Marlborough Salmon Relocation – Economic Impact Assessment

Ministry for Primary Industries

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Private & Confidential

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Dear Hamish

In accordance with our contracts dated 02 May 2016 and 31 August 2016, we present our report on the economic impact assessment of salmon relocation to be undertaken by New Zealand King Salmon. We have completed the simple macro-economic assessment, as discussed, and provide the quantitative information as well as some discussion. Please note that this document should be read in conjunction with the Restrictions in Appendix B.

Thank you for engaging us to conduct this analysis. We have found it an interesting assignment and hope that the results are helpful.

Yours sincerely

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Executive summary

Overview

This report was commissioned as part of a process that is assessing options for salmon farms in the Marlborough Sounds. The Ministry for Primary Industries (MPI), the Marlborough District Council, New Zealand King Salmon (NZKS) and other stakeholders are engaged in a process of reviewing the performance and impacts of existing farms and developing recommendations for their future. One possible option is that current sites are swapped for new sites that are more suitable. Another possible option is that current sites are managed differently. Both options include development and application of Best Management Practices (BMPs) for managing salmon farms in the Marlborough Sounds. The economic analysis in this report is one input into that process.

This report can support an AEE process

One stage of the process will include an Assessment of Environmental Effects (AEE) under the Resource Management Act (RMA). This report has been prepared with that in mind. It identifies likely economic impacts of changes to management of the salmon farms, both from swapping sites and from adopting BMPs. It provides estimates of the annual economic impact per 100 tonnes of salmon production for the Nelson and Marlborough regions. It also estimates the one-off economic impacts of NZKS constructing a single new salmon farm in the Marlborough Sounds for the Nelson and Marlborough regions.

The focus is economic impacts using standard metrics

The report focuses on the following:

- Regional economic impacts on Nelson and Marlborough; impacts outside those areas are not included
- Operational impacts from production of salmon, and construction impacts from developing new sites. Operational impacts are presented as annual impacts and are expected to be ongoing. Construction impacts are one-off and expected to occur within a single year
- Standard metrics of economic impact:
    - Value add or gross domestic product (GDP) impacts
    - Employment impacts, measured as full-time equivalents (FTEs)
    - Direct, first round and industrial support impacts for both value add and employment. Combined, first round and industrial support impacts are called indirect impacts.

We used IO multipliers to estimate future impacts

The method used is input-output (IO) analysis using multipliers, based on data from Statistics New Zealand.[1] Inputs for the analysis were sourced from financial information provided by NZKS and BMP information from Cawthron Institute. Additional data was sourced from the PwC Regional Industry Database (RID).

Because some details about future levels of production and future sites are yet to be decided, our analysis estimated the impacts per 100 tonnes of production and per additional site developed.

[1] The input-output (IO) multipliers for the Nelson and Marlborough regions used in this analysis were provided by Butcher Partners Limited.

Salmon production contributes to the regional economy

Our analysis found that 100 tonnes of net new annual salmon production can be expected to lead to approximately $0.45 million in increased annual value add or GDP in the Nelson and Marlborough regional economy, and would support approximately 4.7 FTEs annually. These impacts are a total of direct and indirect impacts. The impacts in the region are mostly the result of fish production and processing. The corporate functions of NZKS are included in the economic analysis, because they are located in Nelson.

Our modelled FTE impacts are based on sector averages, rather than specifically on employment by NZKS. Estimated FTEs at the current level of production are lower than actual NZKS FTEs. As a result, our estimated FTE figures appear to be conservative when compared with the current level of employment by NZKS.

New site construction creates one-off impacts

Our analysis also considered the impact of building new salmon farms. Components and supplies for the farm could be supplied locally, in which case constructing the farms would have positive direct and indirect effects. Some components may end up being sourced from overseas, reducing the contributions to the local economy from construction activities.

Our analysis found that each new site would produce one-off value add or GDP impacts of approximately $3.2 million for the Nelson and Marlborough economy. Each site would support approximately 39.0 FTEs for the region for a year. No consumption or induced impacts were included.

Low-flow sites still produce economic impacts

Our analysis found that NZKS's projected future production not operating under BMP guidelines at its six existing low-flow salmon farm sites would be expected to lead to an annual value add or GDP in the Nelson and Marlborough regional economy of approximately $10.0 million, and would result in approximately 105 FTEs being supported annually. This level of production is similar to the 2014-2015 level. These impacts are a total of direct and indirect impacts. They do not include any consumption or induced impacts.

BMP guidelines could produce a range of economic impacts

Our analysis used the Cawthron Institute's projected feed discharge levels under BMP guidelines to estimate NZKS's annualised salmon production under BMP guidelines at its six low-flow salmon farm sites. Our analysis found that NZKS implementing BMP guidelines at its six existing low-flow salmon farm sites can be expected to lead to an annual value add or GDP in the Nelson and Marlborough regional economy of approximately $8.2 million to $18.0 million, and would result in approximately 85 to 188 FTEs being supported annually.[2] The range of results is a direct result of the range of feed discharge levels reported in the Cawthron Institute report. The minimum figure represents a decrease from reported 2014-2015 production levels, while the maximum figure represents an increase. These impacts are a total of direct and indirect impacts. They do not include any consumption or induced impacts.

The economic impacts depend on the BMP levels of production being commercially viable. We have used the outputs of an Excel model created by NZKS which calculates whether the Ruakaka, Waihinau and Otanerau salmon farm sites are commercially viable under maximum BMP guidelines. The results of the model show that under maximum BMP guidelines only Otanerau is commercially viable.

[2] These sites are: Otanerau, Ruakaka, Forsyth, Waihinau, Crail MFL 32 and Crail MFL 48.

BMP guidelines lower economic impacts compared to baseline

Production levels may be limited due to operational considerations as well as benthic impacts. The final impact will depend on the combined impacts of these limits and practical site management considerations. Our analysis found that operating under BMP guidelines, incorporating commercial viability and operations considerations can be expected to lead to a decrease of approximately $3.6 million in annual value add or GDP in the Nelson and Marlborough regional economy, and would result in approximately 38 fewer FTEs being supported annually compared to baseline production.

New high-flow salmon farms have positive economic impacts

Our analysis used the Cawthron Institute's projected feed discharge levels under BMP guidelines for Tio Point and the National Institute of Water & Atmospheric Research's projected feed discharge levels under BMP guidelines for the other eight new high-flow salmon farm sites to estimate NZKS's annualised salmon production under BMP guidelines at the nine high-flow salmon farm sites. Using these production figures, our analysis found that the nine new salmon farm sites in the Marlborough Sounds can be expected to lead to approximately $56.8 million in annual value add or GDP in the Nelson and Marlborough regional economy, and would result in approximately 592 FTEs being supported annually. These impacts are a total of direct and indirect impacts. They do not include any consumption or induced impacts.

The analysis is limited by the method and data used

The analysis reported here is an attempt to measure the potential economic impacts for Nelson and Marlborough of certain business activities. It is subject to a number of limitations. One important limitation is the reliance on data from NZKS. A second limitation is the use of IO analysis, with the well-known assumptions of that approach. However, those assumptions are not likely to be important for the economic results: resource constraints are unlikely to be binding on NZKS, with the possible exception of some site development activities.

Introduction

Context and Scope

The Ministry for Primary Industries (MPI), the Marlborough District Council, New Zealand King Salmon (NZKS) and other stakeholders are engaged in a process of reviewing the performance and impacts of existing farms and developing recommendations for their future. One possible option is that current sites are swapped for new sites that are more suitable. Another possible option is that current sites are managed differently. Both options include development and application of Best Management Practices (BMPs) for managing salmon farms in the Marlborough Sounds. The economic analysis in this report is one input into that process.

One stage of the process will include an Assessment of Environmental Effects (AEE) under the Resource Management Act (RMA). This report has been prepared with that in mind. It identifies likely economic impacts of changes to management of the salmon farms, both from swapping sites and from adopting BMPs. It provides estimates of the annual economic impact of 100 tonnes of salmon production for the Nelson and Marlborough regions. It also estimates the one-off economic impacts of NZKS constructing a single new salmon farm in the Marlborough Sounds for the Nelson and Marlborough regions.

This report focuses on the economic analysis of potential impacts from the changes to NZKS activities. Salmon production and processing by NZKS is done in the Nelson and Marlborough regions. Therefore, the analysis focuses on the economic value added to these two regions. We use a macro-economic approach – multiplier analysis based on input-output analysis – to quantify the potential economic impacts. The analysis takes into account two distinct phases of impacts:

- **Operational impacts** – we have estimated the economic impacts of NZKS operations, based on financial and other information from the company and information about the economies of Nelson and Marlborough. After discussion with MPI and NZKS, we understood that some details about future sites and their level of products are yet to be decided. We have therefore estimated the **annual economic impacts per 100 tonnes of salmon production**.
    - In the case of swapping old sites for new sites, this information can be used to estimate the total economic impacts, based on estimates of the total **change** in production from the old sites to the new ones.
    - If current sites are maintained and managed using BMPs, the economic impact can be estimated using the operational impacts. This report estimates the annual economic impacts of NZKS implementing BMP guidelines at its six existing low-flow salmon farm sites.[3] To do this, we scaled the estimated annual economic impacts per 100 tonnes of salmon production to projected production after BMP guidelines are implemented.[4]
    - If current sites are maintained and managed without BMPs, the economic impact can be estimated using the operational impacts. This report estimates the annual economic impacts of NZKS not operating under BMP guidelines at its six existing low-flow salmon farm sites. To do this, we scaled the estimated annual economic impacts per 100 tonnes of salmon production to the estimated baseline production of each farm not using BMPs.
    - If new sites are managed under BMP guidelines, the economic impacts can be estimated using the operational impacts. This report estimates the annual economic impacts of NZKS operating nine new high-flow salmon farm sites under BMP guidelines.[5] To do this, we

[3] These sites are: Otanerau, Ruakaka, Forsyth, Waihinau, Crail MFL 32 and Crail MFL 48.

[4] To estimate annual projected production after BMP guidelines are implemented we use the feed discharge level projections provided by the Cawthron Institute.

[5] These sites are: Horseshoe Bay, Richmond South, Mid-Channel Waitata, Blowhole North, Blowhole South, Tipi Bay, Motukina, Te Weka and Tio Point.

scaled the estimated annual economic impacts per 100 tonnes of salmon production to the estimated production of new farms under BMPs.

- **Construction impacts** – we have estimated the economic impacts of constructing each new site, based on information supplied by NZKS. The construction impacts are **one-off economic impacts per new site**, and are expected to occur within a single year (site development requiring less than a year).

In developing our analysis, we have relied on information provided by NZKS about their finances, production and costs. We have not independently assessed the information provided. We have also focused solely on the economic impacts; we express no opinion on any other impacts of the sites or NZKS activities. In addition, the information presented in this report was developed for use in an Assessment of Environmental Effects; it is not intended for any other use. This report should be read in conjunction with the restriction in Appendix B.

Report structure

The structure of this report is based on the purpose of the report described above.

- First, we present financial and production data on NZKS and develop an economic view of their activities.
- Secondly, we quantify the contribution of NZKS to the economy through the channels identified in the first section. This section includes a description of the approach PwC used in developing this analysis and a methodological discussion on input-output and multiplier analysis.
- Thirdly, we quantify the economic impacts of the current farm sites, in terms of both current production levels and production after implementation of BMPs.
- Finally, we quantify the economic impacts of new salmon farm sites under BMP guidelines.
- Supplemental data tables and a description of our data sources are provided in the appendix.

New Zealand King Salmon in Nelson and Malborough

Overview

NZKS are part of New Zealand's aquaculture industry, identified as the world's fastest growing primary industry. By 2030, aquaculture production volumes are expected to match that of 'wild catch' fisheries.[6] In 2011, the industry employed over 3,000 New Zealanders and generated over $400 million of revenue.[7]

The company's activities are centred in Nelson and Marlborough. Economic data on these two Territorial Local Authorities (TLAs) (Nelson City and Marlborough District) are available in PwC's proprietary Regional Industry Database.[8] Data for 2014, the latest year available, indicate the following:

- The two TLAs have roughly the same level of employment, with 26,700 full time equivalents (FTEs) in Nelson and 25,300 FTEs in Marlborough
- They also have local GDPs of similar sizes: $2.24 billion for Nelson and $2.28 billion for Marlborough. For reference, the New Zealand GDP in 2014 was $230 billion
- The largest industry depends on the classification system used. Manufacturing as a whole is the largest sector, larger than any of the service sectors. The primary sector as a whole is roughly the same scale as manufacturing, and is about equally divided between agriculture and all other primary industries
- The aquaculture farms currently contribute 236 FTEs and $15.9 million in GDP to the combined Nelson and Marlborough economies. Processing produces additional output, which we have not estimated.

NZKS are the largest salmon producer and exporter in New Zealand. Currently, about 39 per cent of their production is exported. They currently operate several marine farms in the Marlborough Sounds, as well as a processing plant in Nelson. We have been provided a map of current and potential sites, which is shown in Figure 1. NZKS produce some 6,028 metric tonnes (mt) of salmon annually. Their brands include Regal, Southern Ocean and Ōra King. They currently employ 104 FTEs in their aquaculture activities and 217 FTEs in their fish processing, for a total of 321 FTEs.[9]

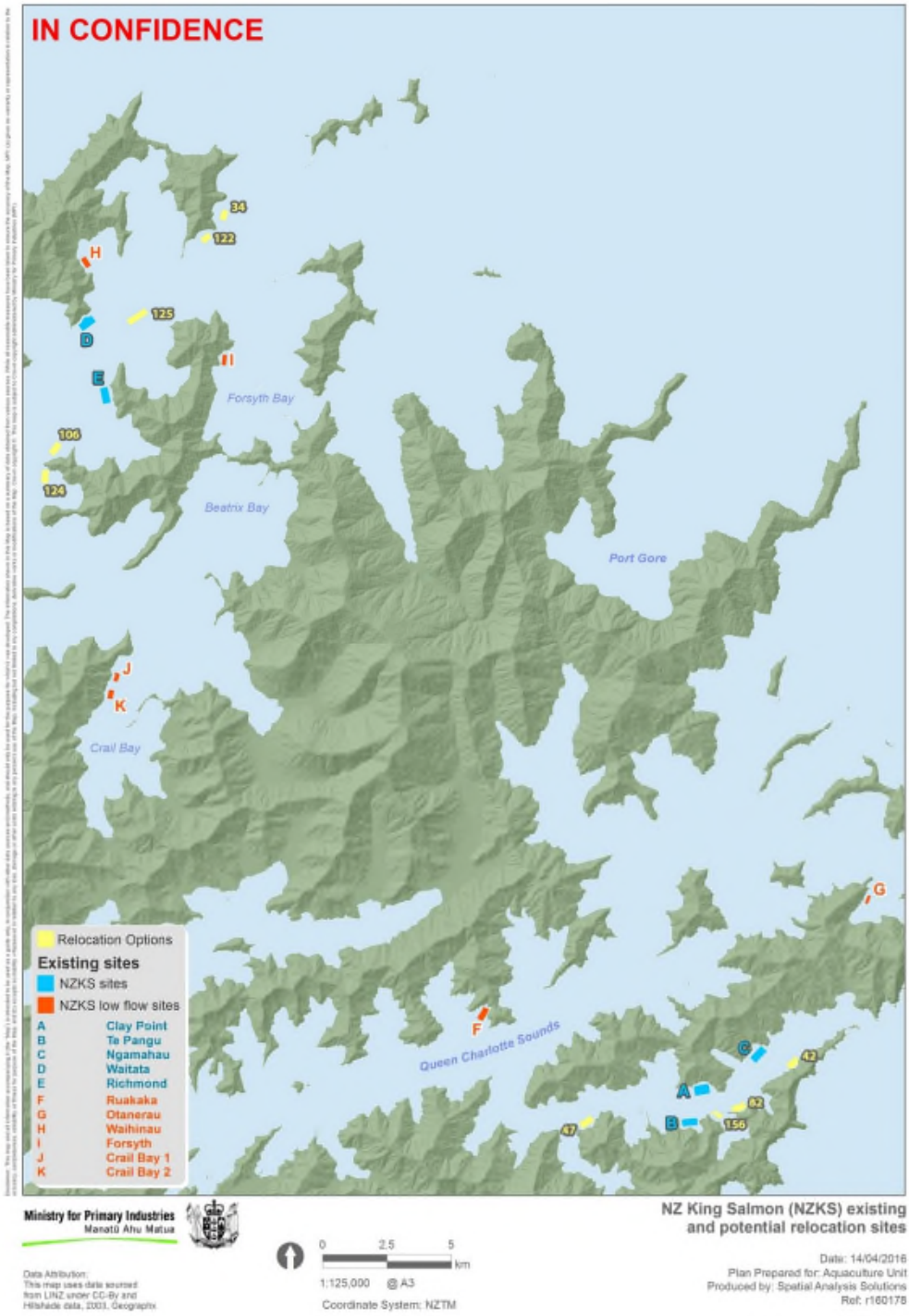
[6] The New Zealand Aquaculture strategy http://www.aquaculture.org.nz/wp-content/uploads/2011/05/Strategy.pdf

[7] New Zealand Aquaculture industry overview http://www.aquaculture.org.nz/industry/overview/

[8] Information about the RID is included in Appendix A.

[9] The number of current FTEs in aquaculture and processing activities is from New Zealand King Salmon's 2015/2016 profit and loss budget forecast.

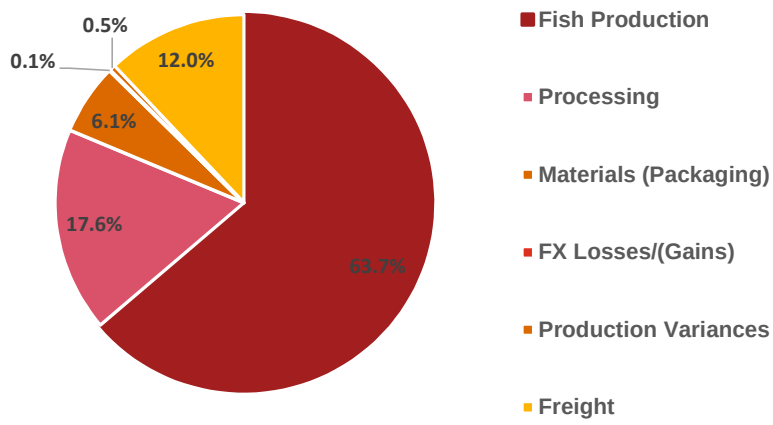
Figure 1 Map of NZKS sites



NZKS's forecast profit and loss statement for FY16 (Figure 2) shows that its sole source of income is from the sale of salmon. Their forecast revenue for FY16 is $112.4 million, which is sensitive to changes in the price of salmon. For example, a $1 decrease in the price per kilogram of salmon would result in New Zealand King Salmon's revenue decreasing by $6.2 million.

Its operating expenses are broken into seven main categories: fish production, processing, materials, FX losses/(gains), production variance, stock management and freight, as shown in Figure 2. In total, its operating expenditure is forecast to be $82.2 million for FY16.

Figure 2: FY16 forecast operating expenditure breakdown



*Note: this figure excludes **stock movements** as they are a negative expense on New Zealand King Salmon's forecast profit and loss (Table 1).*

Table 1 presents forecast profit and loss figures, which show the relative proportions of each operating expenditure category. Fish production makes up 64 per cent of NZKS's operating expenditure. The main input in fish production is feed, which makes up 73 per cent of fish production expenditure. Feed is sourced internationally, with emphasis placed on performance and price.

The operating expenditure is 73 per cent of its revenue giving a forecast margin of $30.2 million for FY 16. NZKS has overheads which are forecast to be $14.0 million for the FY 16 period. This amount is broken into four categories: sales & marketing, distribution & logistics, advertising & promo and corporate. Sales & marketing and corporate expenses make up 76 per cent of these costs.

The profit and loss statement forecasts an operating EBITDA of $16.7 million. On a per-tonne basis, the average EBITDA per tonne of sales is $2,778 on an average price of $18,640 per tonne.

Table 1: New Zealand King Salmon Profit and Loss 2015/2016 forecast

		Forecast June-2016
Sales		
	Harvest Volume (MT)	6,197
	Sales Volume (MT)	6,028
	Average Price (NZD/kg)	18.64
	Sales Value ($)	**112,395,000**
Direct expenses		**($)**
	Fish Production	53,315,000
	Processing	14,689,000
	Materials (Packaging)	5,086,000
	FX Losses/(Gains)	62,000
	Production Variances	429,000
	Stock Movements	(1,444,000)
	Freight	10,053,000
	Total Direct Expenses	**82,190,000**
	Margin	**30,205,000**
Overheads		
	Sales & Marketing	4,964,000
	Distribution & Logistics	1,797,000
	Advertising & Promo	1,521,000
	Corporate	5,701,000
	Total overhead expenses	**13,982,000**
	Add Other Income	(524,000)
Operating EBITDA		**16,747,000**

Capital expenditure

New Zealand King Salmon currently operate several marine farms in the Marlborough Sounds. In order to increase production of salmon significantly, the company will need to build more salmon farms or find sites that are more productive. NZKS have estimated the cost of building a new salmon farm – either for expansion or to replace an old site – at around $6 million. The three main costs in building a salmon farm are the following:

- a barge – a large specialised boat, which can either be purchased off-shore and imported or commissioned in New Zealand
- pens –a structure built with large steel tubes. The construction of pens has changed over time, with NZKS importing new designs from overseas
- nets – polyester nets are attached to the pen structure. They can be imported or produced domestically.

Table 2 below shows a breakdown of these expenditure categories for building a new salmon farm. A salmon farm is normally built in stages with a total build of less than one year.

Table 2: Expenditure breakdown of building a new salmon farm

Expenditure categories	Cost ($)	Time to build
Barge	3,000,000	Six months
Pens	2,000,000	Three – four months
Polyester nets	400,000	Six months
Miscellaneous	600,000	N/A
Total	**6,000,000**	**Less than a year**

Economic impact

Nelson and Marlborough overview

New Zealand King Salmon operates several salmon farms in the Marlborough Sounds and a processing plant in Nelson. The aim of this analysis is to estimate and report the economic impact of NZKS. The key metrics we use for the analysis are the standard ones of gross output, value add and employment. The analysis has been conducted by assessing the impact from producing an extra 100 tonnes of salmon and building a new salmon farm. The analysis shows the economic impact the two activities have on the Nelson and Marlborough regions.

Overall approach

The approach in this analysis was to use Nelson and Marlborough economic data from Statistics New Zealand and the Ministry of Business, Innovation and Employment (MBIE) to analyse the economic impacts of two NZKS activities. The economic data used in the analysis included the National Accounts input-output table from Statistics New Zealand, as well as the PwC Regional Industry Database (RID). The RID is built from data on business demography, regional GDP, industry benchmarks, the Census and housing, and divides the economy into 106 sectors. The first step in the analysis was a matching exercise. The two activities analysed and their initial matching steps are as follows:

- **Operational impacts** – we have estimated the economic impacts of NZKS operations, based on information from the company, particularly the profit and loss statement. After discussion with NZKS, we understood that some details about future sites and their level of products are yet to be decided. We have therefore estimated the **annual economic impacts per 100 tonnes of salmon production**. This information can be used to estimate the total economic impacts, based on estimates on the total **change** in production from the old sites to the new ones. To start the analysis, we matched expense categories from the profit and loss statement for NZKS to relevant industries in the National Accounts.
- **Construction impacts** – we have estimated the economic impacts of constructing each new site, based on information supplied by NZKS. The construction impacts are **one-off economic impacts per new site**, and are expected to occur within a single year (site development requiring less than a year). To start the analysis, we were provided a description of the construction process by NZKS, and we matched expense categories from that description to relevant industries in the National Accounts.

Having done the matching, we were able to calculate the value add and employment contributions to Nelson and Marlborough from NZKS producing 100 tonnes of salmon and building a new salmon farm. We were also able to develop an analysis of the impacts by industry.

Underlying framework

The basic framework of the analysis is input-output (IO) analysis. An IO analysis captures the dependencies across industrial sectors that are a key feature of a modern economy. NZKS, for example, depends on a number of sectors that supply it with the materials it needs, and in turn it supplies a number of sectors. The supplying sectors are called 'upstream' sectors, and the sectors supplied by NZKS are 'downstream' sectors. An IO table captures all the linkages in a single, static picture of the economy.

IO analysis has a few key terms:

- **output / gross output** – output is the gross revenue or sales figure for a sector. It is the sum of all the intermediate inputs supplied by upstream sectors and the value add of the sector, and represents the cost of the sector's outputs for downstream sectors

- **value add / GDP** – value add is the amount of value that a sector adds to the intermediate inputs it uses. It can be calculated as the compensation to employees and the profits the sector earns, or as the gross output less the intermediate inputs. Value add is equivalent to the GDP contribution of the sector
- **intermediate inputs** – intermediate inputs are the costs of inputs or supplies that a sector uses to produce its outputs, and are also the payments that a sector makes to its suppliers or upstream sectors
- **employment** – employment is expressed as full-time equivalents (FTEs), and is calculated as a fixed ratio to output and value add for a sector.

A brief example can make these terms clearer:

- A shirt bought from a retailer might sell for $100. The $100 represents the gross output from the retailing sector.
- The value add of the retailing sector – the extra value it creates by bringing shirts and consumers together – might be $65. This amount accounts for employee compensation and profits in the retail sector that are required in order to produce the $100 in sales.
- The other $35 ($100 - $65 = $35) goes to various costs of supply, including the manufactured shirt, the cost of shop fittings, advertising, etc.
- The manufactured shirt itself, which is an intermediate input, might cost $20. The shirt represents output from the manufacturing sector of $20 dollars. Of that amount, perhaps $8 represents value add by the manufacturing sector. That $8 might go to the employees who make the shirt and profits for the businesses. The other $12 would pay for intermediate inputs, such as fabric and buttons.
- Those other sectors purchase intermediate inputs, such as raw cotton, and add value to them to produce their output.

In this example, $100 is the output of the retail sector, $65 is the value add of the retail sector and the shirt is an intermediate input for that sector. FTE employment can be calculated on the basis of the amount paid to employees and average compensation in the sector.

In an IO analysis, we can choose how far to follow transactions through the economy. There are generally four types of impacts, depending on how far the analysis extends.[10]

- **direct or initial effect** – measures the output, value add or employment impact from the sector being studied
- **first-round effect** – estimates the contribution from the sectors that supply intermediate goods, so estimates the first round of impacts from upstream or backward linkages in the economy
- **industrial support effect** – continues the upstream analysis of backward linkages to include all the supporting sectors and their supporting sectors. The first-round and industrial support effects are collectively called the **indirect effect**
- **induced effect or consumption induced effect** – takes into account the impacts of the sector's income on the whole economy. A sector pays wages to employees and profits to business owners, and they in turn buy consumption goods from the economy.

The different types of analysis are often summarised as multipliers. The direct multiplier is the initial impact on a sector of increasing its output (so the output multiplier of any sector is, by definition, 1.00, while the value-add multiplier is usually less). The indirect multiplier takes into account all the upstream supplying industries to calculate the total supply impact of growth in a sector. Finally, the induced effect

[10] Layman, Bruce, Department of Treasury and Finance, Government of Western Australia, 2002, 'The use and abuse of Input-Output multipliers.'

multiplier takes into account the direct and indirect effects plus the consumption impact of incomes from the sector.

Our analysis

For our analysis, we focused on the direct effect and indirect effects. We have not considered the induced or consumption effect.

There were several reasons for choosing a simple, focused analysis for New Zealand King Salmon:

- the important information for New Zealand King Salmon is how it links into the economy, including how it supports its suppliers. These linkages are captured by the indirect effects
- focusing on the direct and indirect impacts allowed us to use the PwC RID, which provides good data on disaggregated industries and employment
- there is a long-standing debate in economic policy about the validity of multiplier analysis, especially with induced impacts (see sidebar).[11]

Our analysis provides NZKS with a snapshot of how its activities link to the Nelson and Marlborough economies. It estimates the value add of the NZKS producing 100 tonnes of salmon and building a new salmon farm, as well as the value add it creates for its suppliers. The analysis also looks at the FTE employment impacts, both for NZKS and its suppliers, creating an estimate of the number of FTEs created. By taking this approach, we provide a transparent, robust analysis of the contribution of NZKS to the Nelson and Marlborough economies.

Issues with IO analysis

IO tables and multipliers are modelling tools. Like any model, they can be useful but also have shortcomings (Schulze, Cox, & Dixon, 2014; Layman, 2002). Most of these criticisms relate to using multipliers to estimate the economic impact of growth, as opposed to using IO tables to describe a current level of production.

- **unlimited supply** – multipliers assume that the resources (including labour) and industrial capacity exist to produce any increases in output, whereas economies are often constrained in some way
- **fixed prices** – multipliers also assume that prices in the supply chain are fixed, so that suppliers will not put up prices in response to increased demand or capacity constraints
- **static technology** – IO tables are a snapshot in time of the industrial structure of the economy, so they represent the mix of technology that existed at that time
- **fixed consumption shares** – IO tables also work on fixed averages of consumption, so any changes in consumption do not take into account how consumers would adjust their consumption as a result of having a little more or a little less income.

These issues with multipliers become more serious if an analysis includes a long time period, consists of a large change to a sector or to consumption or relies on government subsidies to achieve its result. Using IO analysis for regional analysis has strengths and weaknesses: prices are more likely to be fixed overall, but localised resources constraints may be important to consider.

Applying this approach to NZKS

Producing 100 tonnes of salmon

The 2015/2016 budget forecast provided by New Zealand King Salmon gave estimates of expenditure and revenue breakdown from its activities. We have used the figures to estimate the average costs and revenue from producing 100 tonnes of salmon. For some of the expenditure categories, there was not an industry in the IO table or RID that directly matched. For example, freight encompasses several IO and RID industries such as air transport, sea transport and road transport. For the purpose of this analysis, we have matched each expense category with one or more industry categories in the RID and IO classifications; the resulting mapping is provided in Appendix A. By linking the expense category to an industry in the RID and the IO

[11] Schulze, Cox, & Dixon, BERL, 2014, 'Economic impact assessment of the proposed Wellington Film Museum.'

table, we were able to disaggregate each expense into value add and intermediate inputs. The disaggregation allowed us to estimate the direct impacts and indirect impacts for all the expenses.

To match the IO table industries to the expenditure categories we used the expenditure allocation provided by New Zealand King Salmon.[12] In other words, if there were two IO industries related to an expenditure category we calculated the economic effect for each industry then scaled each industry's economic effect by the proportion of expenditure in that industry. We then summed these industry effects to get the overall economic effect for the expenditure category.

The financial documents from NZKS estimate earnings before tax, depreciation and amortisation (EBITDA) for their operations. In economic terms, EBITDA represents economic returns to the owners of the business or profits. Profits are considered direct value add, as they quantify the returns to capital investment in the sector. However, our analysis is focused on the economic impacts for Nelson and Marlborough. As we understand that the owners of NZKS are not resident in those regions, we have not included EBITDA in our analysis of regional economic impacts.[13]

NZKS source its inputs from essentially three locations: Nelson/Marlborough, the rest of New Zealand and internationally. For example, salmon feed is sourced overseas, and it accounts for 73 per cent of fish production expenses. Advertising & promotion represent spending either overseas (25 per cent) or in the rest of New Zealand, mainly Auckland (75 per cent). Spending that does not happen in Nelson and Marlborough does not contribute to the regional economy, so we excluded them from the analysis.

NZKS source its packing materials from either Nelson/Marlborough or China. In this analysis we have assumed that they have been sourced from Nelson/Marlborough.[14] Therefore, they are included in the analysis. NZKS has also provided different pieces of information on the location for their IT services. In this analysis, we use the information provided in the profit and loss expense breakdown, which shows IT costs are sourced in Nelson/ Marlborough.[15] Therefore, they are included in the analysis.

NZKS's 2015/2016 budget forecast includes smaller expenditure categories: FX losses/ (gains), production variance and stock movements. These are not material in the context of the economic analysis, so we have excluded them from the analysis.

To match the RID table industries to the expenditure categories we summed the value of all the related RID industries for both Nelson and Marlborough to get an overall FTE and GDP count for each of the expenditure categories within the Nelson and Marlborough regions.

For the purpose of this analysis, we are assuming that the economic effect of New Zealand King Salmon producing 100 tonnes of salmon affects the Nelson and Marlborough regions equally.

Building a new salmon farm

NZKS provided us with summary information on the costs of building a new salmon farm. These costs represent one-off increases in demand for the products of a number of sectors. To estimate the direct and indirect impacts of a new farm, we analysed the impact of one-off impacts on the output of the relevant sectors. We used both the IO multipliers and the RID to estimate the economic impact in terms of value add and employment.

The information from NZKS suggested that there are several sources for the inputs to a new salmon farm, and that they have not yet made some key decisions for the future farms. As a result, we have made some assumptions in order to estimate the potential impact of a new farm on the local area. Important assumptions are:

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[12] See profit and loss expense breakdown in Appendix A.

[13] The intuition here is similar to the difference between Gross National Product (GNP) and Gross Domestic Product (GDP). GNP measures production within a country's borders, while GDP measures production from resources owned by the country.

[14] If packing materials were sourced from China then NZKS's freight costs would increase.

[15] See profit and loss expense breakdown in Appendix A.

- For all expenditure categories involved in building a new farm, apart from miscellaneous expenses, there was an industry in the IO table and RID that matched directly, as shown in Appendix A.
- The pen structures and polyester nets for farms can be manufactured in Nelson and Marlborough or overseas. NZKS reported that the costs are relatively similar. In our analysis, we assumed that NZKS uses Nelson and Marlborough-sourced inputs.
- To match the miscellaneous expenses to the IO and RID tables, we selected some broad industries that are commonly involved in building projects.

For the purpose of this analysis and in consultation with NZKS, we have assumed that building a salmon farm would take place within one financial year. Therefore, we have estimated the economic impacts as one-off contributions to value add and employment in Nelson and Marlborough, per farm created.

Analysis of potential impacts

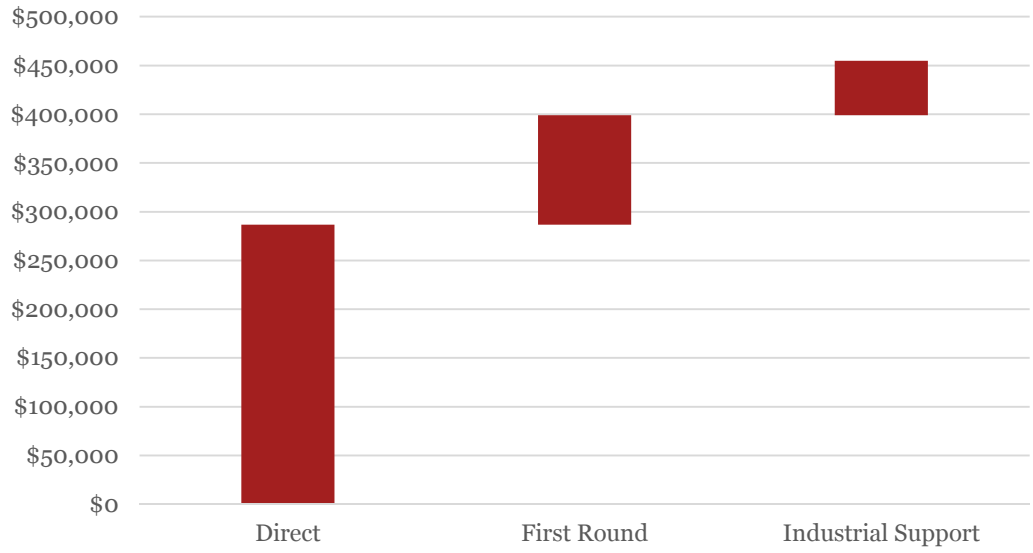
Economic impact of producing 100 tonnes of salmon

We have estimated the impact on Nelson and Marlborough of producing 100 tonnes of salmon, as an average of the production figures for NZKS. The economic impact can be broken into two parts: the amount of value add created and the number of FTEs generated. The impacts described in this section are annual, ongoing impacts: they are the increases to annual value add and employment for the regions.

Impact on value add (GDP impact)

The value add impact from NZKS producing 100 tonnes of salmon is broken into three categories: direct, first round and industrial support, with the latter two together making up indirect impacts.[16] Figure 3 below shows the value add impact broken into these three categories, while Table 3 provides the estimated dollar amounts. The impact of producing 100 tonnes of salmon is an estimated increase in value add in Nelson and Marlborough of $0.45 million. The majority of this impact results from the direct effect of increased business activity by NZKS, with smaller contributions from indirect impacts through the local economy. The result suggests that increasing production by 6,000 tonnes – essentially doubling NZKS's current production – would increase the regional economy by an estimated $27.3 million. This amount represents about 0.6 per cent of the combined GDP for the two regions.

Figure 3: Value add impact from producing 100 tonnes of salmon



[16] See the underlying framework for an explanation of these three categories.

Table 3 Value add impact from producing 100 tonnes of salmon

Type of impact	Amount ($)
Direct	286,838
First Round	112,212
Industrial Support	55,904
Total	**454,955**

The contributions of different expense categories to the total impacts is shown in Figure 4, with the dollar amounts presented in Table 4. There are a few observations to make about the distribution of impacts:

- Fish production contributes more than a quarter of total economic value add, even though the largest input to production is imported and therefore not included in the regional economic impact. This result suggests that importing intermediate goods as inputs to domestic production can produce positive economic impacts.
- Processing has the largest impact, because it happens within the regions being assessed and is a large component of the business.
- Packaging is assumed to be sourced locally for this analysis. The impact of this assumption is relatively small, as this expense category accounts for only 11 per cent of the value add impact.
- Freight, sales & marketing and advertising & promotion are largely sourced outside Nelson and Marlborough and therefore have small regional economic impacts; for advertising & promotion the impact is assumed to be nil.

Figure 4: Value add impact from producing 100 tonnes of salmon, by expense category

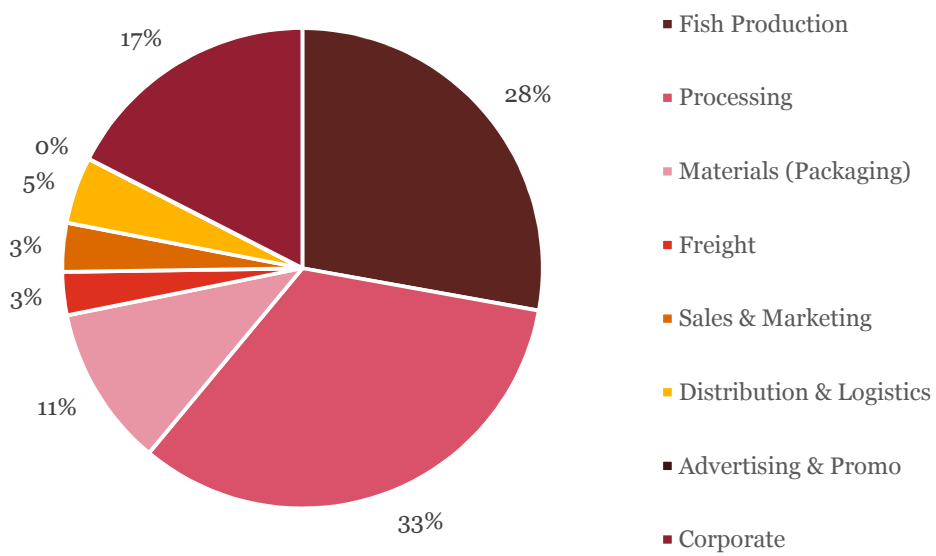


Table 4 Value add impact from producing 100 tonnes of salmon, by expense category

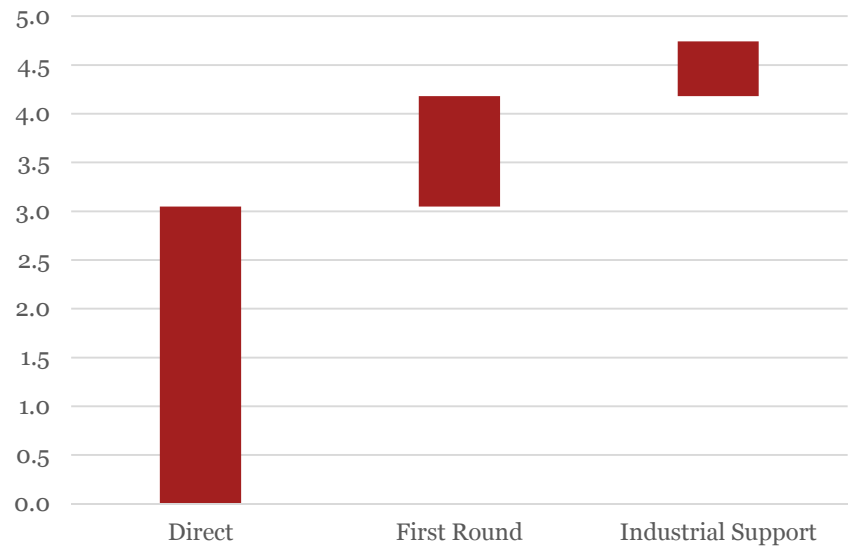
Expense category	Amount ($)
Fish Production	126,566
Processing	151,081
Materials (Packaging)	49,232
Freight	13,225
Sales & Marketing	14,988
Distribution & Logistics	20,420
Advertising & Promo	-
Corporate	79,443
Overall	**454,955**

Impact on the number of FTEs

The FTE impact can be presented in the same way, with direct, first round and industrial support impacts. Figure 5 below shows the FTE impact separated into these three categories, and the FTE amounts are provided in Table 5. In order to produce 100 tonnes, the combined impact for Nelson and Marlborough is approximately 4.7 FTEs. This analysis suggests that the current production of around 6,000 tonnes is supporting approximately 285 FTEs in the two regions, and that doubling production would support a similar number of FTEs.

NZKS currently employ approximately 321 FTEs in aquaculture and processing activities in Nelson/Marlborough, indicating the model approximation of 285 FTEs for all activities in Nelson/Marlborough is a conservative estimate.[17] We have chosen for analytical consistency to use the estimated value, so that all modelled values are taken from a single model.

Figure 5: FTE impact from producing 100 tonnes of salmon



[17] The number of current FTEs in aquaculture and processing activities is from New Zealand King Salmon's 2015/2016 profit and loss budget forecast.

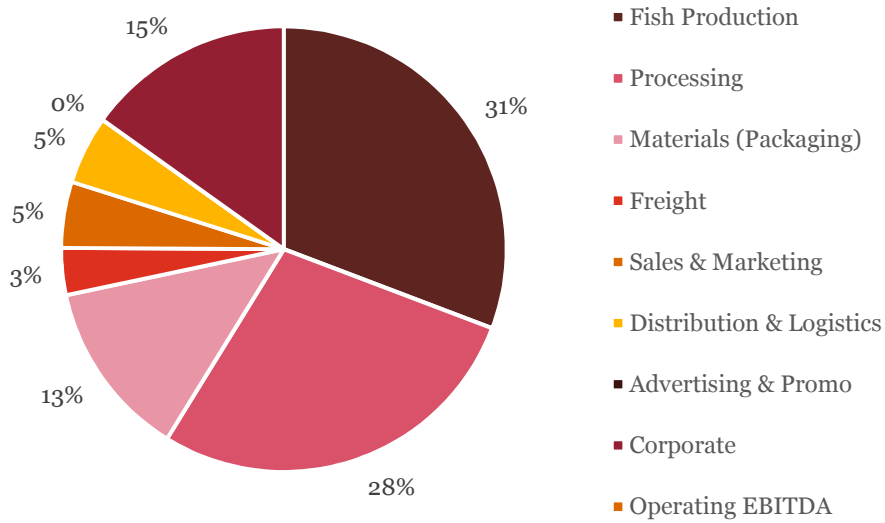
Table 5 FTE impact from producing 100 tonnes of salmon

Type of impact	FTEs
Direct	3.05
First Round	1.13
Industrial Support	0.56
Total	**4.74**

The FTE impact by expenditure category is a result of both the amount of expenditure and the current level of productivity per person or labour intensity in the industry sector.[18] Figure 6 below shows the FTE impact breakdown across NZKS's profit and loss categories, for the Nelson and Marlborough economies.

- Fish production accounts for 31 per cent of the FTE impact, which is lower than its 55 per cent share of expenditure as a result of the imported feed.
- Processing accounts for 28 per cent of the FTE impact compared to 33 per cent of the value add. The difference indicates that processing has high labour productivity relative to other parts of the NZKS operation.
- Freight, sales & marketing and advertising & promotion again have small economic impacts for Nelson and Marlborough, which is reflected in their contributions to overall FTEs.

Figure 6: FTE impact from producing 100 tonnes of salmon, by expense category



[18] Current levels of labour productivity by industry in Nelson and Marlborough are taken from the PwC RID, and have been calculated based on data from Statistics NZ (see Appendix A).

Table 6 FTE impact from producing 100 tonnes of salmon, by expense category

Expense category	FTEs
Fish Production	1.46
Processing	1.33
Materials (Packaging)	0.61
Freight	0.16
Sales & Marketing	0.23
Distribution & Logistics	0.24
Advertising & Promo	-
Corporate	0.72
Overall	**4.74**

One concern with IO modelling is the modelling assumption that the supply of labour is effectively unlimited. The FTEs reported above are off a base of approximately 52,000 FTEs across Nelson and Marlborough, suggesting that there is a large labour pool. We can also consider only the specific industries relevant to the analysis. The mapping between the New Zealand King Salmon expense categories and the IO industries (see Appendix A), as well as data from the PwC RID, allows us to estimate the total FTEs in the relevant industries. The estimated FTEs by industry for Nelson and Marlborough are shown in Table 7. The total is 5,813 FTEs, compared to the estimated 285 FTEs to produce 6,000 tonnes of salmon. As a result, the labour supply assumption required for the IO analysis is not unrealistic.

Table 7 Local FTEs for relevant industries

P&L Account	IO Industry	Sum(FTEs)
Fish Production	Fishing and aquaculture	1,134
Processing	Seafood processing	1,193
Materials (Packaging)	Polymer product and rubber product manufacturing	96
Materials (Packaging)	Building cleaning, pest control, and other support services	151
Freight	Road transport	498
Freight	Other transport	24
Freight	Air and space transport	398
Sales & Marketing	Advertising, market research, and management services	526
Distribution & Logistics	Warehousing and storage services	94
Advertising & Promo	Advertising, market research, and management services	526
Corporate	Legal and accounting services	917
Corporate	Computer system design and related services	255
Total		**5,813**

Economic impact of building a new salmon farm

We have also estimated the impact on Nelson and Marlborough of building one new salmon farm. The economic impact can be broken into two parts: the amount of value add created and the number of FTEs generated. These impacts are one-off construction impacts, and are expected to occur within one year. After construction, value add and FTEs would be expected to return to their baselines.

Impact on value add (GDP impact)

The value add impact from building a new salmon farm can be separated into three categories: direct, first round and industrial support.[19] Figure 7 below shows the value add impact broken into these three categories, assuming that components for the farm are built locally. The value add impact of a new salmon farm is estimated as $3.2 million with the majority of this impact from the direct effect. This figure represents the one-off contribution to regional GDP that would be expected from constructing one farm.

Figure 7: Value add impact from building a new salmon farm

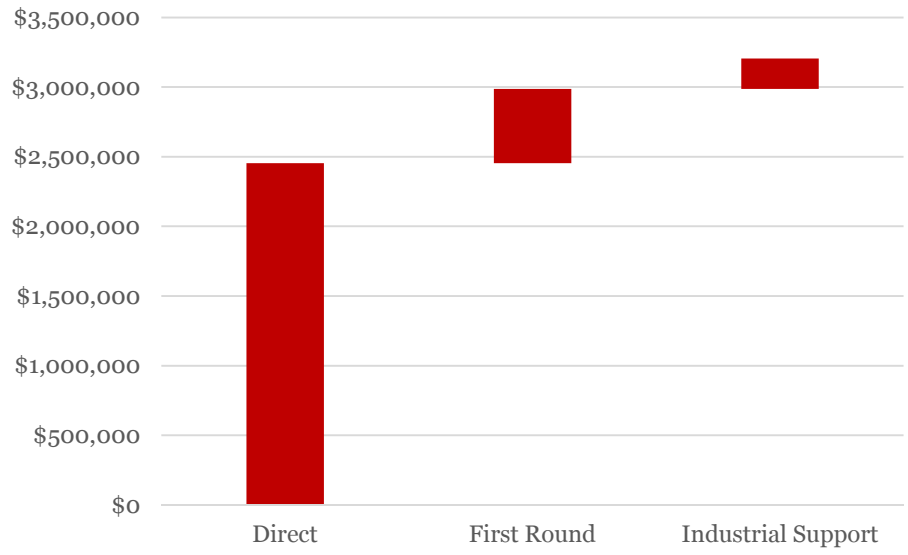


Table 8 Value add impact from building a new salmon farm

Type of impact	Amount ($)
Direct	2,454,000
First Round	532,000
Industrial Support	219,000
Total	**3,205,000**

NZKS identified four main cost categories associated with building a new farm. The largest expenses also create the largest economic impacts in terms of value add, as shown in Figure 8. Because the impacts shown here are based on the assumption that components like the barge and pens are constructed locally, they also indicate the reduction in regional economic impact from sourcing these components

[19] See the underlying framework explanation for an explanation of these three categories.

internationally. For example, if the barge were sourced overseas rather than being constructed locally, the economic impact of developing a new farm would decline by approximately 45 per cent, to approximately $1.8 million. The exact impact would depend on the mix of locally-sourced and foreign-sourced inputs.

Figure 8: Value add impact of building a new salmon farm, by source

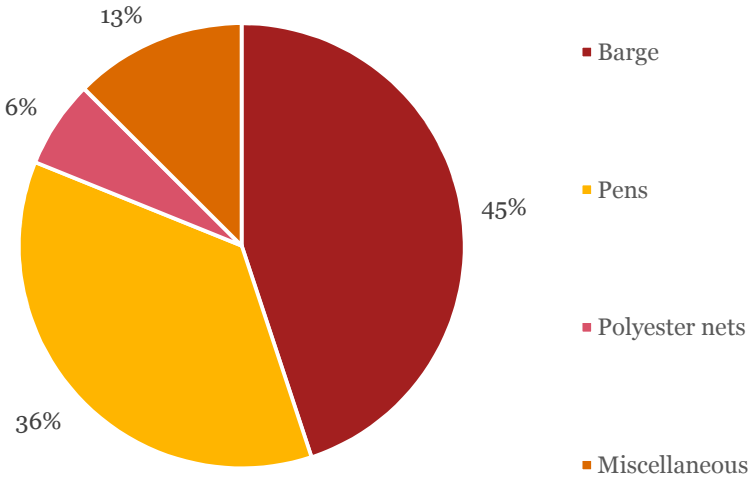


Table 9 Value add impact of building a new salmon farm, by source

Source of impact	Amount ($)
Barge	1,440,000
Pens	1,160,000
Polyester nets	204,000
Miscellaneous	401,000
Total	**3,205,000**

Impact on the number of FTEs

As before, the FTE impact can be separated into direct, first round and industrial support impacts.[20] Table 10 provides figures for these FTE impacts for the four cost categories. The impact from building a new salmon farm is approximately 39.0 additional FTEs in the year of construction, with the majority of the FTEs involved in building the barge or the pens.

[20] See the underlying framework for an explanation of these three categories.

Table 10: FTE impact from building a new salmon farm

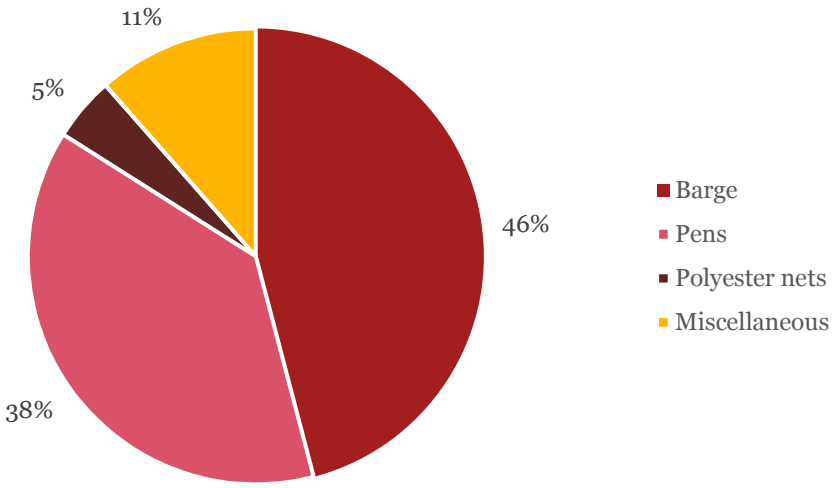
Cost category	New Farm				Current FTEs (Industry Total)	Percentage FTE increase required
	Direct	First Round	Industrial Support	Total FTE Impact		
Barge	13.8	3.2	0.9	17.9	479	3.7%
Pens	12.2	1.8	0.8	14.9	100	14.9%
Polyester nets	1.2	0.4	0.2	1.8	109	1.6%
Miscellaneous	3.3	0.8	0.3	4.5	3,210	0.1%
Total	30.6	6.3	2.2	39.0	3,898	1.0%

In addition, Table 10 includes current FTE counts for the relevant industries in Nelson and Marlborough (see Appendix A for a mapping between the cost categories and the RID industries).[21] As a result, it provides a sense of the scale of the impact on different sectors in Nelson and Marlborough and where resource or supply constraints could lie. We have categorised the pen construction, for example, as 'Other manufacturing', and that industry would see its employment rise by approximately 14.9 per cent. To some extent, these increases by industry are an artefact of choices made in the modelling. However, it does raise the issue of capacity in the region to support the building of multiple farm sites at the same time. These results also suggest that a multi-year plan for constructing new sites could provide a sustained boost to employment in specific industries or businesses in the region.

Figure 9 provides a different view of these FTE impacts. As suggested by the numbers in Table 10 the construction of the pens produces the largest impact on employment, with barge construction producing the second largest impact. As with the value add numbers, these FTE percentages indicate the reduction in local impacts if the components of a new farm are sourced overseas.

[21] The current number of FTEs is from the RID. See Appendix A for more details.

Figure 9: FTE impact breakdown



Analysis of baseline production

Introduction

We have estimated the impact on Nelson and Marlborough of NZKS's potential future production not operating under BMP guidelines at its six existing low-flow salmon farm sites.[22] The economic impact can be broken into two parts: the amount of value add created and the number of FTEs generated. The impacts described in this section are total annual, ongoing impacts: they are the annual value add and employment for the regions from the projected levels of production at the six sites.

To estimate annual baseline production levels at the six existing low-flow salmon farm sites requires complex site-by-site considerations.[23] From discussions with MPI and NZKS, we understand that baseline salmon production levels for Otanerau and Ruakaka can be estimated as the average annual salmon production level over the previous two financial years (FY14 and FY15).[24] We understand that the baseline annual salmon production levels at the two Crail Bay sites will be zero in the short-term.[25] The baseline production levels for Forsyth and Waihinau were estimated by NZKS and agreed by MPI, based in part on annual feed discharge levels of 1,300 metric tonnes and in part on operational considerations for those two sites.[26]

In this chapter, the economic impacts are reported for each of the six sites. For the two Crail Bay sites the annualised salmon production is zero.[27] We understand this is only temporary as NZKS could use these sites after they have optimised their more efficient high-flow sites.[28] As before, the value add and FTE impact from NZKS not implementing BMP guidelines can be separated into three categories: direct, first round and industrial support.[29]

Table 11 details the annualised baseline production figures that we have used in our economic analysis.

[22] These sites are: Otanerau, Ruakaka, Forsyth, Waihinau, Crail MFL 32 and Crail MFL 48.

[23] Through discussions with NZKS, we understand that if they do not follow BMP guidelines they will be able to increase annual salmon production levels, as they would not have to keep feed discharge under a certain level. They would also be able to use oxygenation, water cannons and vaccinations to increase annual salmon production levels.

[24] The previous two years are considered the most accurate as mortality rates at the salmon farm sites has increase since 2013, meaning salmon production levels before 2014 are not reflective of the current environment the salmon farms are operating in. (Source Sam Best, New Zealand King Salmon, September 2016). See appendix A for a detailed breakdown of the salmon production levels for the six low flow salmon farm sites over the previous four years (Fy12-Fy15).

[25] From discussions with MPI and NZKS, we understand that NZKS is prioritising the operations of its more productive high flow sites before increasing production levels at the low flow sites. This is due to the high flow sites being more efficient in terms of feed discharge levels and mortality rates.

[26] Forsyth and Waihinau will be operated in limited capacity due to their low-flow status. They will only operate for three seasons of the year due to high summer mortality. This is due to higher water temperatures and low-flow (Source Andrew Clark, New Zealand King Salmon, September 2016).

[27] From discussions with MPI and NZKS, we understand that the two Crail Bay sites are the most marginal sites, hence they are not currently in use. They are likely to be operated in a limited capacity in the future (Source Andrew Clark, New Zealand King Salmon, September 2016).

[28] Source Andrew Clark, New Zealand King Salmon, September 2016.

[29] See the prior chapters for an explanation of these three categories.

Table 11: Estimated baseline annual production

Site	Annual salmon production (metric tonnes)
Otanerau	672
Ruakaka	773
Forsyth	381
Waihinau	381
Crail MFL 32	0
Crail MFL 48	0

Impact of Otanerau

Table 12 provides figures for the FTE and value add impacts for the Otanerau site. The impact in Nelson and Marlborough is an estimated annual value add of $3.1 million and an estimated 32 FTEs supported annually.

Table 12: Economic impacts from baseline, Otanerau

	Direct	First Round	Industrial Support	Total
Value add ($m)	1.9	0.8	0.4	3.1
FTEs	20	8	4	32

Note: There may be small discrepancies due to rounding.

Impact of Ruakaka

Table 13 provides figures for the FTE and value add impacts for the Ruakaka site. The impact in Nelson and Marlborough is an estimated annual value add of $3.5 million and an estimated 37 FTEs supported annually.

Table 13: Economic impacts from baseline, Ruakaka

	Direct	First Round	Industrial Support	Total
Value add ($m)	2.2	0.9	0.4	3.5
FTEs	24	9	4	37

Note: There may be small discrepancies due to rounding.

Impact of Forsyth

Table 14 provides figures for the FTE and value add impacts for the Forsyth site. The impact in Nelson and Marlborough is an estimated annual value add of $1.7 million and an estimated 18 FTEs supported annually.

Table 14: Economic impacts from baseline, Forsyth

	Direct	First Round	Industrial Support	Total
Value add ($m)	1.1	0.4	0.2	1.7
FTEs	12	4	2	18

Note: There may be small discrepancies due to rounding.

Impact of Waihinau

Table 15 provides figures for the FTE and value add impacts for the Waihinau site. The impact in Nelson and Marlborough is an estimated annual value add of $1.7 million and an estimated 18 FTEs supported annually.

Table 15: Economic impacts from baseline, Waihinau

	Direct	First Round	Industrial Support	Total
Value add ($m)	1.1	0.4	0.2	1.7
FTEs	12	4	2	18

Note: There may be small discrepancies due to rounding.

Summary of baseline economic impacts

Table 16 provides a summary of the economic impacts of NZKS not operating under BMP guidelines at its six existing low-flow salmon farm sites. The total impact in Nelson and Marlborough is an estimated annual value add of $10.0 million and an estimated 105 FTEs supported annually.

Table 16: Total economic impacts from baseline

Salmon Farm	Value add ($m)	FTE
Otanerau	3.1	32
Ruakaka	3.5	37
Forsyth	1.7	18
Waihinau	1.7	18
Crail Bay MFL 32	0	0
Crail Bay MFL 48	0	0
Total	10.0	105

Analysis of BMP guidelines

Introduction

We have estimated the impact on the Nelson and Marlborough economy of NZKS implementing BMP guidelines at its six existing low-flow salmon farm sites using the Cawthron Institute's projected feed discharge levels under BMP guidelines.[30] The economic impact can be broken into two parts: the amount of value add created and the number of FTEs generated. The impacts described in this section are total annual, ongoing impacts: they are the annual value add and employment for the regions based on the level of production at the six sites. In the section below we note whether NZKS considers implementing BMP guidelines at the six low-flow salmon farm sites commercially viable and estimate the resulting economic impacts, based on NZKS judgements as to commercial viability.

The projected production under BMP guidelines is estimated using information from the Cawthron Institute, which reported sustainable feed levels at low-flow farms to comply with BMP-benthic guidelines.[31] The assessment provided the projected feed discharge under BMP guidelines for each of NZKS's six existing low-flow salmon farm sites. From discussions with MPI and NZKS, we understand that annual salmon production at a site can be estimated as 44 per cent of the annual feed discharge tonnage at the site.[32]

In this chapter, the economic impacts are reported for each of the six sites. The feed discharge projections under BMP-benthic guidelines are reported as a range. For completeness, we provide the economic impact of the minimum and maximum feed discharge projections for each salmon farm. As before, the value add and FTE impact from implementing BMP guidelines can be separated into three categories: direct, first round and industrial support.[33]

The Cawthron Institute assessment also details likely additional mitigation requirements that will be needed to meet BMP guidelines. These include: destocking low flow farms until such point as the total carbon in the sediments approaches background levels and initial restocking at levels below the estimated operating maximum (c. 70%). Production could then increase appropriately in response to monitoring results. We estimate the economic impact of production losses from destocking each salmon farm site. The estimated destocking time required for carbon in the sediments to approach background levels is reported as a range.[34] For completeness, we estimate the economic impact of the minimum and maximum estimated destocking periods for each salmon farm site.[35]

Table 17 below details the annualised production figures under BMP guidelines that we have used in our economic analysis.[36]

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[30] These sites are: Otanerau, Ruakaka, Forsyth, Waihinau, Crail MFL 32 and Crail MFL 48.

[31] See NZKS's predicted feed level required to comply with BMP guidelines in Appendix A.

[32] We understand that this rule works when you are looking at the discharge over the life of a fish but not necessarily in a particular year due to the timing of growth or when there is escalated mortality of a mortality event.

[33] See the prior chapters for an explanation of these three categories.

[34] The Cawthron Institute assessment estimates it could take between 2-5 years for carbon levels in the sediments to approach background levels.

[35] The Cawthron Institute assessment indicates that destocking times may be significantly reduced through the development of seabed remediation methods.

[36] The annualised production figures are calculated by multiplying the Cawthron Institute's reported feed discharge levels by 44 per cent.

Table 17: Estimated annual production under BMP guidelines

Salmon Farm	Maximum production (metric tonnes)	Minimum production (metric tonnes)
Otanerau	660	220
Ruakaka	660	264
Forsyth	880	440
Waihinau	880	440
Crail MFL 32	440	220
Crail MFL 48	440	220

Impact on Otanerau

Table 18 provides figures for the FTE and value add impacts for the Otanerau site. The maximum and minimum production projections under BMP guidelines are shown.

The impact in Nelson and Marlborough of implementing the BMP guidelines is an estimated annual value add of $1.0 million to $3.0 million and an estimated 10 to 31 FTEs supported annually.

Table 18: Economic impacts from BMP production, Otanerau

		Direct	First Round	Industrial Support	Total
Value add ($m)	Maximum	1.9	0.7	0.4	3.0
	Minimum	0.6	0.2	0.1	1.0
FTEs	Maximum	20	7	4	31
	Minimum	7	2	1	10

Note: There may be small discrepancies due to rounding.

Impact on Ruakaka

Table 19 provides figures for the FTE and value add impacts for the Ruakaka site. The maximum and minimum production projections under BMP are shown.

The impact in Nelson and Marlborough of implementing the BMP guidelines is an estimated annual value add of $1.2 million to $3.0 million and an estimated 13 to 31 FTEs supported annually.

Table 19: Economic impacts from BMP production, Ruakaka

		Direct	First Round	Industrial Support	Total
Value add ($m)	Maximum	1.9	0.7	0.4	3.0
	Minimum	0.8	0.3	0.1	1.2
FTEs	Maximum	20	7	4	31
	Minimum	8	3	1	13

Note: There may be small discrepancies due to rounding.

Impact on Forsyth

Table 20 provides figures for the FTE and value add impacts for the Forsyth site. The maximum and minimum production projections under BMP guidelines are shown.

The impact in Nelson and Marlborough of implementing the BMP guidelines is an estimated annual value add of $2.0 million to $4.0 million and an estimated 21 to 42 FTEs supported annually.

Table 20: Economic impacts from BMP production, Forsyth

		Direct	First Round	Industrial Support	Total
Value add ($m)	Maximum	2.5	1.0	0.5	4.0
	Minimum	1.3	0.5	0.2	2.0
FTEs	Maximum	27	10	5	42
	Minimum	13	5	2	21

Note: There may be small discrepancies due to rounding.

Impact on Waihinau

Table 21 provides figures for the FTE and value add impacts for the Waihinau site. The maximum and minimum production projections under BMP guidelines are shown.

The impact in Nelson and Marlborough of implementing the BMP guidelines is an estimated annual value add of $2.0 million to $4.0 million and an estimated 21 to 42 FTEs supported annually.

Table 21: Economic impacts from BMP production, Waihinau

		Direct	First Round	Industrial Support	Total
Value add ($m)	Maximum	2.5	1.0	0.5	4.0
	Minimum	1.3	0.5	0.2	2.0
FTEs	Maximum	27	10	5	42
	Minimum	13	5	2	21

Note: There may be small discrepancies due to rounding.

Impact on Crail MFL 32

Table 22 provides figures for the FTE and value add impacts for the Crail MFL 32 site. The maximum and minimum production projections under BMP guidelines are shown.

The impact in Nelson and Marlborough of implementing the BMP guidelines is an estimated annual value add of $1.0 million to $2.0 million and an estimated 10 to 21 FTEs supported annually.

Table 22: Economic impacts from BMP production, Crail MFL 32

		Direct	First Round	Industrial Support	Total
Value add ($m)	Maximum	1.3	0.5	0.2	2.0
	Minimum	0.6	0.2	0.1	1.0
FTEs	Maximum	13	5	2	21
	Minimum	7	2	1	10

Note: There may be small discrepancies due to rounding.

Impact on Crail MFL 48

Table 23 provides figures for the FTE and value add impacts on the Crail MFL 48 site. The maximum and minimum production projections under BMP guidelines are shown.

The impact in Nelson and Marlborough of implementing the BMP guidelines is an estimated annual value add of $1.0 million to $2.0 million and an estimated 10 to 21 FTEs supported annually.

Table 23: Economic impacts from BMP production, Crail MFL 48

		Direct	First Round	Industrial Support	Total
Value add ($m)	Maximum	1.3	0.5	0.2	2.0
	Minimum	0.6	0.2	0.1	1.0
FTEs	Maximum	13	5	2	21
	Minimum	7	2	1	10

Note: There may be small discrepancies due to rounding.

Summary of BMP economic impacts

Table 24 provides a summary of the economic impacts from the analysis of BMP guidelines at the six existing low-flow salmon farm sites. The total impact in Nelson and Marlborough is an estimated annual value add of $8.2 million to $18.0 million and an estimated 85 to 188 FTEs supported annually.

Table 24: Total economic impacts from BMP guidelines

Salmon Farm	-- Maximum --		-- Minimum --	
	Value add ($m)	FTEs	Value add ($m)	FTEs
Otanerau	3.0	31	1.0	10
Ruakaka	3.0	31	1.2	13
Forsyth	4.0	42	2.0	21
Waihinau	4.0	42	2.0	21
Crail Bay MFL 32	2.0	21	1.0	10
Crail Bay MFL 48	2.0	21	1.0	10
Total	18.0	188	8.2	85

Commercial Viability under BMP guidelines

It is important to understand the limiting factor for the low-flow sites. In economic terms, the limiting factor is the resource that is in short supply and therefore constrains production. The BMP production figures assume that the benthic impacts are the limiting factor. The previous chapter considered the low-flow sites from a commercial point of view, in which operational constraints for some sites are considered the limiting factor. The figures in Table 25 below consider the benthic impacts in conjunction with the commercial viability and operational considerations of each site as the limiting factor.

We understand that NZKS considers the Ruakaka and two Crail Bay sites not to be commercially viable under BMP guidelines.[37] They consider that it would be feasible to operate the Otanerau site under BMP guidelines if annual salmon production is close to the maximum projected value in the Cawthron Institute assessment, but not if it is close to the minimum production limit. We understand the Waihinau and Forsyth sites are constrained by operational considerations and considered to not be commercially viable under BMP guidelines.[38] If the sites are not commercially viable, the resulting economic contribution is nil.[39]

NZKS has provided an Excel model which calculates earnings before interest and tax (EBIT) for each operational salmon farm site.[40] We have checked the arithmetic used to calculate FY16 EBIT for all operational salmon farms and EBIT for Ruakaka, Waihinau and Otanerau using the maximum projected salmon production under BMP guidelines. We found that the calculation is internally consistent with NZKS's EBIT calculated using NZKS's audited FY16 statement of comprehensive income, which is provided in the model.[41]

The EBIT calculations in the model show that Ruakaka and Waihinau salmon farm sites have a negative EBIT under maximum BMP guidelines.[42] NZKS has indicated that farms with negative EBIT are not

[37] NZKS have indicated that the commercial viability of the two Crail Bay sites has been affected by high water temperatures and summer mortality and the current cost of fish at the Ruakaka site is approximately $1.50-$2.00 in excess of the NZKS salmon farm sites in the Tory Channel. Commercially viable information has been provided by Andrew Clark and Sam Best, New Zealand King Salmon, September 2016.

[38] From discussions with MPI and NZKS, we understand that these sites are not able to be operate at the production levels estimated under maximum BMP guidelines due to high mortality levels in summer. As before, commercial viability information has been provided by Andrew Clark and Sam Best, New Zealand King Salmon, October 2016.

[39] We understand that NZKS has indicated that all six existing low-flow salmon farm sites would not be commercially viable if sites had to comply with the additional mitigation factors from the Cawthron Institute assessment. As before, commercial viability information has been provided by Andrew Clark and Sam Best, New Zealand King Salmon, October 2016.

[40] The model was provided by Andrew Clark and Sam Best, New Zealand King Salmon, October 2016.

[41] Please see appendix A for details on the calculations and the limitations of the calculations and review performed.

[42] From discussions with MPI and NZKS, we understand that the negative EBIT values are driven by high mortality levels.

commercially viable.[43] From discussions with MPI and NZKS, we understand that NZKS would operate the Forsyth and Waihinau salmon farm sites even if they were not commercially viable as stand-alone operations, as they would help achieve single year class on NZKS's Pelorus high-flow sites.[44] Forsyth and Waihinau would be subsidised by Waitata and Kopaua, as they cannot operate on their own. From discussions with MPI and NZKS, we understand operating Forsyth and Waihinau in limited capacity is suboptimal financially and therefore compromises NZKS's ability to meet community expectations of economic impact. NZKS has indicated that they plan to use Waihinau and Forsyth as seasonal smolt sites from April 2017 and some later date respectively.[45]

Table 25 provides the economic impacts from the analysis of the maximum production under BMP guidelines at the six existing low-flow salmon farm sites, incorporating the operational considerations of each site and the commercial viability proposed in NZKS's Excel model above.[46] The total impact in Nelson and Marlborough is an estimated annual value add of $6.4 million and an estimated 67 FTEs supported annually.

Table 25: Economic impacts from maximum production under BMP guidelines, incorporating NZKS's proposed commercial viability and operational considerations

Salmon Farm	-- Maximum production --	
	Value add ($m)	FTEs
Otanerau	3.0	31
Ruakaka	0	0
Forsyth	1.7	18
Waihinau	1.7	18
Crail Bay MFL 32	0	0
Crail Bay MFL 48	0	0
Total	6.4	67

[43] As before, commercial viability information has been provided by Andrew Clark and Sam Best, New Zealand King Salmon, October 2016.

[44] From discussions with MPI and NZKS, we understand that Waihinau is more likely to operate under maximum BMP guidelines than Forsyth, as consent permits moving the farm around on site. As before, commercial viability information has been provided by Andrew Clark and Sam Best, New Zealand King Salmon, October 2016.

[45] From discussions with MPI and NZKS, we understand that Forsyth will be used once NZKS have grown the Waitata and Kopaua high-flow sites. As before, commercial viability information has been provided by Andrew Clark and Sam Best, New Zealand King Salmon, October 2016.

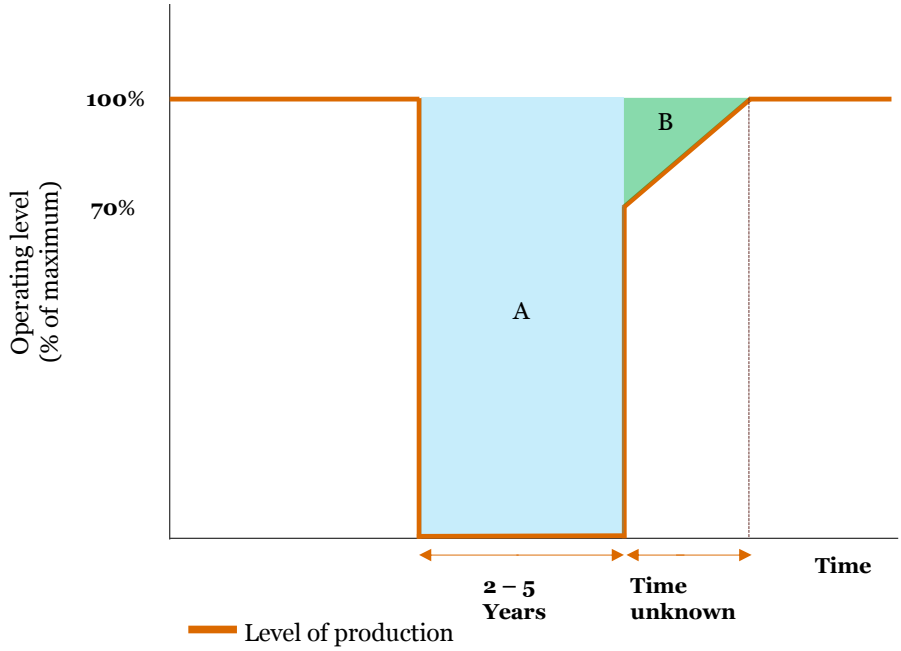
[46] NZKS's model shows that Ruakaka would not be commercially viable, which means the resulting economic impacts will be nil.

Analysis of fallowing current farm sites

Fallowing under BMP guidelines

The Cawthron Institute assessment indicates each current salmon farm site may have to implement additional mitigation requirements beyond complying with the predicted feed discharge levels if they are to meet BMP guidelines.[47] The additional mitigation includes letting farm sites lie fallow for a time and then ramping up production over time. Figure 10 below sketches the impacts on production for each salmon farm site from complying with the additional mitigation activities.[48]

Figure 10: Potential production impacts on existing sites from fallowing under BMPs



The production impacts from complying with the additional mitigation factors can be broken into two sections. In Figure 10, Section A shows the loss of production from destocking the salmon farm, and section B shows the loss of production from initially restocking at levels below the operating maximum (70%), with an increase to the operating maximum.

The net economic impact of fallowing the farm sites can be calculated from the difference between production in the fallow period and the production that would have occurred otherwise. Production in the destocking period (Section A) is nil, and as a result there is no annual economic contribution from a salmon farm site during that time. The annual production and economic impact forgone depends on the assumed level of production. From the earlier analysis, there are three possible assumptions regarding the level of production:

- baseline production
- BMP levels of production

[47] This is due to long term and in some cases continually sustained feed loadings at the existing low flow sites.

[48] Figure 10 shows the effect of destocking and initially restocking at 70% of the estimated operating maximum, which are additional mitigation factors 1 and 3 in the Cawthron Institute assessment.

- BMP plus commercial considerations.

The net economic impacts from the destocking period (Section A in Figure 10) are calculated in the sections below, using each of the three different assumed levels of production. For each level of production, the estimated economic impacts are calculated for two time periods: five years and two years. These time periods are the maximum and minimum destocking periods indicated by the Cawthron Institute. The Cawthron Institute assessment does not provide an approximate timeline for increasing restocking from 70% to 100% of operating maximum,[49] which means we are unable to estimate the economic impacts from initially restocking at levels below the operating maximum (Section B in Figure 10).

Fallowing impacts assuming baseline production

One level of potential production to use for calculating the economic impacts of fallowing the current farm sites is the baseline level of production. Baseline production for the farm sites is shown in Table 11 and the resulting economic impacts are shown in Table 16. The economic impacts from foregone production over five years and two years are shown in Table 26. The total economic impact in Nelson and Marlborough is an estimated total loss in value add of $20.0 to $50.0 million over the affected time period. The employment impact is an estimated 105 FTEs lost per year. These figures put a value on the loss of the potential economic opportunity, which is the difference between holding the farms fallow for a period of time versus running the farms at the baseline production level.

Table 26: Estimated fallowing impacts assuming baseline production

Salmon Farm	Total value add ($m)		FTEs per year
	5-year period	2-year period	
Otanerau	15.5	6.2	32
Ruakaka	17.5	7.0	37
Forsyth	8.5	3.4	18
Waihinau	8.5	3.4	18
Crail Bay MFL 32	0.0	0.0	0
Crail Bay MFL 48	0.0	0.0	0
Total	50.0	20.0	105

Fallowing impacts assuming BMP production

Another potential level of production is that allowed under BMP guidelines. The Cawthron Institute assessment provides both a maximum and a minimum feed discharge level for each site, which leads to two potential levels of production and economic impacts. Table 27 and Table 28 report a summary of the total economic impacts from destocking each of the existing low-flow salmon farm sites under the maximum and minimum feed discharges.

Table 27 provides a summary of the estimated reduction in economic activity from NZKS destocking its six existing low-flow salmon farm sites under the maximum BMP guidelines. The total economic impact in Nelson and Marlborough is an estimated total loss in value add of $36.0 to $90.0 million over the affected time period. The employment impact is an estimated 188 FTEs lost per year. These figures put a value on the lost economic opportunity from holding the farms fallow compared to running the farms at the maximum BMP levels.

[49] They indicate that stocking levels should be increased in response to monitoring levels.

Table 27: Estimated reduction in economic activity operating under maximum BMPs

Salmon Farm	Total value add ($m)		FTEs per year
	5-year period	2-year period	
Otanerau	15.0	6.0	31
Ruakaka	15.0	6.0	31
Forsyth	20.0	8.0	42
Waihinau	20.0	8.0	42
Crail Bay MFL 32	10.0	4.0	21
Crail Bay MFL 48	10.0	4.0	21
Total	90.0	36.0	188

Table 28 provides a summary of the estimated reduction in economic activity from NZKS destocking its six existing low-flow salmon farm sites under the minimum BMP guidelines. The total economic impact in Nelson and Marlborough is an estimated total loss in value add of $16.4 to $41.0 million over the affected time period. The employment impact is an estimated 85 FTEs lost per year. Again, the figures put a value on the lost economic opportunity, in this case from holding the farms fallow compared to running the farms at the minimum BMP levels.

Table 28: Estimated reduction in economic activity operating under minimum BMPs

Salmon Farm	Total value add ($m)		FTEs per year
	5-year period	2-year period	
Otanerau	5.0	2.0	10
Ruakaka	6.0	2.4	13
Forsyth	10.0	4.0	21
Waihinau	10.0	4.0	21
Crail Bay MFL 32	5.0	2.0	10
Crail Bay MFL 48	5.0	2.0	10
Total	41.0	16.4	85

Fallowing impacts assuming BMP guidelines and commercial considerations

The third level of potential production to consider is based on the BMP guidelines as well as commercial considerations for the farm sites, as discussed earlier.

The combination of minimum BMP guidelines and commercial concerns would mean that none of the current farm sites would be commercially viable, according to the advice provided by NZKS. As a result, the loss from having a fallow period under these conditions would nil: there would be no production lost, and therefore no lost economic opportunity.

The combination of maximum BMP guidelines and commercial concerns would lead to some production on the farm sites, as indicated by NZKS. The economic impacts from this level of production are summarised in Table 25, above. The economic impacts from foregone production over five years and two years due to fallowing the farm sites are shown in Table 29. The total economic impact in Nelson and Marlborough is an estimated total loss in value add of $12.8 to $32.0 million over the affected time period. The employment

impact is an estimated 67 FTEs lost per year. These figures represent the loss of the potential economic opportunity from leaving the farms fallow compared to running them at the assumed level of production.

Table 29: Estimated fallowing impacts assuming production based on maximum BMPs and commercial considerations

Salmon Farm	Total value add ($m)		FTEs per year
	5-year period	2-year period	
Otanerau	15.0	6.0	31
Ruakaka	0.0	0.0	0
Forsyth	8.5	3.4	18
Waihinau	8.5	3.4	18
Crail Bay MFL 32	0.0	0.0	0
Crail Bay MFL 48	0.0	0.0	0
Total	32.0	12.8	67

Analysis of new sites

Introduction

We have estimated the impact on the Nelson and Marlborough economy of NZKS operating nine new high-flow sites under BMP guidelines in the Marlborough Sounds.[50] The economic impact can be broken into two parts: the amount of value add created and the number of FTEs generated. The impacts described in this section are total annual, ongoing impacts: they are the annual value add and employment for the regions from the projected levels of production at the nine sites. In the section below we note the operational considerations for operating the new high-flow sites.

The projected annual production levels at the nine new high-flow salmon farm sites under BMP guidelines are estimated using information from the Cawthron Institute and NIWA.[51] The Cawthron Institute reported the projected feed discharge under BMP guidelines for Tio Point and NIWA reported the projected feed discharge under BMP guidelines for the other eight new salmon farm sites.[52] From discussions with MPI and NZKS, we understand that annual salmon production at a site can be estimated as 44 per cent of the annual feed discharge tonnage at the site.[53]

In this chapter, the economic impacts are reported for each of the nine sites. As before, the value add and FTE impact from operating nine new high flow sites under BMP guidelines can be separated into three categories: direct, first round and industrial support.[54]

Table 30 details the annualised production figures that we have used in our economic analysis.

[50] These sites are: Horseshoe Bay, Richmond South, Mid-Channel Waitata, Blowhole North, Blowhole South, Tipi Bay, Motukina, Te Weka and Tio Point.

[51] See Appendix A for more details on the report NIWA and Cawthron Institute assessment.

[52] From discussions with MPI and NZKS, we understand that these new sites would be operated at 50% of the maximum operating capacity under BMP guidelines then increased in stages to full capacity.

[53] We understand that this rule works when you are looking at the discharge over the life of a fish but not necessarily in a particular year due to the timing of growth or when there is escalated mortality of a mortality event.

[54] See the prior chapters for an explanation of these three categories.

Table 30: Estimated annual production for new sites

Site	Site location	Annual salmon production (metric tonnes)
Horseshoe Bay	Pelorus	660
Richmond South	Pelorus	2,200
Mid-Channel Waitata	Pelorus	3,080*
Blowhole North	Pelorus	1,980
Blowhole South	Pelorus	2,200
Tipi Bay	Tory/Queen Charlotte	440
Motukina	Tory/Queen Charlotte	440
Te Weka	Tory/Queen Charlotte	792
Tio Point	Tory/Queen Charlotte	704

**MPI has indicated that farming at Mid-Channel Waitata is likely to be restricted to 7,000 tonnes of feed discharge. NIWA reported that an annual feed discharge level of 12,000 tonnes would comply with the benthic guidelines; however, the lower level may be required to manage potential effects on water quality.*

Impact of Horseshoe Bay

Table 31 provides figures for the FTE and value add impacts for the Horseshoe Bay site. The impact in Nelson and Marlborough is an estimated annual value add of $3.0 million and an estimated 31 FTEs supported annually.

Table 31: Economic impacts from baseline, Horseshoe Bay

	Direct	First Round	Industrial Support	Total
Value add ($m)	1.9	0.7	0.4	3.0
FTEs	20	7	4	31

Note: There may be small discrepancies due to rounding.

Impact of Richmond South

Table 32 provides figures for the FTE and value add impacts for the Richmond South site. The impact in Nelson and Marlborough is an estimated annual value add of $10.0 million and an estimated 104 FTEs supported annually.

Table 32: Economic impacts from baseline, Richmond South

	Direct	First Round	Industrial Support	Total
Value add ($m)	6.3	2.5	1.2	10.0
FTEs	67	25	12	104

Note: There may be small discrepancies due to rounding.

Impact of Mid-Channel Waitata

Table 33 provides figures for the FTE and value add impacts for the Mid-Channel Waitata site. The impact in Nelson and Marlborough is an estimated annual value add of $14.0 million and an estimated 146 FTEs supported annually.

Table 33: Economic impacts from baseline, Mid-Channel Waitata

	Direct	First Round	Industrial Support	Total
Value add ($m)	8.8	3.5	1.7	14.0
FTEs	94	35	17	146

Note: There may be small discrepancies due to rounding.

Impact of Blowhole North

Table 34 provides figures for the FTE and value add impacts for the Blowhole North site. The impact in Nelson and Marlborough is an estimated annual value add of $9.0 million and an estimated 94 FTEs supported annually.

Table 34: Economic impacts from baseline, Blowhole North

	Direct	First Round	Industrial Support	Total
Value add ($m)	5.7	2.2	1.1	9.0
FTEs	60	22	11	94

Note: There may be small discrepancies due to rounding.

Impact of Blowhole South

Table 35 provides figures for the FTE and value add impacts for the Blowhole South site. The impact in Nelson and Marlborough is an estimated annual value add of $10.0 million and an estimated 104 FTEs supported annually.

Table 35: Economic impacts from baseline, Blowhole South

	Direct	First Round	Industrial Support	Total
Value add ($m)	6.3	2.5	1.2	10.0
FTEs	67	25	12	104

Note: There may be small discrepancies due to rounding.

Impact of Tipi Bay

Table 36 provides figures for the FTE and value add impacts for the Tipi Bay site. The impact in Nelson and Marlborough is an estimated annual value add of $2.0 million and an estimated 21 FTEs supported annually.

Table 36: Economic impacts from baseline, Tipi Bay

	Direct	First Round	Industrial Support	Total
Value add ($m)	1.3	0.5	0.2	2.0
FTEs	13	5	2	21

Note: There may be small discrepancies due to rounding.

Impact of Motukina

Table 37 provides figures for the FTE and value add impacts for the Motukina site. The impact in Nelson and Marlborough is an estimated annual value add of $2.0 million and an estimated 21 FTEs supported annually.

Table 37: Economic impacts from baseline, Motukina

	Direct	First Round	Industrial Support	Total
Value add ($m)	1.3	0.5	0.2	2.0
FTEs	13	5	2	21

Note: There may be small discrepancies due to rounding.

Impact of Te Weka

Table 38 provides figures for the FTE and value add impacts for the Te Weka site. The impact in Nelson and Marlborough is an estimated annual value add of $3.6 million and an estimated 38 FTEs supported annually.

Table 38: Economic impacts from baseline, Te Weka

	Direct	First Round	Industrial Support	Total
Value add ($m)	2.3	0.9	0.4	3.6
FTEs	24	9	4	38

Note: There may be small discrepancies due to rounding.

Impact of Tio Point

Table 39 provides figures for the FTE and value add impacts for the Tio Point site. The impact in Nelson and Marlborough is an estimated annual value add of $3.2 million and an estimated 33 FTEs supported annually.

Table 39: Economic impacts from baseline, Tio Point

	Direct	First Round	Industrial Support	Total
Value add ($m)	2.0	0.8	0.4	3.2
FTEs	21	8	4	33

Note: There may be small discrepancies due to rounding.

Summary of economic impacts for new sites

Table 40 provides a summary of the economic impacts of NZKS operating nine new high-flow salmon farm sites in the Marlborough Sounds. The total impact in Nelson and Marlborough is an estimated annual value add of $56.8 million and an estimated 592 FTEs supported annually.

Table 40: Total economic impacts from new sites

Salmon Farm	Value add ($m)	FTE
Horseshoe Bay	3.0	31
Richmond South	10.0	104
Mid-Channel Waitata	14.0	146
Blowhole North	9.0	94
Blowhole South	10.0	104
Tipi Bay	2.0	21
Motukina	2.0	21
Te Weka	3.6	38
Tio Point	3.2	33
Total	56.8	592

Operational considerations of new sites

Our analysis has estimated the economic impacts of operating nine new salmon farm sites in the Marlborough Sounds. From discussions with MPI and NZKS, we understand it is also important to consider the operational aspects which influence each sites' relative contribution and strategic importance overall.

We understand a key focus for NZKS production is to provide a consistent supply of market size salmon all year round. In order to achieve this NZKS need to carefully manage production strategies based on the environmental parameters of each of their sites in combination.

From discussions with MPI and NZKS, we understand smolt are more sensitive to flow and temperature issues than larger fish therefore it is important to maintain a strategic combination of cooler water sites and higher flow warmer water sites. Smolt can be introduced to warmer water sites such as those in the Pelorus

after the summer period but if all sites in combination missed the summer smolt window then a four to six month gap would be created in the availability of harvest sized fish.

In this respect the 'relative value' of a Tory Channel site would be greater than it may appear in purely production terms. For example, while Tio Point is a small site in terms of 'value' it has the ability to play an important role within the overall production strategy of NZKS due to its location in the cooler waters of the Tory Channel allowing pre summer smolt to be transferred to this site if desired.

Discussion

Operational impacts of NZKS

Our analysis indicates that NZKS makes a positive economic contribution to the Nelson and Marlborough economy through its operations. The fish production and processing contribute to economic activity directly as well as indirectly through upstream and downstream linkages to other sectors. The analysis estimates the extent of that contribution by using financial information from NZKS to model the linkages between the company and the rest of the regional economy.

We understand that NZKS has not made a final determination on the size of production after all sites have been relocated. To provide useful economic information, we have therefore estimated the economic impacts per 100 tonnes of salmon production. NZKS and MPI can use these findings to estimate the total economic impact once the net impact on the quantity of salmon production has been determined.

Our analysis found that 100 tonnes of annual salmon production can be expected to lead to approximately $0.45 million in annual value add or GDP in the Nelson and Marlborough regional economy, and would support approximately 4.7 FTEs annually. These impacts are a total of direct and indirect impacts. They do not include any consumption or induced impacts.

The impacts in the region are mostly the result of fish production and processing. Activities that do not take place in the region were not included in the modelling, and those activities include producing fish feed (Australia), freight (New Zealand and overseas) and several other business activities. The corporate functions are included in the economic analysis, because they are located in Nelson.

Impacts of baseline production

Our analysis indicates that NZKS would make a positive economic contribution to the Nelson and Marlborough economy through its operations if it did not operate its six existing low-flow salmon farm sites under BMP guidelines. The fish production and processing contribute to economic activity directly as well as indirectly through upstream and downstream linkages to other sectors. The analysis estimates the extent of that contribution by using financial information from NZKS to model the linkages between the company and the rest of the regional economy.

Our analysis found that NZKS operating its six low-flow salmon farm sites at baseline levels can be expected to lead to approximately $10.0 million in annual value add or GDP in the Nelson and Marlborough regional economy, and would result in approximately 105 FTEs being supported annually. These impacts are a total of direct and indirect impacts. They do not include any consumption or induced impacts.

Impacts of BMP for NZKS

Our analysis used the Cawthron Institute's projected feed discharge levels under BMP guidelines to estimate NZKS's annualised salmon production under BMP guidelines at its six low-flow salmon farm sites. The analysis indicates that NZKS would make a positive economic contribution to the Nelson and Marlborough economy through its operations if BMP guidelines were implemented at its six existing low-flow salmon farm sites. The fish production and processing contribute to economic activity directly as well as indirectly through upstream and downstream linkages to other sectors. The analysis estimates the extent of that contribution by using financial information from NZKS to model the linkages between the company and the rest of the regional economy.

Our analysis found that NZKS implementing BMP guidelines at its six low-flow salmon farm sites can be expected to lead to approximately $8.2 million to $18.0 million in annual value add or GDP in the Nelson and Marlborough regional economy, and would result in approximately 85 to 188 FTEs being supported

annually. These impacts are a total of direct and indirect impacts. They do not include any consumption or induced impacts.

Impacts of combined limits on production

Production levels may be limited due to operational considerations as well as benthic impacts in conjunction with commercial viability. The analysis above presents the estimated economic impact on Nelson and Marlborough given that benthic impacts in conjunction with commercial viability and operational considerations is the limiting factor for the six existing low-flow salmon farm sites. Table 41 shows the maximum production under BMP guidelines, incorporating commercial viability and operational considerations and the baseline production for each site individually, and then calculates the economic impact across all sites from operating under maximum production under BMP guidelines, incorporating commercial viability and operational considerations compared to baseline production.

Table 41: Total economic impacts, combined production limits

	Column A BMP maximum production, incorporating commercial viability and operational considerations		**Column B** Baseline production		**Column C** **Estimated decrease** in economic impact from implementing maximum BMP production, incorporating commercial viability and operational considerations	
Salmon Farm	Value add ($m)	FTE	Value add ($m)	FTEs	Value add ($m)	FTEs
Otanerau	3.0	31	3.1	32	0.1	1
Ruakaka	0	0	3.5	37	3.5	37
Forsyth	1.7	18	1.7	18	0	0
Waihinau	1.7	18	1.7	18	0	0
Crail Bay MFL 32	0	0	0	0	0	0
Crail Bay MFL 48	0	0	0	0	0	0
Total	6.4	67	10.0	105	3.6	38

The economic impact from the six low-flow sites operating under maximum production BMP guidelines, incorporating commercial viability and operational considerations compared to baseline production is an estimated **decrease** in annual value add of $3.6 million and an estimated 38 fewer FTEs supported annually.

Impacts of new salmon farm sites

Our analysis used the Cawthron Institute's reported projected feed discharge under BMP guidelines for Tio Point and NIWA's reported projected feed discharge under BMP guidelines for the other eight new salmon farm sites to estimate NZKS's annualised salmon production under BMP guidelines at the nine high-flow salmon farm sites. The analysis indicates that NZKS would make a positive economic contribution to the Nelson and Marlborough economy through its operations if the nine new high-flow salmon farm sites were operated under BMP guidelines. The fish production and processing contribute to economic activity directly as well as indirectly through upstream and downstream linkages to other sectors. The analysis

estimates the extent of that contribution by using financial information from NZKS to model the linkages between the company and the rest of the regional economy.

Our analysis found that NZKS operating nine new high-flow salmon farm sites in the Marlborough Sounds can be expected to lead to approximately $56.8 million in annual value add or GDP in the Nelson and Marlborough regional economy, and would result in approximately 592 FTEs being supported annually. These impacts are a total of direct and indirect impacts. They do not include any consumption or induced impacts.

Construction impacts of NZKS

Our analysis also considered the impact of building new salmon farms, and showed that construction can have positive impacts on the regional economy. Components and supplies for the farm could be supplied locally, in which case constructing the farms would have positive direct and indirect effects. Some components may end up being sourced from overseas, reducing the contributions to the local economy from construction activities.

We understand that the number of new sites to be developed has not been decided. We have therefore estimated the impact per site, using average costs of farm development from NZKS. The total impact will depend on the number of sites, which can be calculated based on the per-site numbers provided here.

Our analysis found that each site would produce one-off value add or GDP impacts of approximately $3.2 million for the Nelson and Marlborough economy. Each site would support approximately 39.0 FTEs for the region for a year. No consumption or induced impacts were included.

The economic impacts were estimated based on key development activities occurring in Nelson / Marlborough, including building of the site's barge and pen structures. To the extent that those activities occur elsewhere, local impacts would be reduced.

Key limitations of the analysis

The analysis reported here is an attempt to measure the potential economic impacts for Nelson and Marlborough of certain business activities. It is subject to a number of limitations. Some key ones are the following:

- The analysis should be read in conjunction with the Restrictions presented in Appendix B.
- We relied on data provided by NZKS, including financial information about operational activities and costs of new site development. We have not independently verified the information supplied.
- The analysis was an IO multiplier analysis, using company data to model the linkages between NZKS, site development and the regional economy. Multiplier analysis is one kind of economic modelling, and has well-understood assumptions. In particular, it tends to produce higher estimates of economic impacts than other approaches.
- The estimates of FTE impacts are based on industry averages from the PwC Regional Industry Database (RID). The analysis produced a lower estimate of current employment than NZKS currently has. As a result, the employment analysis in this report should be considered conservative.
- One concern with IO analysis is the assumption of infinitely available resources and the lack of price response. This concern is not likely to be an issue with the present analysis because the operations do not represent a large fraction of the local economy. As shown, the relevant industries have local employment of 5,813 FTEs. The impact on resources is small, so the error from having no price response should also be small. The exception is that site development could be affected by local resource constraints, particularly if several sites were developed simultaneously.
- A second price response to consider is the possibility that increased production could reduce the price for New Zealand exports of salmon, which would tend to reduce the net economic impact. The Global Salmon Initiative reports that 3.1 million tonnes of farmed salmon are produced annually

worldwide, and Seafood New Zealand reported 2015 exports of salmon from New Zealand of $47 million. Thus, New Zealand salmon exports are not a large portion of global consumption. Furthermore, fish from aquaculture are a substitute for wild-catch fish, which are considered to be under pressure globally. As a result, we are not able to offer any conclusion about possible price effects without further study of the salmon market as well as competing products.[55]

- Finally, the analysis considered only economic impacts as captured in the standard definition of the economy used in the National Accounts from Statistics New Zealand. No non-market effects were included, and no non-economic impacts were considered.

[55] We note that there exists some economic analysis of the price elasticity of salmon, including retail and trade price elasticity of demand, in particular using Almost Ideal Demand Systems to estimate product-level elasticity.

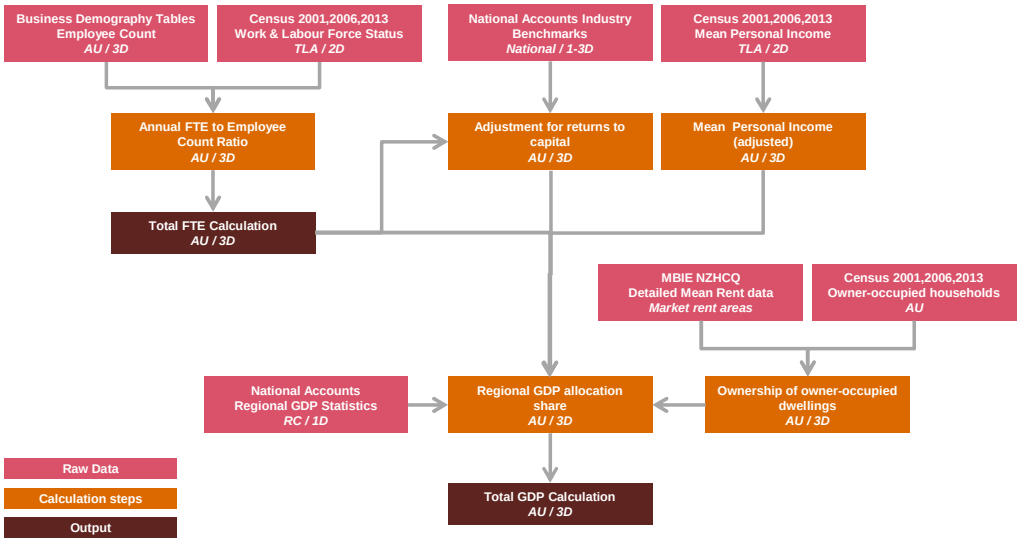
Appendix A Data sources

The following sources were used in calculating the economic benefit of NZ King Salmon's activities on the wider economy:

- **New Zealand King Salmon's 2015/2016 profit and loss budget forecast** – The analysis used information from New Zealand King Salmon's profit and loss budget forecast to gain an understanding of New Zealand King Salmon's revenue and expenditure allocation.
- **New Zealand King Salmon's 2015/2016 expenditure allocation** – The analysis used information from New Zealand King Salmon to gain an understanding of what New Zealand King Salmon's expenditure allocation is within their profit and loss categories.
- **New Zealand King Salmon's capital expenditure profile** – The analysis used information provided by New Zealand King Salmon to gain an understanding of their capital expenditure profile to build a new salmon farm.
- **Assessment of sustainable feed levels at low-flow farms to comply with BMP-benthic guidelines** – The analysis used information provided by the Cawthron Institute to gain an understanding of NZKS's current feed level and the predicted feed level required to comply with BMP guidelines at NZKS's six existing low-flow sites.
- **New Zealand King Salmon's historic four year salmon production levels –** The analysis used information provided by NZKS to gain an understanding of NZKS's four year historic salmon production levels at its six low-flow salmon farm sites.
- **Benthic Ecological Assessments for Proposed Salmon Farm Sites** – The analysis used information provided by NIWA to gain an understanding of the predicted feed level required to comply with BMP guidelines for the following new high-flow sites in the Marlborough Sounds: Horseshoe Bay, Richmond South, Blowhole North, Blowhole South, Tipi Bay, Motukina and Te Weka.
- **Modelled water column effects on potential salmon farm relocation sites in Pelorus Sound** – The (draft) analysis used information provided by NIWA to gain an understanding of the predicted feed level required to comply with BMP guidelines for the new high-flow site at Mid-Channel Waitata.
- **Additional Seabed Information for a Finfish Farm Effects Assessment at Tio Point, Oyster Bay, Tory Channel** – The analysis used information provided by the Cawthron Institute to gain an understanding of the predicted feed level required to comply with BMP guidelines for the new high-flow site at Tio Point.
- **Excel model provided by NZKS** –The Excel model created by NZKS calculates whether the Ruakaka, Waihinau and Otanerau salmon farm sites are commercially viable under maximum BMP guidelines.
- **Input output tables 2013** – These tables describe the detailed structure of the Nelson and Marlborough economies and the relationships between industries. The tables provide data on upstream and downstream linkages between sectors of the economy, showing how one industry produces inputs for other industries.
- **PwC RID 2014** – The PwC RID is a synthetic economic database that estimates employment, GDP and labour productivity at a detailed geographic and sector level. The RID was used to find estimates for GDP, value add and employment numbers by sector. PwC developed the RID with a range of data sources, including:

- Statistics NZ Business Demography Database
- Statistics NZ Regional GDP statistics
- Statistics NZ National Accounts Industry Benchmarks
- Statistics NZ Census data on work and labour force status
- Statistics NZ Census data on personal income for employed people
- MBIE NZ Housing and Construction Quarterly rentals data.

RID model process diagram



Allocation of profit & loss lines to industries in IO table and RID

NZKS P&L category	IO table classification	RID classification
Fish Production	Fishing and Aquaculture	• Aquaculture • Fishing
Processing	Seafood processing	Seafood processing
Materials	• Polymer product manufacturing • Other support services [labelling]	• Polymer product manufacturing • Other support services [labelling]
Freight	• Road transport • Other transport • Air and space transport	• Road transport • Other transport • Air and space transport
Sales and marketing	Advertising, market research and management services	• Advertising services • Market research and statistical support services • Management and related consulting services
Distribution and logistics	• Warehousing and storage services	• Warehouse and storage services
Advertising & Promo	Advertising, market research and management services	• Advertising services • Market research and statistical support services • Management and related consulting services

Corporate	• Legal and accounting services • Computer system design and related services	• Legal and Accounting Services • Computer Systems Design and Related Services
Operating EBITDA	Household Consumption Impact	

Profit & loss expense breakdown

NZKS P&L category	IO table classification	Cost type	Split	Region
Fish Production			100%	
	Fishing and Aquaculture	*Feed*	*73%*	*International*
	Fishing and Aquaculture	*Freight*	*4%*	*Nelson / Marlborough*
	Fishing and Aquaculture	*Labour/ salaries*	*12%*	*Nelson / Marlborough*
	Fishing and Aquaculture	*Overheads*	*11%*	*Nelson / Marlborough*
Processing			100%	
	Seafood processing	*Labour*	*25%*	*Nelson / Marlborough*
	Seafood processing	*Materials*	*55%*	*Nelson / Marlborough*
	Seafood processing	*Overhead*	*20%*	*Nelson / Marlborough*
Materials (Packaging)*			100%	
	Polymer product manufacturing	*Packaging*	*70%*	*Nelson / Marlborough*
	Building cleaning, pest control, and other support services	*Labelling*	*30%*	*Nelson / Marlborough*
Freight			100%	
	Road Transport	*Domestic*	*26%*	*National (majority to AKL)*
	Air and space transport	*Domestic*	*10%*	*National (majority to AKL)*
	Air and space transport	*Export*	*62%*	*International*
	Other transport (Sea)	*Export*	*2%*	*International*
Sales and marketing			100%	
	Advertising, market research and management services	*Salaries & Travel*	*26%*	*Nelson / Marlborough*
	Advertising, market research and management services	*Salaries & Travel*	*29%*	*National (majority to AKL)*
	Advertising, market research and management services	*Salaries & Travel*	*45%*	*International*
Distribution and logistics			100%	
	Warehousing and storage services	*Storage*	*30%*	*Nelson / Marlborough*
	Warehousing and storage services	*Staff, overhead*	*70%*	*Nelson / Marlborough*
Advertising & Promo			100%	

NZKS P&L category	IO table classification	Cost type	Split	Region
	Advertising, market research and management services	*Advertising*	*75%*	*National (majority to AKL)*
	Advertising, market research and management services	*Advertising*	*25%*	*International*
Corporate			100%	
	Legal and accounting Services	*Finance*	*15%*	*Nelson / Marlborough*
	Computer System design and related services	*Information Technology*	*40%*	*Nelson / Marlborough*
	Legal and accounting Services	*Human Resources*	*9%*	*Nelson / Marlborough*
	Legal and accounting Services	*Corporate*	*36%*	*Nelson / Marlborough*

*Source for breakdown for all categories but Materials (Packaging): Sam Best, New Zealand King Salmon, June 2016. * PwC assumption on breakdown for Materials (Packaging).*

Allocation of capital expenditure lines to industries in IO table and RID

NZKS P&L category	IO table classification	RID classification
Barge	Transport equipment manufacturing	Transport equipment manufacturing
Pens	Other manufacturing	Other manufacturing
Polyester nets	Polymer product and rubber product manufacturing	Polymer product and rubber product manufacturing
Miscellaneous	• Construction services • Basic material wholesaling • Machinery and equipment wholesaling	• Construction services • Basic material wholesaling • Machinery and equipment wholesaling

NZKS's current feed level and the predicted feed level required to comply with BMP guidelines

Site	Flow type	Site Depth	Near-bottom current speed		Average historic feed level (range 2005-2015)	Predicted feed level to comply with BMP-Benthic	Percentage decrease (Max-mini decrease from decadal average)
			Ave	Max			
		M	cm/s	cm/s	kt/yr	kt/yr*	
Otanerau	LF	37-39	3.5	13.5	1.7	0.5- 1.5	71-12%
Ruakaka	LF	34-35	3.5	14.2	1.7	0.6- 1.5	65-12%
Forsyth	LF	30-32	3.2	10.9	2.5 (0.6- 3.8)	1.0- 2.0	60-20%
Waihinau	LF	28-30	9.1	29.7	1.8 (0 -3.3)	1.0- 2.0	44% max
Crail MFL 32	LF	22-24	2.5	10	1.3 (1- 1.6)	0.5- 1.0	23-62%
Crail MFL 48	LF	25	2.5	9	0.02	0.5- 1.0	NA

** PwC confirmed with MPI and NZKS that the feed levels should be treated as annual figures. The original Cawthron Institute analysis reported the figures as 'kt/yr class', ie as 18-month feed levels.*

Benthic Ecological Assessments for Proposed Salmon Farm Sites

Site	Feed input (tonnes yr^{-1})	Approximate area of footprint ≥ES3 (Ha)	Approximate area of footprint >ES5 (Ha)
Horseshoe Bay	2,500	8	0.5
	1,500	5.5	0
Richmond South	6,000	26	0.05
	5,000	22	0
Mid-Channel Waitata	12,000	45	0
Blowhole North	5,000	16	0.01
	4,500	15	0
Blowhole South	5,000	20	0
Tipi Bay	2,000	4.25	0.25
	1,000	3.2	0
Motukina	5,000	9.6	1.2
	1,000	3.8	0
Te Weka	5,000	11	1.6
	1,800	6.5	0

Note: From discussions with MPI and NZKS, we understand that the smaller feed input for each site meets the required feed discharge levels to comply with BMP guidelines.

Additional Seabed Information for a Finfish Farm Effects Assessment at Tio Point, Oyster Bay, Tory Channel

Site	Feed input (tonnes yr^{-1})
Tio Point	1,600

NZKS's historic four year salmon production levels at low-flow sites

Site	FY12 (mt)	FY13 (mt)	FY14 (mt)	FY15 (mt)	Two-year average (FY 14-15) (mt)
Otanerau	829	752	638	706	672
Ruakaka	992	938	741	806	773
Forsyth	0	0	0	0	0
Waihinau	1411	1489	694	880	787
Crail MFL 32	544	0	0	0	0
Crail MFL 48	0	0	0	0	0

Source for historic four year salmon production levels at low-flow sites: Sam Best, New Zealand King Salmon, September 2016.

Excel Model provided by NZKS

NZKS has provided an Excel model which calculates earnings before interest and tax (EBIT) for each operational salmon farm site.[56] Page four in the summary worksheet in the Excel model calculates each farm's EBIT for FY16. The total EBIT figure calculated on this sheet is consistent with the FY16 figures reported on the Recon to AFS worksheet, which uses NZKS's audited FY16 statement of comprehensive income to calculate NZKS's FY16 EBIT.[57] Page three in the summary worksheet calculates the EBIT for Ruakaka, Waihinau and Otanerau using the maximum projected salmon production under BMP guidelines.

We have compared the EBIT values calculated in page three with the EBIT values calculated in page four by inputting the harvested tonnage in page four into the page three EBIT calculations. The EBIT values calculated in page three for Ruakaka and Otanerau are larger than the EBIT values calculated in page four using the same harvest tonnage. This suggests that the EBIT calculations in page three may overstate the EBIT values for Ruakaka and Otanerau. We cannot compare the Waihinau EBIT on page three and page four as the overheads are calculated differently.[58] However, the Waihinau EBIT calculation in page three is consistent with the Ruakaka and Otanerau EBIT calculations in page three.

The EBIT calculations on page three in the summary worksheet show that Ruakaka and Waihinau salmon farm sites have a negative EBIT under maximum BMP guidelines. NZKS has indicated that farms with negative EBIT are not commercially viable.[59]

We have checked the arithmetic used to calculate the EBIT in pages three and four using Spreadsheet Detective, which is a tool used to identify inconsistencies in Excel workbooks. We have not found any arithmetic errors in pages three or four. However, we are unable to guarantee pages three and four are 100% free of errors and will perform correctly under all possible scenarios. In checking pages three and four, we have not carried out anything in the nature of an audit, nor have we considered the reasonableness of the information and assumptions supplied to us in any way. Accordingly, we express no opinion on the

[56] The model was provided by Andrew Clark and Sam Best, New Zealand King Salmon, October 2016.

[57] The audited statement of comprehensive income incorporates impairment losses on non-current assets whereas the EBIT calculated in the Recon to AFS worksheet does not. The statement of comprehensive income has been audited by Ernst and Young.

[58] From discussions with NZKS, we understand this is due to the farming cycle of Waihinau affecting the mortality expense. As before, information has been provided by Andrew Clark and Sam Best, New Zealand King Salmon, October 2016.

[59] As before, commercial viability information has been provided by Andrew Clark and Sam Best, New Zealand King Salmon, October 2016.

reliability, accuracy or completeness of the information provided to us and upon which we have relied. Responsibility for the reliability, accuracy and completeness of such information remains with the NZKS.

Appendix B Restrictions

This report has been prepared solely for the purposes stated herein and should not be relied upon for any other purpose. We accept no liability to any party should it be used for any purpose other than that for which it was prepared.

This report is strictly confidential and (save to the extent required by applicable law and/or regulation) must not be released to any third party without our express written consent which is at our sole discretion.

To the fullest extent permitted by law, PwC accepts no duty of care to any third party in connection with the provision of this Report and/or any related information or explanation (together, the "Information"). Accordingly, regardless of the form of action, whether in contract, tort (including without limitation, negligence) or otherwise, and to the extent permitted by applicable law, PwC accepts no liability of any kind to any third party and disclaims all responsibility for the consequences of any third party acting or refraining to act in reliance on the Information.

We have not independently verified the accuracy of information provided to us, and have not conducted any form of audit in respect of the organisation for which work is completed. Accordingly, we express no opinion on the reliability, accuracy, or completeness of the information provided to us and upon which we have relied.

The statements and opinions expressed herein have been made in good faith, and on the basis that all information relied upon is true and accurate in all material respects, and not misleading by reason of omission or otherwise.

The statements and opinions expressed in this report are based on information available as at the date of the report.

We reserve the right, but will be under no obligation, to review or amend our Report, if any additional information, which was in existence on the date of this report, was not brought to our attention, or subsequently comes to light.

This report is issued pursuant to the terms and conditions set out in our contracts dated 02 May 2016 and 31 August 2016.