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NEW ZEALAND INSTITUTE OF ECONOMIC RESEARCH

The economic contribution of marine farming in the Marlborough region

A Computable General Equilibrium (CGE) analysis

NZIER report to Marine Farming Association, September 2015

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NZIER was established in 1958.

Authorship

This paper was prepared at NZIER by Peter Clough and Erwin Corong.

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The assistance of all those who gave their time and information to assist this analysis is gratefully acknowledged.

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Key points

Aquaculture, comprising marine farming and the processing of its produce, makes a significant contribution to Marlborough's economic output, GDP and employment.

Its direct sales and employment creation stimulate other local businesses such as marine service industries, retailing and hospitality trades, and it also supports incomes and consumer spending in the region. It helps to retain people in the region and attract new residents who support voluntary community activities which keep small rural communities functioning.

Aquaculture contributes to both regional and national economies by:

- Creating valuable output based on the natural resources of the marine environment
- Providing employment (859 jobs) for about 3.7% of the Marlborough region's total labour force, with around 1.1% in marine farming and a further 2.6% in seafood processing
- Paying average wages that are substantially higher than the average earnings in Marlborough
- Generating export sales revenue of $276 million in 2014
- Contributing almost 6% ($162 million) to Marlborough's regional GDP, with $105 million (3.7%) from marine farming and $57 million (2%) from seafood processing
- Providing inputs to seafood processing in regions outside Marlborough
- Delivering around 62 % of New Zealand's aquaculture production by tonnes (62% of Greenshell mussels; 61% of salmon and 8% of oysters)

Marlborough was one of the earliest areas in New Zealand to develop aquaculture, and now has the highest marine farming output of any region, mostly from mussels and salmon production.

Marlborough aquaculture is a major contributor to national seafood industries, accounting for about 60% of aquaculture's contribution to national GDP and 11% of the GDP contribution derived from New Zealand's seafood sectors (wild capture and aquaculture). Aquaculture offers an opportunity for New Zealand to grow production that will face increasing global demand

Internationally aquaculture is seen as a growth sector, a source of economic activity in remote or rural areas, providing sustained increase in seafood in face of stable harvesting of fully utilised wild fish stocks. The New Zealand Government has adopted a strategy of increasing aquaculture output. That depends on continued production of both existing and new marine farming areas.

Aquaculture in Marlborough now

A summary of the industry's economic contribution is shown below

Current Measurement	Mussels	Oysters	Salmon	Total
Number of marine farms	565	14 (3 main)	6 +3 in development	588
Consented hectares to June 30 2015	2,991.5ha	68ha	132.4ha	**3191.9ha**
Produced tonnages 2014	59,944	119	6,463	**66,526**
Estimated employees on farms	170	13	71	254
Estimated process employees	605	Not available	(272 in Nelson)	605
Export sales revenue (FOB)	$208.2m	$15.7m	$52.5m	$276.4m
Gross output Marine Farming	$119.9m	$0.43m	$46.1m	$165.5m
Estimated GST, excise and levies	$3.7m	$0.01m	$1.5m	$5.2m
Marine farm contribution to GDP ($)	$90.1m	$0.32m	$15.3m	$105.7m
Marine farm contribution to Marlborough GDP (%)	3.19%	0.01%	0.54%	3.7%
Processing contribution to GDP	$56.6m	-	-	$56.6m
Processing share of GDP	2.0%			2.0%
Marine farm+processing contribution to GDP	$146.7m	$0.32m	$15.3m	$162.3m
Combined share of GDP	5.2%	0.1%	0.54%	5.7%

Source: NZIER, drawing from MFA, MPI, Aquaculture Direct, company sources

Aquaculture in the future

Aquaculture makes a significant contribution to the Marlborough economy and communities.

That contribution however depends on continuing access to the marine resource, on the area allocated to marine farming production and the ability to add value through higher return species. The area consented for marine farming production amounts to about 2.1% of the area of the Marlborough Sounds. Most of this is in the Pelorus Sound, Port Underwood and Admiralty Bay areas, which have been developed as a working landscape much modified by farming and forestry. Less marine farming occurs in Queen Charlotte Sound where there is more recreational/navigational focus.

There have been few new consents issued in recent years. A moratorium was applied to new marine farming in the Sounds in 1996 and a national moratorium from 2002-04. From 2004-2011, there was no marine farming development in the Sounds amid uncertainties created by the introduction of new Aquaculture Management Areas. New legislation was passed in 2011.

Over the four and a half years from 2011-30 June 2015, 9 new sites (including 3 salmon) were consented in the Sounds and 31 extensions granted to existing (mussel) farms. The 6 new mussel farm sites totalled 23.5ha. After allowing for renewals not granted or granted for reduced area, the net increase in marine farming consented area for all species over 13 years was 131.9 ha, equivalent to 0.09% of the area of the Sounds.

The actual surface area occupied by marine farming structures is much less than that consented for mussel farming and considerably less again as a percentage of the consented space for salmon farming, as consented area allows for sub-surface anchors.

About 20% of the Sounds area is zoned for aquaculture (Coastal Marine Zone 2) but current practice limits marine farming to near-shore margins rather than mid-bay developments. There is uncertainty about the future cost and security of aquaculture because 56% of farms face consent renewal by 2025. Potential changes to consent renewals for existing sites as well as expansions or changes to current operations, would add to costs which the MFA has estimated could exceed $40 million if applied to all existing marine farm sites in the Marlborough Sounds.

Uncertainty over future costs can dampen reinvestment to maintain and enhance marine farming production, curtailing a strategic opportunity for aquaculture to fully contribute to Marlborough's economy and communities. We use a Computable General Equilibrium (CGE) model of the economy to illustrate the potential impact on Marlborough's economy from a substantial reduction in current marine farming production.

The What-if Scenario – modelling a contraction in production

We have developed a model of inter-industry transactions across the Marlborough economy to illustrate how sensitive regional and national economic activity would be to a contraction in marine farming productive area in Marlborough.

This modelling shows a 50% reduction in productive area would result in:

- Real loss of 1.3% of regional GDP in Marlborough ($37 million) a year
- Loss of national GDP of 0.05%, roughly equivalent to Marlborough marine farming's current direct contribution.

These impacts of a hypothetical 50% reduction are summarised in the table below.

Effects of 50% contraction in Marlborough	Marlborough ($m Value Added)	Rest of NZ ($m Value Added)	New Zealand ($m Value Added)
Mussels	-19.6	24.9	**5.3**
Oysters	-0.3	-3.2	**-3.5**
Salmon	-4.7	5.5	**0.8**
Seafood processing	-17.9	-160.0	**-178.0**
Total direct impacts	**-42.5**	**-132.9**	**-175.4**
Total indirect impacts	**7.3**	**51.4**	**58.7**
Total (direct + indirect) impacts	**-35.2**	**-81.5**	**-116.7**
Commodity tax impacts	-2.1	-6.0	**-8.1**
Real GDP (Value Added)	**-37.3**	**-87.5**	**-124.8**
Share of current economy	-1.3%	-0.04%	**-0.05%**

Source: NZIER, drawing from MFA, Aquaculture Direct, company sources

All types of marine farming and seafood processing in Marlborough would reduce their contribution to GDP in the face of such a contraction in productive area.

In the rest of New Zealand mussel and salmon production could increase their value added contribution as they pull less productive capital investments and labour resources from Marlborough. The modelling assumes that no new suitable water space and farming consents would become available.

The main impact of a contraction in farmed area in Marlborough is on the value added of the seafood processing sectors.

This is felt both in Marlborough and in the rest of New Zealand, as contraction in local production reduces the supply of seafood and results in a higher proportion attributable to domestic consumption with a lower component of value added processing.

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1. Introduction

The Marine Farming Association (MFA), which represents marine farmers operating in the top of the South Island, commissioned NZIER to assess the economic contribution of Marlborough aquaculture (comprising marine farming and processing of its produce) to both Marlborough and New Zealand economies. This report describes a computable general equilibrium (CGE) analysis using a model of the regional and national economy to estimate that contribution and the effect of a change from current activity levels.

Globally, the output of "capture fisheries" involved in harvesting wild fish stocks has been relatively stable over the past 30 years, hovering around 90 million tonnes per year,[1] the result of wild fisheries becoming fully utilised and quota limits coming into effect. Aquaculture is the main growth area for seafood production, now accounting for around 40 percent of worldwide seafood production by weight.[2] In 2011 global aquaculture production surpassed global beef production for the first time, and aquaculture is expected to exceed wild fish harvest in the next few years.

A similar pattern is observable in New Zealand, where marine farming accounts for about 23% of total seafood production in greenweight tonnes and wild fish harvest has stabilised at a little over 400,000 greenweight tonnes. Marlborough produces about 62% of New Zealand's annual marine farming tonnage which has averaged around 107,000 tonnes over the past 6 years. There are opportunities for seafood expansion in aquaculture and further growth is supported by the Government's Aquaculture Strategy. Knowing the value of current aquaculture and its contribution to the economy is an important input in realising the goals of that Strategy.

Marine farming in Marlborough started in the 1960s with small scale production of mussels, and later expanded to include production of Pacific oysters and salmon. Growth was strong in the 1980s and early 1990s, but then slowed with the imposition of moratoria and the emergence of local opposition to new farms because of perceptions and concerns over visual intrusion and other impacts. Further investment by the industry is hindered by uncertainty over security of many marine farm consents which are due for renewal by 2025 and possible changes to the planning status of marine farming.

The economic contribution of aquaculture is derived primarily from the value added and returns to resources used in producing them. This includes the direct impact on

1 Diana JS (2009) "Aquaculture Production and Biodiversity Conservation", BioScience 59(1) 27-38

2 FAO (2014) "The State of World Fisheries and Aquaculture"; UN Food and Agriculture Organisation, Rome

businesses and people engaged in the industry, indirect impacts on the industries that supply and service the sector (such as marine contractors and boat builders) and induced impacts on unrelated sectors that face increased demand from people with higher incomes. Estimating the scale of these effects and how they are affected by changes in the wider environment is the purpose of this report.

1.1. Approach

Official statistics on seafood industries focus on gross production and export figures that do not always distinguish between fishing and aquaculture or report their separate production and non-export sales. To address this we use a database and model based on Statistics New Zealand's latest table of inter-industry transactions across the economy, updated and adapted to provide insight into the effects on the regional economy. The framework is that of the system of national accounts, which can be used to compare the composition of the national economy and regional economies. The principal measures from these accounts examined in this report are:

- Gross outputs – the FOB value of exports and of sales into the domestic market, for either further processing or final consumption
- Value added – the difference between gross outputs and inputs used up in generating output, comprising principally salaries and wages (return to labour), depreciation (return to capital assets) and operating surplus (a return to management, investment and risk bearing)
- Household consumption – final demand expenditure which can be used as an indicator of economic well-being in the affected community.

In this accounting framework direct taxes like personal income tax or company tax are ignored on two counts: for practical reasons it is difficult to accurately estimate the taxes paid by companies allowing for the diversity of treatments of capital and revenue items; and in principle such taxes can be regarded as a transfer payment of no consequence to the overall economic assessment – the tax is just another claim on the net revenue stream. Similar arguments apply to local government rates: an activity that increases property demand and values raises the rateable capacity in a district but that does not alter the productive value of the district. The national accounting framework does however cover indirect taxes like GST that are embedded in market prices.

Our consultation, modelling and reporting process consists of a number of phases, as shown in Figure 1. Internal peer review (Quality Assurance) and direct consultation with Marine Farming Association (MFA) and key industry participants are carried out throughout the research process.

The first phase involved asking key industry participants—whose contacts were provided by MFA—to participate in a short survey to allow us to gather background information on Marlborough marine farms.

The second research phase involved modifying our standard database to account for aquaculture-detail in all regions of New Zealand. To this end, we have:

- updated Statistics New Zealand's Input-Output table (2007 base year published in 2012) to 2014 levels using latest macroeconomic data
- expanded our standard database by separately identifying oyster, mussels, salmon, and other fishing activities based on production and exports data from Statistics New Zealand, data from Aquaculture New Zealand and Ministry for

Primary Industries, and cost structure of marine farms from domestic and international sources[3].

The resulting database then reflects the initial structure of the New Zealand economy, which by definition is assumed to be in equilibrium in all markets. This means the economy and its mix of sectors is basically stable, and that no sector is over- or under-stated because of a quirk of timing in collecting data for the model.

Phase 3 of our research process involved using our regional economic (computable general equilibrium or CGE) model—to quantify the economic value of Marlborough marine farms to both Marlborough and New Zealand economies.

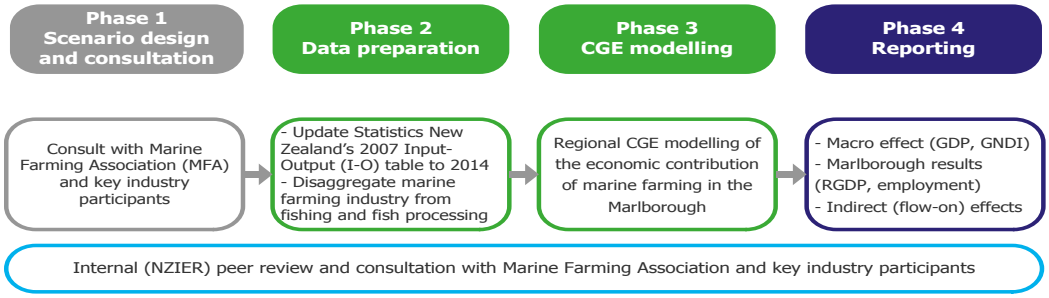
We have employed a 2-region model set up with a separate Marlborough region and an aggregated rest of New Zealand (14) region, based on the modified database. We then used our economic model to simulate a 'scenario' in which half of the marine farms in Marlborough would cease operations due to any one of a number of factors.[4] This disturbs the equilibrium in the economy, and the model calculates changes in demand, supply and prices of inputs (like labour and capital) then reallocates them across sectors according to where they get greatest returns, establishing a new equilibrium after the shock.

The difference between the initial and 'reduced marine farming' economy then provides an estimate of the likely direct and flow-on contribution that Marlborough marine farming makes to the New Zealand economy.

1.2. Outline

This report first outlines the direct contribution of aquaculture to the regional and national economies in 2014. It then examines the effect of changes in productive area to that economic contribution. Implications of this analysis are drawn in the conclusions.

Figure 1 Research phases



Source: NZIER

[3] We have assumed that the production structures of mussels and oysters are similar to the fishing industry found in Statistics New Zealand's input output table. For Salmon, we have used production cost share estimates from Marine harvest's salmon farming handbook. http://www.marineharvest.com/globalassets/investors/handbook/handbook-2014.pdf

[4] This is equivalent to assuming a 50% reduction in output of all marine farms marine (oyster, mussels and salmon) in the Marlborough region.

2. Direct contribution

The direct contribution of aquaculture is the output and value added of the marine farming sector, the value of outputs at the farm gate or the point where shellfish and fish are transferred to the processing sector and transformed into products, plus the output and value added of the processing sector from its sales in domestic or export markets. As processing can (and does) take place outside of Marlborough we focus on region-specific marine farming and seafood processing, and note the additional contribution to seafood processing beyond Marlborough where appropriate.

Direct contribution to GDP, employment, taxes and levies

This section provides a brief overview of the aquaculture industries in Marlborough. Note that a marine farm may hold more than one consent/licence/permit per site for occupying and using public coastal marine space. Also, the consented area is often substantially larger than the area of productive farm structures, particularly for salmon farms, to allow for anchoring lines and minor repositioning of structures from time to time.

Table 1 summarises the characteristics of marine farming in 2014, and the headline results of our modelling. About 3,200 hectares in the Marlborough Sounds have been consented for marine farming, about 2.1% of the surface area of the Sounds.

The table shows the gross output from the marine farming activity (the value of exports plus sales onto the domestic market) across the three main species in 2014 amounted to about $165 million. Their contribution to GDP or value added is smaller at $105 million, as this deducts all the costs of inputs from other sectors that are used to create the output. Processing of aquaculture produce in Marlborough adds another $56 million in value added, so the combined total of marine farming and processing amounts to 5.7% of regional GDP.

Table 1 The direct economic impact of aquaculture in Marlborough

All figures relate to 2014 other than consented area, (updated to 2015 as in Appendix B)

Measurement	Mussels	Oysters	Salmon	Combined total
Number of marine farms	565	14 (3 main ones)	6 + 3 in development	**588**
Consented hectares to June 30 2015	2991.5ha (includes one new farm this year @3.9 ha and 7 extensions totalling 13.6ha	68ha	132.4ha (includes 3 new consented farms totalling 49.5 ha)	**3191.9ha**
Tonnages produced by Marlborough	59,944	119	6,463	**66,526**
Estimated employees on farms	170	13	71	**254**
Estimated wages	$12.1m	$0.9m	$3.8m	**$16.8m**
Estimated process employees	605	na	(272 in Nelson)	**605**
Estimated wages	$24.4m	na		**$24.4m**
Export sales revenue (FOB)[5]	$208.2m	$15.7m	$52.5m	**$276m**
Gross output (marine farming)	$119m	$0.43m	$46.1m	**$165.5m**
Estimated GST, excise and levies	$3.7 m	$0.01 m	$1.5m	**$5.2m**
Marine farm contribution to Marlborough GDP ($)	$90.1 m	$0.32 m	$15.3m	**$105.7m**
Marine farm contribution to Marlborough GDP (%)	3.19%	0.01%	0.54%	**3.7%**
Aquaculture processing contribution to Marlborough GDP ($)	$56.6m			**$56.6m**
Processing contribution to Marlborough GDP (%)	2.0%	0.01%	0.54%	**2.0%**
All aquaculture contribution to Marlborough GDP ($)	$146.7m	$0.32m	$15.3m	**$162.3m**
All aquaculture contribution to Marlborough GDP (%)	5.2%	0.1%	0.54%	**5.7%**

Source: NZIER, drawing from MFA, Aquaculture Direct, company sources

The contribution of Marlborough marine farming to national GDP is about 0.05%.

By way of comparison, Infometrics (2013) in a report on the Marlborough regional economy estimated the contribution to regional GDP of the combined fishing and marine farming sectors to be 0.5%. This is an underestimate, because of the data available at the

[5] These exports are all from the processing sector, and hence are larger than the gross output of the marine farming sector.

time of that study.[6] The average wages in aquaculture are substantially higher than the average earnings in Marlborough, so it is unlikely that the contribution to GDP of aquaculture would be much less than the sector's share of employment in the region.

Relative to the 2013 Census results employment in marine farming is equivalent to 1.5% of full time employees and 1.1% of total labour force (including part time employees and the unemployed) in the region. In addition, the employment in seafood processing associated with marine farming is equivalent to 3.7% of full time employees and 2.6% of the total labour force. This means marine farming and processing has a direct impact about a third the size of that of viticulture and wine-making in Marlborough.

The presence of marine farming and seafood processing in Marlborough also has positive flow-on effects in stimulating business for firms that supply the aquaculture sector or that benefit from the increased incomes and expenditure in the region. Such effects are often expressed as an economic multiplier, a ratio of the total impacts (direct plus indirect) over the direct impact, as commonly derived from a static input-output table of the economy that traces one sector's impact through all other sectors' supply of inputs or uses of its output. But such multipliers are misleading in implying simple linear relationships between direct and total impacts, and for ignoring the effect of one sector's changing demands shifting the prices of inputs for all sectors, some of which may lose profitability or reduce output as a result. Our CGE modelling allows for the presence of constraints, price rises and resources like labour switching between sectors but does not report multipliers to avoid potential misinterpretation. The weaknesses of multipliers are well-documented[7] and also recognised by government agencies and members of the judiciary.

[6] Infometrics (2013) Marlborough Economic Profile. Note this report was based on a Statistics New Zealand Inter-Industry table for 1995/96, which may account for its lower estimate of regional GDP and seafood industries' share in that RGDP.

[7] See Australian Bureau of Statistics which has ceased to provide multiplier estimates from its input output tables. http://www.abs.gov.au/ausstats/abs@.nsf/Previousproducts/5209.0.55.001Main%20Features4Final%20release%202006-07%20tables?opendocument&tabname=Summary&prodno=5209.0.55.001&issue=Final%20release%202006-07%20tables&num=&view=

2.1. Mussels

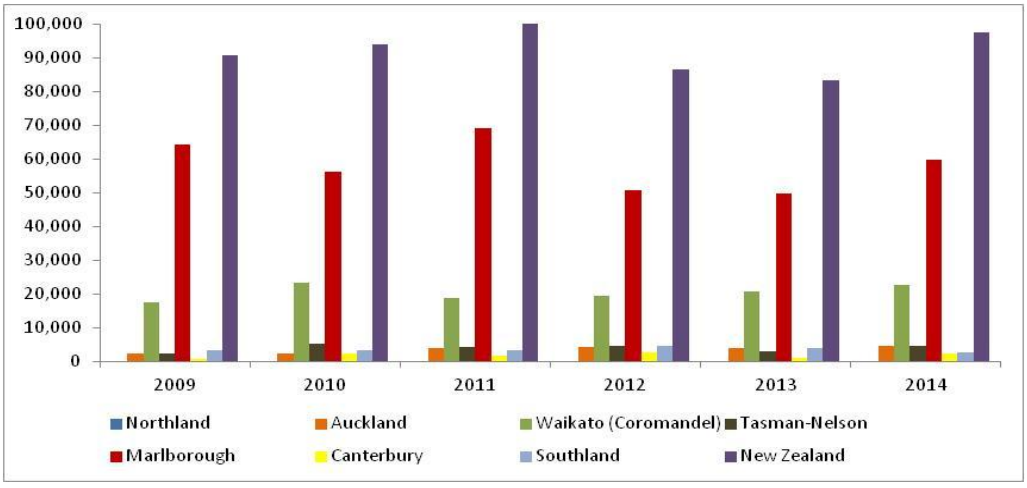
Mussels are New Zealand's largest marine farming product by volume and value. New Zealand produced roughly 97,000 tonnes of mussels in 2014 and Marlborough has accounted for 60-70% of the national production in recent years (Figure 2). The principal species is the greenshell mussel, which is only grown commercially in New Zealand.

Figure 2 shows Marlborough currently accounts for a substantial share of mussel production, around 60-70% of total greenweight tonnage in recent years. Marlborough currently has around 565 operating mussel farms, with a consented area of nearly 3,000 hectares. The area of consented mussel farms represents about 2.0% of the total area of the Sounds (about 150,000 hectares). After rapid expansion through the 1980s and early 1990s, the area of mussel farming in Marlborough has flattened off and fluctuated about that level rather than growing for several years.

Mussel spat for seeding farms in New Zealand are mostly collected from wild stocks in Golden Bay, Tasman Bay, Marlborough Sounds and Northland. In future this will be supplemented by laboratory grown spat in Nelson. They are seeded onto mussel ropes in stockings and later removed then reseeded at a thinner rate to allow for growth. Mussels are filter feeders growing on the natural nutrients in water, so much of the cost is in the labour, transport and energy costs of the on-farm processes during their growing stage.

Figure 2 Mussels production by region

In tonnes



Source: Aquaculture NZ

Mussels are predominantly processed to frozen half shell form and destined for export markets. Other common food formats include completely de-shelled which is sold as frozen mussel meat or in marinated pottles. There is also a steady domestic market for live mussels. Mussel processing in Marlborough takes place in processing plants principally at Havelock (Sanford) and Blenheim (two factories run by Kono and Talley's),

or they may be sorted at Havelock (Clearwater, a subsidiary of Talley's) and sent for processing elsewhere.[8] Other non-food formats have been developed including high value derivative mussel oil and mussel powder nutraceutical products. A number of factories process greenshell mussels for oil and powder in Marlborough and mussels are also supplied to factories in Nelson and Christchurch for similar high value uses.

[8] Mussels have also been sent to the Sanford factory in Christchurch, due to a shortage of labour in the Sounds [according to an annex in a 2012 Report by Sapere on Opotiki Aquaculture and Harbour Development Projects] , but as of this year it was announced this factory will close and all processing will revert to Marlborough.

2.2. Salmon

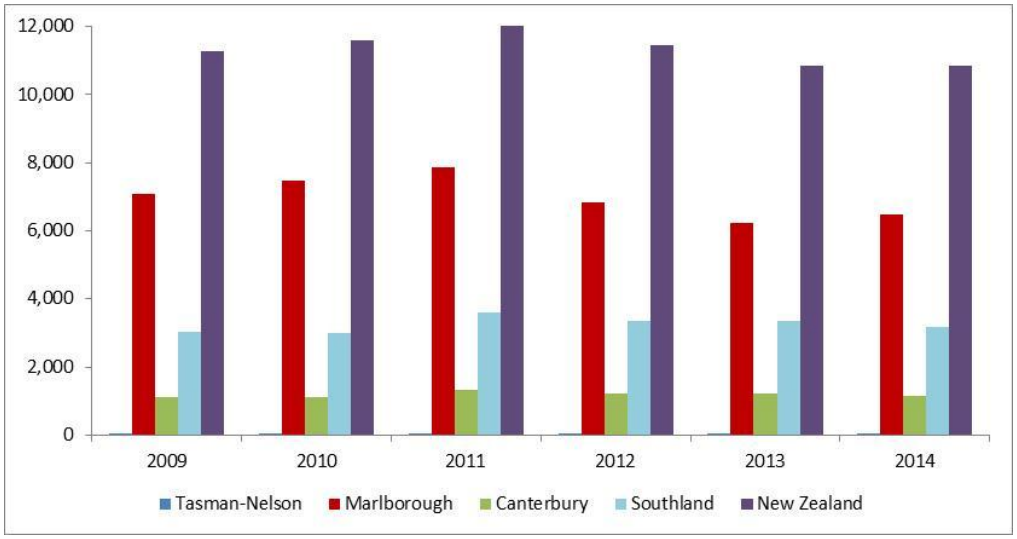
Salmon farming in New Zealand is the second largest aquaculture activity by greenweight tonnage production and export revenues. The species farmed in New Zealand is known as King, Quinnat or Chinook salmon, which has a poorer feed conversion than the Atlantic salmon which predominates in worldwide salmon farming. But King salmon farming in New Zealand is free from sea lice challenges faced by the species worldwide. New Zealand is the dominant supplier of King Salmon onto international markets and the fish achieves a price premium over the more common Atlantic salmon. New Zealand farmed salmon is endorsed as 'best choice' by North America's influential seafood reference guide - Monterey Bay Aquarium's Seafood Watch programme.

New Zealand salmon production has reduced from about 12,800 tonnes in 2012 to 10,800 tonnes in 2014. While warmer water temperatures contributed to higher fish mortality rates in some bays in the Marlborough Sounds, a greater impact has come from changes in fish husbandry to lower density that reduces mortality and improves the premium quality of the flesh.

Marlborough has accounted for 60-74% of the national salmon production in the last 5 years (Figure 3). The other main salmon farming production region is on Stewart Island in Southland, with other smaller salmon farms in Canterbury in Akaroa Harbour, and in the freshwater hydro-canals near Lake Ohau.

Figure 3 Salmon production by region

In tonnes



Source: Aquaculture NZ

The New Zealand King Salmon Co Ltd (NZKS) grow salmon in the Marlborough Sounds, and account for over half New Zealand's total salmon production by volume and value. In 2014 the NZKS employee count was a little below its previous years, with about 71 people full-time on its salmon farms in Marlborough, and about 272 people in processing, marketing and head office functions in Nelson. These figures have been higher but have reduced slightly in recent years due to lower production tonnages.

Salmon eggs are produced in NZKS's Takaka hatchery, before being transferred to Southbridge or Waiau and raised as smolt to a size ready to be reared in net pens in the Marlborough Sounds at between 6 and 12 months of age. They are harvested after 10-18 months in seawater. All NZKS processing is done in Nelson.

Prior to 2012, NZKS had seven salmon farms producing around 7,865 tonnes gilled and gutted with productive farm structures of about 10.5 hectares within a total consented area of about 83 hectares. A Board of Inquiry in 2012 considered NZKS's application for consent for a further nine new farms that could raise production by 14,250 tonnes to 22,500 tonnes per year, with 12 hectares of new structures within 206 hectares of consented sea-bed. The BOI gave consent for four of the proposed farms, however a challenge in the Supreme Court saw one of these lost.

The current total consented area of 132.4 hectares allows for anchoring structures that cover about 6 times the area of the surface structure of the net pens.

Part of NZKS's value margin is due to branding to different markets:

- "Ora King" supplies premium foodservice (restaurants and catering)
- "Regal" supplies premium retail outlets and food service outlets
- "Southern Ocean" is the market entry retail brand.

Marketing of the" Regal" brand makes specific reference to the Marlborough Sounds.

2.3. Pacific Oysters

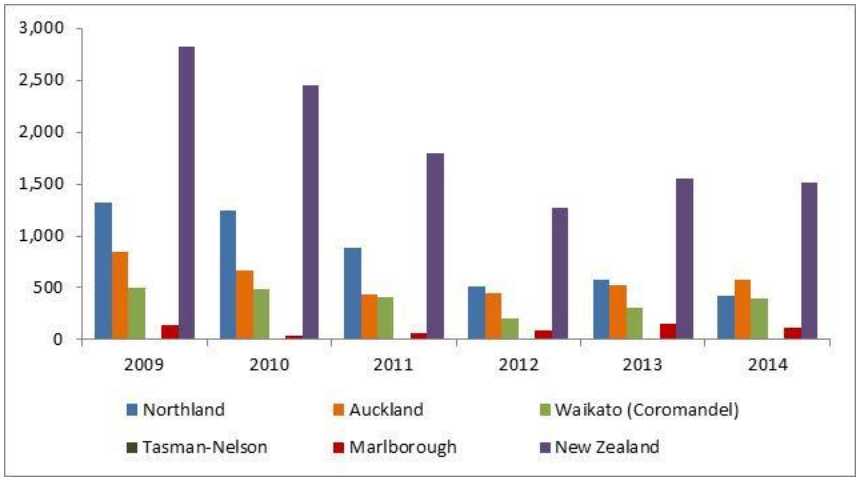
Pacific Oyster production is the smallest of the three main marine farming species in New Zealand. An introduced species, it is usually grown in racks or cages in the inter-tidal zone which are exposed to air part of the time at low tide.

Marlborough currently has 14 operating oyster farms with a consented area of 68 hectares but there are 3 principal farms working from 7.5 hectares of productive structures within that. Marlborough accounted for about 4% of New Zealand's total 1,500 tonnes of farmed oysters produced in 2014.

Figure 4 shows that oyster production is concentrated in Northland, Auckland and Waikato and Marlborough has a minor share of national production.

Figure 4 Oysters production by region

In tonnes



Source: Aquaculture NZ

2.4. Other contributions to the region

Beyond the direct impacts of aquaculture there are also indirect and induced effects on other sectors in the regional economy. For every input used by marine farming and associated seafood processing there will be some value added earned in the supplying sector, and increased incomes from aquaculture will raise demand for consumption goods in other unrelated sectors in the district. All these effects are potentially at risk should marine farming contract, but the net effect depends on the way in which changes in demand change prices and lead to resource reallocation across the economy. These effects are examined in relation to the scenario modelling of contraction in marine farm area.

Marlborough marine farming also supports economic value added in other regions, particularly in sending salmon to Nelson and mussels (until recently) to Christchurch for processing. Our modelling does not isolate the effects on other individual regions, but these linkages do have a material effect on the modelling of the contraction scenario.

The economic impacts of aquaculture also have social impacts which can be particularly important in parts of the country with limited alternatives for employment and production. Increased jobs help to retain people in the district and maintain property values. Improved incomes support a wider range of commercial services in the district. To the extent that production draws migrant workers from elsewhere it widens the diversity of the population and increases the pool of potential volunteers for activities like rural fire brigades and community fund raisers. In the past 25 years Havelock has been transformed from a small fishing settlement to one with a more vibrant mix of local shops and services helped by the growth in aquaculture and its service industries over this period.

Such social impacts are difficult to quantify and no attempt is made to do so here. However, those social impacts are driven by economic activity and the value of production and the incomes it supports, so social impacts are likely to move in concert with changes in economic production.

The presence and growth of marine farming also has consequences for Marlborough District Council in increasing the revenue capacity at its disposal. One example is the revenue collected from marine farms for their use of port facilities, collected as a levy per metre of backbone on mussel farms, or per tonne of product or input passing across the wharf in the case of salmon. In 2014 the Port Marlborough Annual Report identified $669,000 in revenue received from marine farm facilities[9], which is an underestimate as

[9] Port Marlborough Annual Report 2014, page 4

their accounting systems do not allow easy identification of all wharf charges or their attribution to marine farming. Port Marlborough also benefits from berthing fees and the rental of land and buildings used for portside operations by marine farmers. Another effect of the presence of aquaculture is in strengthening property values in the district, which occurs both because business premises gain value from higher turnover, and because the attraction of people to the district for work increases demand for residential housing and lifts their prices. A rise in property values increases the capacity of the Council to raise rates in the sense that a given rate in the dollar will collect more revenue; however, local government legislation requires total rate revenues to be set to cover expenditures provided for in the council's annual plan, so a council simply cannot increase its rates collection from rising property values and the main effect of rising property values is to redistribute the liability for rates across properties whose values rise to differing degrees. Local rates is a charge on fixed asset values that is paid out of property owners' incomes so the wealth effect is largely illusory, and the positive effect on rating capacity and a community's ability to pay is affected more by the generation of jobs and earning streams than by the capitalised value of properties in the district.

Impacts on port revenues and rates are not modelled separately here, but are subsumed within the inter-industry transactions of the regional economic model used in making our estimates.

2.5. Future prospects

Marine farming contributes to Marlborough's economy by providing raw material for seafood processing, stimulating demand for input goods and services from other industries, and by generating incomes in all affected businesses that lift consumption across Marlborough and more widely across New Zealand. That contribution, however, depends on continuing access to the marine resource, and on the area allocated to marine farming production.

At present the consented area for marine farming amounts to about 2.1% of the area of the Marlborough Sounds. Most of this is in the Pelorus Sound, Port Underwood and Admiralty Bay areas, which have developed as a working landscape much modified by farming and forestry. Less marine farming occurs in Queen Charlotte Sound where there is more recreational use.

Consents for expansions in productive structures have been limited in recent years. In response to perceptions of rapid expansion of marine farming, a moratorium was applied to new marine farming in the Sounds in 1996, and superseded by a national moratorium in 2002, which was lifted in 2004. From 2004-2011, there were no new marine farming consents applied for in the Sounds amid uncertainties created by the introduction of new Aquaculture Management Areas, until new legislation was passed in 2011. Since then, 9 new sites with an area of 73 ha and 31 extensions to existing farms with an area of 90.2 ha, have been consented over the four and a half years to June 2015. After allowing for 31.3 ha of renewals not granted or granted for reduced area, this resulted in a net increase in marine farming productive area of 131.9 ha over 13 years, equivalent to 0.09% of the area of the Sounds.[10]

While zoning allows for marine farming over about 20% of the Sounds area (mostly in Coastal Marine Zone 2), current practice upheld in the Environment Court further limits marine farms to coastal margins between 50 metres and 200 (or sometimes 300) metres from the shore, precluding mid-bay development.

Possible changes of status for marine farming within Coastal Marine Zone 2, which increase consent requirements for existing sites to similar level as for expansions or changes to current operations, would add to the cost and uncertainty about future marine farming activity. The MFA has estimated such new consenting requirements, if applied to all marine farm sites in the Marlborough Sounds, could cost the industry in excess of $40 million, and could threaten the viability of some sites within Coastal Marine Zones 1 and 2.[11]

[10] Sourced from Ministry for Primary Industries.

[11] MFA estimated cost of renewal for 322 Deemed Consents in Marlborough in 2024, assuming all have discretionary activity status in the new Marlborough District Council Plan; and scaled up to 580 farms in total.

MFA estimates that about 56% of marine farms have consents that expire and come due for renewal by 2025. There are also some sites which pre-date and are located within Coastal Marine Zone 1 which does not provide for marine farming use. Uncertainty around the security and cost of consenting renewal, and other concerns around the interpretation of the New Zealand Coastal Policy Statement, can dampen the likelihood of investment to maintain and enhance marine farming production or associated 'value enhancing' processes. Such uncertainty surrounds not just the transaction costs of gaining consent renewals under any changed consenting regime, but also potential delays in process and the opportunity cost of production lost if some farms find continued operation no longer viable.

Land use planning and its extension into the coastal marine space evolved as a means of reducing the community-wide costs of resolving conflicts that occur when activities create negative effects on their surroundings. In principle, setting rules on how activities are to be conducted and separating those that are most incompatible with each other can reduce the costs of co-existence compared with the alternative of resolving disputes with multiple affected parties after problems have arisen. By clarifying what is or is not acceptable in particular locations, planning can provide certainty for investment and future expansion, but that can be undermined if objectives, policies or rules raise costs or uncertainty around outcomes, as may occur if all individual projects are subject to consents or public objections. Planning can reduce the transaction costs of establishing and continuing activities if it sets minimum scale thresholds or has a strategic view on the extent of development permissible before wider public interests are triggered.

In such circumstances it can be useful to examine the potential impact of a reduction in marine farm output and its flow-on effects for seafood processing and other businesses in Marlborough. This is what we do in the next section using economic modelling.

3. Economic contributions of Marlborough marine farming

Marlborough marine farming interacts with the rest of the Marlborough and New Zealand economies by employing labour and capital, by using intermediate inputs supplied by other industries, and by supplying inputs to seafood processing and other industries.

We used NZIER's regional computable general equilibrium (hereafter, TERM-NZ CGE) model of the New Zealand economy – to approximate the economic contributions that Marlborough marine farming make to both the Marlborough and New Zealand economies.

Regional CGE modelling captures the various inter-linkages between sectors and regions, as well as their links to households (via the labour market), the government sector, capital markets and the global economy (via imports and exports). It is therefore useful for understanding the likely economic impact of policy changes on Marlborough marine farming.

The key benefit of using TERM-NZ CGE model is that each New Zealand region is modelled as a separate economy, but linked to each other through inter-regional trade in goods and factors. TERM-NZ is therefore the ideal tool for examining how closure of Marlborough marine farms might impact both the Marlborough and New Zealand economies.

A technical description of TERM-NZ is provided in Appendix A.

3.1. CGE modelling

CGE modelling is widely regarded as more robust and providing credible impact assessments than input-output (I-O) multiplier methodologies[12] which are well known to over-state economic impacts. Multiplier methodologies typically over-state economic impact estimates because they assume that economic resources such as land, labour and capital inputs are infinitely available, are never idle or can be reallocated without adjustment costs.

In contrast, CGE models are not only driven by prices but also account for resource constraints and flow-on effects. CGE models therefore produce more conservative, but more credible, economic impacts compared to multiplier methodologies.

3.2. Modelling set-up and interpretation of results

We employed a 2-region model set up with a separate Marlborough region and an aggregated rest of New Zealand (14) region. TERM-NZ was used to simulate a hypothetical 'scenario' in which half of the marine farms in Marlborough would cease operations because of any one of a number of reasons.[13] In consultation with MFA, we assumed that outputs of marine farms outside Marlborough are fixed at their initial level. This allows us to account for uncertainties associated with finding new suitable marine farming sites and obtaining new marine farming consents outside of Marlborough.

In a standard CGE approach, we let the model determine how capital and labour resources would move across industries and regions based on rates of return and wages. In the context of capital, this assumption implies that private investors are profit-driven and would invest in the next best, profitable alternative if half of Marlborough marine farms were to cease operations. Labour would also move to other sectors and regions as Marlborough marine farms reduce their employment capacity. However, not all resources, particularly Marlborough farming sites can be reallocated and will therefore reduce their economic contribution.

The difference between the initial and 'reduced marine farming' economy then provides an estimate of the likely contribution that Marlborough marine farming makes to the New Zealand economy. In the next section, we present our results as either percentage changes or dollar values of 'reduced marine farming' economy relative to the initial 'with marine farming' economy.

3.3. Macroeconomic effects

The overall impacts on the New Zealand economy are analysed by focusing on key economic metrics, particularly regional gross domestic product (RGDP) and household welfare (measured by household consumption). GDP is a widely used metric and reflects the total value of goods and services produced in a region (i.e., regional GDP) or in the entire economy (i.e., national GDP) in a given year. Household consumption is a measure of economic well-being (i.e., how 'well-off' or 'worse-off') of all New Zealand residents.

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12 A CGE model is widely regarded as providing a more robust analysis than input-output multiplier methodologies. See, Gretton, P. (2013). 'On input-output tables: uses and abuses.' Staff Research Note, Productivity Commission, Canberra. http://www.pc.gov.au/__data/assets/pdf_file/0008/128294/input-output-tables.pdf

13 This is equivalent to assuming a 50% reduction in output of all marine farms marine (oyster, mussels and salmon) in the Marlborough region.

Household consumption allows us to measure the amount that New Zealanders spend on goods and services.

Table 2 presents our estimates of key macroeconomic metrics. As agreed with MFA, we focus on the dollar ($NZ) value of Marlborough region and New Zealand:

- gross domestic product (GDP)
- household consumption, which is our measure of economic well-being

The Marlborough economy would contract by $37.3 million annually, if half of its current marine farms were to cease operations. The economies of all other New Zealand regions would also contract by $87.5 million due to flow-on effects associated with closure of Marlborough marine farms. Overall, the entire New Zealand economy would be smaller by $124.8 million per year (roughly 0.05% of $230 billion GDP in 2014).

Over 25 years, the impacts are substantial with national GDP losses amounting to $1.33 billion (discounted at 8%). This is broken down into regional GDP losses in the order of $398 million for Marlborough and $934 million for other New Zealand regions.

Table 2 Impacts on GDP and welfare

In 2014 $NZ million per year (real terms)

	Marlborough	Rest of New Zealand	New Zealand
RGDP (expenditure-side)	-37.3	-87.5	-124.8
RGDP (25-Year PV at 8% discount rate)	-397.8	-934.0	-1,331.7
Consumption (Welfare)	-18.4	-52.1	-70.5

Source: NZIER

Our measure of economic welfare (i.e., consumption), indicates that Marlborough residents would be 'worse off' by $18.4 million with welfare of all households in the entire New Zealand economy being worse off by $70.5 million. This is because of reduction in incomes from wages and capital returns as half of Marlborough marine farms cease operations and due to reduced capacity of seafood processing.

3.4. Direct effects

We now assess the direct impacts to Marlborough and New Zealand economies, if half of current Marlborough marine farms were to cease operations.

The associated direct economic (i.e., value added) losses to Marlborough would be $42.5 million due to reduced economic activities in mussels, oyster and salmon farming, and seafood processing (respectively, -$19.6, -$0.3, -$4.7 and -$17.9 million dollars). Partly offsetting the direct economic losses is some expansion of other industries that results in a net positive indirect impact of $7.3 million per year. The overall effect would be a net reduction in regional GDP of $37.3 million per year.

Indirectly-affected industries would shrink by between $0.2 and $1.3 million per year (e.g., electricity, transport and storage, wholesale and retail, personal and property services), while the central government stands to lose about $2.1 million in commodity tax revenue from Marlborough per year.

While our model traces the economic transactions between sectors, one factor it is unable to assess is the impact of a major reduction in mussels to Marlborough's processing factories. These are currently geared for volume production, sometimes operating across more than one shift due to seasonal and other factors. A prolonged decrease in mussels would change the operating conditions, possibly reducing the viability of factories and causing mussels to be diverted out of the region. Another factor not picked up in the model is the effect on small emerging industries in the region like nutraceuticals which are not visible in the industry categorisation.

Table 3 Direct and Indirect flow-on impacts in Marlborough

In millions $NZ per year, unless other units indicated

	Marlborough
Mussels	-19.6
Oysters	-0.3
Salmon	-4.7
Seafood processing	-17.9
Total direct impacts	**-42.5**
Electricity	-0.2
Transport and storage	-0.6
Wholesale and retail	-0.4
Personal and property services	-1.3
Other industries	9.8
Total indirect impacts	**7.3**
Total value added (direct + indirect) impacts	**-35.2**
Add: Commodity taxes	-2.1
Real GDP (Gross Domestic Product)	**-37.3**
Employment (in number of people)	-128

Source: NZIER

Partly offsetting the negative impacts is the expansion ($9.8 million) in other non-affected industries in Marlborough. This arises from the availability of 'unproductive' capital and labour resources that are no longer in use by marine farming industries and put to their second-best alternative uses. The net effect remains negative: Marlborough's regional GDP would be smaller by $37.3 million per year.

Indirectly-affected industries that service other regions' seafood processing, such as electricity and transport and storage, also see a reduction in their economic activities by $2.5 and $4 million per year, respectively. Industries that households spend money on are also indirectly affected due to lower household incomes. These industries include wholesale and retail services as well as personal and property services (they shrink by $1.6 and $26.7, respectively).

3.5. Effects beyond Marlborough

The contraction of the marine farming activity in Marlborough would also have effects beyond Marlborough, in other regions and in New Zealand as a whole. Most obvious would be a reduction in throughput for seafood processing plant outside Marlborough that currently receive part of the marine farm output, but because reductions in income for those plant owners and employees would curtail their spending in other sectors there would be general contraction across New Zealand at large. Our economic model accounts for this by estimating the changes in input prices and their deployment across sectors.

The negative direct impact in Marlborough reverberates across New Zealand, with seafood processing industries in other New Zealand regions contracting by $160 million. The scale back in processed seafood production is due to reduced inputs from Marlborough marine farms. This important flow-on impact underscores the economic value that Marlborough marine farms make to seafood processing activities in other regions.

Conversely, the model suggests there might be some value added expansion of mussel farming and salmon farming in the regions outside Marlborough, as unproductive capital and labour resources precluded from Marlborough move to other regions. Our modelling assumes that no new water space would become available to account for uncertainties associated with finding new suitable marine farming sites and obtaining new marine farming consents outside of Marlborough. A loss of marine farming space is not offset by new space elsewhere, and the gain in value added in other regions arises from a combination of domestic price rises (reflecting reduced supply) and increases in operating surplus and employee compensation components of value added.

The results of the modelling are summarised in Table 4. This shows the modelled impacts in all regions outside of Marlborough, and the net effect on New Zealand as a whole. The table shows that the effect on aquaculture is dominated by the negative impact on seafood processing, but there could be small net gain in mussels and salmon farming for reasons outlined above. The model shows negative impacts on a range of supplying industries closely associated with seafood processing, but these would be more than offset by increases in other industries.

Table 4 Direct and Indirect flow-on impacts on the rest of New Zealand of reduced marine farming in Marlborough

In millions $NZ per year, unless other units indicated

	Rest of New Zealand	All New Zealand
Mussels	24.9	5.3
Oysters	-3.2	-3.5
Salmon	5.5	0.8
Seafood processing	-160.0	-178.0
Total direct impacts	**-132.9**	**-175.4**
Electricity	-2.5	-2.7
Transport and storage	-4.0	-4.6
Wholesale and retail	-1.6	-2.0
Personal and property services	-26.7	-27.9
Other industries	86.1	95.9
Total indirect impacts	**51.4**	**58.7**
Total value added (direct + indirect) impacts	**-81.5**	**-116.7**
Add: Commodity taxes	-6.0	-8.1
Real GDP (Gross Domestic Product)	**-87.5**	**-124.8**
Employment (in number of people)	128	-

Source: NZIER

Overall, however, there would be net reduction in real GDP of $124.8 million per year across all of New Zealand. About a third of this would be reductions born in Marlborough District.

3.6. Employment effects

Taking account of both direct and indirect effects, the number of people employed in Marlborough would fall by 128, equivalent to about 0.6% of the region's full-time labour force. Employment levels in other regions would rise by the same amount.[14] As is standard in regional CGE modelling exercises, the national employment level is held constant with the labour market adjusting through changes in real wages. This means that workers who become unemployed in Marlborough would be able to find employment in other industries within Marlborough or in other New Zealand regions.

These results reflect the economic model structure for 2014, in which all King Salmon produced in Marlborough are processed in Nelson, and some of the mussels are processed elsewhere. In future, with closure of Sanford's Christchurch mussel processing plant, the effect on processing outside of Marlborough may be reduced somewhat, but the effect on processing within Marlborough will be increased to the extent that the processing that would have occurred in Christchurch takes place in Marlborough. We have insufficient data with which to quantify this effect.

[14] We do not distinguish between full time and part time equivalents

4. Conclusion

Internationally aquaculture is seen as a growth industry with potential to provide sustained food supply as wild capture fisheries are fully exploited. In New Zealand the contribution of aquaculture to seafood supply has yet to reach the proportion of some other countries, but Marlborough was an early location for aquaculture development and it remains the pre-eminent region for marine farming.

The New Zealand Aquaculture Strategy adopted by the Government by 2012 has a goal of achieving $1 billion worth of output by 2025. This would require a six-fold increase in current export and domestic outputs in constant dollar terms, and likely require both continued production from existing marine farming and expansion in suitable locations. Knowing the value obtained from existing areas of marine farming is an important step in weighing up the multiple competing uses and interests in sea-space.

This report estimates the contribution of aquaculture in Marlborough to the regional and national economies. Marine farming alone contributes about 3.7% to Marlborough's regional GDP of $2.83 billion, or about 0.05% of the national GDP of $230 billion. The combination of marine farming and processing of marine farming produce contributes 5.7% of Marlborough's GDP and employs the equivalent of 5.2% of full time employed and 3.7% of the total labour force in the District. This means marine farming and processing has a direct impact about a third that of viticulture and wine-making in Marlborough. These percentages are significant in a diverse regional economy.

All this economic value depends on continued access to the marine resource. At present marine farming consents cover about 2.1% of the surface area of the Marlborough Sounds, and consents for expansions in these structures have been very small in recent years. Currently zoning allows for marine farming in the coastal margins of about 20% of the Sounds area (in Coastal Marine Zone 2), but changes of status for marine farming could create uncertainty over future development.

Uncertainty over continued access or costs of future consenting can dampen reinvestment to maintain and enhance marine farming production and economic value, curtailing a strategic opportunity for aquaculture to contribute to Marlborough's economy and community well-being. Such uncertainty reflects a majority of marine farms facing consent renewal by 2025, the existence of some long-established farms in Coastal Marine Zone 1 where aquaculture is not permitted, and the possibility of increased consenting requirements on renewals. If all existing farms faced on their renewals similar processes applied to new consents, the MFA has estimated a cost to the industry of more than $40 million, but this figure is not used in our economic modelling.

To examine the potential economic consequences for the region and the nation of changes in marine farming activity, we apply a computable general equilibrium model of the regional economy to a hypothetical scenario of 50% reduction in marine farming production. This suggests there would be a $37.3 million annual reduction in the regional economy, equivalent to 1.3% of RGDP. Similarly it results in a $124.8 million annual reduction across New Zealand, equivalent to 0.05% of national GDP.

These results are not linear, as the CGE model specifically accounts for changes in demands and prices of inputs across the economy, and the adjustment across sectors as some pick up resources shed by other sectors. The model shows a mixed pattern of

negative direct impacts on marine farming and seafood processing, positive indirect effects on other sectors, but overall a net reduction in value added in both Marlborough and New Zealand.

As Marlborough marine farming's current direct contribution to national GDP is about 0.05%, such a contraction would be equivalent to negating that contribution. This result is driven by the indirect impacts on processing in regions other than Marlborough, reflecting the fact that an impact on a primary sector supplier of raw material can have an amplified effect as value is added (or forgone) by processing and marketing down the supply chain.

Official data on aquaculture is partial and the model database has drawn on a mix of official statistics and information from industry of variable quality. There is a limit to the precision that can be attached to results, and changes in future market conditions (like prices) from those assumed in the model could also vary the results. However, the model has been based on an update of Statistics New Zealand's latest inter-industry transaction tables, and it has been found to provide adequate results in a range of other modelling applications. Imperfect though the data may be, aquaculture makes a positive contribution to the regional economy.

Aquaculture is particularly important in providing employment in remote areas that might otherwise have few alternatives. There are multiple processing plants in Havelock as well as in Blenheim, and supporting services for marine farming are found throughout the Sounds. There are a number of positive social impacts from that generation of employment and income in the region, in retaining population in small communities, supporting property prices, and invigorating voluntary community services. These are not quantified in this report, but can be expected to be predominantly positive with the existence of marine farming, and to be adversely affected should it contract.

Limitations and caveats

The limitations of our study are the following:

- There are no comprehensive data sources for all aspects of aquaculture's economic consequences, so modelling depends on a mix of Statistics New Zealand's official data supplemented by industry information
- Model runs depend on assumptions about values and other factors that may change over time
- The model and database used are for year ending March 2014.

Despite limitations this modelling indicates the extent of direct and indirect economic impacts of aquaculture, and can be replicated for other regions.

Appendix A TERM-NZ CGE model

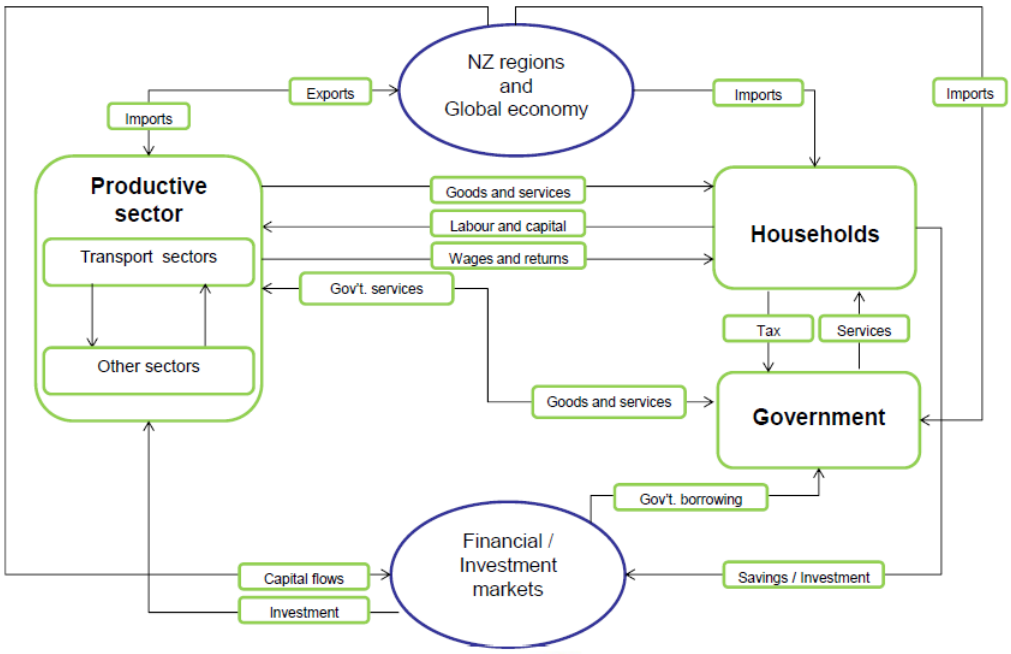
NZIER's TERM-NZ CGE model is a static bottom-up regional CGE model of the New Zealand economy and its key regions.[15]

TERM-NZ is based on an empirical, government-produced database (Statistics New Zealand's Input-Output table) that identifies the structure of the industries involved. TERM-NZ contains information on up to 108 industries, 207 commodities and 15 regions. For this study, we have aggregated the model's database to 50 industries, 100 commodities which include separate sectors for mussels, oysters and salmon. As agreed with MFA, we employed a 2-region model set up with a separate Marlborough region and an aggregated rest of New Zealand (14) region.

TERM-NZ treats Marlborough and rest of New Zealand regions as separate economies. This means that we are able to account for region-specific inter-linkages between industries, as well as their links to households (via the labour market), the local and central government, capital markets, the rest of New Zealand (via inter-regional trade) and the global economy (via imports and exports).

A visual representation of TERM-NZ is shown in Figure 5. It highlights the complex and multidirectional relationships between the various parts of each regional economy and how they interact with the rest of New Zealand and rest of the world.

Figure 5 Perspective of our regional CGE model



Source: NZIER

15 TERM-NZ stands for "The Enormous Regional Model" of the New Zealand economy. It was developed at NZIER by Dr. Erwin Corong based on the original Australian TERM model created by Professor Mark Horridge of the Centre of Policy Studies, Victoria University-Melbourne, Australia. http://www.copsmodels.com/term.htm

Appendix B Area of marine farms in Marlborough

Marine farming in Marlborough expanded rapidly from the 1970s through to the 1990s, but then slowed down, checked by moratoria applied by Marlborough District Council in 1996 and later by national policy from 2004. Consents for expansions in productive structures have been small in recent years. Since the moratoria were lifted in 2011, 9 new sites with an area of 73ha and 31 extensions to existing farms with an area of 90.2 ha, have been consented over the four and a half years January 2011- June 2015. After allowing for 31.3ha of renewals not granted or granted for reduced area, this resulted in a net increase in marine farming productive area of 131.9ha, equivalent to 0.09% of the area of the Sounds.

Current Measurement	Mussels	Oysters	Salmon	Total
Consented hectares to December 31 2014	2,974ha (includes 5 new farms totalling 19.6ha, 24 extensions minus non-renewals totalling 45.3ha, since 2011)	68ha	63.5ha (+19.4 unused)	**3,125ha**
Consented hectares to June 30 2015	2,991.5ha (includes one new farm this year @3.9 ha and 7 extensions totalling 13.6ha, since 2014)	68ha	132.4ha (includes 3 new consented farms totalling 49.5 ha)	**3,192ha**

Source: MFA, drawing from MPI and MDC sources