

Economic Impact of Aquaculture in the Waikato Region

Prepared by:
Reuben Irvine, Mark Robinson & Andrea Carboni
COVEC

For:
Environment Waikato
PO Box 4010
HAMILTON EAST

June 2007

Document #: 1206170

Peer reviewed by:
Alex Steenstra

Date 6 August 2007

Approved for release by:
Paul Chantrill

Date 7 August 2007

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Executive Summary

Introduction

This report estimates the economic impact of the aquaculture industry on the Waikato Region's economy in terms of the additional GDP and employment it generates. It is envisioned that this research will help inform the decision making process for coastal planning in the Waikato Region. This is the first study of its type in New Zealand that estimates the regional economic impact of existing aquacultural activity.

Aquaculture began in the Waikato Region in the late 1960s with the establishment of inter-tidal oyster farms. It now also involves a relatively large amount of mussel farming and some shellfish processing. The Waikato Regional Coastal Plan identifies marine farming as an important industry that provides for the social and economic wellbeing of people and communities, primarily by creating jobs and contributing directly and indirectly to the local, regional and national economy.

Aquaculture Industry

The total value of aquaculture production throughout New Zealand was approximately \$289 million in 2004.¹ Mussels accounted for \$181 million, with 645 farms encompassing 4,747 ha of marine space. This produced around 95,000 tonnes, over three quarters of which was exported, bringing in around \$120 million in export earnings.

Oysters accounted for \$26 million, with 230 farms covering 750 ha of marine space. This produced just under 3,000 tonnes, two-thirds of which was exported, bringing in close to \$15 million in export earnings.

Regional Production

The aquaculture industry in the Waikato Region consists of around 40 core businesses that carry out a range of activities. The dominant form of aquaculture in the Waikato region is mussel farming, with around 900 ha of active mussel farms producing over 21,000 tonnes annually. Thus, mussel farming in the Waikato region accounts for around 20% of national mussel production. Oyster farming in the Waikato Region is relatively small in comparison, with less than 70 ha of farms producing around 640,000 dozen oysters per year, accounting for around 10% of national oyster production.

Most aquacultural activity occurs in the waters around the Coromandel Peninsula, although there are a few small farms on the west coast.

The total mussel harvest size across the Region has been increasing over the past few years (see Figure 1). The total harvest in Coromandel in 2006 was around 21,000 tonnes of mussels, compared with 17,600 in 2005 and around 16,000 in 2004. 2007 began with greater harvest sizes than the corresponding months in 2006.

Economic Impacts

Aquaculture contributes approximately \$27 million to Waikato's annual regional GDP. This is the total value, or wealth, added to the regional economy because of aquacultural activity. This impact of aquaculture can be broken down between the impacts resulting from farming activities (including harvesting) and those from processing activities. The farming of mussels and oysters accounts for around 70% of the industry's impact on regional GDP (\$19.1 million), while processing accounts for the remaining 30% (\$7.8 million).

Economic impacts can also be broken down by direct, indirect and induced impacts. The majority (\$18.9 million) of the \$27 million contribution to regional GDP comes from

¹ New Zealand Aquaculture Council.

the direct impact of revenue earned from within the aquaculture industry itself. Indirect impacts include the value-added by those who provide inputs to the aquaculture industry, eg fuel, utilities, professional services (accountancy, legal services, etc). These indirect impacts contribute \$3.7 million to regional GDP. Induced impacts, arising largely from the spending of households who receive wages and salaries resulting from aquacultural activity, contribute a further \$4.3 million.

Direct employment within the aquaculture industry itself equates to around 270 full time equivalent (FTE) positions. Because a large proportion of jobs are seasonal, especially within the processing sector, just under one-third (140) of the approximately 400 individuals directly employed in the industry are employed on a permanent full-time basis. Total wages and other remuneration received by employees within the industry is around \$10 million.

As well as generating direct employment for 270 FTEs within the industry, with employment split roughly evenly between farming and processing, aquaculture generates the equivalent of an additional 100 jobs throughout the region as a result of flow-on effects to other activities and industries. Accounting for both indirect employment effects as well as employment within the industry itself, aquaculture generates employment for a total of 370 FTEs throughout the entire Waikato Region. Around half of this total employment impact is the result of farming activity, the other half results from processing activity.

1 Introduction

1.1 Background

Aquaculture began in the Waikato Region in the late 1960s with the establishment of inter-tidal oyster farms. In the early 1980s mussel farming began and grew rapidly in the late 1980s and early 1990s. By the year 2000 there was approximately 500 hectares of aquaculture in the region of which 430 hectares were devoted to mussel farming. The majority of these farms are located around the coastline of the Coromandel Peninsula with the main concentration in the vicinity of Coromandel and Manaia Harbours. There is a small amount of oyster farming in Kawhia Harbour and a small amount of mussel farming in Aotea Harbour on the west coast.

In addition to these areas, Environment Waikato established a marine farming zone of about 1,200 hectares in 1999 in the Firth of Thames at Wilson Bay including 220 hectares of existing farms. Half of Area A (470 hectares) of the zone is developed and Area B (520 hectares) will be developed in two stages when it becomes an Aquaculture Management Area under the new legislation. The Waikato Regional Coastal Plan identifies marine farming as an important industry that provides for the social and economic wellbeing of people and communities, primarily by creating jobs and contributing directly and indirectly to the local, regional and national economy. However, there appears to be no recent empirical information on the economic effects of the aquaculture industry on the regional community.

In 2006 PriceWaterhouseCooper were engaged by New Zealand Trade and Enterprise, Auckland Regional Council and Environment Waikato to develop a methodology for assessing the economic effects of aquaculture at a regional and sub-regional level. The methodology developed included Economic Impact Assessment (EIA), Cost-Benefit Analysis (CBA) and Multi Criteria Analysis (MCA).

1.2 Objectives and Scope

The overall objective of this project is to produce research that can help inform the decision making process for coastal planning in the Waikato Region. This is assisted by estimating the economic impact of aquacultural activity. The key components of this research are to assess the regional economic impacts of:

- a) aquacultural farming and harvesting, and
- b) the related processing and distribution.

This report does not seek to provide a comprehensive economic or social cost-benefit analysis. This would require additional analysis to identify the net benefits to society from aquaculture by evaluating the value of resources (farmed areas, labour employed and capital invested) if these resources were used for other activities in the region. Rather, this report estimates the economic impact existing aquaculture activities have on regional GDP and employment.

2 Industry Activity and Structure

The total value of aquaculture production throughout New Zealand was approximately \$289 million in 2004.² Mussels accounted for \$181 million, with 645 farms encompassing 4,747 ha of marine space. Approximately 95,000 tonnes of mussels were produced, over three quarters was exported, bringing in around \$120 million in export earnings.

Oysters accounted for \$26 million, with 230 farms covering 750 ha of marine space. This produced just under 3,000 tonnes, two-thirds of which was exported, bringing in close to \$15 million in export earnings.

The aquaculture industry in the Waikato Region consists of around 40 core businesses that carry out a range of activities. While the majority of these businesses are involved in the farming of mussels, there are a range of other activities carried out by various operators. To understand the role these operators play, it is necessary to understand the activities that occur in the mussel and oyster farming industry.

Mussels are the predominant aquaculture crop in the Waikato region. Most farming activity occurs in the waters around the Coromandel Peninsula, although there are a few farms on the west coast near Kawhia. There are around 900 ha of active mussel farms which produce around 21,000 tonnes annually. This accounts for around 20% of national mussel production. Oyster farming in the Waikato Region is relatively small in comparison, with less than 70 ha of farms producing around 640,000 dozen oysters per year, accounting for around 10% of national production.

2.1 Mussel Farming and Processing³

The mussel farming process begins with the collection of the 'raw material'; mussel spat. Spat are very young shellfish and mussel spat develop from a floating larval stage. The larvae attach themselves to seaweed or ropes and develop into miniature shellfish 0.3 mm long – about the width of a needle tip. They move from site to site until they are 0.6 mm in length, when they attach themselves permanently to a settlement site.⁴ Greenshell mussels spawn at unpredictable times throughout the year.

The majority of the spat used in the Waikato Region is collected from seaweed cast ashore close to Kaitaia in Northland, although a small proportion of spat is collected locally. At least one business in the Coromandel collects spat using spat catching rope frames released from existing mussel farms.

Once delivered to the farms, the spat is placed in cotton stockings and attached to longlines, a process known as seeding. Longlines consist of long ropes attached to anchors and floats (buoys). The stockings are used to ensure that the spat attaches to the rope and does not drift away in the water. These 'seed mussels' are placed in the stocking so that they fix onto the rope at the rate of approximately 1,000 to 5,000 per metre. Once the spat has attached itself to the rope the stockings are no longer required. Over time these stockings biodegrade leaving the mussels attached to the longlines.

Mussels are filter feeders and feed on a wide range of food organisms including single cell algae, planktonic animals and detritus. These small particles are carried through the lines of suspended mussels by the constant tidal currents and provide a non-stop food source which occurs naturally in the sea water.

² New Zealand Aquaculture Council.

³ New Zealand Mussel Industry Council, "The Greenshell Story".

⁴ <http://www.teara.govt.nz/EarthSeaAndSky/HarvestingTheSea/Aquaculture/en>

After a period of some 3-6 months the nursery lines are lifted and the young, but now larger (approximately 10-30 mm) mussels are stripped from the ropes. The process is then repeated with the mussels being seeded at a rate of approximately 150 to 200 per metre onto a thicker and much longer rope, using larger diameter cotton stocking to once again secure them until they attach to the rope of their own accord. If the longlines are not 'thinned out' in this manner there will be greater crop losses because mussels will fall off the ropes as they are squeezed for space as they grow. This rope is then fixed in loops or bights to the fixed surface longline where it will remain until harvest time. As before, the cotton stocking biodegrades after the mussels have firmly attached to the growing line.

The mussels are left to grow until they reach a harvestable size, typically 8 to 11 cm. This entire process takes around 12 to 18 months. The exact timing of harvesting depends upon a couple of factors, including the time of spawning. Mussels are harvested prior to spawning to ensure they are as large as possible. This is because spawning causes them to lose a large proportion of their size and weight.

Weather conditions are another relevant consideration. Heavy rain can delay harvesting because run-off from dairy farms in the region can affect the quality of the sea water. Water quality testing is undertaken by the Coromandel Marine Farmers Association to ensure that the water quality is of sufficient standard before harvesting can be carried out.

Harvesting of the mussels takes place using specialised harvesting barges. These barges have specialised machinery that lifts the longlines from the water, strips the mussels from the rope and loads the mussels in bags. The bags of harvested mussels are deposited at the wharf onto freight trucks and taken for processing.

Processing involves cleaning off any material attached to the outside of the mussel shells. Depending upon the final product being produced, the mussels may or may not be removed from their shells, minced and/or heat shocked and then packaged in containers. Once packaged, the mussels are distributed to either wholesale or retail markets, including export markets. A majority of harvested mussels are exported.⁵

2.1.1 Level of Business Integration

There are a number of separate functions carried out in the mussel farming sector and different businesses perform different combinations of these functions depending on the degree to which they are vertically integrated.

At a basic level, a mussel farm requires an area of sea where longlines can be set and mussels can be grown. Carrying out this activity requires resource consent and an appropriate license. Although many farmers will own the consent (license) to occupy the farmed area, many do not and, instead, are involved in 'share-cropping' relationships with the license holders who are often involved in downstream processing and distribution functions. Licenses grant the holders with a right to occupy certain areas of seawater, but ultimate ownership of these areas remains with the Crown.

A mussel farm also requires a shorebase where various land-based activities can be carried out. Despite the marine nature of the industry, the work carried out on land constitutes a significant proportion of farmers' efforts. Specifically, at various times anchors, ropes and floats need to be stored, cleaned, repaired and maintained. Shorebases are also needed to store vehicles and fuel, prepare cotton stockings and as a location to carry out other miscellaneous activities. Shorebases may be owned by the farmer or leased from another operator. A typical 20 hectare farm would require a shorebase of around 0.8 hectares.

⁵ Although the exact proportion of mussels farmed in the Waikato for export cannot be determined, it may be similar to the proportion of national output that is exported. The proportion of national mussel production that is exported is typically around three quarters.

The ropes used for longlines are typically purchased from marine equipment suppliers in Auckland, as are some of the floats and anchors. Other floats and anchors are manufactured locally, sometimes by farm operators themselves. Growing lines may be around 3500 metres long.

Vessels are required for various purposes; the initial set-up of the longlines including seeding, maintenance and harvesting. Specialised barges may be used for the initial set-up and maintenance of the longlines. These can be worth around \$250,000 to \$500,000. The process of seeding, ie attaching the spat to the lines using cotton stockings, is either undertaken by farmers themselves or contracted out. In some cases, farmers may purchase previously seeded longlines that have 'junior' mussels already attached. Smaller, less specialised vessels are often used for more routine maintenance of lines.

Harvesting typically requires specialised barges that have mechanical apparatus for raising the lines and removing and bagging the mussels. These tend to be large barges costing around \$1 million to \$2 million. The barges, along with the specialised hydraulic machinery they contain, can be expensive to maintain. While some of the larger farms own and operate their own harvesting barges, many farms will contract out the harvesting function and a small number of operators provide harvesting services.

Most of the mussels harvested in Waikato are processed outside the region, with large processing facilities located in Tauranga and Auckland. Some of the processing activity that has previously been carried out in the region has ceased in recent years although some processing activity still remains. The remaining processor is Ocean Products Columbia, located in Whitianga. Processing can involve cleaning the mussels, heat shocking the mussels and/or adding various ingredients and then packaging them. The packaged mussels are distributed for sale to wholesalers or retailers.

The payments received by farmers depend not only on the size of their harvests, but also on the nature of their business relationships with the other players in the industry. For instance, farmers that have a share-cropping relationship may pay a license fee to the farm owner, contribute towards some of the operating costs and then receive a share of the final price for the processed mussels. In this case, there is no well-defined 'wholesale' price for harvested mussels at the wharf, but total revenues, and some costs, are shared between the farmer and the license holder-processor.

The costs of various aspects of a mussel farming operations, along with some indicative costs, are summarised in Table 1 below. Because the actual expenditures can vary significantly across different farms, these details should be treated as indicative only.

Table 1: Major expenses, mussel farming

Asset/expense	Main components	Cost & lifespan
Longlines	Ropes	Variable, 4 – 8 yrs
	Floats (buoys)	\$80 - \$150/float, 10 yrs
	Anchors	Variable
Harvesting barges	Vessel & machinery	\$1 m - \$2 m, 15 + yrs
Barges for set-up & maintenance	Vessel	\$200k - \$500k, 10 + yrs
Cotton stockings	Cotton	\$0.60/metre, disposable
Labour	Seeding & harvesting	Variable

2.2 Oyster Farming and Processing

Although following the same basic process, oyster farming has a few key differences to mussel farming. Instead of being attached to longlines suspended in the water, oysters are typically attached to fixed frames that are below sea level at high tide but exposed at low tide. As with mussels, oysters are filter feeders that consume food that occurs naturally in the seawater. Once the oysters have grown to an appropriate size they are harvested.

Processing involves breaking apart clumps of oysters that move along a conveyor belt towards a high-pressure washing zone. Cleaned oysters are graded by size and then prepared for sale. Some are sold alive in unopened shells, although most are presented in half-shell form, where the flat upper shell is removed and the meat remains in the concave lower shell. Once packaged, the oysters are distributed to wholesale or retail markets.

Oyster farmers may be involved in the processing, which is located in the Waikato Region, or they may sell the harvested oysters to independent processors.

3 Approach

The impact assessment has been conducted using the framework and method developed in Stage 1 of the project.

3.1 Methodology

Gross Domestic Product (GDP) is the most common way of measuring the size of an economy. There are several ways of measuring GDP, the most common being the *value added* approach. The value added approach is based on the premise that businesses purchase basic goods and services, add value to them and then sell the final goods and services to end consumers. The value that each business adds through this process is the difference between the final selling price and the cost of the basic goods and services. GDP describes the total value that all businesses *add* to the economy.

It is common to measure the impact of a development or activity by estimating the additional value (GDP) it adds to the economy. The term 'additional' is very important in the context of economic impact because impacts should only include effects that would not have existed in the absence of the development/activity. This means that simple shifts in market share between firms should be excluded from impact assessments.

There were three broad steps involved in estimating the economic impact of aquaculture in the Waikato Region:

1. Collection of primary data from aquaculture businesses in the region;
2. Calculation of economic multipliers (using the primary data); and
3. Estimation of the impact of the aquaculture industry on the Waikato economy.

3.2 Primary Data Collection

The evaluation method developed in Stage 1 is very data intensive and requires information that can only be sourced directly from participants in the aquaculture industry. The following process was used to collect data from aquaculture businesses in the region:

- Compile a register of all known aquaculture businesses in the Waikato region, including name of contact person, phone number, postal and email address. This was compiled using information held by Environment Waikato (aquaculture license

holders) and membership information held by the Coromandel Marine Farmers Association.

- All listed businesses were contacted initially by letter and/or email to inform them about the research, request their support and cooperation and ask whether there was a preferred means of completing the questionnaire for each operator, ie mail, telephone, email or online.
- A follow-up telephone call was made to each business that did not respond to the letter or email. This allowed information to be provided to those who had not received the initial contact and any specific questions to be answered. This call also allowed the precise nature of the relevant businesses to be identified, ie processors, farmers or specialist harvesters. It also allowed businesses that were situated outside the region to be eliminated from future correspondence.
- A detailed questionnaire for farmers/harvesters and for processors was then designed (see Appendix 2 for details). Although the broad categories of data required from these businesses was specified in the Stage 1 evaluation framework, the actual data requests had to be refined to make the questions more relevant to individual aquaculture businesses.
- Hardcopies of the questionnaire were posted to all businesses that did not register a preference for an alternative method, and the remaining operators were sent an electronic copy and a link to a data collection website. Phone calls were made to those who stated a preference for responding to the survey in this manner.
- Several follow-up phone calls were required to clarify some of the responses received. Publicly available data concerning area harvest totals and total farmed area were used to determine the proportion of output that the responses covered.

3.2.1 Questionnaire Design

The Stage 1 report included a draft questionnaire structure. However, it became apparent early in the research process that the draft questionnaire needed to be amended to: (a) support the production of economic multipliers; and (b) increase the relevance of the expenditure categories to aquaculture businesses.

We spoke to several key people in the industry and carried out extensive background research to inform these amendments, developing a detailed understanding of how the industry is structured, the key production linkages, where inputs are sourced from and how they are made.

Initial consultation was undertaken with Environment Waikato personnel familiar with the industry. Following this, we contacted the relevant industry bodies, including the Coromandel Marine Farmers Association and Aquaculture New Zealand. These organisations provided useful background material, as did the former New Zealand Mussel Industry Council.

A range of industry participants were also interviewed, including farmers, harvesters, processors and farm-owning license holders who are not involved in actual farming activities. Various other general sources were also investigated.

This consultation and research provided us with an understanding of the structure of the industry and the specific functions, operators and tasks within it. This, in turn, allowed us to build a picture of the likely expenses and revenues faced by each type of operator, which enabled us to specify the data that we needed. This understanding also allowed us to remove questions from the PWC questionnaire which were irrelevant to mussel and oyster farming and, therefore, could be potentially confusing for farmers in the Coromandel.

The final questionnaire (see Appendix 2) asked operators to provide detailed financial information about their businesses. This data was collected on a strictly confidential

basis and is not publicly available. The key information related to capital and operating expenditures. The questionnaire also asked businesses to indicate the percentages of expenditure in each category spent in the Waikato region.

3.3 Calculation of Economic Multipliers

The responses to the farming questionnaires collectively accounted for around 62% of the mussel farming and harvesting sector (measured against total output); the entirety of the mussel processing sector; and 77% of the oyster farming and processing sector. Our sample was therefore considered to be highly representative of the Waikato aquaculture industry.

This sample was then scaled to reflect the entire population of Waikato aquaculture businesses by combining our sample estimates of average cost and revenues calculated on a per tonnage basis for mussels and per farmed hectare basis for oysters. This provided a basis for estimating sector totals.

The estimates of revenue received and expenditure incurred in relation to aquaculture in the Waikato Region were then translated to estimates of additional GDP using regional industry multipliers taken from Geoff Butcher of Butcher Partners Ltd. These are included in Appendix 3.

Specifically, the estimated costs were organized according to the specific characteristics of the aquaculture industry and they needed to be resorted into the appropriate industrial categories. The industry categories were the standard categories used by the IO7 programme assess the economic impacts. The values were also price-adjusted using CPI indexation so that they were on the same year basis as the IO7 figures.

IO7 computes the relationships between different economic sectors in the region using several iterations of matrix algebra calculations and generates the economic multipliers.

The multipliers that we used for this study were:

- Output multipliers
- Value-added multipliers
- Employment multipliers

3.3.1 Data accuracy

Covec has relied on the accuracy of the information provided by various parties. We have sourced and accepted this information in good faith and have no reason to doubt its accuracy.

3.4 Estimation of Economic Impact

Once the multipliers have been calculated, they are applied to the revenue estimates. This provides an estimate of the economic impact in terms of regional GDP and employment. These multipliers are included in Appendix 3.

3.5 Limitations of Analysis

The estimates of economic impact relate to economic activity, ie GDP and employment. While these are important impacts and can provide an indication of the value of aquacultural and associated activity in the region, these figures do not indicate whether there is a net economic benefit of this activity to the broader community within the region. That is, these economic impact figures do not allow for the fact that alternative activities could be carried out using the same resources, ie sea, land, labour and capital. For example, rezoning could allow the farming of finfish instead of shellfish which could impose a different range of financial, social and environmental effects.

Depending upon the costs and benefits of this activity relative to the other potential activities, the Waikato Region could be better- or worse-off if existing activities were substituted for alternative land and sea uses.

However, determining whether the existing activity provides a net benefit compared with other possible activities requires a comprehensive cost-benefit analysis. This is outside of the scope of this study.

Regarding other activities currently carried out, with the exception of charter fishing, there is no evidence to suggest that aquaculture has had a significant effect on tourism in the Region. Although at least one fishing and sightseeing tour operator provides a growing number of trips to mussel farms as part of their sightseeing operations, these tours remain a small proportion of total tourist activity. These aquaculture tours are particularly popular with some American tourists who are typically prohibited from approaching within eight kilometres of aquaculture farms in the United States. The tours involve observing the harvesting of mussel farms and provide explanations of the activities within the industry.

The largest external effect from the existence of mussel farms in the Coromandel area is the positive effect on charter fishing operations. Farmed mussels provide a ready supply of food for many fish, including Snapper, John Dory, Kahawai, Kingfish, Tarakihi, Blue Cod and Gurnard. Consequently, a significant number of fish tend to congregate around mussel farms. The density of fish around these farms results in opportunities for charter fishing services that would otherwise not exist. Without these farms many of the fish would be spread too disparately around the Hauraki Gulf to allow much of the current charter fishing activity to be commercially viable. One operator suggested that the existence of the mussel farms contributed to around 80% of the charter fishing activity.

Informal discussions with charter operators suggest that there could be around 15,000 charter fishing customers per year in the Coromandel area. Many, perhaps over half, stay at least one night in the Coromandel as a consequence. Around one third of the fishing charter customers are estimated by the operators to come from outside of the Waikato Region, and thus contribute to the Region's GDP. Most of these customers originate from Auckland with others from Tauranga and the Bay of Plenty or from further south, eg New Plymouth.

The amount charged by fishing charter operators tends to range around \$30 to \$70 per person and depends upon the operator, whether bait needs to be purchased and whether fishing rods need to be hired. Accounting for that activity that may exist in the absence of aquaculture and only including revenue received from individuals that are not residents of the Waikato Region, aquaculture may generate something in the vicinity of \$200,000 of revenue that contributes towards additional GDP. Because of the relatively small size of this amount compared to total gross aquacultural revenue (\$35 million) and in the absence of specific cost information regarding charter fishing activity, this GDP impact has not been included in this report.

4 Results

4.1 Regional Production

The aquaculture industry in the Waikato Region consists of around 40 core businesses that carry out a range of activities. Most farming activity occurs in the waters around the Coromandel Peninsula, although there are a few small farms on the west coast. The dominant form of aquaculture in the Waikato region is mussel farming, with around 900 ha of active mussel farms producing around 21,000 tonnes annually. It has increased in recent years and is set to grow in the future. Oyster farming in the Waikato Region is

relatively small in comparison, with less than 70 ha of farms producing around 640,000 dozen oysters per year.

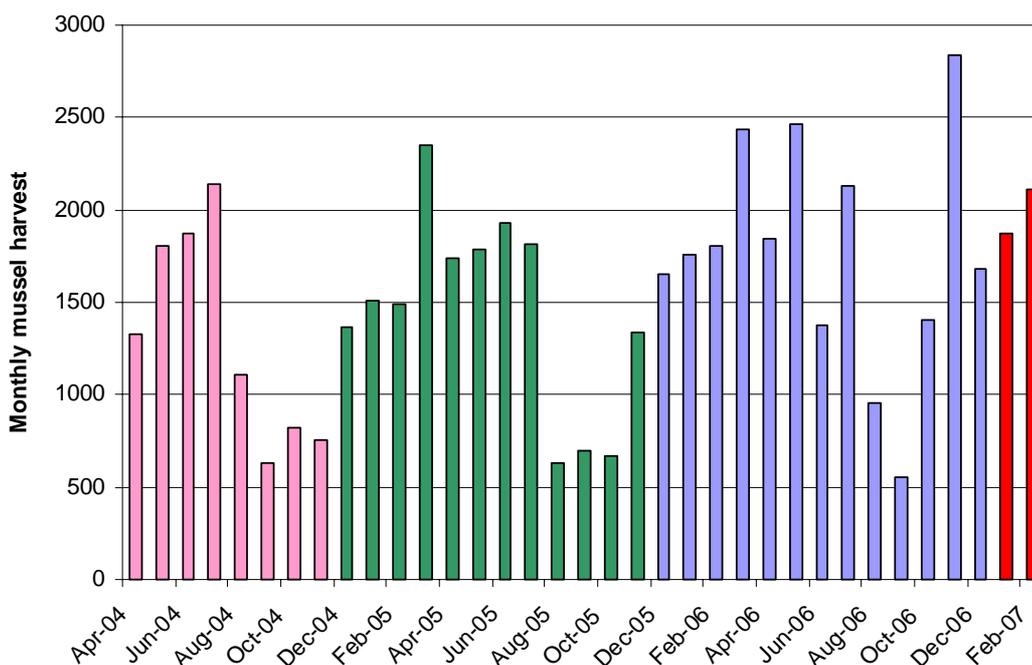


Figure 1: Monthly mussel harvest, Coromandel, April 2004 - February 2007

We estimate that the total turnover received by the aquaculture sector from activities relating to the Waikato Region is approximately \$35 million per year (see Table 2). Because this figure effectively ‘double-counts’ a number of internal transactions within the industry, it is not indicative of the contribution to the Region’s GDP. For example, the sale of, say \$1 million, worth of processed mussels could incorporate the purchase of, say \$500,000, worth of harvested mussels. The total industry turnover figure includes both of these transactions. To avoid this double-counting, GDP is typically calculated by determining the value-added by each level of the supply chain (see Section 4.2 below).

There are around 405 people directly employed in the aquacultural sector, although many are employed on a seasonal and/or part-time basis. We estimate that around one-third (143) are employed on a permanent full-time basis. Of the remaining two-thirds (262), most are employed on a full-time but seasonal basis, typically within the processing sector. There are also a handful of individuals who are employed on a part-time basis. Accounting for the seasonal and part-time nature of many of the jobs, total direct employment within the industry equates to around 270 full time equivalent (FTE) positions. The estimated total wages and other remuneration paid to those employed within the industry is just under \$10 million.

Table 2: Aquaculture industry, Waikato Region

Industry statistics	Estimates (approx.)
Businesses	35 – 45
Industry turnover	\$35m
Employment: Full-Time Equivalents	270
Consisting of:	
Permanent full-time	143
<u>Seasonal & part-time</u>	<u>262</u>
Total employees	405
Total employee remuneration	\$9.6m

4.2 Economic Impacts

The various activities of the aquaculture industry create a positive contribution to the Waikato Region's GDP of approximately \$27 million. This figure represents the total value that is added to the regional economy by the industry.

4.2.1 Breakdown of GDP Impacts

The total output (or expenditure) in the Region generated by aquaculture is around \$50 million annually, as shown in Table 3. Similar to estimates of total industry turnover above, this figure includes all transactions within the industry, effectively double-counting some values. Consequently, the GDP impact estimate, which includes only value-added, provides a more accurate representation of the regional economic impact of this industry.

Of the total \$27 million contribution to regional GDP, about 70% stems from farming activity (\$19.1 million, see Table 3), with processing activities accounting for the remaining 30% of the value-added generated by the industry (\$7.8 million).

The economic impacts of these activities can be further broken down by direct, indirect and induced impacts (see Table 3). The direct impacts account for nearly 70% (\$18.9 million) of the total impact on GDP in the region. These impacts relate to the increase in GDP stemming from revenue earned by the aquaculture industry itself. The indirect impacts, which largely arise from purchases made by the aquaculture industries from other industries, account for roughly 14% (\$3.7 million) of the overall GDP impact. The remaining 16% (\$4.3 million) arises from the induced impact that is generated by the additional wages and salaries paid to employees of businesses impacted directly or indirectly by aquacultural activity. A full explanation of these different effects is provided in Appendix 1.

4.2.2 Employment impacts

Aquaculture generates additional employment for 370 FTEs in the Region. This figure includes 270 FTEs employed in the sector directly. Just under half (127) of these positions are in the farming and harvesting sector, the remaining 143 FTEs relate to mussel and oyster processing. Additional employment is also generated by way of indirect and induced economic impacts. This additional employment is equal in magnitude to a further 100 FTEs.

Of the total 370 FTEs created by aquaculture, 52% relate to farming activity and 48% to processing (see Table 3). This relatively high proportion for processing reflects the more labour-intensive nature of processing activities compared to farming.

Table 3: Aquaculture in the Waikato Region, Economic Impacts

Impact type	Farming (\$ 000's)	Processing (\$ 000's)	Total (\$ 000's)
Output	31,326	19,305	50,630
Employment (jobs)	192 FTEs	178 FTEs	370 FTEs
GDP:			
Direct	14,043	4,826	18,869
Indirect	2,809	917	3,725
Induced	2,247	2,075	4,322
Total GDP	19,098	7,818	26,916

Appendix 1: Economic Impact Modelling

Definitions

An economic impact describes the *net addition* an event makes to an economy, and is generally measured in terms of *net contribution* to GDP and employment.

GDP is used to measure the size of an economy. There are several ways of measuring GDP, but the most common method is the *value added* approach. The value added approach is based on the premise that businesses purchase basic goods and services, add value to them and sell them. The value that each business adds through this process is the difference between the final selling price and the cost of the basic goods and services. This is broadly equivalent to the wages and salaries that the business pays plus its operating surplus, depreciation and tax.

GDP describes the total value that all businesses *add* to the economy in question.

Employment describes the labour units that support the creation of GDP. To overcome problems associated with part-timers, employment is generally measured in terms of *full-time equivalent employees* (FTEs). An FTE is equivalent to one full-time worker, or two part-time workers, where part-time is defined as less than 30 hours per week.

Employment describes the number of active full-time workers plus two times the number of active part-time workers in the economy in question.

Components of an Economic Impact

The economic impact generated by an industry comprises a **direct** impact, an **indirect** impact and an **induced** impact. These impacts are generated by the *additional* money that the industry brings into the economy. As an example, suppose we have Industry A that generates \$5 million per year excluding GST.

The **direct** impact describes the value that is added to the economy as a result of the revenue generated by Industry A. Let's assume that Industry A spends \$4m on the basic goods and services required to deliver their product (excluding wages and salaries), in which case the direct impact of Industry A on the region is \$1m.

In addition, Industry A purchases the basic goods and services required to deliver their product from other businesses in the region, which also add value to the economy when they produce and sell their goods and services. The purchases that Industry A makes therefore generate a second round of impacts which would not exist in the absence of Industry A. In reality Industry A generates many subsequent rounds of impact within the economy because Industry A's suppliers have to purchase additional goods and services from *their* suppliers to meet demand, and so on. These subsequent impacts are collectively referred to as the **indirect** impact because they are generated indirectly by the initial (direct) revenue generated by Industry A.

And finally, the **induced** impact describes the economic activity that is generated by the additional wages and salaries paid to employees of businesses impacted directly or indirectly by Industry A. These impacts are generally realised through greater household expenditures on final goods and services.

Multiplier Analysis

It is clear from the description above that an economic impact analysis comprises a reasonably complex set of transactions and interactions. Fortunately economists have

developed a relatively simple method of calculating the direct, indirect and induced impacts of an event called **multiplier analysis**. Multipliers are derived from input-output (IO) tables, which are mathematical representations of economies that model the relationships between producers and consumers and the interdependencies of industries. IO tables are used in economic impact analysis to estimate how a change in the activity level of one industry is likely to affect others.

Appendix 2: Questionnaires

WAIKATO AQUACULTURE SURVEY

GENERAL INFORMATION

Company/Farmer _____

name: _____

Address: _____

Which functions do you operate within the Waikato Region?
Exclude any carried out in the Auckland or other regions

- Spat Procurement
- Growing and Farming
- Harvesting
- Processing and Packaging
- Sales and Marketing
- Distribution

Farm size: _____ hectares

Primary species:

	Annual tonnage	Farmed hectares
Mussels		
Oysters		

Employment (including Management):

	Number of employees	Number of employees who live in the Waikato Region	Months per year worked
Full-Time year-round			12
Part-Time year-round			12
Full-Time seasonal			
Part-Time seasonal			

ANNUAL REVENUE

Total Revenue (sales at wharf):

\$ _____

% of product processed in Waikato (ie not Tauranga/Auckland): _____%

ANNUAL PROFIT

Total Annual Gross Profit (before tax):

\$ _____

ANNUAL OPERATING COSTS

	\$	Approx % purchased from Waikato Region (incl. Coromandel)
Raw materials (eg spat)		%
All wages, employee compensation (eg bonus)		%
Employee benefits (eg car)		%
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 (incl. any contractors' fees)		%
Vehicles - lease or depreciation		%
Other equipment repair and maintenance		%
Fuel		%
Freight, shipping charges		%
Water quality & admin fee (Coromandel Marine Farmers Association)		N/A
Wharfage fees (Coromandel Marine Farmers Association)		N/A
Legal, accounting, professional fees		%
Insurance		%
Utilities, telephone and internet		%
Interest		%
Property and local rates/taxes		N/A
Other significant expenses (if any)		%
		%
		%

Total Annual Operating Costs	\$
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WAIKATO AQUACULTURE PROCESSING SURVEY

GENERAL INFORMATION

Which functions do you operate within the Waikato Region?

Exclude any carried out in the Auckland or other regions

Freight/transport from suppliers

- Processing and packaging
- Sales and marketing
- Distribution to customers

Primary species:

	Annual tonnage
Mussels	
Oysters	

Employment (including Management):

	Number of employees	Number of employees who live in the Waikato Region	Months per year worked
Full-Time year-round			12
Part-Time year-round			12
Full-Time seasonal			
Part-Time seasonal			

ANNUAL REVENUE

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

ANNUAL PROFIT - Processing

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

ANNUAL OPERATING COSTS - Processing

	\$	Approx % purchased from Waikato Region (incl. Coromandel)
Mussels/Oysters		%
All wages & employee compensation (incl bonuses)		%
Employee benefits (eg cars)		%
Building - lease or depreciation		%
Plant & machinery - depreciation		%
Plant - repair and maintenance		%
Containers & packaging		%
Warehousing/cold storage costs		%
Vehicles – lease or depreciation		%
Vehicles – repairs & maintenance		%
Fuel		%
Office suppliers		%
Miscellaneous supplies		%
Advertising & marketing		%
Any industry levies (eg Coromandel Marine Farmers Association)		%
Legal, accounting, professional fees		%
Insurance		%
Utilities		%
Telephone , internet		%
Interest – mortgage, etc		%
Property and local rates/taxes		%
Other significant expenses (if any)		%
Total Annual Operating Costs	\$	

Appendix 3: Multipliers

Multipliers for Waikato Region (114 industries) at June 2004 Basic Prices

OUTPUT MULTIPLIERS

	Direct + In-		MULTIPLIERS	
	Direct	Direct + Ind.	TYPE II	TYPE II
Mussel and Oyster Farming	1	1.45	1.25	1.45
Processing (excl feedback through mussel farming)	1	1.44	1.15	1.44

EMPLOYMENT IMPACTS AND MULTIPLIERS Emp : Output Ratios (FTEs / \$m)

	Direct + In-		MULTIPLIERS	
	Direct	Direct + Ind.	TYPE II	TYPE II
Mussel and Oyster Farming	5.9	8.9	1.31	1.51
Processing (excl feedback through mussel farming)	10.7	13.3	1.08	1.24

VALUE ADDED IMPACTS AND MULTIPLIERS

Value Added : Output ratios

	Direct + In-		MULTIPLIERS	
	Direct	Direct + Ind.	TYPE II	TYPE II
Mussel and Oyster Farming	0.65	0.88	1.20	1.36
Processing (excl feedback through mussel farming)	0.36	0.59	1.19	1.62

NET HOUSEHOLD INCOME IMPACTS AND MULTIPLIERS

Net Income:Output Ratios

	Direct + In-		MULTIPLIERS	
	Direct	Direct + Ind.	TYPE II	TYPE II
Mussel and Oyster Farming	0.14	0.24	1.42	1.67
Processing (excl feedback through mussel farming)	0.27	0.35	1.10	1.29

GROSS HOUSEHOLD INCOME IMPACTS AND MULTIPLIERS

Gross Inc : Output Ratios

	Direct + In-		MULTIPLIERS	
	Direct	Direct + Ind.	Type II	TYPE II
Mussel and Oyster Farming	0.20	0.34	1.42	1.67
Processing (excl feedback through mussel farming)	0.39	0.50	1.10	1.29