2 million of value added or gross regional product (GDP), or 0.06 per cent of Auckland's total regional GRP. In terms of employment, there are 507 full time equivalents (FTEs) resulting from aquaculture in the region in the 2008/2009 year.

Table 4. Total Economic Impact of Auckland Region Aquaculture Sector, 2008-09

	Aquaculture Farming Impacts[1]	Aquaculture Processing Impacts[2]	Total Economic Impact
Output ($\$_{2004}$mil)			
Direct	6.6	42.2	48.7
Indirect	4.5	14.2	18.7
Induced	0.8	4.1	5.0
Total	**11.9**	**60.5**	**72.4**
Value Added ($\$_{2004}$mil)			
Direct	3.1	13.7	16.8
Indirect	2.2	6.7	8.9
Induced	0.4	2.0	2.5
Total	**5.7**	**22.4**	**28.2**
Employment (FTEs)			
Direct	66	275	341
Indirect	37	104	141
Induced	4	21	25
Total	**107**	**400**	**507**

Notes:
1. Excludes impacts already captured in Aquaculture Processing.
2. Excludes impacts already captured in Aquaculture Farming.

4.1.1 Gross Output

Gross output is the total value of sales before subtracting the value of intermediate goods used in the production of the output. The gross output for the aquaculture industry in the 2008/2009 year was $\$_{2004}$72.4million (Table 4). Sales from aquaculture processing dominated this total (85 percent) with $\$_{2004}$60.5million worth of output, while there was $\$_{2004}$11.9million worth of farming output. The gross output figures were further split into direct (aquaculture industry – farming and processing), indirect (associated industries that supply to the aquaculture industry and also use aquaculture produce) and induced output (associated with the extra money spent in the economy from wages paid within the aquaculture sector). The direct total impact of aquaculture constituted two thirds of gross output (67 percent), indirect was just over a quarter (26 percent), with induced the remaining seven percent.

4.1.2 Value Added

Value added or gross domestic product (GDP) is the value of sales minus the value of intermediate goods used in the production of that output. The aquaculture industry is estimated to account for $\$_{2004}$28.2milllion of Auckland's GDP, or 0.06 per cent of Auckland's total regional GDP. As stated above, a limitation with any static analysis is that it is a snapshot, based on fixed prices and set industry linkages for a fixed time period. It can not capture dynamics such as changing product or commodity prices, which are relevant to an emerging industry such as aquaculture.

The contribution to GDP is comprised of aquaculture farming impacts ($\$_{2004}$5.7milllion or approximately 20 per cent of total) and aquaculture processing impacts ($\$_{2004}$22.4milllion, 80 per cent of GDP impact). As a rough comparison, the fishing industry (aquaculture farming and wild catch) contributed $\$_{2004}$25.4m of value added to Auckland's regional economy[15]. This implies that the aquaculture component (aquaculture farming) makes up approximately one fifth of this total value added ($\$_{2004}$5.7m).

4.1.3 Employment

The employment associated with the aquaculture industry, including direct, indirect and induced employment, is estimated to be 507 full time equivalents (FTEs). Over half of these FTEs (275) are employed directly in aquaculture processing and a further 20 per cent (104 FTEs) employed in industries supporting aquaculture processing. Sixty six FTEs were employed directly in aquaculture farming (13 per cent). The Business Directory data for February 2009 showed that Auckland has 13 per cent of New Zealand's aquaculture farming employee counts and 10 per cent of seafood processing employees (noting that this also includes the processing of all fish).

4.2 Economic Multipliers

An increase in final demand for any sector has repercussions throughout the whole economy, not just for that one sector. The effect of a change in demand in one sector is 'multiplied', through the effects of changes brought about in other sectors. Thus, multipliers are a ratio of

[15] Auckland Regional Council's Economic Futures Model.

the overall economic change to the (initial) direct change in the economy, given that economic activity in one sector has knock-on effects in other sectors. Multipliers are premised on the concept of co-dependence between sectors. The multipliers for the Auckland's aquaculture sector, further divided into type I and type II multipliers, are shown in table 5. Type II differs from type I as it includes induced effects, along with direct and indirect effects.[16] For the Auckland region, if output in the aquaculture industry (both farming and processing) were increased by $1,000, the overall effect in the output of the regional economy would be an increase of $1,490, and takes into account induced effects. This includes the original $1,000, plus an additional $490 through repercussionary effects in other sectors associated with aquaculture and also through increased household expenditure, brought about by wages and salaries paid to employees of the aquaculture sector. If there were an increase in value added (GDP) of $1,000 in the total aquaculture sector, the estimated effect would be an increase of $1,670 to Auckland's GDP. If 100 extra people were employed in the aquaculture industry, it is estimated the effect in the regional economy would be an increase of 149 people (FTE) in total. As with the economic impacts, a breakdown of the multipliers is also given for both farming and processing, alongside the total sector impact.

Table 5: Auckland Region Input-Output Multipliers, 2003-04

	Aquaculture Farming	Aquaculture Processing	Total Aquaculture
Impact Ratios			
Value Added : Gross Output	0.48	0.32	0.35
Employment : Gross Output (FTEs/$\$_{2004}$mil)	10.05	6.52	7.00
Output Multipliers			
Type I Output Multiplier	1.69	1.34	1.38
Type II Output Multiplier	1.82	1.44	1.49
Value Added Multipliers			
Type I Value Added Multiplier	1.69	1.49	1.53
Type II Value Added Multiplier	1.82	1.64	1.67
Employment Multipliers			
Type I Employment Multiplier	1.56	1.38	1.41
Type II Employment Multiplier	1.63	1.45	1.49

[16] See section 3.1.2 for full description of multipliers.

4.3 Scenario: Moderate expansion of the industry.

For the purpose of this economic impact assessment, the effects of an additional scenario were measured, to gauge the economic changes brought about by growth in the sector. The effects of having moderate expansion of the aquaculture industry were modelled. This included the existing farms in the region, plus medium term expansions of the industry until 2025. This scenario was developed in consultation with the industry, and involves an expansion of current farming practices, an increase in oyster and mussel farms (1,165ha) in intertidal areas. It was assumed that there would be an increase of 137ha for oysters, and 1269ha for mussels, given the preferences of industry and through identifying potential areas for the location of these areas. It was also assumed that all produce harvested within the region would be processed within the region for this scenario[17].

Table 6: Summary results: Moderate expansion of the industry scenario

Year	2006	2011	2021	2031
Auckland Region Value Added ($2009m)				
Current situation	65,790	74,072	94,089	117,559
Scenario (moderate expansion)	65,790	74,080	94,172	117,718
Net Increase	0	8	83	159
per cent increase above of current situation	0.00%	0.01%	0.09%	0.14%
Auckland Region Employment (FTEs)				
Current situation	601,612	642,970	744,603	853,333
Scenario (moderate expansion)	601,612	643,034	745,468	854,955
Net Increase	0	64	865	1,622
% of current situation	0.00%	0.01%	0.12%	0.19%

The total economic impact is shown in Table 6, incorporating the overall effects – both farming and processing. The timing of these effects is important, given that benefits are not realised immediately after an expansion, but staged through time. By 2031, value added or regional domestic product would increase by $\$_{2009}$159m over 2009 levels – this is an expansion of the current economy of 0.14 per cent. Cumulatively, this would amount to an additional $\$_{2009}$1,921m in the Auckland economy between 2009 and 2031, equivalent to 2.9 per cent of current regional GDP value.

This would create an additional 1,622 full time equivalent positions in the regional economy by 2031. As with GDP, this increase is gradual over the years between 2009 and 2031. This is an increase in the current number of FTEs of 0.19 per cent.

In the future, growth in the industry is likely to include new higher value species, which would probably have higher value added. However, it was not possible to model such effects in the current framework/methodology, given that there was no data available on the interlinkages of alternative species in the Auckland economy. Nevertheless, it is postulated that the values in this scenario are conservative if higher value species were introduced to the Auckland region.

[17] For a full description of this scenario see Giorgetti (2010).

5 Conclusions

This study looked at Auckland's aquaculture industry through the lens of an Economic Impact Assessment. It used survey data from aquaculture farmers and processors, in conjunction with data from the national aquaculture industry body and secondary data sources to measure the impacts of the industry in the region. Three economic impacts were measured: output, value added and employment. Multiplier analysis was also conducted, for farming and processing separately, and combined. The study revealed that the industry is relatively small in the regional economy, contributing an estimated 0.06 per cent of gross regional product. A limitation to this analysis is that it is static, showing the impacts in one year only – a snapshot of the industry. The lack of time series data masks changes to an emergent industry. Importantly more work needs to be undertaken to gauge the effects of introducing new species into the Auckland region – such as finfish. As the input-output model is based on historical trends, it cannot accurately gauge the effects of these higher value species. A moderate expansion of the aquaculture industry was modelled as a scenario, to measure the projected effects to the regional economy. This was based on the medium term aspirations of the existing industry, an expansion of the mussel and oyster areas farmed.

Aquaculture has been identified as a growth industry nationally, with opportunity for export development, employment and innovation – with the aspiration for the sector to achieve output of $1billion by 2025. This regional analysis is one component of the overall national industry, and should also be seen within this context. Due to lack of national survey data the relative contribution of Auckland's aquaculture sector nationally is not clear. However, such data requires commitment and input from the industry nationwide to assess the national impacts of regional growth, and is out of the scope of this study.

This study highlighted the relative importance of aquaculture processing in the Auckland region, serving the region itself and surrounding regions. The processing facilities are dependent on domestic aquaculture farms, so a symbiotic relationship exists. The proximity of exporting facilities is another consideration for the industry in Auckland, as are the ancillary industries located in Auckland. The economic contribution of these industries (land based aquaculture, research, marketing, legal services) were not factored in the economic impact analysis but are important components to consider for an emergent industry.

6 Acknowledgements

The contribution of aquaculture businesses in the region, who took time to complete and partake in this study is greatly appreciated. The support of the industry body, Aquaculture New Zealand is greatly acknowledged, and their contribution of regional levy data for inclusion in the analysis.

Annabelle Giorgetti of Enveco Ltd. collected survey data and provided information from interviews with ancillary industry members, providing a rich context of the extended value chain of the industry.

Thanks to Environment Waikato for making their 2007 study of the economic impact of aquaculture in the Waikato region available, and to Covec Ltd. for clarifying questions relating to the Environment Waikato methodology.

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Appendix 1 World fisheries and aquaculture production and utilisation.

		2002	2003	2004	2005	2006
Production		Million tones				
	Capture	8.7	9.0	8.9	9.7	10.1
Land	Aquaculture	24.0	25.5	27.8	29.6	31.6
	Total land	32.7	34.4	36.7	39.3	41.7
	Capture	84.5	81.5	85.7	84.5	81.9
Marine	Aquaculture	16.4	17.2	18.1	18.9	20.1
	Total marine	100.9	98.7	103.8	103.4	102.0
	Total Capture	93.2	90.5	94.6	94.2	92.0
	Total Aquaculture	40.4	42.7	45.9	48.5	51.7
	Total World Fisheries	133.6	133.2	140.5	142.7	143.6
Utilisation						
	Human consumption	100.7	103.4	104.5	107.1	110.4
	Non-food uses	32.9	29.8	36.0	35.6	33.3
	Population (billions)	6.3	6.4	6.4	6.5	6.6
	Per capita food fish supply (kg)	16.0	16.3	16.2	16.4	16.7

Note: excluding aquatic plants.
Source: FAO (2009) The State of World Fisheries and Aquaculture, 2008. Rome: United Nations Food and Agriculture Organisation.

Appendix 2 Survey of aquaculture operators

Request for Information from Aquaculture Operators in the Auckland Region

We are attempting to evaluate the contribution of aquaculture to the Auckland regional economy, through an Economic Impact Assessment. An economic Impact Assessment model is an economic tool, which analyses the flows between sectors within the (regional) economy, to understand and evaluate the supply chain impacts of a particular sector. At present, we have a regional model for the Auckland economy, built by an independent consultant (Garry Mc Donald of Market Economics, Auckland), using various datasets from Statistics New Zealand. However, aquaculture at present is treated as a component of the fishing industry. Given the different cost structure and nature of activities between marine and farmed fishing, it is not possible to disaggregate relative contributions in our model, in the current form. We require more information on the actual inter-linkages between the aquaculture industry and the regional economy.

There are two components to these inter-linkages:

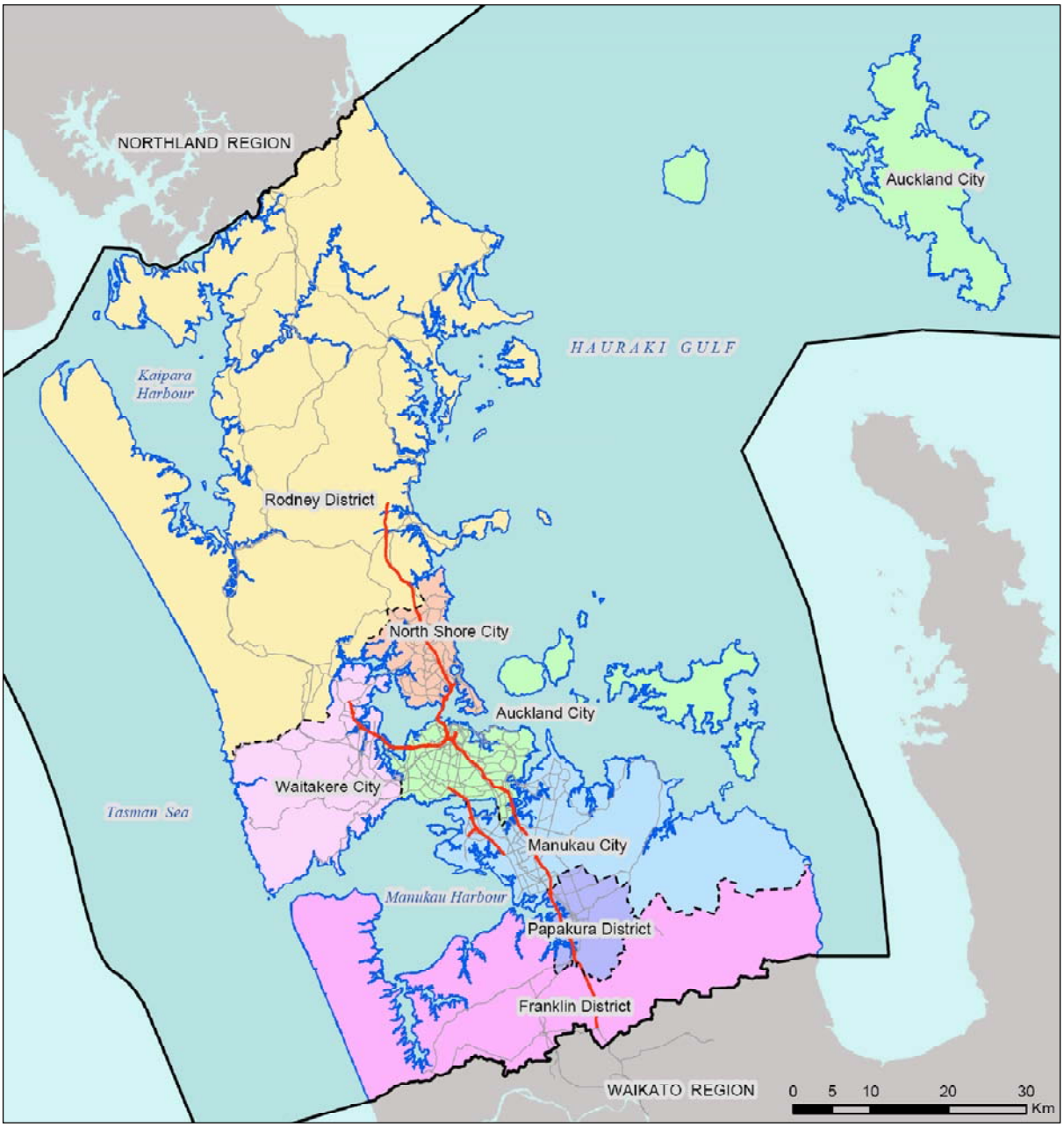
The first is finding out what the Auckland aquaculture industry purchases from other sectors in the Auckland economy (including capital expenditure on boats, buildings and other equipment; running costs including wages, administrative costs for services etc).

The second component is finding out where output/produce goes to – how much is consumed directly, processed or exported.

This exercise was completed for the Waikato Region, by Environment Waikato and their consultants, Covec. We considered using the data obtained from the Environment Waikato study as a base for scaling aquaculture activities to the Auckland Region. However, it soon became apparent that the proportion of mussel and oyster farms differed significantly between regions; that it was inaccurate to extrapolate 'average' figures for activities in the Auckland region; and we needed more information on what was spent by the Auckland aquaculture industry within the region itself. Therefore we are looking to fill this information gap, for the Auckland region. We would use the same methodology as the Environment Waikato report, for the Economic Impact Assessment.

Once the contribution of the aquaculture industry in understood, it is possible to extrapolate the effect of expansion of the sector into the future, and its contribution to the economy. This would not take into account any changes in technology associated with aquaculture, but would capture the net effect on the economy, if it were to be similarly structured at a future date.

There is quite detailed cost structures and information on private businesses required in this survey. This data will be collected for the sole purpose of carrying out an economic impact assessment, and will be used for no other purpose by the Auckland Regional Council, or any other organisation. Confidentiality of data will be ensured by the aggregation of individualised data into a cost structure for the (Auckland) aquaculture industry as a whole. At no point will data on an individual business be published, nor will detailed information relating to businesses in a geographical location within the region be discernible. Under the Local Government Official Information and Meetings Act 1987, confidentiality of the data supplied by the aquaculture industry would be ensured given that disclosure of such information "would be likely unreasonably to prejudice the commercial position of the person who supplied or who is the subject of the information" (LGOIMA 1987 No. 174 (7)-2b).



Map showing Auckland Region's Boundaries

Aquaculture Survey for the Auckland Region – Aquaculture Grower/Farmer

Name: (company/farmer)_____
Farm Size (hectares)_____

Species farmed: *Annual Harvest Tonnage* *Farmed Hectares*
Mussels
Oysters
Other (please specify species)……

Activity conducted in the last year, and in/from which region/location

	Auckland Region	Elsewhere in New Zealand (Please state location)	Offshore
Spat procurement			
Growing and Farming			
Harvesting			
Processing **			
Packaging			
Sales (please indicate relative proportion "%" of sales):			
Unprocessed product to seafood wholesaler			
Unprocessed product to shop/supermarket			
Unprocessed product to seafood processor			
Unprocessed product to cafes/restaurants			
Unprocessed product for export			
Direct to consumers/households (e.g. at food stalls, farmer's markets, own café/restaurant etc).			
Processed, to wholesaler			
Processed to export market			
Processed to cafes/restaurants			
Revenue from non-fish products (e.g. expertise on aquaculture, conferences, research grants etc.)			
Marketing			

Employment on Fish Farm

	No. of employees	No. of employees living in Auckland Region	Months per year worked
Full time year round			12
Part time year round			12
Full time seasonal			
Part time seasonal			

Total Revenue (for all aquaculture business activities) $_____
Total annual gross profit (before tax): $_____

** If your business also processes your own product, please go to page X for producer and processing questions

Annual Operating Costs for Farming Activities

	$	If you buy any of these products/ services from outside the Auckland region, please specify from where, and/or the proportion from the other region.
Spat		
Wages, employee compensation (e.g. bonus, kiwisaver)		
Employee benefits (e.g. vehicles or other, please specify)		
Building/shore base – lease or depreciation		
Barges/vessels – lease or depreciation		
Barges/harvesting contracting fees		
Barges/vessels – repair and maintenance		
Ropes, floats & anchors – depreciation		
Cotton stockings		
Vehicles – lease or depreciation		
Other equipment repair and maintenance (please specify)		
Fuel		
Freight, shipping charges		
Water quality and administration fee		
Wharfage fees		
Legal, accounting, professional fees		
Insurance		
Utilities – telephone, power, internet etc		
Bank Interest		
Property and local rates/taxes		
Consent Application		
Aquaculture New Zealand fees		
Other significant expenses (if any, please specify)		
Total Annual Operating Costs	**$**	

Auckland Aquaculture Processing Survey

Name of Company……..

Main Products/activities……

Employment

	No. of employees	No. of employees living in Auckland Region	Months per year worked
Full time year round			12
Part time year round			12
Full time seasonal			
Part time seasonal			

Markets for products/type of sales (Please state relative proportions – per cent of sales, or value of sales)

	Auckland Region	Elsewhere in New Zealand (Please state	Exported Offshore
Seafood wholesaler			
Shop/supermarket			
Cafes/Restaurants			
Direct to households (e.g. at food stalls, farmer's markets, own café/restaurant etc)			
Direct export markets			
Other market (please specify)			

Annual Revenue

Total Revenue (sales from processing operation): **$**_____

Total Annual Gross Profit (before tax): **$**_____

Proportion of fish stocks purchased in last year (if more than one product)?

	Annual Tonnage	Dollar Value $	Proportion purchased from Auckland Region	Proportion purchased from other region
Mussels				
Oysters				
Other farmed stock (please specify)				
Non-farmed fish (no need to specify region purchased from)				

Annual Operating Costs for Processing Activities

	$	If you buy any of these products/ services from outside the Auckland region, please specify from where, and/or the proportion from the other region.
Total Fish Purchases		
Wages, employee compensation (e.g. bonus, kiwisaver)		
Employee benefits (e.g. vehicles or other, please specify)		
Building - lease or depreciation		
Vehicles – lease or depreciation		
Vehicles - maintenance		
Fuel		
Plant and machinery (lease or depreciation)		
Plant and machinery – repair and maintenance		
Containers and packaging		
Warehousing/cold storage costs		
Office Supplies		
Other Supplies		
Advertising and Marketing		
Industry Levies		
Legal, accounting, professional fees		
Insurance		
Utilities – telephone, power, internet etc		
Interest (mortgage etc)		
Property and local rates/taxes		
Other significant expenses (if any)		
Total Annual Operating Costs		

Questionnaire for businesses that have farming and processing activities

Name: (company/farmer)_____

Farm Size (hectares)_____

Species farmed: *Annual Harvest Tonnage* *Farmed Hectares*

Mussels

Oysters

Other (please specify species)……

What proportion of your harvest is:

Processed in your own premises?.....

Sold as unprocessed product?.....

Do you buy in/process any fish from other farms?

If yes, what proportion of all processed product is from bought in stock?

Sales Activity conducted by region (for last financial year)

Please indicate $ value of sales, (or relative proportion of sales)	Auckland Region	Elsewhere in New Zealand (Please state location)	Offshore
Sales			
Unprocessed product to seafood wholesaler			
Unprocessed product to shop/supermarket			
Unprocessed product to seafood			
Unprocessed product to cafes/restaurants			
Unprocessed product for export			
Direct to consumers/households (e.g. at food stalls, farmer's markets, own café/restaurant etc).			
Processed, to wholesaler			
Processed to export market			
Processed to cafes/restaurants			
Revenue from non-fish products (e.g. expertise on aquaculture, conferences, research grants etc.)			
Marketing			

Annual Revenue

Total Revenue: $_____

Total Annual Gross Profit (before tax): $_____

It is important that you differentiate the costs associated with farming and those associated with processing. If some of the cost items are for both farming and processing, please give an indication of the proportion attributed to each activity.

	Farming	Processing
Building/shore base – lease or depreciation		
Barges/vessels – lease or depreciation		
Barges/harvesting contracting fees		
Barges/vessels – repair and maintenance		
Ropes, floats & anchors – depreciation		
Cotton stockings		
Other equipment repair and maintenance (please specify)		
Water quality and administration fee		
Wharfage fees		
Legal, accounting, professional fees		
Insurance		
Utilities – telephone, power, internet etc		
Bank Interest		
Property and local rates/taxes		
Consent Application		
Aquaculture New Zealand fees		
Total Fish Purchases (spat for farming, non farmed for processing)		
Wages, employee compensation (e.g. bonus, kiwisaver)		
Employee benefits (e.g. vehicles or other, please specify)		
Building - lease or depreciation		
Vehicles – lease or depreciation		
Vehicles - maintenance		
Fuel		
Plant and machinery (lease or depreciation)		
Plant and machinery – repair and maintenance		
Containers and packaging		
Warehousing/cold storage costs		
Office Supplies		
Other Supplies		
Advertising and Marketing		
Industry Levies		
Total Annual Operating Costs		