TABLE OF CONTENTS

1. Executive Summary and Introduction................................................................. 7
   Report Structure .................................................................................................. 8
2. The New Zealand King Salmon Company Limited........................................... 10
   Facilities .............................................................................................................. 11
   Employees ........................................................................................................... 17
   Revenue ............................................................................................................. 18
   Socially Responsible Corporate ....................................................................... 19
3. Global Market Situation.................................................................................... 19
   Global Demand Trends and Growth Potential ................................................. 19
   Global Seafood Production and Supply ............................................................ 23
   Global Aquaculture Production ...................................................................... 24
   Global Salmon Production ............................................................................. 25
4. Sales and Marketing ......................................................................................... 26
   Health Benefits of King Salmon ........................................................................ 26
   Culinary Advantages......................................................................................... 26
   Environmental Credentials ............................................................................. 27
   Brands and Products ........................................................................................ 27
   Approach to Markets ....................................................................................... 28
   Growth and Supply Issues ............................................................................... 31
5. Opportunities for Expansion .......................................................................... 31
   New Zealand Aquaculture – A Priority Growth Sector .................................... 31
   Increased Production Requirements .................................................................... 32
   Rationale for Site Selection and Space ............................................................... 35
   Operational Capacity and Capital Requirements ............................................. 37
   Development and Implementation .................................................................... 38
   Employment Opportunities ............................................................................. 38
   Regional Spill-over Benefits .......................................................................... 39
6. Site Selection Process ...................................................................................... 39
   Initial Investigations .......................................................................................... 40
   Marlborough Sounds Investigations .................................................................. 41
7. Consultation on expansion plans ..................................................................... 42
   Scope of Consultation ....................................................................................... 42
   Themes Arising Through Consultation............................................................. 44
   The Value Lost to Marlborough Through Processing Salmon in Nelson ............ 44
   Monitoring of Benthic Effects .......................................................................... 44
   The Profile of NZ King Salmon in the Marlborough Community ....................... 45
   Additional Points .............................................................................................. 45
   Iwi Consultation ............................................................................................... 45
8. Farming the Salmon - Operational Detail ......................................................... 47
   Smolt Production .............................................................................................. 47
14. Conclusions .................................................................................................85
15. Appendix 1: NZ King Salmon Environmental Policy .................................88
16. Appendix 2: New Zealand Salmon Farmers Association Finfish Aquaculture
    Environmental Code of Practice .....................................................................96
17. Appendix 3: Location of Existing and Proposed Farm Sites .......................123
18. Appendix 4: Investigation of Marlborough Sounds Salmon Farm Sites within the 
    Coastal Marine Zone 1 ................................................................................125
19. Appendix 5: Biology and History of King Salmon in New Zealand ............160
20. Appendix 6: Salmon Aquaculture Production – Globally and the New Zealand
    Situation .....................................................................................................163
LIST OF TABLES

Table 1: Major infrastructure required to achieve proposed production capacity ...............37
Table 2: Current NZ King Salmon employees and approximate numbers of additional employees required to support the proposed increase in production .........................38
Table 3: Expected long-chain Omega-3 content of King Salmon fillets grown on different diet oil blends ..........................................................74

LIST OF FIGURES

Figure 1: Aerial view of Takaka hatchery with Springs River to the right .........................12
Figure 2: Aerial view of the hatchery at Tentburn showing proximity to the sea .................13
Figure 3: NZ King Salmon revenue growth history and projections ..................................18
Figure 4: World population projections globally 2000-2050; and regionally 2000-2035 .......20
Figure 5: Forecast growth in protein consumption by protein type and economic development .........................................................................................21
Figure 6: Global fish protein consumption by region ..........................................................21
Figure 7: Global seafood production mix - aquaculture versus capture fisheries ...............23
Figure 8: World aquaculture production by quantity and value for the major species groups. .................................................................................................................24
Figure 9: Total global salmon (excluding trout) production by year, with estimates for 2011. For comparison NZ King Salmon production is shown in red at the top of each column .....25
Figure 10: Key export markets as a percentage of total sales as at 2011 ............................29
Figure 11: Total NZ King Salmon sales (CIF NZD) between 2004 and 2010, and total sales (CIF NZD) to export markets .................................................................30
Figure 12: History and projections of NZ King Salmon product volume sold into key markets under (top) current farm management practices and (b) farm management practices that include single year class sites, fallowing and biosecure areas ..................................................33
Figure 13: History and projections of NZ King Salmon revenue by key market under (a) current farm management practices and (b) farm management practices that include single year class sites, fallowing and biosecure areas ........................................34
Figure 14: Maximum total production by NZ King Salmon site and financial year, with development window for new farms indicated ..............................................36
Figure 15: Total NZ King Salmon production by site and financial year assuming three bio-secure areas with single year class fish at each farm ........................................37
Figure 16: Truck and trailer unit containing live salmon being transported by barge to a seafarm ..................................................48
Figure 17: Aerial shot of a NZ King Salmon farm ................................................................49
Figure 18: Fish transport sea pens (to right) with tug .......................................................50
Figure 19: Typical barge attached to NZ King Salmon seafarm with sea pens in the foreground.

Figure 20: Salmon sea pens with walkway between and predator net next to walkway and on-site barge in background.

Figure 21: Circular sea pens similar to those that are currently used at the Crail Bay farms.

Figure 22: View to barge from sea pen structures showing bird nets across the top of the sea pens.

Figure 23: Akva Smart computer programme running in seafarm office during feeding.

Figure 24: Salmon feeding systems; (a) transportable hopper; (b) spinning disk; (c) Aquasmart buoy and feeder; (d) AKVA camera.

Figure 25: Roto-spreader in operation feeding the fish.

Figure 26: Harvesting pontoon showing compartments with Aqui-S and carbon dioxide saturated water.

Figure 27: Harvested salmon being lifted by brailer onto table on dumb barge.

Figure 28: Salmon being bled on dumb barge and placed in bins for transport to the processing factory.

Figure 29: Index price of fishmeal and fish oil since 1998 (USD per tonne), from Crystal Ocean/Kilpatrick.

Figure 30: Trends in fishmeal and fish oil used in New Zealand King Salmon diets. Amounts shown are weighted averages for whole-of-life production.

Figure 31: Trends in reduction fisheries used per kilogram of King Salmon production.

Figure 32: Kilograms of fish protein produced per kilogram of fish protein consumed in NZ King Salmon farming, historically and today.

Figure 33: Kilograms of fish oil produced per kilogram of fish oil consumed in NZ King Salmon farming, historically and today.

Figure 34: Maximum and minimum water temperatures at NZ King Salmon's existing farms.

Figure 35: Global capture production for *Oncorhynchus tshawytscha*. 
EXECUTIVE SUMMARY AND INTRODUCTION

1. The New Zealand King Salmon Company Limited (“NZ King Salmon”) is seeking a private plan change to the Marlborough Sounds Resource Management Plan (“MSRMP”); the plan change is being sought in conjunction with applications for individual resource consents on each of the plan change sites.

2. NZ King Salmon is the pre-eminent producer and global marketer of King Salmon, also known as ‘Chinook’ and ‘Quinnat’. King Salmon is a native salmon of the North Pacific. It is highly prized as a game fish because of its size, taste, colour and nutritional content, particularly its substantial level of Omega-3 fatty acids, which are generally considered superior in content to other salmon types (and indeed most other food sources).

3. These qualities are increasingly recognized by global consumers, chefs, restaurateurs and nutritional professionals as being advantageous. NZ King Salmon has seen high demand growth rates over the last eight years and the company has reached production capacity, with substantial compounding opportunity foregone.

4. King Salmon was introduced as a game fish to New Zealand over 100 years ago, to the exclusion of other types of salmon. While King Salmon attributes are prized, domestication of this species is recognized as being the most challenging of all salmon types, due to its fragility and the fact it is prone to maturation and stress. It is not farmed to any extent outside New Zealand and forms a minute proportion of global salmon production.

5. Rarity, quality, tailored product, year round supply, along with the recognized exclusive disease free status of New Zealand salmon production, are the hallmarks of demand that set NZ King Salmon apart from the major industrial salmon producers of Norway, Canada and Chile.

6. New Zealand has unique advantages due to its long developed mastery of King Salmon aquaculture and this underpins the high importance of accommodating the proposed expansion of NZ King Salmon’s marine production farms.

7. Production and sales for NZ King Salmon have grown at a compounding rate of 9% over the last nine years and 13.5% over the last three years. The company is now putting considerable resource behind branding and communication in its export markets and expects to maintain and exceed these growth rates in the future.

8. Production of seafood protein, is authoritatively projected to need to increase by 14% between 2008 and 2020 to simply maintain current per capita consumption of seafood (without allowance for switching protein source as sources either become scarce or less desirable).

9. In that framework NZ King Salmon has projected growth; targeting northern hemisphere markets and Asia for increasing demand, incorporating moderate price inflation and equally a modest move towards value added products, which is a key plank in the company’s strategy.

10. While substantial growth is projected, this matches global trends and can be considered conservative given the competitive advantages that New Zealand enjoys.

11. NZ King Salmon recognises that timelines portrayed in this report may accelerate or be slowed down by the challenges of implementation and equally a need to ensure that
production growth doesn’t exceed the expected rate of demand growth. To the contrary, the company expects that demand will always be slightly ahead of our ability to supply, which will ensure that best market values are obtained and the rarity of the product along with the other attributes are continuously enhanced.

12. This application seeks to obtain the additional water space needed for growth of farming operations in the medium future to enable NZ King Salmon to meet customer demand.

13. Identifying appropriate sites has been a major exercise for the NZ King Salmon, who employed additional service and professional providers to ensure an inclusive community consultative process has occurred during the development of this application.

14. Through the consultation process and the various professional reports provided as part of this application, NZ King Salmon has also addressed concerns and perceptions raised about the impact of growth these new sites (indeed current sites as well) could have on the environment and community.

15. Optimal conditions for King Salmon growth are not plentiful in New Zealand’s coastal waters. NZ King Salmon has identified eight sites within the Marlborough Sounds. The eight proposed sites meet detailed site selection criteria which are soundly based on the optimum conditions for the salmon’s care and biological performance in empathy with the environment and other users of the Sounds.

16. It is a key part of the company’s brand protection that the NZ King Salmon is seen to be a responsible steward of its farm sites in what is otherwise publicly owned waterways. It embraces and leads best practice in these areas. Not only is its practice an important surety for the growing awareness of consumers regarding ecological effects but there is a simple truth that such practices augment the grow-out performance and quality of the salmon. This is an important economic driver which in turn provides the resources for expansion and returns. Without this approach the company would be unsuccessful.

17. This application signals a major watershed in the growth of aquaculture in New Zealand. It will result in significant investment, export growth and community involvement, beyond any alternative commercial development.

18. The information provided in this report is factually based.

19. NZ King Salmon’s Board endorses this application along with the consequential investment required and commends the application for favourable approval.

**REPORT STRUCTURE**

20. This report provides an overview of NZ King Salmon operations. It includes discussion of the rationale and process undertaken to support the current application, as well as providing detailed information on NZ King Salmon’s farming processes and associated management practices. The report is divided into a number of sections, as follows:

i. **The New Zealand King Salmon Company Limited.** A summary of the history of NZ King Salmon operations from formation in 1996 through to the present day; this section also includes detail on the offices, depots, three hatcheries, eight marine farms and four processing plants currently owned by NZ King Salmon. It provides information on company employees, revenue and NZ King Salmon’s role as a socially responsible corporate.
ii. **Global Market Situation.** This section sets the scene for the global sales and marketing environment in which NZ King Salmon operates. Global market demand trends and associated growth potentials are discussed along with current global and New Zealand salmon production.

iii. **Sales and Marketing.** Information is provided in this section about the health benefits and culinary advantages of King Salmon, the company’s environmental credentials and NZ King Salmon’s various brands and products. NZ King Salmon’s approach to both domestic and international markets is discussed, along with the growth and supply issues currently faced by the company, which have lead to the development of the current application.

iv. **Opportunities for Expansion.** Aquaculture has been identified by recent Governments as a priority growth sector for New Zealand. This section discusses the rationale and approach NZ King Salmon is using for its expansion proposal in the context of aquaculture as a growth sector. The operational requirements, employment opportunities and spill-over benefits of increased production are also provided in this section.

v. **Site Selection Process.** A discussion of the detailed and not insignificant process undertaken by NZ King Salmon to select the eight sites proposed in this application. This section discusses the rationale for not applying for water space in other areas of New Zealand, and the reasons for the company’s focus on the Marlborough Sounds.

vi. **Consultation on Expansion Plans.** This section summarises the consultation with relevant local and regional representatives currently undertaken by NZ King Salmon on the company’s expansion plans. Consultation to date has been deliberately high level and based around general areas of the Marlborough Sounds in order to maintain confidentiality around the exact location of the proposed sites. Specific consultation with local Iwi, which is still continuing, is also discussed in this section.

vii. **Farming the Salmon – Operational Details.** Details of NZ King Salmon’s operations from producing the smolt (juvenile salmon) in the freshwater hatcheries, through to transfer to the sea pens and finally harvesting, processing and distribution of the product are provided in here. This section includes discussion of company policies, and management responses to various issues that have arisen over the years that the company has been farming in the Sounds. NZ King Salmon is continually seeking to improve its farm operations, and the various trials that have been conducted to refine farming activities are also discussed in this section.

viii. **Environmental Management.** NZ King Salmon’s environmental management policies and practices are provided in this section. Detail is included about the process associated with annual monitoring of the environment around the farms, required as part of resource consent conditions, and the mitigation measures put in place as part of the adaptive management process that NZ King Salmon utilises to support the environmental management of the farms.

ix. **Consolidated Farm Management.** NZ King Salmon uses an integrated management strategy (predominantly based on temperature) to operate its farms, whereby all the
existing farms are treated as one integrated system to farm salmon. This section provides details about how this strategy works, as well as examples of other salmon farm management strategies utilised globally. Information is also provided on the management of biosecurity and other risks associated with salmon farming. Mitigation of seabed effects is also addressed, with a brief discussion of the various options investigated by NZ King Salmon.

x. Infrastructure Requirements. This section discusses the range of infrastructure requirements necessary to support NZ King Salmon’s farming operations.

xi. Alternatives to Sea pens. This section briefly addresses other possible options for producing salmon, such as wild fishing; ocean ranching and land-based marine systems. The pros and cons of these methods are discussed along with the reasons for NZ King Salmon’s preference for sea pen farming of their salmon.

xii. Salmon Feed. Detailed information about farmed salmon feed is provided in this section, which includes information on the nutritional requirements of salmon and the history of salmon feed development and associated improvements. There are both economic and environmental drivers to reduce the level of marine raw materials used in salmon feed, and information is provided on the research undertaken by feed suppliers to reduce the amount of marine oil and protein in salmon feed. The main ingredients used in NZ King Salmon’s feed, and the sustainability of the fish species currently used to provide marine oil and protein are also detailed. The absence of genetically modified organisms, antibiotics, mercury and persistent organic pollutants in the feed is discussed along with a brief discussion about reducing the feed component of faeces.

21. This report is supported by a number of detailed appendices, which are referred to in the relevant places in the text.

THE NEW ZEALAND KING SALMON COMPANY LIMITED

22. The New Zealand King Salmon Company Limited (“NZ King Salmon”) was formed in 1996 as the result of a merger between Regal Salmon Ltd and Southern Ocean Seafoods Ltd, and is now the largest producer of King Salmon in the world. The Company is ultimately owned by Evergreen Holdings Ltd, whose parent Company is The Tiong Group, one of the largest private companies in Malaysia with substantial global investments in forestry, property and media. The company also has significant New Zealand ownership with Direct Capital purchasing 43.5% interest in 2008.

23. NZ King Salmon is a dedicated leader in the world’s commercial salmon farming industry. The fully vertically integrated company has hatcheries in mid-Canterbury (Tentburn), Kaituna (Marlborough) and Golden Bay (Waikoropupu Springs, near Takaka); farms in the Marlborough Sounds; and factories and offices in Marlborough and Nelson. Currently NZ King Salmon markets salmon under three brands: Regal, Seasmoke, and Southern Ocean. Approximately 50% of the salmon produced by NZ King Salmon is exported.

24. NZ King Salmon is still a very small player on the international salmon scene where 99% of the international production of over two million metric tonnes (mt) of farmed salmon is species other than King Salmon (mainly Atlantic and Coho salmon and
NZ King Salmon produces approximately 8,900 mt of salmon per annum, more than half of the world’s production of approximately 13,500 mt of King Salmon, or approximately 0.4% of the total global salmon production.

25. In the last eight years, NZ King Salmon has been able to consolidate and develop specialised training programmes for staff ensuring the skills and technology necessary to develop an increasingly wide range of products to maximise value. Money has been available to upgrade farms and to build a new farm at Clay Point, as well as to further develop the selective breeding programme in the hatcheries, and to focus on expansion opportunities as a result of market demand.

26. NZ King Salmon production is currently constrained by a lack of water space for the rearing of its salmon. In order to help fill a production gap over the next period until farms currently under application become operative, NZ King Salmon has recently purchased the two small Pacifica Salmon farms in Crail Bay. The acquisition also includes a small hatchery at Waiau, North Canterbury.

FACILITIES

27. NZ King Salmon is a vertically integrated company, currently operating three hatcheries, seven marine farms (eight sites) and four processing plants, with office facilities and depots in Nelson, Picton, Auckland, Sydney and San Francisco. In addition there are two proposed farming sites currently under appeal; White Horse Rock, in Waitata Reach, Pelorus Sound and Melville Cove in Port Gore. Further detail on each of these facilities is provided below:

28. Hatchery in Takaka:

Located immediately downstream from the Waikoropupu Springs in Golden Bay, the Takaka hatchery benefits from one of the clearest sources of freshwater in the world bubbling from the ground at 14,000 litres per second at an unvarying temperature of just under 12°C. This is an ideal temperature for rearing salmon. The facility was established by a private individual in the mid-1970s, and in 1977 a diversion of Springs River into the farm was established and permits were granted to increase the water take and discharge. Water take and discharge permits currently allow NZ King Salmon to take and use water from downstream of the Waikoropupu Springs for the purposes of salmon farming, as well as to discharge water and salmon farming effluent via a settling pond to the Springs River (Figure 1). Operating under these consents, the hatchery is one of NZ King Salmon’s broodstock facilities and currently provides approximately half of the smolt requirements for the sea farms. The Takaka hatchery employs a farm manager, seven full-time permanent and one seasonal staff member (for six months per year) and produces up to 1,500,000 smolt annually.
29. Hatchery at Tentburn:

Close to the mouth of the Rakaia River, Tentburn was developed during the mid-1980s by The New Zealand Salmon Company Ltd (Figure 2). It was initially conceived as an ocean-ranching site whereby the salmon would be hatched and released to the ocean with the intent that they would return three years later as harvestable salmon. During this time, the facility came close to achieving the 1% return of salmon required to ensure profitability, but never quite succeeded. A number of factors led to the ultimate failure of Tentburn as an ocean-ranching site. These included the presence of trawlers fishing off the coast of New Zealand; shags, seals and predatory fish; as well as public fishers who lined the culvert leading into the hatchery. There were also difficulties with maintaining the fish ladder across a beach frequented by gravel movement. Tentburn is however an ideal facility for producing smolt for sea pens, with the main advantages including the sites’ proximity to the sea, plentiful freshwater supply and a lack of disease.

Using technology developed in the United States, the Tentburn hatchery has 60 raceways, and water is continuously pumped from two streams. NZ King Salmon’s world class selective breeding programme is based at Tentburn, and as such all eggs will pass through the hatchery before being on-grown on site, or transported to Takaka and Waiau. During winter two wells are used at Tentburn to obtain better quality water for incubation and development of the smolt during the early stages of the lifecycle. The Tentburn hatchery currently employs a farm manager, 13 full-time permanent, one permanent part-time, two part-time fixed term seasonal staff and a casual staff member, and produces up to 2,000,000 smolt annually.
30. Hatchery at Waiau:

Located between Rotherham and Waiau on SH70 in North Canterbury, Waiau Hatchery was established in 1987 as Amuri Salmon. For the next 20 years it produced up to 100 tonnes of 2kg+ freshwater salmon per year, which were grown in a combination of raceways and ponds. The main water supply originates in springs 1km upstream that are fed from the Waiau river catchment, and in addition there are three wells on site. In 2008 the site was purchased by Pacifica Salmon and used as a hatchery to supply smolt to the Crail Bay farms. The hatchery and sea farms were purchased by NZ King Salmon in 2011. NZ King Salmon currently uses the hatchery to rear 300,000 smolt per annum as well as broodstock, but it has the potential to produce up to 1,000,000 smolt. There are three full-time permanent employees located at Waiau.

31. Ruakaka farm:

The Ruakaka Bay farm, in Queen Charlotte Sound was established in 1985 as a small research based, one-acre farm by the South Island Salmon Partnership (the precursor to Regal Salmon). It is located on the site of the first registered mussel farm in New Zealand and still retains Marine Farm Number 1 status. Previously the South Island Salmon Partnership had operated salmon sea pens in Elie Bay however the elevated water temperature at this site meant that smolt survival was low and stock losses due to scale loss were high. The site, the oldest of NZ King Salmon’s farms, is characterised by water depths of around 35m and low current flows (average mid-water flow of 3.7 cm/s). Over an annual period, water temperatures at this site range from ~11-18°C. Salmon are raised in 20 steel sea pens (20x20m) at this site. As at early 2011 the site produces some 1000 metric tonne (mt) of salmon per annum.

**Figure 2**: Aerial view of the hatchery at Tentburn showing proximity to the sea.
32. Forsyth Bay farm:

The farm at Forsyth Bay was originally developed by Southern Ocean Seafoods in 1994. Water depths at the site are around 35m and as with Ruakaka, current flows are classified as ‘low’ (average mid-water flow of 3.1 cm/s) and water temperatures range from ~12-17.5°C. This site was fallowed for nine years prior to December 2009 and, at that time the seabed had substantially recovered from the previous salmon farming activities. Forsyth Bay has now been farmed since 2009 and the 1750mt of salmon produced at this site annually (in conjunction with the Waihinau farm) are also raised in 24 steel sea pens (20x20m).

33. Waihinau farm:

The Waihinau farm was originally located in Hallam Cove, and following a decision by then owners Newhaven Salmon Company, it was moved down Pelorus Sound to the cooler waters of Waihinau Bay in 1989-90. Southern Ocean Seafoods took over the site in 1990. Water depth at the site ranges from 28-30m, and water flow is categorised as ‘low’ to ‘moderate’ with an average mid-water current speed of 8.4 cm/s. Over an annual period, water temperature ranges from ~12-17.5°C. Currently there are no salmon farmed at this site, as it is presently managed on a rotational/fallowing basis with the Forsyth Bay farm.

34. Otanerau farm:

Prior to considering Tory Channel as a safe place to locate salmon sea pens, Regal Salmon sought and were granted a salmon farming permit in Otanerau Bay, the southern extension of East Bay in the north of Arapawa Island. The site, which was developed late 1989, is adjacent to mussel farms and the two industries have been compatible since that time. Water depth at this site ranges from 37-39m and current flows are characterised as ‘low’ to ‘moderate’ with an average mid-water current speed of 6 cm/s. Water temperature ranges from ~11.5–18°C, but due to the consistently higher warmer temperatures in summer at this site, salmon are only grown here for nine months of the year (April to January). In 2009, Otanerau was significantly reduced in size with a number of sea pens removed from the farm and shifted to other NZ King Salmon sites. Currently Otanerau has an annual harvest of ~1000mt of salmon which are grown in 12, 20x20m steel sea pens at this site.

35. Te Pangu farm:

In their search to find deeper sites and cooler water temperatures Regal Salmon applied for and obtained a permit to farm salmon in the cooler, high current flow Te Pangu Bay site (Tory Channel) in the early 1990’s. The motivation behind this innovative move was to reduce the mortality of smolt during spring, which at times could reach 50% if the spring water temperature rose in conjunction with the smolt introduction into the seawater. At Te Pangu this phenomenon did not occur because of the tidal flows of water from the cooler Tory Channel. In 2006 the Te Pangu farm snapped its mooring lines compounded by adverse weather and strong tidal conditions and much of the farm drifted into Tory Channel. In 2009 NZ King Salmon upgraded the farm, installing larger sea pens, new barge facilities and a number of innovations including modern feeding systems, net cleaning technology and mooring line tension monitoring. Water depth at this site ranges from 27-31m, with ‘high’ mid-water current water flows averaging 15 cm/s, and water temperatures ranging from ~11.5–15.5 °C. Currently there are 12, 25x25m and six 30x30m steel sea pens at this site, producing approximately 2,500mt of salmon per annum.
36. Clay Point farm:
Following the success of the Te Pangu farm, NZ King Salmon sought further suitable areas of Tory Channel to establish farms. In the initial years, development at the Clay Point site was limited because of the restructuring of the industry and the challenges posed by such a deep and fast moving water force. The farm was eventually opened in 2007, operating under a marine farm licence shared with local Iwi Te Atiawa. This site is located in water depths ranging from 30-40m and it has the highest water velocities of all of NZ King Salmon’s farms with average mid-water flows of 19.6 cm/s. The high water flows, and cooler water temperatures (~10.5-16°C) compared to farms in Pelorus and Queen Charlotte Sounds make this site ideal for growing salmon. Currently there are eight, 30x30m steel growing sea pens at this site which produce 2000mt of salmon per annum.

37. NZ King Salmon currently has 55 full-time permanent staff working on its farms; with each farm employing approximately nine permanent staff; comprising a manager who usually commutes daily to the farm, and two shift crews who live on the farms when working (seven days on, seven days off). To achieve the company focus of year round production of similar sized fish (~4kg), the seven farms are currently managed as an integrated system, rather than as independent production units. Further detail about NZ King Salmon’s farming approach is provided from paragraph 165.

38. NZ King Salmon has recently taken over the two Pacifica salmon farms in Crail Bay. The intent of these farms is to fill the gap in production until the farms currently being applied for start producing salmon. The Crail Bay sites were historically used for mussel farming; however Pacifica has used Li32 to trial various finfish species at the sites since 2003, and has been growing salmon on the site since 2006. The farms are located in water depths ranging from 19-31m, and with ‘low’ mid-water current flows ranging from 2.5-3.5cm/s and water temperature ranging from 11-20°C. The northern site (Li48) currently has one 60m diameter, and two 90m diameter circular plastic sea pens, which are used for juveniles and grow-out respectively. The southern site (Li32) has nine circular plastic sea pens installed – six of which are the larger 90m diameter grow-out sea pens, and three are 60m diameter in size. NZ King Salmon does not intend to make any changes to the operation of these two farms for a time; however they will eventually be incorporated into NZ King Salmon’s farming operations. Should highly productive water space, as is being applied for in this application, be obtained, then Crail Bay may be used for other applications such as providing specialist product, fallowing, emergency use or as a research site. The Crail Bay farms are expected to produce approximately 500mt this year, with subsequent production expected to reach approximately 800mt/annum.

The Crail Bay sites are seen to be of transitional assistance to the company as they are suboptimal in terms of production ability.

39. In addition, the following two sites have been applied for and are currently under appeal.
   a. White Horse Rock, Waitata Reach, Pelorus Sound:
      The White Horse Rock site is currently undeveloped; however it does have a resource consent which permits farming of various bivalves and algae. NZ King Salmon considers the site to have characteristics suitable for salmon farming, with moderate current flows and depths ranging from 22-43m. The company currently has an application (under appeal) to obtain a coastal permit with conditions that
would allow farming of salmon at the site. The consent was turned down in the Environment Court as the Judge found that the Grandfathering clause enacted by the Aquaculture Reform Legislation on 1 January 2005 does not permit for a change in species. Should consent be granted it is intended that a number of steel sea pens, similar to those at existing sites, will be deployed. A maximum annual production of 1,500mt has been proposed for this site.

b. Melville Cove, Port Gore:

The Melville Cove site is fully developed as a Greenshell™ mussel farm; however the water temperatures, relative isolation and water depth (15-36m) at this site mean it is suitable for rearing salmon. NZ King Salmon currently has a coastal permit (under appeal) at this site. The consent is being appealed on the basis of the terms of the consent and the consent conditions. Should consent be granted, it is intended that a number of 38m diameter high-density polyethylene (HDPE) circular sea pens be deployed at this site (similar to the existing structures in Crail Bay), with a maximum annual production of 1000mt.

40. Factory and offices in Nelson:

NZ King Salmon has four processing factories, all located in Tahunanui, Nelson. Fish arrive at the primary processing plant, where they are gilled, gutted and undergo a quality control inspection. Fish are then graded and sorted and either processed for fillets, steaks or kebabs at the main factory, or sent to one of the other three processing plants where the ‘value-added’ processing (e.g. hot smoked, cold smoked, gravlax, portion control) is undertaken. This processing occurs in two shifts by 247 staff, who comprise over 50% of NZ King Salmon’s work force.

NZ King Salmon’s head office, which houses approximately 60 staff, is also located at the Bullen Street site in Tahunanui. The CEO, all the General Managers (apart from Aquaculture) and the export marketing team are located in these offices, along with associated support staff. The finance, information technology and human resources staff are part of the corporate team, but are located in the ex-Sealord building in Beatty Street, Tahunanui; only a short drive from the Bullen Street site.

41. Offices and net-making facility in Picton:

The aquaculture general manager and the majority of the aquaculture senior managers and support staff are based in Picton at NZ King Salmon’s head office for the aquaculture division. This division comprises 132 staff, comprising administration; engineering research and development; field team; fish performance team; harvesting team; livestock transport and a net making team. The net making / repair facilities are located at this site; while all the grower nets are purchased ready-made, there is always a need for repairs and ‘one-off’ type nets which are made here. The Picton premises also house a significant engineering workshop with a staff of eight qualified engineers and electricians, as well as a storeman who runs the warehouse facility.
42. National marketing office in Auckland:
   NZ King Salmon has an office in Auckland where 17 domestic sales and marketing and customer service staff are based. NZ King Salmon brands are the pre-eminent salmon brands in New Zealand, and this site is the head office for the domestic marketing team.

43. NZ King Salmon has seven staff members based in Australia. Five of these are located at the NZ King Salmon depot and processing factory in western Sydney. The Australian market for NZ King Salmon product is food service based, so it is the role of these staff to market the product to chefs. Product is usually processed and packaged at the New Zealand factories, however fresh whole salmon is sold to the Australian market, so if necessary NZ King Salmon can further process these fish to meet ‘short order’ market demand. NZ King Salmon also has one staff member located in each of Brisbane and Melbourne.

44. NZ King Salmon also has one person based in San Francisco in a market development role, and two people based in Tokyo, also fulfilling market development roles. It is anticipated that these offices will eventually be similar in size to the Sydney office.

EMPLOYEES

45. NZ King Salmon’s staffing numbers have increased from 271 in July 2002 to the current staff of 468. Many NZ King Salmon staff are highly skilled, with approximately 20% of the Marlborough based aquaculture team being graduates.

46. The average earning per employee is approximately $47,800.

47. NZ King Salmon is committed to developing a safe and highly skilled workforce through investing in people. The Seafood Industry Training Organisation (SITO) training programmes are heavily promoted within the company with a major ongoing investment in the development of Unit Standards.

48. As the largest employer of industry divers in New Zealand, NZ King Salmon supports training for divers to ADAS part III level (the highest international standard) and has approximately 30 qualified aquaculture divers. Diving is a key part of NZ King Salmon’s husbandry, and training to meet these standards is provided ‘on the job’.

49. By operating in remote areas of rural New Zealand, NZ King Salmon helps to maintain viable communities and so counter some of the effects of a general population drift to the urban centres. NZ King Salmon employment is open to applicants that live anywhere and some of the current marine operations team members live in remote parts of the Sounds.

50. NZ King Salmon is proud of its company culture; the company’s value system is such that people are encouraged to care about each other, the environment and the product. As a result, NZ King Salmon is recognised as an innovative company with passionate staff who care about the product and the environment in which the fish are raised.

51. Given current staffing levels, it is expected that a further 50-70 staff may be required to run the new farms proposed in this application, with a further 20-40 staff (depending on the level of automation) to work in the proposed Picton factory which may be developed if this proposal is successful.
REVENUE

52. NZ King Salmon operations generate significant regional and national economic benefits. The following statistics illustrate the scale of economic contribution for the year ended 30 June 2011:
   a. Company turn-over of $111m (~$20m per surface structure hectare);
   b. Foreign exchange earnings equivalent to $50m ($9.1m per surface structure hectare);
   c. Staff spend (nationwide) $21m (~$4m per surface structure hectare);
   d. Staff spend (aquaculture) $6m (~$1.1m per surface structure hectare).

53. In addition, NZ King Salmon provides significant contributions to support service companies such as charter boats, freight, road, sea and air haulers, specialist divers, hardware suppliers, feed producers, science providers and a host of other New Zealand based companies.

54. NZ King Salmon predict steady growth in revenue between 2011 and 2020 as production from the proposed farms comes on line (Figure 3).

![NZKS Revenue Growth History and Supply Projections](image)

Figure 3: NZ King Salmon revenue growth history and projections.
SOCIALY RESPONSIBLE CORPORATE

55. NZ King Salmon is regularly contacted by Destination Marlborough to undertake promotional tours with visiting television programme makers and other VIPs who visit the region. Participating in these promotional activities allows NZ King Salmon to assist with lifting the profile of Marlborough within New Zealand and overseas. For example, in late 2009, company staff participated in the filming of an ‘NZ on a Plate’ episode that was screened in New Zealand and overseas.

56. NZ King Salmon also supports community events, normally with product for functions and fundraising. Some examples of events/organisations that the company has supported are: Nelson/Marlborough Rescue Helicopter and Life Flight NZ; DIY Marae make-over of the Waikawa Marae; the Waikawa Boating Club; Rapaura School Annual Country Harvest Fair; Queen Charlotte Yacht Club Sailing Regatta; New Zealand Hang-gliding and Paragliding National Championships; Waitaria Bay Classic Tri-plus; Picton Maritime Festival; Endeavour Park Sports Pavilion; Havelock Mussel Festival; the Life Education Community Trust and the Foundation for Youth Development. More recently the company has supported the NZ Red Cross Earthquake 2011 Appeal, The Grape Ride, Picton School 150th Reunion, Picton Maritime Festival and the 2011 Interislander Regatta.

57. In recent years NZ King Salmon has increased participation in environmental based initiatives in the Marlborough region as this fits well with the NZ King Salmon sustainability ethos. For example NZ King Salmon became a cornerstone supporter of the Mistletoe Bay Trust by being the first commercial organisation to sponsor the development of one of eight whare used for eco-tourist accommodation in Mistletoe Bay (www.mistletoebay.co.nz). The company also supports the Marlborough Sounds Restoration Trust wilding pine project (www.soundsrestoration.org.nz/wilding-pine-control.html); the Kaipupu Point mainland island project (www.kaipupupoint.co.nz); Tui Nature Reserve (www.tuinaturereserve.co.nz); NZ Bird Rescue Charitable Trust (www.birdrescue.org.nz) and continues to assist with the Queen Charlotte College aquaculture academy, including sponsoring a scholarship for this academy (www.qcc.school.nz/aqua.html).

GLOBAL MARKET SITUATION

GLOBAL DEMAND TRENDS AND GROWTH POTENTIAL

58. The increasing global demand for quality fish protein and consumer trends (outlined below) that are aligned with NZ King Salmon’s products all support significant growth potential.

59. World population projections (Figure 4) support significant increased demand across all protein types. Over half of the forecast growth in animal protein consumption is within the developing Asia-Pacific countries (Figure 5).
60. As is shown in Figure 5, 14% of the world's increase in protein consumption will be of seafood products. Given that wild catch volumes have been flat for many years, the majority of this increase in demand will need to be met by an increase in aquaculture production.
Figure 5: Forecast growth in protein consumption by protein type and economic development.

Figure 6: Global fish protein consumption by region.
61. A significant part of this growth will be driven by developing countries, which while having lower per capita GDP, will see significant population growth (Figure 6). This will drive demand for lower value species, but will also represent opportunities for higher value species within the more affluent segments of these populations. In 2011 NZ King Salmon added China as one of its export markets. The company is optimistic about the potential of China, but as this potential is as yet unproven volumes for this market have not been included in future projections.

62. While there is substantial demand for fish protein forecast in the Asia-Pacific region, the market for protein is globalised, and global supply will be redirected to higher consumption areas, creating shortages in other markets. There are also significant global consumer demand trends impacting the demand for quality protein within NZ King Salmon's existing markets. Relevant key trends include:

a. The growing interest globally in premium food products, which has resulted in chefs being elevated to celebrity status. NZ King Salmon has been able to leverage this growing trend in all of the main markets via endorsement and association.

b. An increasing desire from restaurateurs wanting to differentiate their menu by using unique and scarce ingredients. Atlantic salmon is a relatively common product, whereas King Salmon enjoys the benefit of being differentiated as unique, yet at the same time still sufficiently familiar to be attractive to clientele.

c. “Insperience” (having the best at home). Increase in demand for quality ingredients for at-home consumption. Retailers are seeking to improve their ‘ready to eat’ offerings, including high quality seafood within the ‘chilled’ category for up-market ready prepared meals.

d. Time is greater than money. Consumers are demanding convenience in buying, handling and consuming products without compromising on quality.

e. Health and wellness. A significant and evolving trend that can be subdivided into three key consumer trends:
   i. Naturally healthy – pure and simple products, super foods;
   ii. Shape management – maintaining weight, ‘light’ and good taste;
   iii. Functional products – to fulfil beauty, health and longevity objectives.

63. Functional products include nutraceuticals, which is completely dominated in the media by the growth and continued potential for Omega-3 oils. There has been considerable growth in Omega-3 usage. Estimates of the global market for the Omega-3 ingredients range from USD 1.2 to 1.5 billion, with current annual growth at 10-13% and the market predicted to rise to USD 3 billion within five years. King Salmon enjoys an advantage over other species as it contains considerably greater levels of Omega-3.

64. Growth in the Omega-3 market is being driven by recognition of the science underlying these valuable fatty acids. Media coverage has resulted in significant awareness amongst consumers; as such there is a renewed consumer emphasis on the source product rather than a processed derivative1.

65. In the developed economies (and existing markets of NZ King Salmon), there has also been an increasing consumer focus on non-price aspects in the purchase decision. As

---

a result aquaculture is increasingly being exposed to scrutiny on a number of fronts, including quality, safety and ecological and environmental sustainability. These issues will continue to emerge as factors that will shape aquaculture globally in years to come. Those producers and countries with their house in order on all of these consumer issues will have a key advantage in terms of building sustainable premiums and access to these higher value aquaculture markets. On this basis, New Zealand aquaculture has much to be confident about.

GLOBAL SEAFOOD PRODUCTION AND SUPPLY

66. By 2020, 18 million tonnes of extra seafood will be required to maintain current consumption, 40 million by 2030.

67. The Food and Agriculture Organisation of the United Nations (FAO) predict that aquaculture will increase from 42% to 58% of global seafood production by 2020 Figure 7). This alone will result in steadily increasing prices as increased demand cannot be met by wild capture (an annual increase in prices of 2.2% to 2020).

Figure 7: Global seafood production mix - aquaculture versus capture fisheries.

68. Globally, wild capture fisheries are mostly at or above sustainable exploitation levels. Also, despite an increase in capacity and many technological advances, wild catch has not increased and high fuel costs will contribute to a global decline in production.

---

GLOBAL AQUACULTURE PRODUCTION

69. As at 2011, the latest assessment of global aquaculture is contained within the biannually produced Food and Agriculture Organisation of the United Nations (FAO) publication “The State of World Fisheries and Aquaculture 2010”. This document states that global production of food fish from aquaculture, including fin fish, crustaceans, molluscs and other aquatic animals for human consumption reached 52.5 million tonnes in 2008, compared with less than one million tonnes in 1950. This increase is three times that of world meat production (from poultry and livestock combined) in the same period.

70. The FAO report summarises aquaculture production figures by major species group, and as is shown in Figure 8, globally diadromous fish (such as salmon) make up only 6.3% by quantity of the total aquaculture production tonnages. However by value these fish account for US$13.1 billion or 13.3% of total aquaculture production.

Figure 8: World aquaculture production by quantity and value for the major species groups.
71. Diadromous fish production in 2008 was dominated by Atlantic salmon (1.5 million tonnes, or 44%). Norway and Chile are the world’s leading aquaculture producers of salmonids, accounting for 36.4 percent and 28 percent of world production, respectively. Other European countries produced another 18.9%, while Asia and North America contributed only 7.9% and 7.4%, respectively.

72. High-value species such as shrimp, prawns, salmon, tuna, groundfish, flatfish, seabass and seabream are highly traded, in particular as exports to more affluent economies. However, low-value species such as small pelagic fish are also traded in large quantities in the other direction to feed low-income consumers in developing countries.

GLOBAL SALMON PRODUCTION

73. The global salmon market is dominated by production of Atlantic salmon (around 90%), with the majority of the production based in the northern hemisphere. The largest producer is Norway with approximately 40% of total salmon production and Chile is the second largest with around 30%. Global production of King Salmon, of which New Zealand is the largest supplier, equates to less than 1% of the global salmon market.

Figure 9: Total global salmon (excluding trout) production by year, with estimates for 2011. For comparison NZ King Salmon production is shown in red at the top of each column.

---

74. For the global market, the growth of salmon consumption has been rapid and is likely to continue (Figure 9). Production is growing at a similar rate to consumption, with global farmed salmon a key component of this production. The share of salmonids (including trout) in world trade has increased considerably in recent decades and now stands at 12%. However, 2009 was overshadowed by lower salmon production in Chile, owing to disease, resulting in a decline in cultured salmon output for the first time. Higher salmon output from Norway failed to offset this decline. Salmon prices reached record high levels in all markets.

75. Global supply of salmon was at its lowest in 2010 after several years of growth. This combined with the increase in demand for salmon over several years; means the market for the world’s salmon production companies is very good.

SALES AND MARKETING

HEALTH BENEFITS OF KING SALMON

76. New Zealand King Salmon has been categorised as a natural ‘super source’ of the beneficial long chain Omega-3’s (DHA and EPA’s) by the Australasian Omega-3 Centre. Long chain Omega-3’s are essential fatty acids important for overall health, which cannot be synthesised by the human body. They play a major role in heart health and the prevention and management of cardiovascular disease; the management of rheumatoid arthritis; and chronic pain management. In addition, Omega-3 DHA helps to develop and maintain eyesight and plays a fundamental role in brain development and function including motor skills and mental development.

77. The National Health and Medical Research Council (NHMRC) of Australia have suggested dietary targets of 430mg/day and 610mg/day of EPA, DPA and DHA for females and males over 14 years respectively. One to two servings of King Salmon per week would supply sufficient Omega-3’s to fulfil an average persons requirements.

78. King Salmon is also an excellent source of selenium (required for the proper functioning of the immune system), phosphorus and vitamins B6, B12, D3 and E. Vitamin D is essential for promoting calcium absorption in the gut and insufficiency has now reached epidemic proportions.

CULINARY ADVANTAGES

79. King Salmon has a naturally higher oil content than Atlantic salmon. This high natural oil content imparts a more pronounced yet clean flavour (not fishy). The firm texture is maintained with good husbandry and harvesting techniques. King Salmon colour is usually darker and richer, than Atlantic salmon, especially when cooked.

---

5 IntraFish 2010. Top 30 Salmon Producers.
9 Australasian Omega3 Centre
10 Food Standards Australia, New Zealand recorded Total long chain fatty acids of 2970mg per 100g portion of New Zealand King Salmon
11 Identification of Health and Nutritional Benefits of New Zealand Aquaculture Seafoods, Grant MacDonald, 2010
12 Food Standards Australia New Zealand, Consumer Information 2010: 2970mg per 100gm of Total long chain Omega3 fatty acids versus 1564.7mg for Atlantic Salmon
80. A core focus for the New Zealand salmon industry has been to differentiate King Salmon from Atlantic salmon, with influential chefs and chef ambassadors in key export markets raising awareness of the unique culinary attributes and flavour and establishing a premium positioning. A highly influential U.S celebrity Chef Rick Moonen described King Salmon as the ‘Wagyu of salmon’, a comparison to Wagyu beef - a culinary delicacy.

ENVIRONMENTAL CREDENTIALS

81. The supply chain (particularly within North America) and wider stakeholders, including regulators, non-governmental organisations (NGO’s), consumers and the public are placing increasing demands on food producers to demonstrate environmentally sustainable practices. Influential NGO’s are producing seafood ‘sustainability’ guidelines which consumers and chefs are utilising when sourcing products.

82. NZ King Salmon is committed to the on-going development of its company Environmental Policy (Appendix 1). In addition, its practices meet the requirements of the New Zealand Salmon Farmers Association Environmental Code of Practice (Appendix 2). This Code of Practice (ECOP) was independently benchmarked by Global Trust Certification Ltd (an independent and accredited certification body). The Salmon ECOP performed equal to, or better than, most other international standards and codes examined and was acknowledged as providing a sound basis from which the development of accredited standards and third party certification could take place.

83. NZ King Salmon, because of the disease free status of King Salmon in New Zealand, is able to farm its fish in a very natural and wholesome way. Global Trust Certification Ltd carried out ‘on farm’ audits as part of the Environmental Benchmarking Survey in 2009 which reinforced this position. “The New Zealand Salmon industry is better placed than most (if not all) salmon sectors across the world due to the lack of species specific diseases/pests which are considered prevalent in other countries. This has led to the unique position that the New Zealand Salmon industry as a whole does not use chemicals, or anti parasitic treatments in the day to day production.”

84. Wild salmon do not live or breed in the waters adjacent to the Marlborough Sounds, nor apart from the Pelorus River, are there any major river system for salmon to spawn in. The nearest salmon fishery is a minor and sporadic fishery in the Wairau River; and as such, NZ King Salmon’s fish do not have any interaction with wild salmon stocks. However, if northern hemisphere salmon diseases do one day arrive in New Zealand, they will be detrimental to the farmed salmon, and will not affect the general coastal marine environment or the New Zealand public.

BRANDS AND PRODUCTS

85. NZ King Salmon have a range of brands targeted to both the food service and retail sectors. The approach to brands and product forms has moved away from commodity type products towards higher value products aligned with demand trends around convenience, nutrition and quality. NZ King Salmon have also identified demand for both premium and more affordable products, and as such, have positioned each brand at different levels across the retail offering.

---

13 Environmental Benchmarking of the New Zealand Aquaculture Industry by Global Trust Certification Ltd, September 2009
New Zealand King Salmon brand:
Fresh, chilled, gilled and gutted salmon
Frozen whole salmon
Portion control, fillets, steaks and medallions

Regal brand:
Hot smoked salmon
Cold smoked salmon
Salmon pastrami
Salmon Gravalax
Salmon Kebabs
Salmon Caviar

Southern Ocean brand:
Cold smoked salmon
Cold smoked salmon pieces

Seasmoke brand:
Manuka cold smoked salmon
Smoked Mussels
Smoked Mackerel
Hot smoked Kebabs

86. A key element to NZ King Salmon’s strategy which will help realise additional value is the introduction of a premium food service brand (“Ora King”) designed to be used on menus around the world. It is anticipated that ultimately 75% of NZ King Salmon’s product will be sold under the new brand name.

APPROACH TO MARKETS

87. NZ King Salmon currently sells product into 13 countries, with particular focus on the four key markets of New Zealand, Australia, Japan and North America. The New Zealand market currently accounts for approximately 50% of total sales with a rapid growth rate (approx 7-12% per annum). The remaining production is exported with the other three key markets accounting for approximately 15% each of total export volume, the other 5% to countries in South East Asia, the Pacific, the Middle East and Europe (Figure 10).
88. To be profitable within these competitive markets, NZ King Salmon is focused on establishing a premium market position and connecting with quality channel targets, and each market is treated independently. To justify a premium market position, NZ King Salmon is required to clearly demonstrate the culinary, nutritional and environmental benefits of King Salmon over Atlantic salmon. To achieve this, NZ King Salmon have invested in the establishment of ‘in-market’ representatives within each of the key export markets to establish relationships across the supply chains both within food service and retail. NZ King Salmon also recruits former chefs and restaurateurs into key sales roles to help develop its premium food service business worldwide.

89. An example of premium positioning and long-standing relationships is the supply of smoked salmon into the Japanese market. An opportunity was identified for a premium positioning of NZ King Salmon’s brand; this positioning has enabled the company to remain the largest single supplier of imported smoked salmon in Japan, competing against major global producers from North America, Europe and Chile. This relationship continues to exist after 15 years.

90. In addition to in-market representatives, NZ King Salmon continue to invest in promotional activity to raise the profile of their brands around quality and freshness; the nutritional and culinary advantages; the provenance story of the Marlborough region and the environmental credentials of King Salmon farmed in New Zealand. This is achieved through attendance and exposure at targeted food and beverage trade shows and through alignment with influential chef ambassadors (www.regalsalmon.co.nz/regal-chefs). NZ King Salmon contracts a public relations company to maximise exposure with nutrition and health experts, chefs, distributors and consumers.

91. King Salmon currently commands a premium price approximately 30-40% above all farmed salmon. NZ King Salmon have identified the premium end of food service and retail as providing significant market opportunities. This segment will pay a premium for:

a. Quality in flavour and freshness;
b. Consistency of supply;
c. Attractive branding and functional packaging (for retail);
d. Appealing species/breed/provenance proposition (e.g. King Salmon, Marlborough Sounds, New Zealand).

92. This premium segment within each of the four markets is typified by independent restaurants – fine dining; small to medium chains (with more sophisticated and contemporary menu options); higher end retail outlets and sushi restaurants.

93. The key focus for NZ King Salmon is to continue to strengthen and grow existing markets (Figure 11). Four strong markets have previously enabled the company to manage the natural variability in fish supply and grade mix. NZ King Salmon is about to diversify some risk by operating in multiple markets.

Figure 11: Total NZ King Salmon sales (CIF NZD) between 2004 and 2010 (upper graph), and total sales (CIF NZD) to export markets (lower graph).
94. NZ King Salmon featured in the most recent Sydney Fish Market's Seafood Excellence Awards 2011. The company was judged the Best Supplier - Aquaculture, with the award comparing products from aquaculture suppliers to determine who delivers the most popular and highest quality aquaculture product into New South Wales markets. The entry highlighted NZ King Salmon's world class farming practices as well as awards from the British Humane Society for its harvesting practices.

**GROWTH AND SUPPLY ISSUES**

95. NZ King Salmon's growth is largely being driven by global demand or 'pull', rather than product ‘push’. As a result, supply constraints have become an issue. To meet the increased demand for product over the past two years, some fish were harvested early. This had negative consequences with some customers where expectations were not met due to the smaller size of the fish. This was not a sustainable approach and since the first quarter of 2011, NZ King Salmon has been unable to meet current customer demands.

96. The development of new water space is critical for meeting customer demand within the higher value niche market NZ King Salmon has established. Additional farms will enable NZ King Salmon to remain market led and focused, with the ability to supply the fish and portion sizes on-demand.

**OPPORTUNITIES FOR EXPANSION**

**NEW ZEALAND AQUACULTURE – A PRIORITY GROWTH SECTOR**

97. Aquaculture is an important contributor to the New Zealand economy, with exports of $380 million in 2009, and a goal of becoming a $1 billion industry by 2025.\(^{14}\)

98. Independent expert assessment of the sector growth potential\(^{15,16}\) confirm revenues closer to $2 billion are attainable by the New Zealand aquaculture industry. This level of growth will also drive net economic benefit of $1.1 billion, GDP increases of $740 million and create 1,100 new jobs in the sector. These independent assessments observed that delays in reforming the sector have lead to decreased spill-over benefits.

99. Overall, the value of New Zealand aquaculture exports has grown at an average annual rate of 10.4% since 1989. This growth rate, albeit from a relatively low base, has been faster than that of total exports (5.3%); food and beverage exports (6.1%); dairy (8.2%); meat (4.2%); vegetables (4.7%) and fruit (4.6%)\(^{15}\).

100. Aquaculture has been identified as a priority growth sector by successive governments under the Economic Transformation Agenda and more recently the Economic Growth Agenda.

101. Industry and government efforts for collaborative investment in technology and innovation that boost aquaculture productivity generate a significant economic return for both the aquaculture industry and New Zealand as a whole\(^{16}\).

---


\(^{15}\) Ernst & Young. 2009. New Zealand Aquaculture Industry Growth Scenarios.

\(^{16}\) NZIER. 2010. The Net Economic Benefit of aquaculture growth in New Zealand
INCREASED PRODUCTION REQUIREMENTS

102. NZ King Salmon has a proven performance record in the farming, marketing and sales of King salmon, and produces well in excess of 50% of the total farmed King salmon sold globally. The company is continually evolving its understanding of salmon farming and adjusting farm management practices.

103. NZ King Salmon has increased production volumes, sales and profitability over the last decade and has continued to maintain King Salmon prices at a premium over Atlantic salmon. This increase in volume has not compromised quality. Paragraph 94 refers to a recent award in Australia for ‘Best Supplier – Aquaculture’ for product quality.

104. NZ King Salmon currently produces 8,900 tonnes of salmon annually and is well placed to expand production to meet the forecasted demand for its premium King Salmon product if additional water space is made available. In this globally competitive environment, if NZ King Salmon is unable to take advantage of consumer demand, the opportunity will be lost to international competitors reducing not only revenue gains to NZ King Salmon, but also significantly impacting on national and regional economic benefit.

105. The company target is to double its production to 15,000 tonnes by around 2015, with the ability to expand beyond this by 2020 based on the following (this demand forecast is conservative):

a. The FAO prediction for the requirement of 18 million tonnes of extra seafood required to maintain current per capita consumption by 2020 (paragraph 66).

b. The FAO prediction that aquaculture will increase from 42% to 58% of global seafood production by 2020 (paragraphs 67,71).

c. The consumer demand trends for quality protein aligned with NZ King Salmon’s product and product format in existing markets.

d. Proven increase in demand and consistent growth of the premium segment within existing markets through the establishment of new channels and customer relationships (paragraph 92).

e. New market potential for higher value species within the more affluent segments of the developing Asia-Pacific countries (for which over half of the forecast growth in animal protein consumption is predicted).

106. The graphs below show the history and projections of NZ King Salmon incremental sales growth by volume and revenue for existing key markets only. The top two graphs in Figure 12 and Figure 13 show volume and revenue predictions based on current farming practices. While New Zealand is unique to other farming countries in that diseases are not an issue, NZ King Salmon will not continue to operate as if their farms are ‘disease free’. Instead they are likely to take a conservative biosecure approach which will place constraints on production. These constraints are reflected in the lower two graphs of Figure 12 and Figure 13, which show volume and revenue predictions if farm management operations are altered to include single year class sites, fallowing and biosecure areas.
Figure 12: History and projections of NZ King Salmon product volume sold into key markets under (top) current farm management practices and (b) farm management practices that include single year class sites, falling and biosecure areas.
Figure 13: History and projections of NZ King Salmon revenue by key market under (a) current farm management practices and (b) farm management practices that include single year class sites, fallowing and biosecure areas.
107. NZ King Salmon is projecting that the company will eventually receive equal revenue from the massive (400,000mt) USA and Japanese markets as they receive from the small (5,000mt) NZ market. In real terms this is less than 1% of the market. This does not reflect the additional sales opportunity into the emerging affluent demographic within the Asia Pacific region for which significant population growth is forecast.

RATIONALE FOR SITE SELECTION AND SPACE

108. NZ King Salmon considered a number of options for increasing production capacity, these included development of international water space, acquisition of space from other New Zealand producers and obtaining new space in other areas within New Zealand. Given the total infrastructure investment and existing employee expertise within New Zealand, the company decided to maintain operations in New Zealand.

109. The following section ‘Site Selection Process’ provides an outline of the regions considered for expansion of NZ King Salmon’s operations outside of the Marlborough region. These locations were not considered to be viable due to (or a combination of), water temperature, coastline exposure, environmental considerations, and/or less than optimal growing conditions. NZ King Salmon’s investigations reinforced the Marlborough Sounds as the only suitable growing area within New Zealand to sustain the level of salmon production increases proposed.

110. A key market strength of NZ King Salmon is the ability to produce fish year round that are consistent in quality and size. Individual sites each have different attributes such as water temperature and current flow. To maximise the attributes of each site, an integrated management strategy, as discussed in paragraphs 321-331 allows all resources to be utilised efficiently, minimising risk and achieving year round production and consistency of size. As an example, water temperature has the strongest effect on salmon growth; therefore management of sites according to their temperature profiles enables NZ King Salmon to achieve greater growth rates of the young fish during the warmer summer months.

111. Based on the known production capacity of NZ King Salmon’s existing sites, it was determined that eight additional sites incorporated into the existing integrated farm management system would enable NZ King Salmon to meet the company’s volume targets.

112. The eight proposed sites (Appendix 3) meet the six criteria (site characteristics; operative MSRMP Zoning; natural character; ecology; outstanding natural features and landscapes; and amenity, recreation and navigation) and are suitable for development. The sites are:
   a. Post Office Point
   b. Tapipi
   c. Richmond
   d. Papatua
   e. Kaitapeha
   f. Ruaomoko
   g. Ngamahau
   h. Waitata
113. Figure 14 illustrates ‘maximum’ production against the sales forecast phased over nine years. Despite NZ King Salmon identifying a market demand of 30,000 mt, there are production limitations based on the company operating ‘best practice’ principles in relation to consolidated farm management and biosecurity. At the time this report was prepared; two additional farms are under appeal: Whitehorse Rock and Melville Cove. Proposed production from Whitehorse Rock has been accounted for in the scenarios outlined below under Waitata production.

114. Figure 15 illustrates the significant difference in production against the forecasted sales if NZ King Salmon operates using three bio-secure areas with single year class fish at each farm. The production volumes for this scenario ensure single year class fish are grown in designated areas as part of an integrated strategy and in recognition of the proposed three-year lapse term in the Aquaculture Amendment Bill (No. 3).

Figure 14: Maximum total production by NZ King Salmon site and financial year, with development window for new farms indicated.
Figure 15: Total NZ King Salmon production by site and financial year assuming three bio-secure areas with single year class fish at each farm.

**OPERATIONAL CAPACITY AND CAPITAL REQUIREMENTS**

**Table 1: Major infrastructure required to achieve proposed production capacity.**

<table>
<thead>
<tr>
<th>Major infrastructure required</th>
<th>Structures include:</th>
<th>Approximate CAPEX required per farm: $4.5m (eight farms = $36m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Establishment of 8 farm sites</td>
<td>• Mooring systems • Sea Pens • Predator Nets • Bird Nets • Barge</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Note: A barge may not be applied to each site in the initial stages of development.</td>
<td></td>
</tr>
<tr>
<td>Increased processing capacity</td>
<td>When volume &gt;15,000 tonne:</td>
<td>Approximate CAPEX required to build a company owned facility with specialist technology: $8 - 10m (subject to land location and price)</td>
</tr>
<tr>
<td></td>
<td>• NZ King Salmon will transfer primary processing to Marlborough either by contract processing or through a company owned facility.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• The mix of value added (VA) product will also influence the requirement for additional factory space. This would occur where the mix of VA products (fresh or frozen) increases disproportionately to the current mix and cannot be accommodated through current shift patterns or factory space.</td>
<td></td>
</tr>
<tr>
<td>Hatchery Development</td>
<td>• Current facilities allow for expansion to at least 15,000 tonne. Further expansion is likely to require re-circulation technology.</td>
<td>Costs subject to technology utilised.</td>
</tr>
</tbody>
</table>
115. The NZ King Salmon Board of Directors has approved the proposed expansion plan for eight additional sites. Table 1 provides an indication of the investment and major infrastructure required to achieve the proposed production capacity.

**DEVELOPMENT AND IMPLEMENTATION**

116. An implementation programme for the development of the proposed eight sites must be aligned with the individual consent conditions for each site. NZ King Salmon will work within the environmental parameters at each farm site by staging the development. Continued development is not permitted until it is shown the farm is operating within the conditions of the consent, further outlined in paragraph 316.

117. Consent conditions will dictate the number of fish per site and the feed loadings, and hence this will drive the timing and requirements for the level of infrastructure including barges.

**EMPLOYMENT OPPORTUNITIES**

118. By operating in remote areas of rural New Zealand, King Salmon helps to maintain viable communities and so counter some of the effects of a general population drift to the urban centres. NZ King Salmon employment is open to applicants that live anywhere and some of the current marine operations team members live in remote parts of the Sounds.

119. The operational developments will provide significant employment opportunities, particularly for the Marlborough region as shown in Table 2.

**Table 2: Current NZ King Salmon employees and approximate numbers of additional employees required to support the proposed increase in production.**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Current Employees</th>
<th>Additional Employees Required (approximately)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hatchery</td>
<td>26 permanent (full time) 5 fixed term seasonal (full time)</td>
<td>9 (3 per site when production &gt; 15,000 tonne)</td>
</tr>
<tr>
<td>Farms</td>
<td>55 (each farm employs ~9 permanent staff - a manager who commutes daily and two shift crews of 4 staff who live on farms when working) 3 casual – Crail Bay</td>
<td>50-70 Marlborough</td>
</tr>
<tr>
<td>Processing</td>
<td>247 (comprised of two shifts)</td>
<td>20 – 40 (dependant on the level of automation) Marlborough</td>
</tr>
<tr>
<td>Head Office (Nelson) (Export Marketing, Finance, IT, HR &amp; Support)</td>
<td>60</td>
<td>12</td>
</tr>
<tr>
<td>Aquaculture Office (Picton) including net making &amp; repairs</td>
<td>41 (Picton) 2 (Nelson)</td>
<td>8 Marlborough</td>
</tr>
<tr>
<td>National Marketing Office (Auckland)</td>
<td>17</td>
<td>3</td>
</tr>
<tr>
<td>Depot and Processing Facility (Sydney)</td>
<td>5 (Sydney) 1 (Brisbane) 1 (Melbourne)</td>
<td>1</td>
</tr>
<tr>
<td>San Francisco</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Tokyo</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>
REGIONAL SPILL-OVER BENEFITS

120. The June 2011 ASB Regional Economic Scoreboard by CBA NZ Economist Chris Tennant-Brown rated the economic performance of Marlborough as one of the lowest in the country\textsuperscript{17}. Ratings are updated every three months and are based on measures such as employment, construction, retail trade and house prices.

121. As part of its operations, NZ King Salmon is linked to other supply sectors; therefore any growth has ‘ripple’ effects whereby increased expenditure can deliver additional benefits elsewhere in the regional economy.

122. During the development phase of the farms, 70% of the value of developing each farm will be spent locally as the major new infrastructure (steel sea pens, barges) will be built in the Nelson Marlborough region.

123. There are also a number of local servicing companies who stand to benefit significantly from the expansion of NZ King Salmon’s operations; these include:

   a. Barge services;
   b. Wharf and port facility providers
   c. Marine and engineering services;
   d. Trucking companies;
   e. Vessel servicing and support services;
   f. Specialist divers;
   g. Hardware suppliers;
   h. Science providers;
   i. Tourism and travel operators;
   j. Professional service providers (e.g. information technology, employment/human resources, etc).

124. As the most significant growing area in New Zealand for King Salmon, the Marlborough region will receive significant profile worldwide as NZ King Salmon evolves the ‘provenance’ proposition. While it is hard to assign a dollar value to this in terms of benefit to the region, there is no denying the benefits received from the Marlborough regions profile as a producer of ‘sauvignon blanc’.

SITE SELECTION PROCESS

125. NZ King Salmon have undertaken a thorough and detailed process to determine the best locations for the proposed new farm sites; this process is detailed below.

---

\textsuperscript{17} June Report: “A hangover from the wine boom is still affecting Marlborough. The region continues to struggle with a very weak construction outlook and declining retail spending. New car registrations are also down on a year ago. House prices continue to record larger declines than in most other regions, but housing turnover has been picking up for two consecutive quarters which is encouraging”.
INITIAL INVESTIGATIONS

126. Following identification of the need to increase production, NZ King Salmon staff assessed a number of potential options which could potentially facilitate an increase in production capacity. These included obtaining new water space in New Zealand; investigating international opportunities; and acquiring sites from other salmon producers in New Zealand, which resulted in the purchase of the Crail Bay sites.

127. NZ King Salmon decided to maintain operations in New Zealand, and as a result undertook an assessment of potential salmon farming sites around the country. The key factors required for optimum growth of King Salmon are good water flows, water depth of greater than 30m and water temperature which ranges from 12-18°C. Ideal growth occurs within this temperature range; on either side of this range a marked deterioration in performance is observed.

128. The following additional factors must also be considered:
   a. Zoning of water space (as designated by the local council’s Coastal Plan);
   b. Recreational, commercial and cultural fishing users (assessed by MFish Undue Adverse Effects test);
   c. Marine and land-based reserve and historical site locations;
   d. Adjacent land-use;
   e. Ease of access to site, and to land-based infrastructure;
   f. Proximity of sensitive habitats or areas of particular importance to marine life;
   g. Landscape values, natural character and visual effects;
   h. Location of other marine farms in the vicinity;
   i. Other users of the marine environment (e.g. local user groups, environmental groups, tourism, education, recreation, holiday home owners);

129. NZ King Salmon’s initial investigation failed to identify any areas considered suitable for the expansion of the company’s operations outside of the Marlborough region. The areas considered and ruled out are as follows:
   a. North Island: water temperatures are too high, and this region is outside the natural range of King Salmon in New Zealand.
   b. Tasman and Golden Bays: Water temperatures are too high, with average sea surface temperature ranging from 17-25°C in both these bays. In addition, economically viable finfish farming structures that can withstand open ocean conditions such as those observed in these bays do not currently exist.
   c. South Island West Coast: coastline too exposed to sustain safe, economically viable finfish farming using current technology.
   d. Fiordland: ideal location for salmon farming, however access to infrastructure is limited and the region is a recognised as a significant wilderness area which is within a national park and World Heritage Site; as such it has internationally significant environmental, tourism and recreational values.
e. Big Glory Bay, Stewart Island: the site of one of New Zealand’s first salmon farms, Sanford is now the only company to grow salmon in this location and as at 2011, salmon production is nearing the maximum allowable nitrogen input levels in the water column. A large part of the remainder of Stewart Island is national park and therefore unsuitable for salmon farming.

f. South Island East Coast (including Catlins): coastline too exposed to sustain safe, economically viable finfish farming using current technology.

g. Otago Harbour: too constrained by depth and boat traffic to sustain safe, economically viable finfish farming.

h. Akaroa Harbour: water temperatures are suitable; however this harbour is already the site of a boutique salmon farming operation, in the only area (the outer third of the harbour) that has flows and depths suitable for salmon farming. The exposed waters near the entrance also preclude further development.

i. Port Underwood: a relatively protected and shallow embayment, with low flows and, at times, high sediment levels. Attempts at farming salmon in this bay were made in the 1980’s, however they were unsuccessful.

j. Admiralty Bay: Water temperatures are too high, with average sea surface temperature ranging from 17-25°C. This, in conjunction with low water current flows, mean this bay is considered unsuitable for farming salmon.

130. As a result of these investigations, and given NZ King Salmon’s first-hand experience with salmon farming in the Marlborough Sounds, the company came to the conclusion that the Marlborough Sounds is the only place in New Zealand that will sustain significant increases in King Salmon production, such as those being proposed in this application.

MARLBOROUGH SOUNDS INVESTIGATIONS

131. The next step in the site selection process was to initiate a detailed assessment of potential sites for expansion of NZ King Salmon’s activities in the Marlborough Sounds. This process took into account NZ King Salmon’s desire to spread the sites geographically for biosecurity and disease management purposes, as well as to have at least one new site in the highly productive Tory Channel waters.

132. Initially the institutional knowledge of NZ King Salmon staff with years of experience in growing salmon in the Marlborough Sounds was utilised to identify a number of sites suitable for growing salmon. In addition to sites within the Sounds, areas such as Cloudy Bay, outside Pelorus Sound and adjacent to D’Urville Island were also included in this initial desktop process.

133. This process included an intensive investigation of CMZ2 (based on MDC advice to focus on this area), including existing mussel farm and bare water sites that could be suitable for conversion to salmon farming (including all the Sealord farms). Only one farm was identified as suitable for salmon farming and the owner was approached, however they were not willing to sell their site to NZ King Salmon.

134. Following Department of Conservation input, the NZ King Salmon management team then agreed to remove any sites outside of the Marlborough Sounds. Some of the rejected sites (e.g. Cloudy Bay) were considered too exposed for commercially viable salmon farming and, given the experience of past applicants (e.g. Kukumara); it was
considered that mid-bay sites would likely be challenged during the application process and not permitted.

135. The remaining sites were assessed against a list of criteria, including water depth, likely water temperature profile, distance from servicing port, likely water flows, adjacent residential or wharf developments and site exposure. This further desktop process left 20 sites remaining on NZ King Salmon’s list.

136. A working group consisting of NZ King Salmon, Boffa Miskell (landscape and planning) and Cawthron (environmental) staff then visited each of the 20 sites and conducted a preliminary site assessment (refer Appendix 4). During these site visits, each site was assessed against six criteria (site characteristics; operative MSRMP Zoning; natural character; ecology; outstanding natural features and landscapes; and amenity, recreation and navigation) and given an overall ranking (1-5) as to its suitability for development.

137. In conjunction with the working group assessments, the proposed sites were also discussed (in confidence) with the Department of Conservation, Ministry of Fisheries and Marlborough District Council and their feedback was incorporated into the decision making process.

138. Further benthic and water column assessments were undertaken by Cawthron at the sites assessed to be the most suitable. The results from these investigations limited the number of sites that sufficiently met the assessment criteria to five (Kaitira, Tapipi, Richmond, Kaitapeha and Ngamahau). Waitata was not included in the site assessment process, as this site was already deemed suitable as a result of earlier environmental and landscape assessments undertaken at this location. Two further sites, Ruaomoko and Papatua, were included at a later date, following assessment against the same criteria as the other sites.

139. Following the decision to lodge an application with the Environmental Protection Authority, further detailed ecological assessments of the chosen sites have resulted in slight alterations to the original locations to ensure benthic environmental effects are minimised.

CONSULTATION ON EXPANSION PLANS

SCOPE OF CONSULTATION

140. In July 2010, NZ King Salmon initiated consultation within the wider Marlborough Community by outlining their proposal to extend their farming operations in the Marlborough Sounds. Feedback about the perception of the company, and salmon farming in general, was sought from the Marlborough community.

141. The initial consultation process included engagement with the Marlborough public via press releases to the local newspapers (i.e. Marlborough Express, Blenheim Sun, Seaport News) and publication of the mail out insert feature “A Marlborough Success Story” (January 2011). The summary document “Proposition for Expanding Farming and Processing Operations in Marlborough” was also widely distributed in the Marlborough region.

142. Promotional visits to the NZ King Salmon Clay Point farm in Tory Channel were also organised. Each farm visit comprised an opportunity for participants to ask NZ King
Salmon staff questions about all aspects of salmon farming, with follow up information provided if required. Representatives from the following organisations were invited to attend the farm visits:

   a. Sounds Advisory Group (representatives from across the Marlborough Sounds community who advise the Marlborough District Council (MDC) on issues affecting Sounds residents);
   b. Marlborough recreational anglers;
   c. Members of the public who had raised concerns about expansion plans;
   d. Newly elected MDC Councillors, Mayor and senior staff;
   e. Work and Income;
   f. Marlborough Chamber of Commerce;
   g. Local media;
   h. Marlborough Shellfish Quality Programme (MSQP);
   i. Port Marlborough Executive and Directors;
   j. Destination Marlborough;
   k. Picton Business Group;
   l. Marlborough Service Club;
   m. Boating Club;
   n. Ministry of Fisheries;
   o. Department of Conservation.

143. NZ King Salmon also made presentations to Te Tau Iwi Fisheries Forum; Waikawa Probus Club; Marlborough Chamber of Commerce- Inspiring Speaker series; Marlborough Recreational Fishers Association; Picton Business Group; Picton Tourism Operators.

144. In addition, NZ King Salmon held meetings with the following people:

   a. Peter Beech (Guardians of the Sounds) and Stefan Browning (Green Party Spokesperson);
   b. Brian Dawson (Marlborough Chamber of Commerce);
   c. Alistair Sowman (Mayor), Hanz Versteegh (Regulatory Manager MDC) and Andrew Beasley (CEO MDC);
   d. Grant Palmer (Work and Income);
   e. Ian Shapcott (Senior Projects Coordinator MDC);
   f. Francis Pauwels (Manager Strategic Policy MDC);
   g. Roy Grosse and Robin Cox (Department of Conservation - Marlborough);
   h. Marlborough Sounds Advisory Group;
   i. Ian McNabb (CEO Port Marlborough);
   j. Richard Bradley (CEO Te Runanga a Rangitane O Wairau);
k. Alex van Wijngaarden and Chris Spurling (Harbourmasters MDC);

145. A consultation report has been completed for each of these meetings. The following section provides a summary of the key themes arising during the consultation, and the NZ King Salmon responses to these concerns.

THEMES ARISING THROUGH CONSULTATION

THE VALUE LOST TO MARLBOROUGH THROUGH PROCESSING SALMON IN NELSON

146. A number of consultees raised the issue that it was their perception that the economic benefit of the farming of salmon is generated in NZ King Salmon’s processing facilities in Nelson rather than in Marlborough.

147. This perception overlooks the considerable wage, contracting, capital works and community support that the district enjoys from NZ King Salmon activities.

148. The expansion of NZ King Salmon’s production will require a corresponding expansion in processing; to address this, NZ King Salmon intends to open a primary processing plant in Picton within five years, subject to an increase in the tonnages of harvested fish. Not only will this generate jobs in Picton, but it will also reduce NZ King Salmon’s transport costs associated with trucking harvested fish from the Marlborough Sounds to Nelson.

MONITORING OF BENTHIC EFFECTS

149. Some consultees identified the fact that while there were regulatory requirements for the monitoring of benthic effects on a yearly basis, there is no community certainty as to how this is dealt with by NZ King Salmon.

150. NZ King Salmon is required to undertake annual monitoring and reporting of all operating salmon farms as part of their existing resource consent conditions. Cawthron prepares an annual monitoring programme for each of NZ King Salmon’s farms which details the monitoring to be undertaken in that year. Following the completion of the annual monitoring, Cawthron provides NZ King Salmon and MDC with externally peer-reviewed annual monitoring reports, which become public information. In the event that any farms are non-compliant with the consent conditions, a farm management response is immediately activated to ensure that any areas of non-compliance are addressed.

151. In addition NZ King Salmon has recently developed an environmental policy (see Appendix 1), in which responsibility for the environmental performance of NZ King Salmon is shared throughout the company. The responsibility to ensure that NZ King Salmon is meeting their obligations under this policy lies with the Executive Environmental Management Committee (EEMC), a group appointed by the NZ King Salmon Board of Directors which, in addition to NZ King Salmon staff, includes an independent representative from Marlborough. The function of this committee is to ensure that all monitoring is carried out and an appropriate response is provided and acted upon. The CEO chairs the Committee and reports monthly to the Board of Directors.
THE PROFILE OF NZ KING SALMON IN THE MARLBOROUGH COMMUNITY

152. Some consultees believed that NZ King Salmon did not have a high profile in Marlborough and in particular did little to support initiatives in Picton and wider Marlborough Community.

153. While NZ King Salmon’s focus is on producing salmon, the company does not accept these comments as it has long-standing relationships with a number of community groups, and in response to these comments has further expanded community engagement (paragraphs 55-57).

ADDITIONAL POINTS

154. Other points raised during the community consultation included the following:
   a. How many salmon farms are enough?
   b. Visual impact of farms;
   c. Navigational issues for large vessels;
   d. The benthic effect of the farms;
   e. The effect of salmon farms on recreational fishing;
   f. The effects of antifouling on other species and adjacent marine farms.

155. These issues have all been addressed in the application documents, and the answers will be made public when the application is notified.

IWI CONSULTATION

156. An initial presentation was made by NZ King Salmon to the Te Tau Ihu of Te Waka a Maui Fisheries Forum, which comprises representatives of the eight Iwi organisations across the top of the South Island, at the invitation of the Chairman of the body. The outline ‘Proposition for Expanding Farming and Processing Operations in Marlborough’ was used as a basis for the presentation and a plan was developed on how best to undertake Iwi consultation.

157. Following this presentation, in late April, a letter was sent to each of the eight Iwi organisations from the top of the South. This letter included the following:
   a. A statement that “NZ King Salmon is committed to consulting with you on the site selection process and any cultural concerns you may have with regards to particular areas of interest in an open, honest and transparent manner”.
   b. Notification of the general location (outer Pelorus Sound, western Port Gore and near Tory Channel) of the sites currently under consideration.
   c. A request for Iwi to “…identify any parts of these areas that are of particular cultural significance to...” each specific tribe.
   d. The offer to meet with each Iwi leader to “discuss any concerns or considerations you would like NZ King Salmon to take into account in relation to those particular areas, as well as the progress of NZ King Salmon’s site selection process, and any other questions you may have”.

158. NZ King Salmon received responses to this letter from Ngati Apa and Ngati Koata, and contacted leaders from both these Iwi to explain in a general sense the site locations in relation to their rohe.
159. Following the initial approach, NZ King Salmon contacted the leaders, or their delegated authority, of all eight Iwi from the top of the South Island, in order to ascertain the most appropriate way to include all eight Iwi in the consultation process. Each representative was spoken to personally, or by telephone, during the period Monday 24<sup>th</sup> May and Tuesday 31 May 2011.

160. Iwi leaders spoken/contacted to were as follows:
   a. Matiu Rei, Ngati Toa;
   b. Fred Te Miha, Ngati Tama;
   c. John Morgan, Ngati Rarua;
   d. Glenice Paine, Te Ati Awa;
   e. Richard Bradley, Rangitane;
   f. Paia Riwaka-Herbert, Ngati Apa;
   g. George Elkington, Ngati Koata;
   h. Joe Mason, Ngati Kuia.

161. During these initial discussions the aim was to find common ground on NZ King Salmon meeting all Iwi at the same location on the same date, so potential farm sites and the Maori Commercial Aquaculture Settlement Act were not discussed. It was accepted however that the Aquaculture Law Reforms and the Bill before Parliament would eventually allow Iwi to make settlements on a regional basis. Advice was also sought from Te Ohu Kai Moana (TOKM, Craig Lawson).

162. As at 31 July, NZ King Salmon is still awaiting final confirmation from Ngati Koata; however parties spoken to agreed that a joint meeting of the tribes would be the most appropriate method of consultation; and that a meeting of the Te Tau Ihu of Te Waka a Maui Fisheries Forum would be an appropriate venue.

163. Other comments included:
   a. The meeting should be about consultation and listening (as opposed to preaching);
   b. The presentation at the last Forum meeting was not well received;
   c. The context of the meeting should be open and transparent;
   d. TOKM's presence would be useful but not essential;
   e. Iwi had discussed future outcomes and understood NZ King Salmon’s position re individual site joint ventures;
   f. Most appeared to accept the lease/rental concept for Iwi space;
   g. Suggestions that Ngai Tahu should also attend.

164. In addition, NZ King Salmon has engaged an expert historian, Dave Armstrong, to identify the Iwi who have Mana Whenua and Mana Moana over the proposed sites. This information will be used to inform further Iwi consultation.
FARMING THE SALMON - OPERATIONAL DETAIL

165. The following description of existing NZ King Salmon farming operations is also relevant for the sites proposed in this application.

SMOLT PRODUCTION

166. NZ King Salmon’s world class selective breeding programme, which breeds for grow-out performance and marketing qualities in the fish, is similar to those run for land-based farm animals. King Salmon spawn in freshwater so the breeding programme is located at the Tentburn hatchery in south Canterbury. However the Tentburn, Takaka and Waiau hatcheries are run together as one operation. At any one time there are three year classes of brood stock at the hatcheries, and these are currently located at both Tentburn and Takaka in a roughly 50:50 ratio.

167. Detailed information on King Salmon and the history of King Salmon in New Zealand is provided in Appendix 5 and with further information to be found at the following link: http://www.fao.org/fishery/species/2933/en).

168. During the April-May spawning period, brood stock salmon, weighing between 7-15 kg are stripped of eggs at three years of age; producing ~6,500 eggs each; resulting in the production of ~10million eggs in total. About 70% of the eggs survive, and about 50% of the resulting fry and fingerlings that are not performing to required levels are culled.

169. Using the latest technology, each broodstock fish carries a PIT identification tag (microchip) which is recovered from the female fish post-spawning and used to identify her eggs. Following collection of the eggs, the milt from a predetermined male is collected, chilled and the PIT number of that male is recorded to enable appropriate ‘matches’ to be made as part of the breeding programme.

170. The PIT tags enable NZ King Salmon to keep track of the individual fish and the ninety family lines currently used as part of the breeding programme. In addition, maintaining the families from each cohort at both locations is a risk management tool to ensure that the company is protected in the event of significant fish loss at one site. There are also 7000 fish from the family lines that are reared in a sea pen, enabling NZ King Salmon to assess family and individual performance in the seawater environment. The siblings (growing in freshwater) of the best performing fish in seawater, are then identified and used for further selective breeding of the broodstock lines.

171. NZ King Salmon utilises various controls (e.g. feeding, lights, chilling the fertilised eggs, grading out small fish and selective breeding) to enable staff at the hatchery to regulate the growth and maturation rate of the juvenile salmon. This enables the company to stagger entry of the fish to the sea pens and therefore assists NZ King Salmon to produce fish that are consistent and predictable in size, and able to be harvested year round.

SMOLT TRANSFER

172. Smolt transfer to the sea pens occurs on two occasions during the year; in spring (October to December) and again in autumn (April to June). Pursuant to the Freshwater Fish Farming Regulations, a Fish Transfer Authorisation is obtained prior to transfer of the smolt.

173. Pumps at the hatchery are used to pass the smolt through an electronic counter to custom-made insulated tanks on truck and trailer units, which are fitted with an aeration
system and supplied with oxygen. Oxygen levels are monitored and computer controlled in the tanks. The units are fitted with a top opening for loading, and chutes at the bottom for release.

174. Following arrival at either Picton or Havelock, the truck and trailer units are loaded onto a barge and taken to the sea pens, a journey which can take up to four hours (Figure 16). During this journey seawater from a deck hose is flushed through the tanks to help the smolt acclimatise to the seawater growing environment. Once the truck and trailer units arrive at the farm, the smolt are discharged directly into the seawater.

175. To ensure year round market supply, NZ King Salmon operate three strategies of selectively bred fish which, along with the environmental characteristics of each farm site, determine where the final destination of the smolt will be. The growth strategies are as follows:

a. Rapid growth, high maturation; must be harvested in a certain time-frame to avoid maturation.

b. Rapid growth, low maturation; harvest time is critical in order to fill a difficult harvest window.

c. Low growth, low maturation; used to fill in the remainder of the harvest year.

Figure 16: Truck and trailer unit containing live salmon being transported by barge to a seafarm.

SEA FARM OVERVIEW

176. This description applies to NZ King Salmon’s existing and proposed farms, including the recently purchased Crail Bay farms. NZ King Salmon intends to operate the Crail Bay farms as they are for several months; eventually they will be managed according to NZ King Salmon policies, processes and procedures.
177. NZ King Salmon utilises seven of the eight currently consented farms in Marlborough (detailed in paragraphs 31-38), to on-grow the fish from smolt (~50-150g) to a harvestable size of approximately 3.5kg to 4kg (Figure 17). The Waihinau and Forsyth farms are being farmed in rotation, so the eighth farm site is currently fallow. The farm structures are due to be returned to Waihinau from Forsyth in November 2011.

178. While each sea farm has its own environmental characteristics (discussed in paragraphs 31-38), the seven operational farms are currently managed as one integrated system, rather than as independent production units. This management approach is discussed further in paragraphs 321-324.

179. NZ King Salmon farms are categorised as one of two types:
   a. Higher flow sites with cooler water temperatures located in Tory Channel (Clay Point and Te Pangu); and
   b. Lower flow sites with warmer water temperatures in the remainder of the Sounds.

Salmon are distributed between these sites according to the site characteristics in terms of water flows, temperature profiles, smolt growth strategy and forecast harvest requirements. Generally the cool water sites in Tory Channel receive smolt in spring, while the warmer sites receive smolt during the autumn transfer.

180. Fish are transferred between sites by counting them across from the grower nets at the farm they are being transferred from, into another sea pen that is moored alongside the farm. That sea pen unit is then very carefully towed by tug using tidal flows to propel them to the new site (Figure 18).
181. Each component of NZ King Salmon’s farm management strategies, processes and techniques has been tried and tested over the years. NZ King Salmon has comprehensive operating and training manuals which are regularly updated, and farm staff are expected to have a thorough understanding of these manuals.

182. Since the early development of the industry in New Zealand, salmon farming technology and processes have evolved and NZ King Salmon has a wealth of institutional knowledge gained over many years of first-hand experience in the marine environment. However, many challenges have arisen along the way, and the resulting lessons learned are discussed in the following sections. Acknowledgement of these challenges and taking actions to implement a satisfactory response is one of the reasons why NZ King Salmon is the successful company it is today. Some of the specific challenges and the company’s operational responses are discussed in the following sections.

**THE ON-SITE BARGE**

183. NZ King Salmon historically has serviced its farms from a combination of land-based and water-based accommodation. However the company now services each farm from an on-site barge which provides accommodation for shift staff, offices, feed storage and workshop facilities (Figure 19).

184. The on-site barge is attached to the sea pen structures via round metal pipes (‘stiff arms’), with wire strops used to prevent excess movement. Each barge is required to have navigational lighting installed to the standard required by the Maritime Transport Act 1994. This lighting is operational between the hours of sunset and sunrise.

185. The interior of the on-site barge has the same lighting as any residential accommodation. In addition, the entrance to the barge (from the farm side) has floodlights fitted which, while not routinely used, do allow NZ King Salmon staff to work outside if necessary.
186. Barges are used instead of boats as they provide a good stable working platform, allow more effective use of the deck area, are more cost effective and can be custom made in accordance with NZ King Salmon specifications.

187. A 'standard' barge comprises a floating two storey building of approximately 20 x 13m attached to the farm structures. The lower floor consists of the large feed storage area, feeding equipment, a workshop, freshwater holding tank, shower, diesel storage and generator room. The upper level houses the offices, including a feeding station where the feeding process is closely monitored; a staff kitchen area, shift worker bedrooms, shower and toilet.

188. In addition to being able to address issues should they arise, the presence of the shift workers on the farm 24-hours a day, seven days a week provides an added security function, protecting both the site and the fish. There is always a trained first aider present, and an oxygen kit is held on each farm. The farm staff usually communicate with the outside world via cellphone, but each farm also has an alternate source of communication.

189. Freshwater is delivered to the farm holding tanks via a tank on a delivery barge.

190. Providing discharge does not exceed 500 m$^3$ per day, the discharge of grey water, (from showers and other personal hygiene uses, food preparation and clothes washing) is a permitted activity in the Marlborough Sounds, under the Marlborough Sounds Resource Management Plan (Rule 35.1.2.8). As at 2011, the discharge of grey water from NZ King Salmon farms remains well below 500 m$^3$ per day.

191. Black water or sewage is contained in tanks on the barge, and regularly collected by Marlborough Waste Collection on the servicing barge.
**SEA PENS**

192. Currently the majority of NZ King Salmon’s fish are grown using steel sea pens of a range of different sizes (from 42 x 42m with 20x20m nets) to single structures of approximately 125m x 65m with 30x30m nets). Sea pens comprise a floating structure, which consists of a perimeter of spirally welded steel pipe (up to 1m diameter), with an internal surface area that is divided into sections (sea pens) using the same steel pipe. The grower nets are attached to each sea pen to enclose an area of sea; these nets prevent the fish from escaping.

193. The grower nets are made of nylon, and the mesh size varies from 12.5 to 35mm on the bar (knot to knot). NZ King Salmon has utilised various mesh size options in the past and experience has shown the best mesh size to use. In order to contain the smolt when they are first introduced to the sea pen, a smaller mesh size is required, however smaller mesh constrains water flow and enhances biofouling. To reduce the effects of biofouling and maintain water circulation, which replenishes dissolved oxygen levels and assists with waste removal from the sea pen, it is important to move the fish to grower nets with a larger mesh size as soon as possible.

194. Typically the steel sea pens will have a walkway attached to the top of the sea pen structure, with associated handrails attached to the walkway (Figure 20). At some of the existing farms there is also a suspended walkway across the centre of the sea pen.

![Figure 20: Salmon sea pens with walkway between and predator net next to walkway and on-site barge in background.](image)

195. Circular plastic sea pens are used at the Crail Bay farms; for these sea pens welded HDPE pipe provides the flotation (Figure 21). It is proposed that these sea pens will also be used at the Papatua site. These sea pens do not have interconnecting walkways and are serviced by boat.
While typically the sea pens and barge on a salmon farm will only occupy 1-1.5 ha of
surface area, the farm moorings do not lie directly beneath the sea pens. Ensuring the
structural integrity of the farm, means that the moorings (with mooring lines attached)
need to be located a sufficient distance from the structures so as to provide adequate
tension to hold the farm securely in place. This is the reason why salmon farm
consents are typically for an area approximately 10-times greater than the area covered
by the surface structures alone.

There are a number of different types of sea pen anchoring systems available to salmon
farmers, and it is critical that the appropriate systems are used for the location in which
they are deployed.

NZ King Salmon was faced with the consequence of inappropriate moorings for the
location on 1 March 2006, when the Te Pangu farm broke its moorings and drifted into
Tory channel. A comprehensive investigation of the causes of this catastrophic failure
was undertaken by the company. The investigation found that the mooring failure was
predominantly due to uneven loading (tensioning) on the moorings occurring over time,
which eventually caused a cascade type failure event.

Following the Te Pangu event, NZ King Salmon undertook a complete review of the
mooring systems used by the company. Engineering advice stated that screw anchors
are the preferred means of mooring the sea pens to the seabed. These anchors consist
of large auger shaped steel plates that are hydraulically driven into the seabed. The
screw anchors are connected to the farm by way of a rope, which is spliced to the
anchor just above the seabed, this rope then joins to 13m of chain which is attached to
the sea pen. The advantage of screw anchors is that, once set, they do not move, so

Figure 21: Circular sea pens similar to those that are currently used at the Crail Bay farms.

MOORING SYSTEMS

196. While typically the sea pens and barge on a salmon farm will only occupy 1-1.5 ha of
surface area, the farm moorings do not lie directly beneath the sea pens. Ensuring the
structural integrity of the farm, means that the moorings (with mooring lines attached)
need to be located a sufficient distance from the structures so as to provide adequate
tension to hold the farm securely in place. This is the reason why salmon farm
consents are typically for an area approximately 10-times greater than the area covered
by the surface structures alone.

197. There are a number of different types of sea pen anchoring systems available to salmon
farmers, and it is critical that the appropriate systems are used for the location in which
they are deployed.

198. NZ King Salmon was faced with the consequence of inappropriate moorings for the
location on 1 March 2006, when the Te Pangu farm broke its moorings and drifted into
Tory channel. A comprehensive investigation of the causes of this catastrophic failure
was undertaken by the company. The investigation found that the mooring failure was
predominantly due to uneven loading (tensioning) on the moorings occurring over time,
which eventually caused a cascade type failure event.

199. Following the Te Pangu event, NZ King Salmon undertook a complete review of the
mooring systems used by the company. Engineering advice stated that screw anchors
are the preferred means of mooring the sea pens to the seabed. These anchors consist
of large auger shaped steel plates that are hydraulically driven into the seabed. The
screw anchors are connected to the farm by way of a rope, which is spliced to the
anchor just above the seabed, this rope then joins to 13m of chain which is attached to
the sea pen. The advantage of screw anchors is that, once set, they do not move, so
mooring tension should remain more even and can be more accurately managed. In contrast concrete blocks can and do shift over time, altering the tension on each mooring line.

200. OCEL Consultants Ltd were contracted to develop a new mooring design for Te Pangu. This design removed concrete blocks and relied solely on screw anchors as moorings. The Te Pangu farm was not relocated until NZ King Salmon was certain that the proposed new mooring system was safe.

201. Each farm mooring line and mooring layout is designed by a qualified engineer. An agreed mooring maintenance programme forms part of the consent conditions and operating policy of each farm. Tension measuring devices, known as load cells, are fitted to the chain and used to monitor and manage the mooring systems to ensure safe working loads are maintained at all times.

**PREDATOR NETS**

202. Seals, in particular the New Zealand fur seal, should not be under-rated in terms of their intelligence. They are able to assess opportunities and take advantage of any compromise in predator defence systems on salmon farms. Seals are protected under the Marine Mammal Protection Act 1978, administered by the Department of Conservation (DoC), and have caused problems for NZ King Salmon farms since around 1992.

203. NZ King Salmon has worked with DoC for a number of years in order to come up with the best solution to dealing with the seals. Trials have included attempts to transport the tagged seals to another colony in Kaikoura, or the South Island West Coast, however these same animals were usually back to the Marlborough Sounds (and place of capture) within a few days of being released.

204. In the early days, any seal which got too close to a salmon farm was dissuaded from investigating by throwing a detonator (in essence a small firework) into the water nearby. Following an injury to a farm worker, the use of detonators was ceased, and absence of a deterrent meant that seals soon recognised the farms as an easy source of food. They rapidly learnt how to push the net and grab the salmon or to climb into the feed barge and move along the gangway and jump to a pen.

205. NZ King Salmon has been granted a permit from DoC which allows seals entering the sea pens to be caught and released. The permit also allows farm staff to deter seals from entering the sea pens. The killing of any seal is not permitted.

206. NZ King Salmon also has a specific Seal Policy in conjunction with DoC, which, in addition to providing guidelines for the handling of seals that do enter the farm, aims to minimise the risk of seal entry to farms. On occasion NZ King Salmon staff have been involved with training of DoC staff in seal handling.

207. The seal policy includes recording and reporting seal activity around the farm to company management and DoC (Picton office). An increase in seal activity around the farm can be a result of seals penetrating the predator net. Therefore, increases in seal activity result in inspection dives by farm staff to verify a breach and if need be repair the exclusion net.

208. A range of predator netting configurations have been trialled by NZ King Salmon over the years, including predator nets around each grower pen. The preferred predator net system currently utilised by NZ King Salmon, is a combination nylon/polyethylene net
that surrounds the whole farm structure. This net extends for over 2m above the water and acts as a deterrent to both seals and sharks (see Figure 20). Mesh size ranges from 100-120mm on the bar. The net is tensioned off the farm anchors to prevent the seals pressing against it to close the gap to the grower net. This type of exclusion net was first installed on company farms in 2000.

209. While seals are still a common sight around the edge of the predator nets, and very occasionally they manage to obtain a reward for their attention, predator nets are by far the most effective method of excluding seals and other predators. They have the added advantage of distancing the fish from the predators, thereby reducing stress in the fish.

210. Unlike the grower nets, the underwater predator netting is treated with copper-based antifouling paint that, together with cleaning, ensures fouling does not restrict the flow of water through the nets nor allow mussel biomass to exceed the flotation capacity of the sea pen structures.

211. NZ King Salmon currently hold a coastal permit that provides for the use of two antifouling paints:
   a. Hempel “Hempanet”; and
   b. International Paints “Interclene 175 Red”, produced by Azko Nobel Pty Ltd.

The coastal permit requires that annual monitoring be undertaken to determine the effects of any discharge of the anti-fouling paint on water quality, the seabed and benthic community composition, particularly in relation to copper from the antifouling paint.

212. NZ King Salmon has ongoing trials underway to determine whether the use of antifouling paint can be reduced, and/or stopped completely at the company’s farms. The results from these trials at Otanerau and Ruakaka have been as follows:
   a. Otanerau: Since March 2010, only predator nets that have not been recently treated with antifouling paint have been deployed at the farm. These nets are removed each December/January and replaced each February/March. This process has been working well, thereby reducing the antifouling paint used on this site to zero.
   b. Ruakaka: The smolt predator nets installed in September 2010 were not treated with antifouling paint. These nets have been assessed every three months, and as at March 2011, some biofouling was observed, but the levels were not concerning to NZ King Salmon. The next inspection is due at the nine month interval (July 2011) and the nets will be inspected again in late October 2011. Assuming the level of fouling on these nets is still not at concerning levels at the 12 month interval; this will mean that the amount of antifouling paint used at this site has been reduced by at least one third. In the event that positive results are continued to be observed at this site, as with Otanerau, the entire site will also have predator nets installed that are not treated with antifouling paint.

Bird Nets

213. Salmon farms tend to be attractive structures for birds; fish feed is appealing to gulls and a range of shags species use the sea pens for drying, roosting and as a base from which to catch fish in the surrounding waters.
214. Bird access to feed and/or smolt has been an issue in the past. Acoustic orchard bird scarers were trialled over a decade ago on the farms, however they were found to attract, rather than deter, seabirds. A gas cannon similar to those used on orchards was also trialled, but was determined to be ineffective as the birds became used to it.

215. Currently, predator nets keep species such as shags from spearing the fish through the grower net and overhead bird nets exclude birds from the sea pen structure (Figure 22). The black polyethylene bird nets are still under development, as while generally effective, birds are still observed over the farm.

216. NZ King Salmon has undertaken mesh size trials to determine the best option for the bird nets and as a result of these trials; the 47.5 mm has been determined to be the most effective mesh size.

217. In addition to the use of bird netting, NZ King Salmon has a seabird policy in place which forms part of the Seacage Operations manual. As part of this policy, in order to minimise the attraction of seabirds to the farm sites, all salmon feed held on the farms must be covered. Floating dead fish are collected as soon as they are noticed, and the mortality bins are covered at all times.

218. The NZ King Salmon seabird policy also allows appropriately licensed and registered NZ King Salmon staff to shoot Black-backed Gulls, which are known as a problem species in the marine environment and are not protected by under the Wildlife Act 1953. If any Black-backed Gulls are shot they will be collected and disposed of appropriately.

Figure 22: View to barge from sea pen structures showing bird nets across the top of the sea pens.
NET CLEANING

219. In order to achieve maximum growth rates, farmed salmon require clean water which contains high levels of dissolved oxygen, and low levels of waste. Any restrictions to the water flow through the netting results in less water flowing through the net, this in turn has a negative impact on dissolved oxygen and waste levels in the sea pens.

220. Unfortunately, salmon nets suspended in the marine environment provide an ideal growing structure for small marine organisms (e.g. algae, barnacles, tubeworms, mussels etc) which are collectively referred to as biofouling. This biofouling not only reduces water flow, but also makes the nets heavy, which means they are difficult to handle, add additional strain to the mooring structures and cause wear and tear on the equipment, sea pen structures and the net mesh. In order to prevent this, regular net cleaning is a critical part of NZ King Salmon’s operations.

221. The grower nets (used for holding salmon in the sea pens) are not treated with antifouling products, so need to be cleaned approximately once a month, especially during the summer months. The older 20m x 20m grower nets are cleaned when there are no fish in the pen; this is generally done by having one empty pen for every seven pens in use, which means that the fish can be rotated around the eight sea pens to allow cleaning to occur. At the older farms the nets are spread and lifted above the water so that they can be walked over and water-blasted clean. Nets are then left to dry to ensure that all biofouling organisms have died. A shower of rain (i.e. freshwater) further assists with killing off biofouling.

222. NZ King Salmon has developed an automated net cleaner which cleans the larger and newer grower nets in the water (in-situ). This cleaner uses high pressure water directed through rotating discs. The ‘head’ which contains the discs slides up and down the sides of the net and blasts off the fouling organisms. Not only is the in situ cleaning much quicker, it also reduces farm noise by minimising the use of water blasting equipment. In situ net cleaning is carried out with fish in the sea pen.

223. The predator nets are coated in a copper-based antifouling paint. When due for a change out these nets are brought to the surface and crushed through a mussel crusher to remove the larger biofouling organisms which settle on the net over time. They are then taken to the land-based facility to dry out and the remaining biofouling is removed. If necessary, predator nets may be cleaned in the water, however this usually only occurs in the event that:

   a. Mussels growing on the nets have reached a size that impacts on water flows through the sea pens; or
   
   b. Unexpected mussel growth has added dangerous levels of weight to the nets, which can occur over a matter of days.

224. Discharges from net cleaning activities are covered by resource consent which allows NZ King Salmon to discharge biofouling organisms and copper based anti-fouling from nets and structures (paragraph 211). Copper levels under the farms are monitored and reported on annually and NZ King Salmon is currently undertaking trials to reduce the leaching of copper to the seafloor; these trials are discussed in paragraph 212.
**Feeding The Salmon**

225. Feeding the salmon is one of the most important operations on a salmon farm, with the main objective being to achieve maximum growth of the salmon while minimising feed wastage. NZ King Salmon uses the principle of satiation feeding to ensure that the fish are fed an amount that matches their appetite, which varies throughout the salmon life cycle. Further detail on salmon feed is provided in paragraphs 259-314.

226. Salmon feeding behaviour is complex, and the appetite of the fish varies over time, in addition they feed to a depth of at least 7-10m making feeding behaviour difficult to monitor from the surface. There are two key parts to NZ King Salmon’s feeding system; the feed delivery equipment which delivers the food to the sea pens, and the feed monitoring equipment which monitors pellet wastage (Figure 23).

227. Given the size of the modern larger sea pens and the associated volumes of feed involved, hand feeding is no longer practiced. On NZ King Salmon farms ‘spinner’ and ‘Akva’ systems are used to deliver the feed. These systems have been developed to minimise feed wastage and maximize salmon satiation. They ensure adequate distribution of the pellets in the sea pen to enable every fish access to them.

228. Feed pellets are delivered to the farm in large bags (~1mt) and stored in the barge until required. During feeding the bags are emptied into a hopper or feed silo and the feed is either delivered to the sea pens via a mobile hopper (older spinner system), or propelled from the feed silos in the barge through pipes by air to the individual sea pens (Akva system). Further detail on these two systems is provided below.

Figure 23: Akva Smart computer programme running in seafarm office during feeding.

229. The older spinner system is used at the lower current sites. Feed is delivered to the spinners via transportable hoppers (Figure 24a,b). Pellets are fed into the system from these transportable hoppers suspended above each sea pen; the pellets fall into a
motorised spinning disk that spins them out via a restriction plate (to control the rate of feed delivery) over a wide area of the sea pen. Feeding rate is monitored by one of the following methods:

a. An underwater video-camera placed in the water under the feed drift zone; this is connected to a television monitor in the farm office, which is watched constantly during feeding to enable the feed rate to be adjusted based on the number of pellets drifting past the camera.

b. The AkvaSmart AQ1 computer-based feeding system whereby a computer program regulates the rate and quantity of feed delivered to the fish based on feedback from an underwater sensor that counts pellets.

Figure 24: Salmon feeding systems; (a) transportable hopper; (b) spinning disk; (c) Aquasmart buoy and feeder; (d) AKVA camera.
230. The Akva system, used at the newer sites, is used as a means to move feed pellets which have been emptied into the feed silos in the barge. The feed is transported in plastic (HDPE) pipes using airflow to the appropriate sea pen where it is spread around using a roto-spreader which is attached to the end of the feed pipe in the sea pen (Figure 24c,d). The rate and quantity of feed delivered to the sea pens is controlled using the AkvaSmart computer programme (Figure 23).

231. When the fish reach the required harvest weight, at 10-15 months, feeding is stopped for approximately three days to ensure their stomachs are empty prior to harvest.

**REducing Waste Feed**

232. Feed costs are the most expensive component of producing salmon, accounting for up to 65% of production costs. In addition, the high organic content of feed means that a possible deposit of waste feed on the sea bed over time will have a greater environmental impact than the faecal matter that is deposited in the farm footprint. The minimisation of waste feed is therefore both a commercial and environmental objective of NZ King Salmon’s.

233. Although very minimal, feed lost to the environment may occur as a result of:

   a. Too much feed delivered to the fish during a feeding period as a result of incorrect settings and/or monitoring of feed delivery systems.
   
   b. Fish swimming activity during feeding causing feed to be dispersed/lost through the netting sea pen.
   
   c. Failure of control mechanisms in feed delivery system, leading to non-programmed feed delivery.
   
   d. Catastrophic loss caused by, for example, the feed hopper, or bulk bag falling into the sea.
   
   e. Small fish such as mullets and spotties may enter the sea pens through the mesh and feed along with the salmon; however this has not been observed to be a major issue at NZ King Salmon’s farms.

234. NZ King Salmon has addressed all the points above and continues to work to further reduce feed wastage. Measures to reduce any feed wastage include:

   a. Continual evolution of feeding strategies and feeds with better understanding leading to reduced wastes. In particular, NZ King Salmon has observed considerable reductions in feed wastage by constantly monitoring sea pens with cameras in them to ensure feeding is stopped before feed is wasted. As a result, all camera monitored pens are continuously monitored by NZ King Salmon staff during feeding in order to reduce feed pellet waste.
   
   b. Feed is delivered to each sea pen either by a spinning disc on the hopper or rotating blower system (roto-spreader, Figure 25). Salmon feeding activity is kept away from the outside edges of the sea pen by adjusting the spread of the feed; this reduces the risk of feed in the water being dispersed out of the sea pen through the netting while fish move energetically within the sea pen.
c. Feeders, hoppers and delivery systems are checked at least once a day to ensure that they are working properly, and audits on the spinners are conducted once a week.

d. Feed is moved to the farm using a vessel certified to carry a certain weight. The crane and forklift used are certified to lift in excess of the weight of a feed bag. Lifting strops and chains comply with OSH requirements for the task of off-loading from the transfer vessel to the barge at the site. The barge is enclosed and the feed is stored in an area where spillage cannot directly enter the sea. Feed is moved within the barge by electric hand forklifts and chain hoists are used to lift the feed into the silos or hoppers.

Figure 25: Roto-spreader in operation feeding the fish.

235. In addition, NZ King Salmon has recently carried out initial experiments to measure feed loss at two of its farms using existing feeding equipment. The trials were conducted at Te Pangu, a high flow site where the Akva camera feeding equipment is used, and Ruakaka, a lower flow site where the spinner and AQ1 feeding system is employed. The methodology and results of these assessments were as follows:

a. Te Pangu. The airlift system, generally used to assist with the retrieval of morts was activated in the test sea pens during feeding, to direct any waste pellets into a multilayer net where they were trapped. The quantities of trapped pellets were counted and recorded daily. At the end of the month long trial, the percentage waste was calculated as a proportion of the total amount fed, and was found to be far less than 0.1%, or a handful of pellets over the course of a month.
b. Ruakaka: Divers checked the bottoms of the nets after every feed for a week. These initial trials found no evidence of feed pellets caught in the nets, which were fouled enough to prevent pellets falling through the net.

NZ King Salmon has commissioned NIWA, an independent science provider, to carry out feed loss monitoring trials at two of its farm sites.

MANAGING MORTALITIES

236. Mortalities are a fact of life when raising animals, and salmon that die in the sea pens are known as “morts”. The deaths occur for a number of reasons, such as age, from lesions, predator damage, congenital defects, secondary infections, running or natural attrition. These impacts naturally occur in the wild.

237. Mortals collect at the bottom of the sea pens and are retrieved by divers at least twice a week, or on the new farms by running the air lift equipment which creates air flow and sucks the fish to the top of the net where they can be collected.

238. Mort collection is important for a number of reasons, as follows:
   a. To count and classify them according to cause of death;
   b. To ensure early detection of problems with the fish, and if necessary implement a management response to prevent further losses;
   c. To minimise attraction of predators to the sea pen; either seals that will attack live salmon, and other predators, such as sharks, which feed on the morts and damage the nets;
   d. To minimise the spread of any disease from morts to the living salmon;
   e. To minimise waste and additional weight in the sea pen from the morts.

239. For a time, NZ King Salmon kept morts in unsealed bins; however this created a smell problem, and lead to complaints from close neighbours. In response to these concerns, NZ King Salmon has installed a storage unit on all farms which consists of a floating platform on which sealed designated ‘mort’ bins sit. The morts are regularly collected by one of the service vessels and disposed of at the landfill in Blenheim, thereby eliminating any odour associated with fish mortalities.

FISH WELFARE

240. King Salmon are naturally shoaling animals, and as such being contained in a sea pen is not contrary to their natural instinct. NZ King Salmon’s maximum stocking rates result in only 2.5% of the sea pen volume being occupied by fish, with seawater comprising the remaining volume.

241. Salmon producers globally suffer from significant diseases and parasites; however New Zealand is fortunate in that our coastal waters are currently free of salmon pathogens such as bacterial kidney disease (BKD), the skin parasite *Gyrodactylus salaris*, and infectious salmon anaemia (ISA). While sea lice species such as *Caligus sp.* are a major concern to salmon farmers in the northern hemisphere, parasitic sea lice are not an issue for New Zealand raised King Salmon.

242. Every fish in the farm is valuable to NZ King Salmon, and fish welfare is therefore very important. NZ King Salmon have a detailed section on King Salmon (biology, life-cycle, diseases) in their Training Manual, which is used as a resource for all new staff joining the Aquaculture team.
243. The likely cause of death is determined for all morts as a preventative measure to identify trends and potential problems (e.g. algae bloom, disease outbreak, poor water quality). NZ King Salmon also have a protocol that must be followed by farm staff in the event that elevated numbers of morts are observed. This includes detailed instructions for taking samples of the morts and healthy fish for histological and bacteriological analysis so that the cause of the increased mortalities can be accurately determined.

244. NZ King Salmon harvest their fish when they are still immature, as once mature they have very little market value. The Humane Slaughter Association, based in the UK, has visited NZ King Salmon operations and approved the harvesting techniques employed.

**Harvesting**

245. NZ King Salmon has a specialist harvesting team of nine staff who commute on a dedicated vessel to the farm they are harvesting from. During the harvest period at a given farm, the team harvests up to 50-60 tonne per day, five days a week (Sunday to Thursday), which ensures continuance and consistent supply to all customers.

246. In order to collect the fish for harvest, the harvest team drop a ‘snatch’ net into the sea pen that the fish are to be harvested from and a proportion of the fish in that sea pen are confined. The net then holds these fish at the surface and is used to guide them to a floating pontoon which has been placed in the sea pen by the harvest team.

247. Once guided into the pontoon, the fish pass through a number of compartments containing anaesthetic (Aqui-S) to sedate them and finally into a compartment containing carbon dioxide saturated water which renders them comatose (Figure 26). The practice of using carbon dioxide will cease at the end of August 2011. This series of compartments ensures that the fish are anaesthetised prior to death and is designed to make the harvest process as stress free and humane as possible for the fish with the added benefit of maintaining quality out-turn.

*Figure 26: Harvesting pontoon showing compartments with Aqui-S (front) and carbon dioxide saturated water.*
248. Once comatose, the salmon are lifted by a brailer onto a table on the ‘dumb’ barge moored alongside the farm during harvest operations (Figure 27). The main artery in the throat of the fish is cut by hand and they are placed into insulated bins filled with ice slurry where they continue to bleed (Figure 28). The harvested fish are then collected by a motorised barge and transported back to the closest port (Picton or Havelock) and trucked to the NZ King Salmon factory for immediate processing. The blood and water is contained in the insulated bins and disposed of appropriately at NZ King Salmon’s primary processing plant along with other waste.

Figure 27: Harvested salmon being lifted by brailer onto table on dumb barge.

Figure 28: Salmon being bled on dumb barge and placed in bins for transport to the processing factory.
OPERATIONAL VESSELS

249. NZ King Salmon has a range of vessels that are used by team members for transportation to and from the sea farms. Health and Safety is of the utmost importance to NZ King Salmon and the company has a detailed Vessel Operation Policy, including a maintenance plan, to ensure the vessels are operated in a safe and responsible manner so as to minimise risk to NZ King Salmon personnel and property.

250. NZ King Salmon currently utilises three distinct types of vessel, as follows:

   a. Farm tenders for use in the enclosed water limits of the Marlborough Sounds, operations restricted to particular areas depending on the farm they are based at.
   b. Water taxis for use by commuting staff in the enclosed water limits of the Marlborough Sounds.
   c. Larger work vessels, also for use within the enclosed water limits of the Marlborough Sounds.

251. All staff operating the vessels must have undertaken appropriate training to enable them to operate the vessel safely and responsibly. There is a fully qualified skipper and first aider on board at all times, and staff in the vessels can communicate with the farms and land-based operations via cellphone. The vessels are also fitted with marine radios and emergency locator beacons. In addition NZ King Salmon has a Designated Person Ashore who is responsible for the appointment, training and management of vessel skippers and vessel operations.

252. NZ King Salmon's Safe Ship Management programme requires all vessels to keep logbooks. In addition, any damage, accident or incident that occurs to or on the vessels is reported in accordance with NZ King Salmon accident and incident reporting procedures. Following an accident/incident, a review of the event is undertaken, and operating procedures are modified if necessary.

253. In addition to the vessels owned by NZ King Salmon, a number of other specialist vessels are utilised during salmon farming operations, these include:

   a. Large barges to transport the truck and trailer units carrying smolt for the farms, bulk bags of feed, harvested fish and other large freight. These barges are operated by O'Donnell Park Barging Ltd (Picton) and Johnsons Barge Service Ltd (Havelock).
   b. The 'dumb' barge used by the harvest team.
   c. Barges for special activities such as predator net changes. These barges are usually supplied by Kenny Barging Ltd.
   d. Tugboat used for towing the sea pens between sites. This vessel is operated by McManaway Marine.

254. NZ King Salmon vessel activity varies seasonally, with the main activity as follows:

   a. During harvest (which lasts approximately three months at any given farm), the harvest barge and harvest crew vessel commute daily from Sunday to Thursday, with the 'dumb' barge remaining alongside the farm for the duration of the harvest.
   b. Commuter vessels travel to and from the farms Monday to Friday.
c. Barges transporting food, and carrying out other logistical work (e.g. net changing, moving equipment etc) usually travel to the farms twice a week.

d. Tugs and barges are utilised to move sea pens/fish once or twice a year.

e. Vessels carrying customers, television crews and other one-off visitors.

**PROCESSING AND DISTRIBUTION**

255. The newly harvested fish are transported via truck to NZ King Salmon’s main primary processing plant in Nelson, where they are gilled, gutted and undergo a quality control inspection. The Picton factory, to be developed once volume threshold is obtained, is also intended to be a primary processing plant, which will eventually receive a proportion of the newly harvested fish.

256. At the primary processing plant fish are then graded and, if not being dispatched whole as gilled and gutted (G&G) product, they are sorted and either processed for fillets, steaks or kebabs at the main factory, or sent to one of the other three processing plants where the ‘value-added’ processing (e.g. hot smoked, cold smoked, gravlax, portion control etc) is undertaken.

257. Following processing and packaging, the salmon products are distributed to both domestic and export markets via truck to Christchurch or the North Island. Some fresh G&G salmon are air freighted from Nelson direct to Auckland or Christchurch and on to the export markets.

**SALMON FEED**

258. As discussed in paragraphs 225-231, feeding the salmon is one of the most important operations on a salmon farm, with the main objective being to achieve maximum growth of the salmon while minimising feed wastage.

**NUTRITIONAL REQUIREMENTS OF SALMON**

259. King Salmon are carnivorous fish, and as such the primary macronutrients in a salmon diet are protein and fat; they have only limited capacity to utilise carbohydrate. Salmon also require a range of micronutrients, for example vitamins C and E, selenium and zinc.

260. As an anadromous species (born in freshwater but spend the majority of their life in seawater), wild salmon juveniles start feeding in freshwater, on a range of freshwater invertebrates. After salmon migrate to sea, their diet consists mainly of crustaceans (e.g. krill) and small fish.

261. The diet of salmon in the wild also contains astaxanthin, a carotenoid and strong antioxidant. Astaxanthin gives salmon flesh its pink colour. Salmon cannot synthesise astaxanthin but instead astaxanthin is accumulated from natural sources in the diet, such as krill and other crustaceans. Astaxanthin is required for egg and fry development and for fish health. It is also redistributed when fish sexually mature in order to pigment the skin.

---

18 This section has been prepared with the assistance of Skretting Australia.
262. The diet of wild salmon in seawater is also high in the long-chain Omega-3 fatty acids DHA and EPA. Salmon cannot synthesise long-chain Omega-3 in any quantity, so must obtain it from the diet.

**History**

263. Types of feed for farmed salmon have evolved markedly over the years, as described in the following paragraphs.

264. The very first salmon and trout grown in captivity were often fed “trash fish” – consisting of fish and molluscs), chopped to pieces and fed out. Salmon will grow when fed on trash fish, but there is much potential for spoilage and disease transfer. In addition such diets do not allow the use of automatic feeders; they pollute the holding water and are generally costly (per kilogram of fish grown) and inefficient – the Feed Conversion Ratio (FCR - kilograms of feed used per kilogram of fish produced) is commonly over 10, compared with ~1.8 today. These original diets did not allow the addition of any ingredients other than raw marine materials, which reduces the sustainability characteristics of the diet.

265. Later, “semi-moist” pellets were developed; these pellets were made on-site on an as-needed basis. These were more convenient than trash fish, but were laborious to make and lacked shelf life and nutrient density (due to the high water content). In addition, in those early days of salmon farming, the knowledge of the nutrient requirements of fish was very rudimentary. Diets contained mostly raw marine materials (e.g. high levels of fishmeal), which were cheap and abundant.

266. By the 1980’s steam pressed pellets began to be used, including in the NZ industry. These pellets contained dry, ground materials (e.g. fishmeal, flour) that are processed through a pellet press, with steam applied. Such diets continue to be fed to poultry, calves and pigs today. Some oils can also be incorporated into the pellets, and the resulting pellet is dry (<10% moisture) and shelf stable. However this technology struggles to deliver pellets containing more than 12% oil and typically results in 5% chip and dust (which fish do not eat). FCR's of 2 to 3 were common in the NZ industry on steam pressed pellets. Those diets continued to contain mostly fishmeal and fish oil.

267. In the 1990’s extruded pellets became available. Increasing the oil content (and thus energy content) of diets greatly improves the efficiency with which fish can convert feed into flesh. This was the key motivation for the global shift to extruded pellets. By the mid to late 1990’s these were common in New Zealand and today are used almost exclusively.

268. Extruded pellets are made using highly technical production lines that incorporate a cooking extruder. Extruded pellets can be made that contain high oil levels – above 40% oil is possible. Compared to steam pressed pellets, extruded pellets are also durable (little chip and dust, which reduces feed wastage) and have increased nutrient digestibility, due to the increased level of cooking that occurs during production.

269. Increasing the oil content also allows the protein content of the diet to be reduced. It can be considered that low oil steam-pressed pellets contain “too much” protein per unit of energy, i.e. more protein than the fish need in order to build their own tissue. In this situation the surplus protein is used by the fish for energy. Using protein for energy is costly and increases nitrogen excretion into the environment. The concept of using oil (or carbohydrate) to supply energy to prevent protein being used for energy is known as “protein sparing”.

NZ King Salmon Report  13 August 2011
270. Extruded King Salmon diets used in the NZ industry today typically contain 25% oil and 38% protein. While affected by growing conditions and a range of other factors, the industry-wide FCR is currently around 1.8. This is higher than is commonly seen in the Atlantic salmon industry (which has average FCRs of approximately 1.3). This difference is likely primarily due to the following:

a. King Salmon have higher flesh oil (typically 25% at harvest in the fillet) than Atlantic salmon (17%). Because the tissue of King Salmon contains more energy than Atlantic salmon, they require more feed energy to build each kilogram of tissue.

b. Atlantic salmon diets are manufactured to contain more energy (>35% oil is common) than King Salmon diets (26% oil maximum). This is because King Salmon are naturally oily fish, and too much oil in the diet can cause flesh quality problems in this species.

c. Energy partitioning calculations show that the points noted in (a) and (b) above account for at least 80% of the difference in FCRs between Atlantic salmon and King Salmon.

d. Despite the higher FCR of King Salmon, because they use lower-oil diets and retain more oil in the flesh, the efficiency with which Atlantic salmon and King Salmon retain oil and energy is similar.

**SUBSTITUTION OF MARINE RAW MATERIALS IN SALMON FEED**

271. Early diets contained mostly fishmeal and fish oil, which has resulted in the criticism that salmon farming consumes far more fish than it produces.

272. Two sources supply fishmeal and fish oil for use in salmon diets:

   a. Reduction fisheries; these are fish specifically caught for fish meal production; and

   b. Trimmings; these are by-products of fish caught for human consumption.

273. Skretting Australia supplies over 85% of the feed to the New Zealand salmon farming industry and over 90% of NZ King Salmon’s feed. Diets supplied by Skretting (and other suppliers) to the New Zealand industry source >80% of the fishmeal used from reduction fisheries (primarily Peruvian anchovy).

274. There are both economic and environmental drivers to reduce the level of marine raw materials used in salmon feed. While volatile, the long term trend in fishmeal and fish oil prices has shown a steady rise (Figure 29). Aside from absolute price, avoiding the volatility of fishmeal and fish oil prices is also a strong commercial incentive to reduce their use in fish feed.
275. Fishmeal and fish oil prices have risen due to the following:
   a. Increasing demand from aquaculture, particularly from China;
   b. Strong demand from agriculture (pig farming, poultry farming) - although currently fishmeal is usually priced out of this market;
   c. In the case of fish oil, the rise of the nutraceuticals industry (Omega-3 health supplements); on current trends, it is possible by 2020 this industry will consume all the world’s production of fish oil;
   d. Static supply. While the key reduction fisheries are tightly controlled and relatively stable, they are fully exploited. There is no opportunity to increase harvests.

276. As a result, the major salmon feed producers have invested heavily in research to determine how the use of marine raw materials in fish feeds can be reduced, while still retaining fish health, performance and product quality and flavour. Skretting, for example, currently spends approximately NZ$10m per annum researching this field, including some money spent directly on research into fishmeal and fish oil substitution in King Salmon feed for NZ King Salmon.

277. This research has resulted in significant progress. Marine oil has been replaced by other animal or vegetable oils, while marine protein has been replaced by land animal proteins and vegetable proteins. This substitution of products has led to lower cost fish feeds and an improvement in the raw material sustainability of the diets without compromising fish performance and product quality.

278. A recent advance in knowledge on fishmeal replacement (now branded as the “MicroBalance™” concept by Skretting) has allowed a further step in fishmeal replacement with no loss in fish performance or product quality. Diets currently supplied to NZ King Salmon contain slightly less than 10% fishmeal, in contrast to 1990 diets that contained 70% fishmeal. In addition, the total amount of 1990 diet required per tonne of
fish produced was greater than is needed with modern, energy-dense extruded diets. The amount of fishmeal and fish oil used historically and today in New Zealand King Salmon diets is shown in Figure 30.

279. Combining the information from Figure 30 with industry FCR’s and reduction fishery yields of fishmeal and fish oil, allows the calculation of the kilograms of reduction fisheries consumed to produce each kilogram of farmed King Salmon. Such calculations are commonly referred to as “FIFO calculations” (“Fish-In / Fish-Out”) and the results are shown in Figure 31. This is a worst-case scenario, as it does not allow for the use of trimming meals.

280. It can be seen that the tonnes of marine resources used per tonne of King Salmon produced has more than halved over the last 20 years. Currently, for each tonne of NZ King Salmon produced, 2.7 tonnes of anchovy is used for fish oil. Because the fishmeal from only 0.8 tonnes of anchovy is required, in addition to the tonne of salmon produced, a surplus of 422kg of fishmeal remains, which can be used for other productive purposes. By comparison, a wild salmon is estimated to require 10-20 kg of wild fish per kg of salmon produced.

281. NZ King Salmon now produces more fish protein and fish oil than is consumed, and thus is a net producer of fish protein and fish oil (Figure 32, Figure 33). This is in marked contrast to the situation for King Salmon production only 10 years ago, when two to three times more fish protein and fish oil was consumed than was produced.
Figure 31: Trends in reduction fisheries used per kilogram of King Salmon production (separate requirements for fishmeal and fish oil).

Figure 32: Kilograms of fish protein produced per kilogram of fish protein consumed in NZ King Salmon farming, historically and today.
SUMMARY OF INGREDIENTS USED IN NZ KING SALMON FEED

PROTEIN SOURCES

282. The proteins contained in fish food are a mixture of fish meal, land animal proteins and vegetable proteins.

283. It has been determined that fish do not require any particular protein raw material (such as fishmeal) per se, rather they require an appropriate mix of digestible amino acids (the building blocks of protein). The necessary mix of amino acids can be derived from a varied mix of different raw materials. Understanding the amino acid availability from specific raw materials is an important topic of research at fish feed companies.

284. The choice of protein source varies with cost and availability, which varies around globally according to local conditions. Protein in New Zealand diets is typically derived from:

a. Fishmeal; primarily Peruvian anchovy;

b. Poultry meals (meatmeal, bloodmeal, feathermeal); these rendered products are a by-product of poultry slaughtered for human consumption in Australia. These products are excellent nutritional materials for carnivorous fish.

c. Mammalian meals (meatmeal, bloodmeal); these rendered products are a by-product of cattle, sheep and pigs slaughtered for human consumption in Australia. Currently only bloodmeal can include porcine products due to New Zealand import restrictions.
d. Plant protein meals; faba bean meal, lupin meal, corn gluten, wheat gluten and soya protein concentrate.

285. Bovine Spongiform Encephalopathy (BSE) has been raised as a concern around the use of mammalian meals in fish diets. This concern is unwarranted for the following reasons:

a. Molecular studies indicate that fish prion proteins (PrP) have low similarity to mammalian PrP’s, indicating a high species barrier.

b. No transmissible spongiform encephalopathies (TSE’s, of which BSE is an example) have been found in any fish species. Scientific committees of the European Union have concluded that there is no evidence of TSE’s existing in any wild or farmed fish.

c. Transmission studies have found no evidence that TSE agents can replicate or persist in fish, or pass from mammals to fish or from fish to mammals. Comparable studies in susceptible mammalian species readily demonstrate replication and transmission of TSE agents.

d. It has been shown that trout do not absorb prions from their intestines and that prions cannot be detected in the tissues of trout that have been experimentally fed high loads of infectious prions.

e. All mammalian products fed to fish in New Zealand must derive from only Australia or New Zealand – both of which are regarded by the World Health Organisation as being free from BSE.

286. Concerns around the presence of antibiotics and banned substances (e.g. growth hormones) in poultry products included in salmon diets have been raised. However these concerns are unwarranted, as poultry by-products used in NZ King Salmon diets derive from poultry slaughtered for human consumption in Australia. As such they are subject to strict controls on residues and a comprehensive residue monitoring program. For example, the Australian Government’s National Residue Survey (NRS) for 2009-10 tested 330 commercial poultry samples (9570 analyses) and found no residues (including antibiotics) or environmental contaminants above the Limits of Reporting for products for human consumption.

OILS

287. It was traditionally thought that fish required fish oil in their diet. However research has shown that fish have a digestible fatty acid requirement that can be met from a variety of oil sources. Fish oil is still used extensively in salmon diets, but primarily to introduce long chain Omega-3 fatty acids (mostly EPA and DHA) into the salmon fillet. The fatty acid composition of a salmon fillet is strongly influenced (and to an extent mirrors) the fatty acid composition of the diet. At present fish oil is the only practical source of EPA and DHA.

288. Fish oil is a by-product of fishmeal production, although due to the rise of the nutraceutical industry it is now considered a particularly valuable commodity in its own right.

289. Poultry oil, a by-product of poultry slaughtered for human consumption, is used to replace fish oil in New Zealand salmon diets. This poultry oil is sourced from Australian
poultry. Poultry oil acts as an energy source for the fish and has the same saturated fat content as fish oil.

290. The principal reason poultry oil is used in New Zealand is because of price and quality. In both Australasia and North America poultry oil is less expensive than the available vegetable oils. In some parts of the world, especially Europe and also Chile, vegetable oils are used in salmon diets. Neither vegetable oils nor poultry oil contain appreciable levels of EPA and DHA.

291. The proportion of marine oil used compared with the total oil added to the feed determines the proportion of long-chain Omega-3 expected within the oil in a salmon fillet. As the amount of marine oil used falls, the EPA and DHA in the diet is retained more efficiently; salmon retain Omega-3 more efficiently when there is less in their diet

Table 3: Expected long-chain Omega-3 content of King Salmon fillets grown on different diet oil blends.

<table>
<thead>
<tr>
<th>Fish oil as % of total oil added to feed</th>
<th>LC-Omega 3 expected per 100g of fillet, harvest-size fish</th>
<th>Relative to requirement for FSANZ* claim “Good Source of Omega 3”</th>
<th>Fillet needed for Recommended Daily Intake of 500mg LC-omega-3 per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td>5000 mg</td>
<td>167 x</td>
<td>10 g</td>
</tr>
<tr>
<td>50%</td>
<td>2750 mg</td>
<td>92 x</td>
<td>18 g</td>
</tr>
<tr>
<td>40% (Current NZKS Diets)</td>
<td>2250 mg</td>
<td>75 x</td>
<td>22 g</td>
</tr>
</tbody>
</table>

* Food Standards Australia and New Zealand

292. While the substitution of fish oil in King Salmon diets has resulted in lower EPA and DHA content in the fillet compared to that seen with 100% fish oil diets, fillets remain a very good source of long-chain Omega-3, requiring the consumption of only 22 grams of fillet per day to meet the human recommended daily intake (Table 3).

293. Table 3).

CARBOHYDRATE

294. Carbohydrate in the diet supplies a limited amount of energy to the fish, but in extruded diets is useful as a binding agent (it holds the pellets together).

295. The sources of carbohydrate used in diets to NZ King Salmon are typically:

a. Australian wheat;

b. Faba bean meal (which contains both protein and carbohydrate);

c. Potato starch.

MICRONUTRIENTS

296. A number of vitamins and minerals are required to maintain fish health; most are not discussed individually in this document. Research over many decades has identified these requirements, with refinement in understanding continuing today. A vitamin and mineral premix is added to all modern diets, at an inclusion rate below 1%.
297. To allow salmon to develop normal flesh colour and for fish health, astaxanthin is added to diets at amount of less than 80ppm. Astaxanthin accumulation is a biological requirement of salmon, as demonstrated by the fact that salmon muscle contains binding sites specific to astaxanthin, unlike the muscle of most other fish species. These binding sites cause salmon to capture and store ingested astaxanthin. When astaxanthin is fed to species of fish that lack these binding sites, their flesh remains white. The astaxanthin used is synthesised chemically, but is chemically identical\(^\text{19}\) to that which exists in nature.

298. Zinc is an essential micro-nutrient in salmon diets. Insufficient zinc leads to cataract formation and other fish health problems. Zinc can be supplemented in the diet in two forms – inorganic zinc (for example zinc sulphate) or organic zinc (generally complexed with an amino acid, e.g. zinc methionine). While both can meet the zinc requirements of fish, organic zinc is absorbed much more efficiently by fish than inorganic zinc. The raw materials in the NZ King Salmon diet contains about 50-70 ppm zinc. This zinc is associated with calcium and as such is unavailable to the fish and is not considered to be able to meet any of the zinc requirement of the salmon. Currently diets are supplemented with 100ppm inorganic zinc, resulting in a total diet zinc content of about 160ppm.

299. Dietary zinc has a potential environmental impact because some of the zinc in the feed is excreted and can accumulate in the sediments under and around a fish farm. In August 2011 NZ King Salmon will switch to using organic zinc in their feed; this will be supplemented at 37.5ppm, and will reduce the total zinc content in the diet to approximately 95ppm. In addition, use of organic zinc will mean a greater percentage of the zinc remaining in the diet will be absorbed, rather than excreted. The overall result will be much reduced zinc output from the fish into the environment.

300. Experience of organic zinc at Canadian salmon farms indicates it produces very marked reductions in sediment zinc, compared to the use of inorganic zinc, with improvements of between 40-60% observed. It is expected that similar improvements will be observed at the NZ King Salmon farms.

**Sustainability of Fish Species Used for Marine Oil and Marine Protein**

301. Reduction fishery species are often small, bony and not favoured (or readily caught and processed) for direct human consumption. Species caught in reduction fisheries (such as Peruvian anchovy) are generally fast-growing and short-lived. As a result they are considered generally resilient to fishing pressure.

302. However reduction fisheries can be over-fished. The Peruvian anchovy fishery, from which most NZ King Salmon fishmeal and fish oil currently derives, was increasingly over-fished through the 1960’s and effectively collapsed in the early 1970’s. It did not show significant recovery until the 1990’s, when strict controls supported by research were introduced\(^\text{20}\).

303. Since the 1990’s the fishery has shown generally stable biomass despite natural environmental swings (particularly due to *El Niño*). Government authorities apply tight

---

\(^{19}\) Astaxanthin (both natural and synthetic) includes several different stereo-isomers. All are present in both synthetic astaxanthin and in wild astaxanthin sources, but the proportions of each are slightly different. As a result, the ratio of each isomer can be used to distinguish farmed from wild salmon.

\(^{20}\) [www.fishsource.org](http://www.fishsource.org)
monitoring and control to this fishery, regularly restricting or halting fishing when biomass surveys indicate this is necessary.

**ABSENCE OF GMO, ANTIBIOTICS, MERCURY, POP’S**

304. Feed supplied to NZ King Salmon does not contain genetically modified organisms (GMOs) according to legislation in the EU, Japan and Norway.

305. Under Australian and New Zealand regulations the feed is deemed “GMO DNA-free”. While the feed contains no GM organisms, some of the vitamins included as micro-additions have been manufactured by GM organisms. The organisms themselves are not present in the feed.

306. Unwanted contaminants, or residues (e.g. heavy metals, antibiotics, persistent organic pollutants (POPs, such as dioxin)) can potentially enter feed primarily through raw materials. To control the risk from residues, feed companies operate a comprehensive residue monitoring program. Skretting for example has the following contaminant residue monitoring programme in place:

a. Consists of global analysis (shared results tested at specially selected overseas laboratories) and local analysis (additional tests chosen by Skretting).

b. The global tests are decided each year by Nutreco’s Food Safety specialists (Nutreco is Skretting’s parent company) who have an understanding of which contaminants are the most important scientifically, politically and socially.

c. Skretting tests many samples of feed and raw materials for a profile of residues each year. Hundreds of results are collected each year mainly focussed on heavy metals, antioxidants, dioxins, polychlorinated biphenyls (PCB’s), nitrosamines and pesticides.

d. EU limits are applied to all tests, as these are the most thorough and stringent.

307. Results from these monitoring programmes enable feed companies to purchase their raw materials from low risk regions and suppliers, and to obtain a thorough understanding of food safety risk in the aquaculture industry around the world.

308. Skretting publishes a Residue Report biannually, which is available to customers on request. These monitoring systems have shown residues in all Skretting feed to be far below all FDA, EU and Australian limits.

309. As with terrestrial agriculture, antibiotics may be applied in aquaculture to control disease. Such antibiotics are often delivered in the feed fed to the fish; however under Australian and New Zealand law, they can only be included when prescribed by a veterinarian.

310. Due to the lack of salmon diseases in New Zealand coastal waters, antibiotics are not required in the New Zealand salmon industry, and as such, Skretting has never supplied salmon diets that contain antibiotics to any New Zealand customer. However, it should be recognised that although this is the current enviable situation for New Zealand salmon farmers, there may be a requirement to use an animal remedy at some point in the future. Management of this use will be under the Agricultural Compounds and Veterinary Medicines Act 1997, and the Hazardous Substances and New Organisms (HSNO) Act 1996.
311. Similarly, there is no need for lice treatments or anthelmintics (also sometimes supplied via feed) in the New Zealand salmon industry, and such products have never been used in commercial production. However, if the need arose, antibiotics, lice treatments, anthelmintics or other animal remedies could be added to the feed.

FEED AND FAECES

312. The majority of benthic nutrient enrichment around a well-managed salmon farm derives from faeces excreted by the salmon. With poor feed management, uneaten feed pellets can also contribute to benthic enrichment. Old-fashioned steam-pressed pellets resulted in the release of uneaten chip and dust to the seabed. Modern farms that use waste feed detection systems (such as feeding cameras) when feeding extruded diets, avoid most uneaten pellet loss. NZ King Salmon’s efforts to reduce waste feed are discussed in paragraphs 232-235.

313. There is some scope to influence the release of faecal nutrients into the environment by manipulating feed composition. Switching to higher-energy diets could potentially reduce faecal dry matter output by 20% or greater. This is likely to be the subject of research in the next few years. It is expected that, for NZ King Salmon’s current feed range, about 20% of the dry matter consumed is excreted as faeces.

314. Technology is already being applied to manipulate the physical properties of fish faeces for some applications (e.g. hatchery systems). This could potentially be used to assist faeces to disperse from around seafarms, diluting them, or to concentrate faeces directly under farms to limit the size of effect footprints (or to assist collection). Such manipulation will require further research before commercial application in a seafarm setting.

ENVIRONMENTAL MANAGEMENT

315. At its core, the challenge of salmon farming is to farm sustainably by working within the parameters of the marine environment. Farms which are run in an environmentally unsustainable manner compromise fish health, thereby compromising the quality of the farmed salmon and affecting the economics of the business.

316. NZ King Salmon works within the environmental parameters at each farm site by staging the development of new salmon farms, with further development not permitted unless it can be shown that the farm is operating within the conditions of its resource consent.

317. As part of their resource consent conditions, NZ King Salmon is required to undertake annual environmental monitoring and reporting for all operating salmon farms. This monitoring is conducted by Cawthron scientists, who firstly prepare an annual monitoring programme for each of NZ King Salmon’s farms for approval by NZ King Salmon and MDC. This programme describes the monitoring and analysis to be undertaken in that year.

318. Following completion of the annual monitoring, Cawthron provides NZ King Salmon and MDC with an annual monitoring report which is independently peer reviewed. NZ King Salmon operates its farms using an adaptive management process, which ensures that, in the event that any farm that exceeds the agreed environmental quality standards, a
farm management response is immediately activated to bring the farm back within the agreed standard.

319. The NZ King Salmon Board, management team and staff are fully aware and committed to the need to act responsibly to ensure the ongoing environmental integrity of the Marlborough Sounds. In 2010 NZ King Salmon recognised the communities concerns and desire to better understand the impact of farming operations on the environment, as a result, an Environmental Policy for Aquaculture Operations has recently been developed (refer Appendix 1). A Board appointed committee, which includes an external expert, has been appointed to oversee the implementation and management of this policy.

320. Salmon farming does result in an environmental footprint, but this is kept to a minimum by modern and effective farming practices and technical innovations. The objectives of the Environmental Policy are a commitment by NZ King Salmon to:

a. Implement sustainable and environmentally sound business practices using our LEAN programme (“the Toyota way”, whereby practices are as efficient as possible and waste is minimised).

b. Work in harmony with our unique environment.

c. Meet the requirements of the relevant legislation and the NZ Salmon Farmers Association Finfish Aquaculture Environmental Code of Practice (refer Appendix 2).

d. Continuous improvement to strive for world class environmental standards.

e. Take organisational and personal ownership for the Environmental Policy.

f. Ensure that NZ King Salmon’s environmental footprint is well managed.

g. Work within the principles and implementation of sustainability and environmental awareness.

h. Provide corporate leadership in environmental awareness.

CONSOLIDATED FARM MANAGEMENT

321. One of the strengths of NZ King Salmon from a market perspective is the ability to produce fish year round that are consistent in quality and size. Recognition of the various attributes of each of the farm sites, and managing these sites in conjunction with one another is an important aspect that contributes to the company’s ability to achieve consistent production.

322. Each of NZ King Salmon’s existing and proposed sites have slightly different attributes, in particular with regards to water temperature and current flows. In order to maximise the attributes of each site, NZ King Salmon uses an integrated management strategy, whereby all the existing farms are treated as one integrated system to farm salmon. This allows NZ King Salmon to utilise resources efficiently, whilst minimising risk, as well as to achieve year-round production of a consistent product for customers.

323. NZ King Salmon acknowledge that ideally the farms would be managed in three discrete geographic areas to minimise the potential for disease or pest species introduction and transference around the Sounds. However this strategy is not practical
from an operational perspective, and given the low likelihood of disease outbreaks or the transfer of pest species as a result of salmon farming, the company has chosen to operate the farms as an integrated unit, although with separation distances are in excess of overseas norms. In the event of a disease outbreak or marine pest infestation, NZ King Salmon would implement a management response to ensure that salmon farming operations are not responsible for spreading disease or marine pests throughout the Sounds.

324. Water temperature has the strongest effect on salmon growth, so managing the sites according to their temperature profiles (Figure 34) enables NZ King Salmon to achieve greater growth rates of the young fish during the warmer summer months. Examples of this approach include:

   a. Only introducing smolt into the cooler Tory Channel sites (Clay Point and Te Pangu) during spring, in order to avoid warmer water temperatures over summer (which results in high smolt mortalities). The young salmon are held at these two sites until around April, when water temperatures have dropped sufficiently at the other sites so as not to impact on growth or survival. The fish are then transferred, by towing them in sea pens, to these sites where they will stay until harvested.

   b. In the cooler autumn month’s smolt can be introduced to any of the operating sites, as water temperatures are well within the optimum range of the fish.

   c. Water temperatures at Otanerau in summer exceed the maximum temperature for optimum growth of the salmon (18°C), so salmon are only grown on this site during the cooler eight or nine months of the year. During summer the designated Otanerau smolt are held at one of the Tory Channel sites with cooler water temperatures.
Figure 34: Maximum and minimum water temperatures at NZ King Salmon's existing farms.

325. Other specific methods utilised internationally for managing a group of salmon farms include the following:

a. Fallowing: There are two different options for the use of fallowing as a management strategy, as follows:
   i. Disease management: Fallowing could potentially be used by NZ King Salmon to manage disease, as removing disease hosts (i.e. fish) from the site results in the disease cycle being broken.
   ii. Increase operational efficiency: NZ King Salmon is currently investigating fallowing as an option to maximise operational efficiency. The company is operating a fallowing policy between the Waikinala and Forsyth Bay farm sites in order to determine whether a two year rotational programme can be managed and remain compliant with agreed environmental quality standards.

b. Single Year Class: This is a good strategy in salmon farming areas where disease is an issue, as it prevents diseases from being transferred across the generations. However this is not currently an issue in New Zealand.

c. Geographic Spread of Farms: In salmon farming areas where disease is prevalent, this is a good strategy. However in New Zealand, salmon farms are widely spread, particularly in areas where water currents are slower and therefore the farm is ‘flushed’ less often.

**BIOSECURITY**

326. Salmon genetic material (i.e. eggs, milt, broodstock) is not imported to New Zealand, so there is no biosecurity risk posed by that means.

327. Marine farms do provide a perfect site for the establishment of unwanted organisms which have breached New Zealand’s biosecurity networks. NZ King Salmon were involved with the Didemnum Working Group that managed the last major marine biosecurity event in the Marlborough Sounds and biosecurity is addressed as part of the company’s environmental monitoring programme.

**RISK MANAGEMENT**

328. NZ King Salmon have undertaken an assessment of the potential risks to farming operations and are developing a tsunami and disaster preparedness plan. In addition the company has the following emergency response plans in place:

a. A detailed Oil Spill Plan is included as part of the sea pen operations manual. This instructs farm workers on specific protocols that must be followed to enable a planned response to an oil or hydrocarbon spill from any of the farm sites.

b. Sea pens are able to be towed to a ‘safe’ location in the event of another toxic algae bloom such as that of *Heterosigma akashiwo* which affected the Big Glory Bay farms.

c. Jellyfish can be ‘attracted’ to the grower nets by the vortex created by the salmon swimming behaviour. This is not a problem if the jellyfish are present in small numbers, but if the jellyfish bloom as a result of favourable environmental conditions, ‘jellyfish strike’ can occur. This is where the sheer numbers of jellyfish
block off the water exchange to the sea pens (by blocking the mesh), thereby depleting oxygen and causing the net sides to contract. This causes the fish to panic and increase their swimming speed, thus creating a vortex and ‘attracting’ more jellyfish to the sea pen. A process for preventing and resolving such an event, should it occur, is detailed in the sea pen operations manual.

SEABED REMEDIATION OPTIONS

329. Salmon farming is known to cause a localised impact to the seabed within the ‘footprint’ of the farm. Remediation of this impact by natural processes can only occur if the farm stops production, or waste matter falling to the seabed from the farm ceases.

330. Numerous attempts have been made by the global aquaculture industry to minimise the environmental effects of salmon farming operations. Some of the options assessed by Cawthron for the Ministry of Fisheries (MFish) and NZ King Salmon, to minimise the environmental impact include:

a. Collection of organic wastes before they reach the seabed, or physical remediation of impacted sediments. A number of solutions have been proposed or trialled overseas, including: collection of particles falling to the seabed; deployment of artificial reefs beneath sea pens to process farm waste before deposition; collection of detritus from the seabed using submersible pumps; and harrowing of enriched seabed sediments to enhance oxygenation and organic matter processing.

b. Microbial and chemical remediation. Techniques that involve adding a mixture of bio-fixed bacterial species (bio-augmentation) and oxygen release compounds (bio-stimulation) as a means of enhancing the rate of decomposition of organic matter in sediments have been trialled beneath fish farms overseas. These trials have indicated the potential for enhancing recovery rates in organically rich sediments, but they are yet to be tested at full farm scale.

331. Most of the solutions discussed above have been found to be impractical or have no demonstrable net environmental benefit, or are yet to be proven viable at a full farm scale. NZ King Salmon maintains a watching brief on developments in this area.

INFRASTRUCTURE REQUIREMENTS

332. NZ King Salmon has a range of infrastructure requirements necessary to support farming operations, these are discussed below.

333. NZ King Salmon only utilises the ports of Havelock and Picton to support its sea pen operations; it is very rare for the company to access alternative port facilities such as those at Elaine Bay, Pelorus Sound. It is not envisaged that this level of usage will change with the development of the proposed sites.

334. The Havelock and Picton facilities are well placed to support marine farming operations, and at each of these ports NZ King Salmon utilises the following:

a. Port facilities to transfer feed, ice, equipment and fish;

---

b. Barge services;
c. Light engineering and utility services;
d. Vessel repair and maintenance services;
e. Dive industry services.

335. The factories in Nelson currently undertake all of NZ King Salmon’s processing; however in the event that the proposed farms are developed and production is markedly increased, it is likely that NZ King Salmon will develop a processing factory in Picton, closer to the Marlborough Sounds farms.

336. Currently all salmon feed is imported; however the feed companies have indicated that the increase in NZ King Salmon’s production which would occur as a result of the development of the proposed sites would provide the opportunity for the construction of a feed mill in New Zealand.

337. NZ King Salmon currently air freights whole fresh gilled and gutted fish from Nelson airport, however at times this puts pressure on the freight capacity of the airport and charter planes have been used on occasion. The development of a primary processing factory in Picton, and the potential for increased air freight requirements would strongly support the case for Blenheim airport to utilise larger planes, which would also benefit tourism operators and other primary producers in the Marlborough region.

**Alternatives to Sea Pens**

338. Harvest of salmon can be achieved in a number of ways:

a. Wild fishing;
b. Ocean ranching whereby the salmon are hatched in a hatchery, released to the wild, and caught during their run back up the river to spawn (generally considered a form of wild fish);
c. Sea pens, utilised by NZ King Salmon, and the most common form of global salmon production; or
d. Closed containment salmon aquaculture, also known as re-circulating aquaculture systems, whereby either a land or sea-based containment system of some description is used and the water recycled through the system.

**Wild Fishing**

339. The indigenous King Salmon population in the northern Pacific Ocean and southern Arctic Ocean is heavily fished. FAO Fisheries statistics for the global capture production for King Salmon show a steady decline in wild catch (Figure 35).

340. Wild fishing of salmon commercially is not an option as salmon is not part of the quota management system; all wild salmon in New Zealand are reserved for amateur fishing, and any salmon caught at sea must be landed as bycatch. In addition it is not likely that there are sufficient wild stocks in this country to sustain a regular commercial salmon harvest.

341. The declining quantities of wild salmon caught can be contrasted with the increasing demand for the species. Wild King Salmon are at risk of overfishing and global
aquaculture and New Zealand aquaculture alone, which produced ~11,000mt of King Salmon in 2009, exceeds the King Salmon global capture industry (6,364mt in 2009). Further detail on salmon aquaculture production globally and in New Zealand is provided in Appendix 6.

Figure 35: Global capture production for Oncorhynchus tshawytscha (FAO Fisheries statistics).

OCEAN RANCHING

342. Ocean ranching is the method by which much of the wild salmon fisheries in New Zealand and in other parts of the world remain stocked. First attempts at ocean ranching in New Zealand were carried out in the 1980s in Golden Bay, and on the Waitaki and Clutha Rivers (as part of the ICI/Wattie Salmon project). The first major commercial attempt was at Tentburn, a 6.7 hectare site on the Canterbury Coast which was originally established for this purpose, however, this site failed as an ocean ranching facility due to fishing pressure and other predatory species. The Tentburn site is currently one of NZ King Salmon’s three hatcheries (see paragraph 29).

343. Internationally, ocean ranching was attempted in countries like the US, Canada and Scandinavia before sea pens were introduced in the 1960’s and 1970’s. However, because the fish are “wild” the hatchery has no proprietary interest until the grown salmon are back within the facility, limiting a company’s chances of benefiting financially from their investment.

344. Because of this, the method has mainly been used by public authorities and non-profit groups as a way of artificially increasing salmon populations in situations where they have declined due to over-harvest, the construction of dams and habitat destruction or disruption. Unfortunately, there can be negative consequences of this sort of population manipulation, including genetic ‘dilution’ of the wild stocks and as at 2011, many jurisdictions are beginning to discourage supplemental fish planting in favour of harvest controlled habitat improvement and protection. As New Zealand does not have native stocks this is not an issue.

LAND BASED SYSTEMS

345. There are two main types of land based systems for raising salmon, as follows:

a. Flow-through freshwater systems, employed by salmon farmers in the hydro-electric canals and rivers of the central South Island;
b. Closed containment systems, where seawater is pumped ashore. Such systems are not common in areas where coastal land has a high value and energy costs are high. This precludes the majority of New Zealand for this type of farming.

346. NZ King Salmon has had firsthand experience with growing fish to a harvestable size in a freshwater land-based facility. Prior to 1998, the Waikoropupu Springs, Takaka site was producing up to 367 mt of harvest salmon per annum. Quality issues, including fish size, along with an increased need by the company for space and water for smolt and broodstock rearing resulting in NZ King Salmon ending land-based rearing of adult fish.

347. Internationally, there are a number of small-scale operators that use closed containment systems to grow salmon to harvest. These include:

   a. Aqua Sea Corporation in Washington State; who grow Coho salmon in a land-based freshwater system and market the product as “Sweet Spring salmon” [http://www.sweetspringsalmon.com/];


   c. Agrimarine in British Columbia grow Atlantic salmon in a freshwater system on land, and recently launched a floating seawater system [www.agrimarine.com];

   d. A Danish company, DTU Aqua is currently developing technologies to produce large trout (and potentially salmon) in a land-based seawater system [www.aquacultureworld.com].

348. Currently there are no large scale land-based seawater farms in New Zealand, as they are generally not suited to the New Zealand way of farming. The risks associated with the water intake system collapsing and/or breaking, disease management and disposal of effluent trapped in the settlement tanks remain problematical for this type of land based farming system.

349. While favoured by some environmental groups and those opposed to sea pen farming, closed containment and re-circulating aquaculture systems are mainly limited to hatcheries and small producers. The primary reason for this is that both land based marine farms and re-circulating water systems require large amounts of capital and a high degree of technical skill.

350. The commercial application of land-based systems has received considerable attention and debate in the last 18 months. In May 2010 Dr Andrew Wright published a draft report “Technologies for a Viable Salmon Aquaculture: An Examination of Land-based Closed Containment Aquaculture”. That report produced detailed design and cost benefit structures for systems ranging from 1,000 tonnes to 100,000 tonnes. In his opinion:

   “Land-based closed containment is technically and economically feasible. Moreover, the design presented if refined would allow for substantial reductions in both capital and operating expenses”.

351. Dr Wright’s report bases all options around a 100 tonne model which he scales up to 1,000 tonnes and then 100,000 tonnes. He states that closed containment systems are technologically feasible using proven and reliable off-the-shelf equipment and that large
operations are also technically feasible – you just need more of the same to increase output.

352. NZ King Salmon’s criticism of Dr Wright’s draft report comes down to the economics and scale. Dr Wright’s figures are optimistic in a New Zealand context; however, even if you use these optimistic figures, the operating costs of a closed containment system is double NZ King Salmon’s current operating costs for seafarms.

353. In February 2011 at the Seafood Summit in British Columbia, a panel discussion on closed containment systems was attended by major industry players, who conceded that these systems would have a role to play in the future of aquaculture. As such, there may come a day when closed containment systems are considered economically viable in New Zealand; however NZ King Salmon do not consider this method an option for the foreseeable future.

CONCLUSIONS

354. This report has provided an overview of NZ King Salmon operations. The intent is that it has provided the reader with a good understanding of the rationale and processes undertaken to support the plan change application, as well as providing detailed information on NZ King Salmon’s farming processes and associated management practices.

355. NZ King Salmon is the pre-eminent producer and global marketer of King Salmon. The qualities of this fish are increasingly recognized by global consumers, chefs, restaurateurs and nutritional professionals as being advantageous. NZ King Salmon has seen high demand growth rates over the last eight years and the company has reached production capacity, with substantial compounding opportunity foregone.

356. NZ King Salmon has projected growth; targeting northern hemisphere markets and Asia for increasing demand, incorporating moderate price inflation and equally a modest move towards value added products, which is a key plank in the company’s strategy.

357. NZ King Salmon recognises that timelines portrayed in this report may accelerate or be slowed down by the challenges of implementation and equally a need to ensure that production growth doesn’t exceed the expected rate of demand growth. To the contrary, the company expects that demand will always be slightly ahead of our ability to supply, which will ensure that best market values are obtained and the rarity of the product along with the other attributes are continuously enhanced.

358. This application seeks to obtain the additional water space needed for growth of farming operations in the medium future to enable NZ King Salmon to meet customer demand.

359. Identifying appropriate sites has been a major exercise for the NZ King Salmon, who employed additional service and professional providers to ensure an inclusive community consultative process has occurred during the development of this application.

360. Through the consultation process and the various professional reports provided as part of this application, NZ King Salmon has also addressed concerns and perceptions raised about the impact of growth these new sites (indeed current sites as well) could have on the environment and community.
361. It is a key part of the company’s brand protection that the NZ King Salmon is seen to be a responsible steward of its farm sites in what is otherwise publicly owned waterways. It embraces and leads best practice in these areas. Not only is its practice an important surety for the growing awareness of consumers regarding ecological effects but there is a simple truth that such practices augment the grow-out performance and quality of the salmon. This is an important economic driver which in turn provides the resources for expansion and returns. Without this approach the company would be unsuccessful.

362. This application signals a major watershed in the growth of aquaculture in New Zealand. It will result in significant investment, export growth and community involvement, beyond any alternative commercial development.
APPENDICES
APPENDIX 1: NZ KING SALMON ENVIRONMENTAL POLICY
ENVIRONMENTAL POLICY

The New Zealand King Salmon Co. Ltd

AQUACULTURE OPERATIONS

Including Marlborough Sounds Sea Farms, Golden Bay Hatchery and Canterbury Hatchery

Approved by NZKS Board 2011
CONTENTS

Section 1: Vision and Purpose

1.1 Environment Objectives

Section 2: Organisational Structures

2.1 Environmental Management in the organisation structure

2.2 The Executive Environment Management Committee (EEMC)

2.3 Aquaculture Management Group (AMG)

Section 3: Environment Reporting Procedures

3.1 Standard Operating Procedures review

3.2 Emergency response

3.3 Non Compliance

3.4 Environmental Management Plan

3.5 Changes to Environment Policy

3.6 Environmental Policy Review

Section 4: Supporting Documents

4.1 Annual Reviews

4.2 Chart – King Salmon Aquaculture Environmental Organisational Structure

Approved by NZKS Board 2011
Section 1: Vision and Purpose

Environmental Vision:

New Zealand King Salmon (King Salmon) will actively demonstrate the concepts of environmental sustainability in the local and global environment.

Purpose:

This policy defines the environmental obligations of the Company and considers how implementation of the policy should occur. The environmental policy is consistent with the Company’s strategic plan and will enhance King Salmon’s place as a world leading salmon producer. Commitment to this environmental policy will be met by demonstrating leadership in applying environmentally responsible practices for the purposes of sustainability.

1.1 Environmental Objectives

The environmental objectives are a commitment to:

- implementing sustainable and environmentally sound business practices using our LEAN programme.
- working in harmony with our unique environment.
- meet the requirements of the relevant legislation and the NZ Salmon Farmers Association Environmental Code of Practice.
- continuous improvement to strive for world class environmental standards.
- organisational and personal ownership of this environmental policy.
- ensuring that King Salmon’s environmental ‘footprint’ is well managed.
- the principles and implementation of sustainability and environmental awareness.
- providing corporate leadership and environmental awareness.

Section 2: Organisational Structure

The environmental management of Sea Cages and Freshwater farms is dependent upon the following working together effectively:

- Company structure (personnel including staff, contractors and suppliers),
- Executive Environmental Committee (EEMC), and
- Aquaculture Management Group (AMG).

2.1 Environmental Management in the Organisational Structure

Within the company structure there is accountability for the environment at each level. Due to the nature of the operation this direct responsibility is the job of the Board and all staff through each level of the organisation.

To maintain environmental management of King Salmon aquaculture operations each role must fulfil the following responsibilities. Board of Directors must:

- appoint EEMC members,
- review the Environment Manager’s report,
- review EEMC reports,
- evaluate the CEO on environmental performance, and
- evaluate EEMC to ensure it is achieving its functions.
CEO must:

- be accountable to the Board,
- oversee and support the General Manager Aquaculture and Aquaculture Management Group in maintaining and improving environmental management systems that meet or are better than current accepted practice standards,
- maintain an Environmental Risk Management Plan,
- report on non compliance in respect of the policy, and
- foster an environmentally aware culture throughout King Salmon aquaculture operations and the wider organisation.

General Manager Aquaculture must:

- be fully responsible for the environmental management of the aquaculture operations,
- oversee and support staff and farm managers to operate at the relevant current accepted practice standard through annual review and regular appraisal,
- implement continuous environmental improvement, and
- foster a positive environmental culture.

Environmental Manager must:

- conduct environmental meetings,
- oversee incident reporting, and analysis,
- review and update Standard Operating Procedures (SOPs),
- oversee compliance with SOPs,
- implement continuous environmental improvement,
- foster a positive environmental culture,
- co-ordinate and process recommendations from environmental audits and reports,
- maintain Environmental Emergency Response Procedures,
- attend EEMC meetings,
- provide environmental reports to the Board, and
- provide environmental meeting (AMG) minutes to EEMC.

All of the Managers have a role in the environmental management of their operation. The Seawater Operations Manager and Seafarm Managers however, have a larger role in the daily operations.

Seawater Operations Manager must:

- oversee Seafarm and Harvesting Managers to ensure compliance with regulations and SOPs,
- implement continuous environmental improvement, and
- Immediately report any breaches of SOPs.

Seafarm and Harvesting Managers must:

- oversee that staff, contractors and suppliers have access to equipment and information to ensure compliance with regulations and SOPs,
- implement continuous environmental improvement, and
- Immediately report any breaches of SOPs.

Approved by NZKS Board 2011
Staff, contractors and suppliers must:

- develop and maintain the currently accepted standard of skills and qualifications,
- work within Standard Operating Procedures (SOPs),
- implement continuous environmental improvement,
- report all environment related incidents, and
- attend or read minutes of all environmental meetings.

2.2 The Executive Environmental Management Committee (EEMC)

2.2.1 Function

The EEMC is a sub-committee of the Board and its purpose is to ensure compliance with the Environmental Management System by (including, but not limited to):

1. reporting to the Board on environmental matters,
2. reviewing reports on all breaches to SOPs,
3. approving new SOPs or changes to existing SOPs,
4. overseeing schedule of regulatory reports and audits,
5. monitoring advances in technology that would improve environmental performance, and
6. arranging for the review of any environmental matter referred by the CEO, farm managers or other appropriate parties

2.2.2 Composition

The chair and sub-committee are appointed by the Board.

The skill base of EEMC should cover the areas of expertise listed below. When skills or experience are not present then EEMC has a duty to seek advice from external experts.

1. CEO (Chair) } Ex officio member
2. General Manager Aquaculture } Ex officio member
3. Environmental Manager } Ex officio member
4. Current external relevant Environmental Scientist
   A further external appointment may be required in the future.

Note:

1. A quorum of three of which two must be non ex officio members is required.
2. The Chairperson has the duty to co-opt when expert advice is required.

In addition to the above listed positions the EEMC may retain additional external specialists to advise the committee when necessary.

The specialists are not required to attend EEMC meetings but are required to review all reports and minutes to provide their expert opinion where appropriate.

Approved by NZKS Board 2011
2.2.3 Terms of EEMC members
The Board will appoint non executive EEMC members for a two year term.

2.2.4 EEMC Operating Procedures
1. EEMC will meet four times per year.
2. The committee will regulate its own meeting procedures.
3. Meetings and decisions will be minuted.
4. The EEMC Chair will report to the Board after each meeting.

2.3 Aquaculture Management Group (AMG) Function
A committee of Salmon farm staff whose purpose is to manage the environmental SOPs in accordance with regulations and legislation.

2.3.1 AMG composition
- Environmental Manager – Committee Chair
- General Manager Aquaculture
- Seawater Operations Manager
- Freshwater Operations Manager
- Harvest Manager
- Operations & Contracts Manager
- Process and Facilities Manager

2.3.2 AMG Operating Procedures
1. AMG will meet quarterly to review any environmental reports and audits.
2. AMG will oversee that reports have been addressed.
3. The AMG meeting minutes will be made available to all staff.
4. A staff representative will be identified and is required to participate in AMG meetings.
5. All meetings and decisions will be minuted.

Section 3: Environmental Reporting Procedures
3.1 The Environmental Manager will review the SOPs annually, and provide a report on that review to EEMC.
3.2 The Environmental Manager will maintain Environmental Emergency Response Procedures for the aquaculture facilities and review annually.
3.3 The Environmental Manager will report any non compliance to the Policy or SOPs.
3.4 The CEO will maintain an Environmental Management Plan that defines media protocol.

Approved by NZKS Board 2011
Changes in the Environmental Policy

3.5 Changes to the Environmental Policy will be approved by the Board.

3.6 The Environmental Policy will be reviewed annually and updated as necessary.

Section 4: Supporting Documents

4.1 The Environmental Manager or designate, will schedule the following documents for annual review:
- King Salmon Sea Cage and Freshwater Standard Operating Procedures (SOPs)
- NZ Salmon Farmers Association Finfish Aquaculture Environmental Code of Practice
- Farm audits
- Cawthron environmental reports

4.2 Chart: King Salmon Aquaculture Environmental Organisation and Structure

Diagram showing the organisational structure:

- Board of Directors
- Chief Executive Officer
- General Manager Aquaculture
- Environmental Manager in conjunction with other Managers
- Seafarm Managers
- Staff, contractors and suppliers

Executive Environmental Management Committee (EEMC)

Strategies
- Staff Training
- Standard Operating Procedures
- Environmental Audits
- AMG

Approved by NZKS Board 2011
APPENDIX 2: NEW ZEALAND SALMON FARMERS ASSOCIATION FINFISH AQUACULTURE ENVIRONMENTAL CODE OF PRACTICE
NEW ZEALAND
SALMON
FARMERS
ASSOCIATION INC

FINFISH
AQUACULTURE
ENVIRONMENTAL
CODE OF PRACTICE

The Salmon Farmers Association Inc.
C/o Chairman
New Zealand King Salmon Company Limited
10-18 Bullen Street, Tahunanui
PO Box 1180
Nelson, New Zealand
Tel: +64 3 548 5714   Fax: +64 3 548 6993
Email: contact@kingsalmon.co.nz
# CONTENTS

1.1 Document Distribution List 3
1.2 Document Amendment Record 3

## Part 2  Introduction
2.1 Purpose 4
2.2 Scope 4
2.3 Industry and Company Overview 4
2.4 Company Environmental Policy 4
2.5 Guidance for Using the COP 5

## Part 3  Legislation
3.1 Regulatory Overview 6
3.2 Consents and Licences 7

## Part 4  Aquaculture
4.1 Farm Development and Structures 8
4.1.1 Site 8
4.1.2 Structures 9
4.1.3 Services 11
4.1.4 Tangata Whenua 11
4.2 Operations 10
4.2.1 Fish Stocks 10
4.2.2 Hatchery 11
4.2.3 Husbandry/fish resource 11
4.2.4 Fish health and management of disease and mortalities 13
4.2.5 Feed and feeding 14
4.2.6 Harvest 15
4.2.7 Fish Transport 16
4.2.8 Chemical and toxic substances management 17
4.2.9 Effects on the seabed and water quality 18
4.2.10 Marine mammals and other wildlife 19
4.2.11 Waste management 20
4.2.12 Fuel 21
4.2.13 Services 22
4.3 Emergency Events 23
4.3.1 Emergency response plan 23
4.3.2 Evacuation plan 24
4.3.3 Exotic disease 24

## Part 5  Training and Communication 25

## Part 6  Audit, Review and Continuous Improvement 26
PART 1
DOCUMENT CONTROL PROVISIONS

This Code of Practice has been developed by, and remains the property of, The New Zealand Salmon Farmers Association. This document may not be copied or reproduced without consent. The document has been prepared for use by member companies.

1.1 DOCUMENT DISTRIBUTION LIST

The Environmental Code of Practice is issued to the following personnel:

<table>
<thead>
<tr>
<th>Manual</th>
<th>Company / Manual Holder</th>
<th>Manual Held By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>NZSFA</td>
<td>Mark Gillard</td>
</tr>
</tbody>
</table>

1.2 DOCUMENT AMENDMENT RECORD

The Environmental Code of Practice is issued to the following personnel:

<table>
<thead>
<tr>
<th>Issue Date</th>
<th>Version No.</th>
<th>Summary of Amendment</th>
<th>Authorisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Nov 2007</td>
<td>1</td>
<td>First Issue</td>
<td></td>
</tr>
<tr>
<td>22 Dec 2009</td>
<td>2</td>
<td>Second Issue</td>
<td></td>
</tr>
</tbody>
</table>
PART 2
INTRODUCTION

2.1 PURPOSE

This Code of Practice has been developed by the New Zealand Salmon Farmers Association, with support from the Seafood Industry Training Organisation. Each member of the Association agrees to comply with this Code of Practice.

The Code of Practice is intended to provide a suite of standards and guidelines which form the basis of best practice for environmental management of company operations, with regard to the legislative requirements under the Marine Farming Act 1971 and the Resource Management Act 1991 and the principles of sustainable use of the environment.

The Code of Practice is expected to evolve over time, incorporating new knowledge, research results, regulations and management practices as they arise.

2.2 SCOPE

This code of practice applies to the New Zealand Salmon Farmers Association farming member’s aquaculture activities. It is limited to procedures that impact on the environment.

2.3 INDUSTRY OVERVIEW

New Zealand is the largest producer of Chinook or Pacific King Salmon (Oncorhynchus tshawytscha) in the world. Production volumes are approximately 8,500 mt, which is approximately 60% of the world’s production of farmed king salmon.

New Zealand salmon aquaculture activities cover sea cage rearing in the Marlborough Sounds, Akaroa Harbour and Stewart Island, various fresh water pond and cage rearing operations, and hatcheries throughout the South Island.

2.4 ENVIRONMENTAL POLICY

The association is committed to sustainable use of the environment and to act as a guardian of the water and land space it occupies; it has adapted management practices over the years to ensure this. Because the association activities do involve environmental effects, it is important to ensure that these effects are identified and monitored, and where these cannot be avoided they are mitigated and remedied.
2.5 GUIDANCE FOR USING THE COP

The Code of Practice (COP) is sectioned, with each section providing an initial Guidance statement, followed by a description of the Standard required. Company Procedures should be provided where available to specify company documents and records that support the implementation of the procedures in practice.

**Guidance**  This is an initial statement of principal, intent and explanation, written in bold. These principals are the achievable goal set by the company to meet environmental best practice, but are not auditable.

**Standard**  The required standard is stated. Where a standard is stated as “shall” or “must”, the company must comply with the minimum standard. Where “should” is used, this is a recommendation to be implemented where possible in order to achieve best practice.

**Procedures**  Procedures are currently implemented within the company at different levels. Some practices are informal; others are documented and embedded in day-to-day management of the operation. Where a procedure is supported by company documents, formally monitored and with records to verify it, then this information is provided in the COP. It is intended that formalisation of COP procedures will occur over time.
PART 3
LEGISLATION

The purpose of the legislation is to promote sustainable management of the natural and physical resource. Sustainable management requires avoiding, remedying or mitigating any adverse effects of activities on the environment.

3.1 REGULATORY OVERVIEW

The overarching legislation regulating marine aquaculture in New Zealand is the Aquaculture Reform Bill, enacted 1 January 2005 and repealing the Marine Farming Act 1971. The Bill provides the main tool for managing aquaculture space, and makes provision for the enabling legislation under the Resource Management Act 1991.

The Resource Management Act (RMA) came into force on 1 October 1991, with the intention of streamlining and simplifying the environmental management of the land, air and water under a single law.

Under this legislation, Aquaculture Management Areas (AMAs) are created, initiated either by regional councils, invited private plan change or by standard private plan change. Within these areas resource consents may be granted for aquaculture activities by the Regional Councils acting under the Resource Management Act.

Other key legislation which impacts on marine aquaculture, and is part of the consent process, includes but is not limited to:

(a) The Fisheries Act
Assessment by the Ministry of Fisheries to determine if a proposed aquaculture management area would have undue adverse effect on existing fisheries

(b) Biosecurity Act
Consideration of any potential biosecurity risks from the activity, (e.g. introduction of exotic species, potential disease vector, accidental release)

(c) Hazardous Substances and New Organisms Act
(d) Marine Mammals Protection Act

In addition to the Resource Management Act, freshwater aquaculture is also covered by the Freshwater Fish Farm Regulations administered by the Ministry of Fisheries.

The Animal Welfare Act 1999 must be complied with when rearing all animals including fish.
The Resource Management Act also governs the resource consents which are required for food processing activities by the Regional Councils.

Despite the Resource Management Act’s all-embracing intentions, it is not New Zealand’s only environmental legislation. Other legislation also relates to climate change, energy efficiency, land, minerals and other resources, as well as land administered by the Department of Conservation including national parks and reserves. Under the Local Government Act 2002, many councils pursue a wide variety of environmental initiatives e.g., recycling, development of work programs and establishing programs for protecting native bush or wetlands. The Local Government Act also provides councils with an ability to enact bylaws covering activities such as public health, the use of roads, drainage and sanitation.

### 3.2 CONSENTS AND LICENSES

Under the current system aquaculture may only occur within a designated Aquaculture Management Area (AMA). If an area is not designated, then it is possible to apply for a plan change for re-designation for the area as an Aquaculture Management Area.

To carry out an aquaculture activity (marine farming) within a designated AMA a Resource Consent under the Resource Management Act is required. The Consent authorises the occupation of a coastal marine area for the purpose of a specified aquaculture activity. The specific Resource Consent provided for the activity of marine farming is a Coastal Permit. This provides the consent that applies to the Company’s activities, including structures consent, disturbance of the seabed, discharge and consent to carry out the farming activity.

For freshwater farming, including onshore marine farming, a Freshwater Fish Farm Licence is required under the Freshwater Fish Farm Regulations along with relevant resource Management Consents such water take, use, dam and discharge, etc.

Processing plants are required to comply with regional authority regulations, requiring resource consents for discharge, building consents for structures, and any other applicable by-laws. In addition, registration of a Risk Management Programme is required under the Animal Products Act 1999 for factories involved in primary processing or export of fish and fish products.

All operations are required to comply with regional authority regulations, requiring resource consents for discharge, building consents for structures, and any other applicable by-laws.
PART 4
AQUACULTURE

Marine and freshwater aquaculture activities shall be carried out so as to avoid, remedy or mitigate any adverse effects on the environment.

4.1 FARM DEVELOPMENT AND STRUCTURES

4.1.1 Site

Farms sites and design are chosen to meet regulatory requirements, and to minimise the environmental impact.

4.1.1.1 The Company shall comply with the Resource Management Act in the development of aquaculture sites.

4.1.1.2 If a project relates to new developments, activities, products or services, approved environmental management practices shall be applied to each project. Consideration should be made of the environmental impact, and attempts made to minimise the environmental effects of the work activity.

4.1.1.3 Prior to expansion of any marine site or addition of new marine structures, an assessment of the seabed beneath and adjacent to the proposed change shall be undertaken.

4.1.1.4 Prior to selection or expansion of any freshwater or hatchery site, consideration and assessment of freshwater availability and quality shall be undertaken.

4.1.2 Structures

Structures and equipment used at facilities should be as unobtrusive as possible. They should be designed, constructed, installed, and maintained to be fit for purpose, capable of dealing with the weather and other environmental conditions likely to be experienced on the site, to minimise interference with the natural environment and other uses of the body of water and to ensure the containment of farm stocks.

4.1.2.1 The Company shall obtain the required consents prior to structures being placed on the site.

4.1.2.2 The design, construction, installation and maintenance of structures and equipment shall be done so as to:
a) be capable of the function it was designed for
b) minimise visual alteration to or obstruction of the landscape
c) minimise the impact on the environment and wildlife
d) be capable of dealing with floods in the case of tank, raceway and pond systems
e) be capable of dealing with the weather and other environmental conditions likely to be experienced on the site
f) ensure the containment of farm stocks.

4.1.2.3 Management should ensure that critical structures and equipment are designed to withstand the conditions expected in its geographical location. Specific requirements include:
   a) mooring systems for marine farms shall be fit for purpose
   b) pumps and generators in hatcheries shall be capable of continuous provision of water.

4.1.2.4 Specifications and other design records for critical structures and equipment, including moorings, anchors, cages and nets shall be documented and recorded.

4.1.2.5 The Company shall document and implement routine maintenance programs to ensure that the structures and equipment are maintained in a manner that assures operational, farm stock and environmental integrity. Maintenance records shall be maintained.

4.1.2.6 The Company shall document and implement regular inspections of structures and equipment to ensure they are sound and operating correctly. Maintenance records shall be maintained. Specific checks required include:
   a) regular inspections of moorings, anchors, cages and nets
   b) visual post-storm inspections of the above
   c) periodic mooring and anchoring inspections

4.1.2.7 The Company should be aware of, and consider implementation of, technological advances in aquaculture structures and equipment that may improve operations.

4.1.2.8 The Company shall have contingency plans to cover events where there is catastrophic damage to structures that could impact on fish containment or affect the environment (see Section 4.3 Emergency Events).
4.1.3 Services

Design and installation of services to new sites and facilities should consider use of best efficiencies and use of renewable resources.

4.1.4 Tangata Whenua The company shall recognize and provide for the relationship of Maori to their culture and traditions with their ancestral lands, waters, sites, waahi tapu and other taonga.

4.2 OPERATIONS

4.2.1 Fish Stocks

The source of stock should not cause an unacceptable biosecurity risk.

4.2.1.1 Broodstock and smolt are sourced from New Zealand fish stocks to minimise any potential environmental impact in the event of escape.

4.2.1.2 There are risks to fish health in New Zealand from imported marine and freshwater fish from any source. Consignments of live fish, ova or milt into New Zealand are not currently permitted. For the regulatory requirements to change to permit this, a risk assessment in association with the regulatory authority shall be undertaken, and the import can only take place if the risk is acceptable. In addition, any importation must meet current regulatory requirements and have the required assurance or certification to ensure that the stock is free from relevant pathogens.

4.2.1.3 The Company shall not use transgenic or other genetically modified salmon as broodstock for production purposes.

4.2.1.4 Sex-reversal and triploidy shall be carried out in strict accordance with industry and Company codes of practice.

4.2.1.5 Breeding programs should employ established and scientifically sound procedures.

4.2.1.6 Positive support for angler and other existing salmon enhancement programmes should be promoted and provided where possible.
4.2.2 Hatchery

Hatchery breeding and rearing programs should provide healthy, sustainable stocks for the company.

4.2.2.1 Hatchery breeding and rearing programmes shall be managed by documented systems.

4.2.2.2 Genetic diversity and management of inbreeding to maintain genetically healthy and viable stocks shall be achieved without genetic engineering.

4.2.2.3 The company shall recognize and adhere to approved biosecurity practices.

4.2.3 Husbandry / Fish Resource

Fish management and husbandry have direct impact on the integrity of the surrounding environment. Poor management practices including overstocking and fish escapes have the potential to cause build up of organic waste, and disruption of local ecosystems.

4.2.3.1 The Company shall comply with all conditions stated in their farm consents.

Containment

Effective containment of fish in freshwater and marine sites limits the potential effect of escaped fish on natural populations.

4.2.3.2 Tank and pond systems shall be designed to contain fish effectively, including provision for containment during periods of flooding.
   a) Both inflow and outflow shall be screened to prevent passage of fish.

4.2.3.3 Marine sea-cages, nets and other structures holding salmon shall be designed and constructed so as to be capable of dealing with the weather and other environmental conditions likely to be experienced on the site (Section 4.1).
   a) The mesh size and gauge shall be sufficient to contain the smallest fish in the cage’s population.

4.2.3.4 Screens for inflow/outflow in ponds and tanks, and nets in sea cages should be inspected regularly for holes or fouling, and records of this inspection held. Remedial action should be taken immediately to rectify any unsatisfactory situation.
Fish procedures such as grading, transfers and harvesting, which can increase the risk of escape, should be:
   a) planned
   b) supervised
   c) and follow company procedures.

Any incidence or occurrence that did, or could have, led to an escape shall be recorded.

There should be a site-specific plan that describes actions to be taken in the event of any mass escapes (Section 4.3.1).

**Stocking**

Farm management practices of stocking density are highly effective in controlling the magnitude of seabed impacts, as well as having a significant impact on fish health and welfare.

The Company shall maintain rearing conditions to provide for good animal welfare.

The Company shall maintain stocking densities to maximum biomass targets, and shall regularly monitor and record cage, tank, raceway and pond biomass.

Stocking densities should be monitored in relation to water quality, and action taken when water quality falls outside limits specified in consents, or acceptable to fish health.

Before stocking or re-stocking:
   a) nets/ponds/raceways should be examined for holes prior to fish release
   b) staff should follow procedures to ensure no fish escape (Section 4.2.7).

**General Fish Husbandry**

On a daily basis (weather and unforeseen circumstances permitting), the following should be inspected, monitored, and recorded on the farm site:
   a) fish behaviour for signs of stress or other abnormalities
   b) integrity of the structures and equipment
   c) environmental factors
   d) feeding behaviour
   e) presence or absence of predators.

Remedial action should be taken immediately to rectify any unsatisfactory situation.
4.2.3.14 All fish movements onto the farm site and from cage to cage or raceway to raceway shall be recorded for destination, fish age and date of shift.

4.2.4 Fish Health and Management of Disease and Mortalities

A preventative approach to disease in salmon uses management techniques and routine monitoring of fish health and mortality by personnel trained in the recognition of disease.

4.2.4.1 The use of authorised veterinary medicines and other approved treatments to prevent disease, or to treat disease symptoms, is not current practice at any NZSFA farms but may in the event of a disease threat or outbreak be required to be implemented. Its use at hatcheries is strictly limited to the prevention or treatment of diseases in eggs and juvenile salmon, and always in strict accordance with veterinary instructions.

4.2.4.2 Preventative techniques of disease management using natural alternatives (diet, stocking, temperature) without treatments are to be used wherever practicable.

4.2.4.3 Every farm/hatchery shall undergo once yearly assessment for the disease status of fish. The hatchery disease status assessment should cover current (e.g., spawning stock) and future (smolt prior to transfer) populations. The agent should be a certified pathologist and the assays should be conducted using approved/accepted procedures.

4.2.4.4 Movements between farms, and other farm practices, shall adhere to any regulatory or voluntary Industry or Company Codes of Practice for the management of disease vectors (section 4.2.7).

4.2.4.5 Passive transmission of infectious agents should be minimised by:
   a) structures designed to exclude birds and other animals (section 4.2.10)
   b) good hygiene routines in handling mortalities.

4.2.4.6 All fish stocks shall be routinely monitored for early signs of stress, behavioural changes, abnormalities and disease.

4.2.4.7 Farms should have procedures to ensure staff notify the manager responsible immediately on suspicion of abnormalities or disease.

4.2.4.8 Mortalities should be regularly removed at least twice a week; daily removal is optimal (weather permitting). Mortalities shall be counted and recorded. The likely cause of death should be recorded by a suitably trained person.
4.2.4.9 Mortalities shall be disposed of in a way that shall not cause hazard to other stocks, wildlife or human health (section 4.2.11).

4.2.4.10 Where problems are identified during recovery of mortalities, or other monitoring, action shall be taken promptly to identify the cause and take remedial action, in consultation with a veterinary surgeon or other expert when appropriate.

4.2.4.11 Farm staff as required shall be trained in the recognition of fish health problems. There should be a trained staff member on site during normal working hours.

4.2.4.12 Each farm should have access to a fish pathologist experienced in fish health to advise on fish health matters and who is available to provide advice at short notice in case of disease. Veterinary examinations to determine the cause of epizootics should be made where there are abnormal, unexplained mortalities.

### 4.2.5 Feed and Feeding

**Proper feed composition and feed administration systems help to protect the environment by minimizing feed wastage.**

#### Feed Composition

4.2.5.1 Fish feed raw material should be sourced from sustainable fisheries such as the closely managed fisheries of Peru and Chile. The utilisation of alternative, sustainable raw materials in feeds should be optimised.

4.2.5.2 The Company should obtain written assurances from their feed suppliers that the feeds supplied to them:

   a) do not contain any contaminants in excess of the regulatory limits

   b) do not contain any antibiotics, vaccines and steroids (excepting where required to manage disease under conditions in the ECP Section 4.2.4)

Where this information is not provided, The Company should request the information.

4.2.5.3 Feed specifications and composition shall be documented and available at the Company.

4.2.5.4 Feeds shall be formulated specifically for the species, environment, feeding systems, and the life stage of the species that are being fed.
4.2.5.5 There should be on-going assessment and review of feed suppliers and feed types which include consideration of changes that may reduce environmental impact (e.g. improved efficiencies, reduced wastage).

4.2.5.6 Feed storage and delivery systems shall be secure, and properly designed and maintained to:
   a) prevent spoilage and contamination;
   b) prevent avian and wildlife access;
   c) be protected from the environment and any other contaminants;
   d) maintain feed integrity
   e) prevent catastrophic loss (e.g., feed bag/hopper falling into the sea).

**Feeding**

4.2.5.7 The Company shall have a feed administration and management system. This should include, but not be limited to, guidance on:
   a) correct feeds and feed sizes for the fish
   b) how to deliver the correct amount of feed, in the proper manner, at the correct time of day
   c) how to monitor the effectiveness and other key points of feeding
   d) how to monitor feed use
   e) how to monitor and prevent feed wastage
   f) non-compliance procedures

4.2.5.8 All staff involved in feed delivery shall undergo relevant training.

4.2.5.9 Staff shall feed to established feeding protocols and feed regimes. Feeding regimes should be calculated and followed, which include in their calculation minimal wastage and levels which will not cause adverse environmental effect.

4.2.5.10 Staff should monitor and record feeding behaviours in order to review feed management and delivery in response to any changes or abnormality.

4.2.5.11 Staff shall have procedures to record feed non-compliance and other issues.

**4.2.6 Harvest**

4.2.6.1 The Company shall maintain and comply with harvest procedures.

4.2.6.2 Procedures shall be in place to ensure there are no fish escapes.
4.2.9.1 Waste shall be collected and disposed of in an approved manner (Section 4.2.11), including:
   a) Blood and effluent from harvest should be contained, collected and disposed of in an approved manner.
   b) Mortalities shall be collected, identified, and disposed of in an approved manner (Section 4.2.4).

4.2.6.3 Harvest bins should be leak-proof and have well fitting lids.

4.2.6.4 Vessels carrying harvest bins should be in good repair, having contingency plans for poor weather and ensuring harvest bins are properly loaded and secure.

4.2.7 Fish Transport

Fish transport should safely transfer fish, while ensuring fish welfare is maintained and mortalities are minimised and that the environment is protected against any waste discharge or escaped fish.

4.2.7.1 Vessels and equipment used for transport, whether on land or water, shall be designed and maintained to safely load, hold, and transport farm stock, and to ensure containment of transport water and fish. They shall be equipped with suitable monitoring equipment to maintain standards during transport.

4.2.7.2 The Company shall obtain Ministry of Fisheries approval for transfer between farms prior to transport. The Ministry of Fisheries authorisation for fish and egg transfer is required under regulations 18 and 22 of the Freshwater Fish Farming Regulations 1983 and Section 26ZM.2 of the Conservation Act 1987

4.2.7.3 A written procedure shall be constructed for transporting fish. This procedure shall include environmental standards for transport conditions, fish standards for transport, equipment requirements, water preparation and quality, provisions for preventing fish loss or stress, and for discharge of transport water and other organic waste.

4.2.7.4 The Company should:
   a) Check on the day of transport to ensure all fish are healthy and to minimise the risk of spread of disease, stress and mortality
   b) Assess fish, equipment and water quality prior to and during transport
   c) Initiate remedial action to immediately rectify any unsatisfactory situation
   d) Maintain written records of these checks.
4.2.7.5 Transporters shall have suitable emergency response equipment on hand for containing fish. All vessels and vehicles transporting live fish shall have on board company contact phone numbers for reporting unusual or emergency events.

4.2.7.6 Records of fish death or injury during transport shall be maintained, and the cause of death determined by a competent person. Mortalities should be disposed of per farm procedures (section 4.2.11)

4.2.7.7 There should be post-transfer monitoring of fish condition to determine transport effects, and these checks should be recorded.

4.2.7.8 Data from transport monitoring should be used to make improvements / changes in procedures

4.2.7.9 Transport water and other waste should not be discharged into natural water courses such as streams or ponds that are outside of the farm/hatchery boundaries. Hatchery or freshwater farm water supplies shall be tested under Biosecurity NZ guidelines for the absence of Didymo prior to that water being used for transporting fish.

4.2.8 Chemical and toxic substances management

Chemicals used on farms can have an environmental impact through low level residue effects, or through spillage or other accident.

4.2.8.1 Use of chemical treatments and other compounds on farms shall be minimised.

4.2.8.2 Any chemicals used shall be approved, and be used according to the manufacturer’s instructions by trained staff. The Company should obtain and maintain records of data and other evidence to ensure any chemicals used on-site are:
   a) suitable for use
   b) will not cause direct harm to the environment or other wildlife.

4.2.8.3 Consideration should be made of the environmental impact of these compounds prior to use, including the risk of residues. Wherever possible natural alternatives to chemicals should be selected, or alternatives that minimise any environmental affect.

4.2.8.4 Where possible farm structures in contact with water should not be treated with chemicals.
4.2.8.5 Feed used by The Company should not contain any antibiotics and vaccines, steroids (excepting where required to manage disease under conditions in section 4.2.4).

4.2.8.6 The use of any chemicals for spawning, breeding or hatchery programmes shall be carried out in strict accordance with veterinary instructions and company protocol.

4.2.8.7 The Company should continue to investigate alternatives to chemical use on site.

4.2.8.8 All chemical discharges are prohibited unless permitted under Resource Management Act or unless authorised chemicals are being used to provide for fish health and welfare.

4.2.8.9 The Company shall have an action plan in the event of chemical spillage.

4.2.9 Effects on the Seabed, Riverbed and Water Quality

Seabed effects from the intensive sea cage rearing of salmon result directly from the sedimentation of organic wastes (fish faeces and uneaten salmon feed) which can alter the chemistry and ecology of the seafloor sediments, flora and fauna. Riverbeds can similarly be affected by organic wastes from hatcheries. The discharge of dissolved nutrients into the water raises issues of changes in water quality, particularly with regard to phytoplankton and microalgae enrichment, and in the sea water algal blooms. Feed and fish management techniques that minimise this impact should be followed, in conjunction with an environmental monitoring programme which monitors the water and seabed and riverbed impact.

Seabed Effects

4.2.9.1 The Company shall meet their resource consent conditions by developing and following an adaptive management (seabed environmental monitoring) programme. This programme shall be approved by the regulatory body.

4.2.9.2 The annual seabed environmental monitoring programme described above shall be carried out by a person with the appropriate expertise.

4.2.9.3 In addition to annual seabed monitoring, the Company should determine measurable indicators of nutrient enrichment in the water column and carry out regular monitoring of these.

4.2.9.4 Annual and regular monitoring programmes should document standards and thresholds.
4.2.9.5 If environmental thresholds have been exceeded as stated in consent or appear to be going to be exceeded, then action shall be taken to avoid, remedy or mitigate the impact, e.g., reduction in stocking densities, fallowing the site.

**Riverbed effects**

4.2.9.6 The Company shall meet their resource consent conditions at freshwater sites and hatcheries.

4.2.9.7 The monitoring programme described above shall be carried out by a person with the appropriate expertise.

### 4.2.10 Marine Mammals and Other Wildlife

Fish farming should minimise the interaction and disruption between farm stocks, farming activity, and wild fauna.

4.2.10.1 All efforts should be made to minimise effects on adjacent habitats as a result of the activities of a farm.

4.2.10.2 Where possible, the position, design and construction of farms should consider the interaction with wildlife, and the exclusion of predators at the planning stage (section 4.1).

4.2.10.3 Fish should be protected from predators. In protecting fish from predators, every effort should be made to use humane, non-destructive means. This is mandatory for marine mammals which are protected under the Marine Mammals Protection Act 1978, administered by the Department of Conservation.

4.2.10.4 Preventative measures to reduce conflict between the farm are to be implemented to cover:
   a) exclusion of birds
   b) exclusion of seals and other marine mammals

4.2.10.5 These deterrents may include, but are not limited to:
   a) predator netting
   b) specialized weighting
   c) coated and treated nets, using treatments that will not have a toxic environmental impact
   d) bird netting
   e) proper husbandry
   f) electric fences
   g) authorized live trapping and relocation of seals. All measures to exclude seals must be approved by DOC.
4.2.10.6 In the design and operation of nets all measures should be taken to minimize risk of entanglement of marine mammals and other wildlife.

4.2.10.7 All personnel handling seals **shall** hold the relevant unit standards.

4.2.10.8 The Company **shall** report any accidental ensnarement of marine mammals to DOC without unnecessary delay.

4.2.10.9 Records of losses to predators, and of deaths or injury to marine mammals and other wildlife should be kept.

### 4.2.11 Waste Management

Management techniques should be used to minimize inorganic and organic waste. Waste materials should be gathered, and disposed of according to regulatory and Company requirements.

4.2.11.1 Where applicable, The Company **shall** obtain all resource consents for any wastes under the Resource Management Act.

4.2.11.2 All waste material shall be collected on-site.

4.2.11.3 All collected waste **shall** be stored in leak proof, vermin proof and covered containers.

**Inorganic Waste and Shoreline Clean –Up**

4.2.11.4 The Company **shall not** discharge any inorganic waste material such as garbage, used nets, and equipment directly into the natural environment.

4.2.11.5 All inorganic waste collected **shall** be returned to shore for disposal at approved landfill or by other legal means.

4.2.11.6 Staff should regularly clean up each site and the surrounding shoreline within 1 kilometre of the marine farming operations, including all litter whether from the fish farm or not.

4.2.11.7 A recycling policy should be implemented wherever practical. Recyclable materials will be sorted and sent to the appropriate facilities.

4.2.11.8 Redundant equipment should be salvaged and bought back to shore for re-use or re-cycling.
Organic Waste

4.2.11.9 The Company will support farm management practices and initiatives that will minimize organic waste input into the marine and freshwater environment including:
   a) Feed management strategies, including improved feed quality (section 4.2.5)
   b) Appropriate husbandry techniques (section 4.2.3)
   c) Appropriate site selection (section 4.1.1)
   d) Water treatment for hatchery / freshwater farm discharge
   e) Investigate use of mortalities rather than dispose in landfill.

4.2.11.10 Company sea farms should dispose of mortalities onshore. Large scale mortality events may require resource consent prior to dumping. Freshwater farms will dispose of mortalities according to their freshwater fishfarm licence conditions. All attempts should be made to dispose of the mortalities so as to avoid adverse environmental effect.

4.2.12 Fuel

Fuel and oils should be transported and held securely to prevent spillage or pollution. Farms should have in place measures to minimise risks associated with fuel and oil spillage, and also to deal with emergencies in the event of spillage. The HSNO Act specifies minimum levels of compliance.

4.2.12.1 Vehicles carrying fuel oils shall be appropriately certified.

4.2.12.2 Any equipment that contains or uses fuel oils shall be:
   a) of sound construction
   b) have a secure air-tight lid on the fuel tank or storage vessel
   c) be secured to the structure on which it is placed in order to prevent spillage or tipping over
   d) comply with all HSNO requirements.

4.2.12.3 Fuel oil storage vessels should have full secondary containment and be bonded according with HSNO requirements.

4.2.12.4 Equipment containing or using fuel oils should be inspected regularly for leakage.

4.2.12.5 Used oils shall be disposed of per waste management procedures

4.2.12.6 The Company shall have an action plan in the event of fuel or oil spillage.
4.2.13 Services

Farms should be designed and operated to minimise the disturbance from their day-to-day operation to wildlife, mariners and the local community. Effort should be made to improve efficiencies in use of non-renewable services, such as power.

**Noise**

4.2.13.1 Wherever reasonably possible, noise from generators, pumps, feeding systems, and other equipment will be minimized through shielding, enclosure or by replacement with improved low-noise emitting equipment to avoid disturbance to wildlife, mariners and the local community.

4.2.13.2 Outdoor radios/music from farm sites shall not occur where they may cause a public nuisance.

**Lights**

4.2.13.3 Fish farms **shall** be lit in accordance with port authority requirements for marking a potential navigation hazard at night (Maritime Transport Act 1994). Hatcheries **shall** be lit for health and safety and security reasons.

4.2.13.4 Lights may be used in hatcheries as part of the salmon rearing cycle.

4.2.13.5 Glare from lights should be minimised to avoid disturbance to mariners and the local community.

4.2.13.6 All lighting should be installed and if required shielded to direct the light only to where it is required.

**Power**

4.2.13.7 Generator use **shall** be minimised and invertors used where possible.

4.2.13.8 Company systems and policies should minimise use of electricity generated by non-renewable resources such as petrol and diesel, and should endeavour to use renewable resources including biodiesel, solar and wind generation and small hydro.

**Water**

4.2.13.9 Water discharges **shall** be managed according to relevant RMA consents.
Sewage

4.2.13.10 There shall be no sewage discharge at the marine farm site.

4.2.13.11 Sewage discharges shall be collected in sealed tanks on accommodation barges and transported on shore for disposal in approved outlets.

4.2.13.12 Hatchery / freshwater farm sewage and grey water shall be managed in accordance with local regulations.

Visual

4.2.13.13 Farm sites should be kept clean and organized.

4.2.13.14 Colours for buildings should be chosen for their ability to blend into the background.

Odour

4.2.13.15 The Company should ensure that offensive odours that might arise from operations are strictly managed and minimised.

4.3 EMERGENCY EVENTS

Farms should have contingency plans for emergency events such as mass fish escape, serious storm damage, fire, flooding, and water quality challenges including algal blooms. Contingency plans should cover both welfare provisions for the fish stocks, and provisions for environmental and staff protection.

4.3.1 Emergency Response Plan

4.3.1.1 There should be adequate monitoring and communication systems to monitor weather and other warnings of events that could affect the farm.

4.3.1.2 Each farm site shall document company procedures for emergency response. This may but is not limited to include procedures to cover the following emergency events:
   a) mass fish escape
   b) oil or chemical spill
   c) fire
   d) flood
   e) severe storm
   f) tsunami
4.3.1.3 Each farm site **shall** train all staff in the emergency response plan.

4.3.1.4 Communication systems should be designed and maintained so as to be functional, or to have functional back-up in the event of any emergency.

4.3.1.5 Emergencies **shall** be reported to the relevant regulatory or emergency response body. This includes the reporting of any suspected pollution events to the Regional Council.

### 4.3.2 Evacuation Plan

4.3.2.1 Each farm site **shall** document a company procedure for farm evacuation. This will include procedures to move farm stock if required.

4.3.2.2 The Company **shall** conduct training in accordance with their written evacuation plan.

### 4.3.3 Exotic Disease/Pest Organisms

4.3.3.1 Wherever there is unusual or extreme mortality, parasites, predators or fouling of the farm, the Company should consider reporting it to Biosecurity NZ.

4.3.3.2 Six major pest species are identified currently in the “Keep our marine environment free from pests” document ([www.biosecurity.govt.nz](http://www.biosecurity.govt.nz)). Divers and managers should be familiar with the list and with the reporting procedures for new organism incidents as required by MAF ([www.maf.govt.nz](http://www.maf.govt.nz)).

4.3.3.3 The Company **shall** develop and maintain a policy to prevent the infestation and spread of *Didymo* in freshwater sites, and of *Didemnum* in seawater.

4.3.3.4 Managers **shall** be familiar with the notifiable disease provisions as described in ([www.biosecurity.govt.nz](http://www.biosecurity.govt.nz)).

4.3.3.5 In the event of exotic organisms being suspected or detected the company **shall**:
   a) notify the appropriate regulatory body
   b) follow the MAF Biosecurity Guidelines for Exotic Disease Control in the Aquaculture Industry
   c) comply with any requirements from the regulatory body
   d) cease movement of equipment or stock unless authorised by the regulatory body.
PART 5
TRAINING AND COMMUNICATION

5.1 Training

Staff training can lessen environmental impacts by maintaining standards set in environmental and associated codes of practice, and can prevent incidents resulting in environmental impacts.

5.1.1 The Company shall determine the level of experience, competence and training necessary to ensure the competence of personnel, especially those carrying out specialised environmental functions.

5.1.2 The Company shall have an employee training program, which should include structured employee training in the Code of Practice and other company specific procedures, as appropriate to each employee’s job description.

5.1.3 Training should be adequate to ensure that all employees have the competence to meet the standards of the Code and relevant government regulations, as is applicable to their job descriptions.

5.1.4 The Company should support on-going training and encourage employees to take advantage of external training opportunities, including:

- Formal training courses and qualifications, including NZQA work-based training courses which can be accessed through the Seafood Industry Training Organisation (SITO). This includes two levels of training in Environmental Best Practice.
- Supporting NZ based employees to gain national or international experience in the aquaculture industry.

5.2 Communication

Communication, including the maintenance of written policies and procedures and the communication of these to staff through planned training, is critical to ensuring staff are all aware of their role in maintaining environmental standards.

5.2.1 The Company will maintain written policies and procedures to guide staff in conducting the business of aquaculture in a manner that maintains the integrity of the environment.
PART 6
AUDIT, REVIEW AND CONTINUOUS IMPROVEMENT

6.1 Audit

Failure to comply with regulatory and company procedures for environmental practice may lead to adverse environmental effects. A programme for periodic environmental management system audits will determine if Company practices conform to planned arrangements for environmental management, including the requirements of this Code of Practice and regulatory requirements.

6.1.1 The Company shall establish and maintain written procedures to audit environmental management procedures to determine whether:
- The Code of Practice is properly written, implemented and maintained.
- The written environmental management systems meet regulatory and industry standards.
- Company practices conform to the systems described in the ECP to recommend changes and improvements to the ECP as new information becomes available.

6.1.2 A record of the audit should be maintained.

6.2 Continuous Improvement

The Code of Practice is a live document, and should be used to enact continuous and sustainable improvement in company environmental policy and procedures.

6.2.1 The Company should establish and maintain written procedures to monitor and measure, on a regular basis, the KPI / key characteristics of its operations that can have a significant impact on the environment (section 4.2.3).

6.2.2 The Company should use these KPI’s, and other data collected to enact improvements in policy, standards, measurables and other elements of the environmental management system in light of results.

The aim is to enact measurable, sustainable improvement in each section of the Code of Practice over next five years.
APPENDIX 3: LOCATION OF EXISTING AND PROPOSED FARM SITES
APPENDIX 4: INVESTIGATION OF MARLBOROUGH SOUNDS SALMON FARM SITES WITHIN THE COASTAL MARINE ZONE 1 (2010)

<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes 1</th>
<th>Ecological Attributes 2</th>
<th>Site Selected</th>
</tr>
</thead>
</table>
| 9 – Outer Queen Charlotte Sound | CMZ1 Zone. Conservation Zone along foreshore with Rural Zone beyond | Coastal Natural Character:  
- Very high natural character – there are no coastal structures, moorings or marine farms evident.  
Adjacent Land Natural Character:  
- High natural character – there has been no | Coastal Ecology:  
- Good currents with steeply sloping seabed, however has a potentially high wave climate;  
- Seabed sand and occasional cobbles;  
- Benthic environment has low diversity with no highly sensitive species observed; MSRMP | Operative MSRMP: Outstanding  
Current site assessment: Outstanding:  
- Site is within a remote part of the wild outer sounds environment;  
- Location relatively unmodified;  
- High ecological values;  
- Impressive cliffs, exposure to elements, high legibility of landform. | Visual Amenity:  
- Outstanding visual amenity landscape;  
- No views of houses or roads from site;  
- High amenity values for recreational, scenic, wilderness, views, and naturalness values for boaties. | 1–2  
Benthic environment and currents suitable; High Natural Character (little modification); Outstanding Landscape; High amenity values | Site not assessed further | Site not assessed further | x |

Initial Assessment (mid-2010)

Additional Physical and Ecological Assessment (late 2010)
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes ¹</th>
<th>Ecological Attributes ²</th>
<th>Site Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 – Outer Queen Charlotte Sound</td>
<td>CMZ1 Zone. Conservatio n Zone adjacent Coastal Natural Character: - Very high natural Coastal Ecology: - Reasonable currents with a</td>
<td></td>
<td>modification apart from historical vegetatio n clearance and some wilding pines. Native vegetatio n is regenerat ing strongly.</td>
<td>ecology area 1/22 – large area of nationally significant hectors dolphin habitat; - Adjoins extensive significant marine site 4.16 – Queen Charlotte hectors dolphin; - Sea birds include gannets from East Bay colony, shags, etc.</td>
<td>fishing on calm days; - Within blue cod ban area; - Limited diving attractions. Navigation: - Boating route to outer sounds; - Ferries may get rerouted through sound when they cannot use Tory Channel. No recorded cultural sites nearby.</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking 1 – 5</td>
<td>Physical Attributes</td>
<td>Ecological Attributes</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>---------</td>
<td>--------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>--------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>character – there are no coastal structure s or marine farms evident.</td>
<td>steeply sloping seabed; Cobbles and boulders occupy slopes, with sands at lower depths; Tubeworms and sponges observed at lower depths; Blue cod and spotties abundant at this site; MSRMP ecology area 1/22 – large area of nationally significant hectors dolphin habitat; Adjoins extensive significant</td>
<td>Outstanding: Site is within a remote part of the wild outer sounds environment; Location relatively unmodified; Very high ecological values due to indigenous forest cover.</td>
<td>- No views of houses or roads from site; - High amenity values for recreational, scenic, wilderness, views, and naturalness values for boaties.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Adjacent Land Natural Character: - Very high natural character – indigenou s bush cover intact from ridge to shoreline, and no structure s or modificati on apparent.</td>
<td>Adjoins</td>
<td>Recreational Activity: - High likelihood of recreational fishing on calm days; - Potential for recreational boating, especially passing enroute to Ships Cove; - Potential for scallop dredging.</td>
<td></td>
<td></td>
<td>with good currents; Adjacent land highly valued Conservation Estate; Very high natural character (no modification); Outstanding landscape; Very high amenity values</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NZ King Salmon Report 13 August 2011
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes</th>
<th>Ecological Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>marine site 4.16 – Queen Charlotte hectors dolphin; MSRMP ecology area 1/11 - nationally significant king shag feeding habitat.</td>
<td>Navigation: &lt;ul&gt;&lt;li&gt;No moorings.&lt;/li&gt;&lt;li&gt;Not a recorded cultural site, although several Maori and one European site in the wider area.&lt;/li&gt;&lt;/ul&gt;</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

**Adjacent Land Ecology:**<br>- Native forest containing mature trees;<br>- Intact communities;<br>- Part of DOC estate;<br>- MSRMP ecology area 4/08 – large area of nationally significant ecological area.
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes</th>
<th>Ecological Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>11 – Outer Queen Charlotte Sound</td>
<td>CMZ1 Zone. Conservation Zone along foreshore with Rural Zone beyond</td>
<td>Coastal Natural Character: Very high natural character – there are no coastal structure evident in the general vicinity, and no marine farms evident. Adjacent Land Natural Character: Moderate natural character</td>
<td>Coastal Ecology: Good currents with very steeply sloping seabed; Seafloor comprises cobbles and boulders; Hydroid communities present which are sensitive to marine farm deposition; MSRMP ecology area 1:22 – large area of nationally significant hectares</td>
<td>Operative MSRMP: Not outstanding</td>
<td>Visual Amenity: Visual amenity landscape; No views of houses or roads from site; Potential amenity values for boaties. Recreational Activity: Sheltered recreational fishing; Several small beaches. Navigation: No</td>
<td>3-4 (Ranking would vary depending on location within Bay)</td>
<td>Benthic environment conditions, with potential presence of hydroids, would require detailed surveying and may require a farm to be located well away from the land; Not outstanding landscape; Moderate</td>
<td>High ecological values - reduced overall site ranking from initial assessment</td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking 1 – 5</td>
<td>Physical Attributes</td>
<td>Ecological Attributes</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>---------</td>
<td>------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| 12 – Outer Queen Charlotte Sound | CMZ1 Zone Conservatio n Zone along foreshore with Rural Zone beyond | Coastal Natural Character:  - High natural character – no coastal structure s locally | Coastal Ecology:  - Reasonable , but not high, currents, with shallow seabed;  - Benthic environment | Operative MSRMP: Not outstanding  
Current site assessment: Not outstanding | moorings;  - No navigation issues.  
No recorded cultural sites nearby. | 3 |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  | Adjacent Land Ecology:  - Pine forest, with some native vegetation in gullies and at foreshore.  
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |

- Modifications in the form of forestry cover.

- Extensive significant marine site 4.16 – Queen Charlotte hectors dolphin.

- High natural character – no coastal structure locally

- Benthic environment

- Visual amenity landscape;
- Houses to north of the bay may potentially gain view of a farm

- Visual amenity landscape;
- Houses to north of the bay may potentially gain view of a farm

- Shallow benthic environment, with poor currents;
- Potentially unsuitable for fin fish farming.

Site not assessed further

Site not assessed further

x
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes</th>
<th>Ecological Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>not surveyed due to shallowness of seabed and its unsuitability for fish farming; MSRMP ecology area 1/22 – large area of nationally significant hectors dolphin habitat; Extensive significant marine site 4.16 – Queen Charlotte hectors dolphin.</td>
<td>subject to farm location; Potential amenity values for boaties.</td>
<td>Not outstanding landscape; Reasonably high natural character; Potential navigational issues if sited away from shore; Amenity issues due to several houses located nearby.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Recreational Activity: Near to houses, population, and associated recreational activity; Potential for fishing due to nearby houses; Several small beaches.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Navigation: No moorings; No navigation issues.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Adjacent Land Ecology: Pine forest, with some native</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Adjacent Land Natural Character: Moderate natural character – modification in the form of forestry cover.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking</td>
<td>Physical Attributes&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Ecological Attributes&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------</td>
<td>------------------</td>
<td>---------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>---------------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>13 – Outer Queen Charlotte Sound</td>
<td>CMZ1 Zone: Conservation Zone adjacent</td>
<td>Coastal Natural Character:  - Very high natural character – no coastal structures locally evident although jetties and moorings in bays to the south. Rocky foreshore. Adjacent</td>
<td>Coastal Ecology:  - Low currents with shallow seabed;  - Benthic environment not surveyed due to low current flows and unsuitability for fish farming;  - Healthy scallop bed, and abundant blue cod and Tarakihi observed on</td>
<td>Operative MSRMP: Not outstanding on adjoining land  Current site assessment: Not outstanding</td>
<td>Visual Amenity:  - Visual amenity landscape;  - Site visible from nearby house;  - Potential amenity values for boaters.  Recreational Activity:  - Potential for fishing due to nearby houses.  Navigation:  - No</td>
<td>2</td>
<td></td>
<td>Site not assessed further</td>
</tr>
</tbody>
</table>

13 – Outer Queen Charlotte Sound: Conservational Zone adjacent

- Very high natural character – no coastal structures locally evident although jetties and moorings in bays to the south. Rocky foreshore.

Operative MSRMP: Not outstanding on adjoining land

Current site assessment: Not outstanding

Visual Amenity:
- Visual amenity landscape;
- Site visible from nearby house;
- Potential amenity values for boaters.

Recreational Activity:
- Potential for fishing due to nearby houses.

Navigation:
- No

Site not assessed further
### Initial Assessment (mid-2010)

<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes</th>
<th>Ecological Attributes^2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Land Natural Character:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- High to moderate natural character – regenerating indigenous bush, albeit patchy through previous clearance.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Adjacent Land Ecology:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Regenerating scrub with some wilding and planted pines: MSRMP ecology area 3/39 –</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- previous dive; MSRMP ecology area 1/22 – large area of nationally significant hectors dolphin habitat; Extensive significant marine site 4.16 – Queen Charlotte hectors dolphin.  
- moorings; No navigation issues.  
- A recorded cultural site exists nearby.  
- natural character to the landward side.
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5³</th>
<th>Physical Attributes ¹</th>
<th>Ecological Attributes²</th>
<th>Site Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>14 – Outer Queen Charlotte Sound</td>
<td>CMZ1 Zone, Conservation Zone adjacent</td>
<td>Coastal Natural Character: - Very high natural character – no coastal structures locally evident although jetties and moorings in bays to the south. Rocky foreshore.</td>
<td>Coastal Ecology: - Strong currents with steeply sloping seabed; - Significant benthic communities including high densities of scallops, hydroids, and small bryozoans. These are all highly sensitive to marine farm deposition; MSRMP ecology area 1/22 – large area</td>
<td>Operative MSRMP: Not outstanding on adjoining land</td>
<td>Current site assessment: Not outstanding</td>
<td>Visual Amenity: - Visual amenity landscape; - Site visible from houses on the other side of Queen Charlotte Sound (2.5km distant); - Potential amenity values for boaties.</td>
<td>Visual Amenity: 1</td>
<td>Significant benthic communities (high densities of scallops, hydroids and small bryozoans); Not outstanding landscape; Reasonably high natural character.</td>
<td>Site not assessed further</td>
</tr>
</tbody>
</table>
### Initial Assessment (mid-2010)

<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5³ (late 2010)</th>
<th>Physical Attributes ¹</th>
<th>Ecological Attributes ²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- High natural character – regenerating indigenous bush, albeit patchy through previous clearance. No evidence of structures and tracks.</td>
<td>- of nationally significant hectors dolphin habitat; - Extensive significant marine site 4.16 – Queen Charlotte hectors dolphin.</td>
<td>- No moorings; - No navigation issues. A recorded cultural site exists nearby.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking 1 – 5</td>
<td>Physical Attributes</td>
<td>Ecological Attributes²</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>------------------</td>
<td>---------</td>
<td>------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------</td>
<td>-------------------</td>
<td>----------------------</td>
</tr>
</tbody>
</table>
| 15 – Outer Queen Charlotte Sound (Sth Kaiatepeha Bay) | CMZ1 Zone. Rural 1 Zone adjacent surrounded by Conservation Zone | Coastal Natural Character:  
- Very high natural character — no coastal structure s locally evident although jetties and moorings to north. Rocky / gravel foreshore.  
- Adjacent Land Natural Character:  
- High natural character – mix of gorse, | Coastal Ecology:  
- High currents with steeply sloping seabed;  
- Low densities of small hydroids observed;  
- Hard reef structure nearby requires detailed surveying;  
- MSRMP ecology area 1/22 – large area of nationally significant hectors dolphin habitat;  
- Extensive significant marine site | Operative MSRMP: Not outstanding on adjoining land  
Current site assessment: Not outstanding | Visual Amenity:  
- Visual amenity landscape;  
- Site visible from houses on the other side of Queen Charlotte Sound (3km distant);  
- Potential amenity values for boaties;  

Recreational Activity:  
- Potential for fishing activity.  

Navigation:  
- No moorings;  
- No navigation | 3 | Good potential for salmon farm | Moderate ecological values | ✓ |
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes 1</th>
<th>Ecological Attributes 2</th>
<th>Site Selected</th>
</tr>
</thead>
</table>
| 16 – Tory Channel | CMZ1. Conservation Zone adjacent | Coastal Natural Character:  
- Very high natural character – no coastal structure locally evident. | 4.16 – Queen Charlotte hectors dolphin.  
Adjacent Land Ecology:  
- Grey shrub land, flaxes, wilding pines, gorse and broom. Some dead shrubs. | Visual Amenity:  
- Outstanding visual amenity landscape;  
- Site visible from house on opposite side of the bay.  
Recreational Activity:  
2 - Large hydroids, of significant size evident on seabed beyond 20m depth;  
Sensitive to deposition;  
Potential navigational issues if site was located | No cultural sites recorded in the immediate area however a recorded midden/oven is evident nearby. | 3 | | | x |
### Initial Assessment (mid-2010)

<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes</th>
<th>Ecological Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tory Channel (Sth Ngamahau)</td>
<td>CMZ1 Zone: Conservation Zone along foreshore with Rural</td>
<td>Coastal Natural Character: High natural</td>
<td>Adjacent Land Natural Character: Very high natural character – regeneration of indigenous bush, occasional wilding pine. Adjacent Land Ecology: Regenerating bush with some wilding pines; MSRMP ecology area 3/39 – nationally significant Arapawa Island reserves.</td>
<td>advanced nature of regeneration.</td>
<td>Potential for fishing activity both sides of Tory Channel. Navigation: No moorings; Close to navigational route for ferry.</td>
<td>further away from the land; Outstanding landscape; High natural character.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Additional Physical and Ecological Assessment (late 2010)

<table>
<thead>
<tr>
<th>Site Selected</th>
<th>Physical Attributes</th>
<th>Ecological Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Moderate potential for salmon farming</td>
<td>Requires avoidance of adverse ecological values</td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Zone beyond</td>
<td>character – no coastal structures locally evident. Jetties and moorings evident in most bays adjacent to the site. Rocky foreshore with occasional small sandy beaches. Adjacent Land Natural Character: - Moderate natural character – regeneration of</td>
<td>embayment with lower water movement in the embayment; - Rocky reefs at either end of embayment transitioning to cobbles and coarse sand patches; - MSRMP significant marine site 5.8 - Tory Channel hydroid community, located to the west; - High densities of juvenile crayfish and paua. Could be sensitive to marine farm deposition</td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>18 – Tory Channel</td>
<td>CMZ1 Zone. Rural Zone and Conservation Zone adjacent.</td>
<td>Coastal Natural Character: - High - very high natural character – no coastal structure s locally evident.</td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Rocky foreshore with occasional small sandy beaches.</td>
<td>- Large shallow reef in north-eastern corner of bay; - Bay relatively shallow with suitable depth being some 150m offshore; - No significant benthic communities present however blue cod and spotties observed.</td>
<td>peninsula, with dramatic and rugged sea-cut cliffs on the eastern side of peninsula; - Highly legible land form due to cleared land at the northern point; - Forms part of visual gateway from ferry.</td>
</tr>
</tbody>
</table>

Adjacent Land Natural Character: |
- Very high moderate natural character - regeneration of indigenou bush, although patchy through gorse and wilding pines/pine plantation. No tracks or

Adjacent Land Ecology: |
- Pine plantation and wilding pines with some regeneratio

A Maori terrace has been recorded close to the site, with further Maori artefacts recorded south.
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes</th>
<th>Ecological Attributes</th>
<th>Site Selected</th>
</tr>
</thead>
</table>
| 19 – Tory Channel | CMZ2 and CMZ1. Conservation Zone along foreshore with Rural Zone beyond | Coastal Natural Character:  
  - Moderate natural character – mussel farms nearby.  
  - Rocky foreshore.  
  - Adjacent Land Natural Character:  
  - High natural character – regeneration of indigenous bush through gorse on lower | Coastal Ecology:  
  - Strong currents at northern edge of area with a steeply sloping seabed away from the shore;  
  - Hydroids common in area, however unlikely to be present in whole area;  
  - Large blue cod observed;  
  - Closeness to other marine farms may impact upon | Operative MSRMP: Not outstanding  
  Current site assessment: Not outstanding | Visual Amenity:  
  - Visual amenity landscape;  
  - Site potentially visible from houses further up Tory Channel.  
  Recreational Activity:  
  - Likely to be some recreational fishing activity both sides of Tory Channel.  
  Navigation:  
  - Close to navigational | 3-4  
  Close proximity to other salmon farms and mussel farms;  
  Seabed slopes steeply away from shore;  
  Potential for unacceptable nutrient loading to occur due to other sites in proximity;  
  Site suitability subject to nutrient modelling;  
  Not outstanding landscape;  
  Moderate natural | Site not assessed further | Site not assessed further | x  
  Adjoining mussel farm not available for sale. Chose not to pursue this site further |
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking</th>
<th>Physical Attributes</th>
<th>Ecological Attributes²</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 – Outer Pelorus Sound (Post Office Point - Kaitira)</td>
<td>CMZ1 Zone. Conservation Zone along foreshore with Rural Zone beyond</td>
<td>Coastal Natural Character: - Very high natural character – no modification to coastline. Rugged, rocky and characteristic of outer sounds. Adjacent</td>
<td>Coastal Ecology: - Good currents with steeply sloping seabed to 20m before flattening out, and then continuing to 50m depth 150m from shore; Abundance of hydroid communities</td>
<td></td>
<td>route for ferry. No recorded cultural sites on adjacent land. Immediately adjoins an existing mussel farm. Footprint would overlap with this farm.</td>
<td>2-3 (Potential for ranking to be higher (3) if placement away from shore is not found to cause navigation difficulties) Seabed steeply sloping with good water current away from shore; Abundance</td>
<td>Good potential for salmon farming</td>
<td>Moderate ecological values</td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking 1 – 5</td>
<td>Physical Attributes</td>
<td>Ecological Attributes²</td>
</tr>
<tr>
<td>------</td>
<td>-----------------------</td>
<td>-------------------</td>
<td>---------</td>
<td>-------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>--------------------------</td>
<td>---------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Land Natural Character:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Moderate natural character – grazing and pockets of regenerating indigenous bush. No fencing or other structures, apart from small farm tracks and a jetty in Wynens Bay to the east.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjacent Land Ecology:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Pasture with scattered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little recreational boating, fishing or diving; In blue cod ban area; Some reefs nearby which may be suitable for fishing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Navigation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Marine farm and other boating traffic pass around Post Office Point to go to Forsyth Bay and Allens Strait.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potential historic gun emplacement on Post Office Point.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking 1 – 5</td>
<td>Physical Attributes</td>
<td>Ecological Attributes</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>------------------</td>
<td>---------</td>
<td>-------------------------------------------</td>
<td>-------------------------------------------------</td>
<td>----------------------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>21 – Outer Pelorus Sound</td>
<td>CMZ1 Zone. Conservation Zone along foreshore with Rural Zone beyond</td>
<td>Coastal Natural Character: - Very high natural character – no modification to coastline. Rugged, rocky with occasional gravel beach and characteristic of the outer sounds. No</td>
<td>Coastal Ecology: - Average currents with steeply sloping seabed; - Numerous small hydroids found throughout the area which are sensitive to marine farm deposition; - Abundance of scallops present; - MSRMP ecology</td>
<td>Operating MSRMP: Outstanding Current site assessment: Not Outstanding</td>
<td>Visual Amenity: - Visual amenity landscape; - Views to houses from bays on the opposite side of Pelorus Sound (approximately 5km distant); - Existing marine farming throughout Pelorus Sound.</td>
<td>Recreational 3 Average water currents, with potential depositional issues; Numerous small hydroids found throughout the area; Scallop fishing area in vicinity; Suitability requires further benthic investigation; Not an</td>
<td>Poor potential for salmon farming</td>
<td>High ecological values - reduced overall site ranking from initial assessment</td>
</tr>
</tbody>
</table>

NZ King Salmon Report 13 August 2011
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes</th>
<th>Ecological Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>mussel farms in this vicinity.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Adjacent Land Natural Character:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Moderate to high natural character – regenerating indigenous bush from farmland with gorse and wilding pines present. No fencing or other structures apart from a small</td>
<td>area 1/11 - extensive areas of nationally significant king shag feeding habitat nearby. Adjacent Land Ecology: Regenerating shrubland from farmland with wilding pines and gorse present.</td>
<td>Activity: Little recreational boating; Fishing for scallops; Fishing or diving; Some reefs nearby. Navigation: Moorings within nearby bay Boating route up Waitata Reach. Commercial scalloping in vicinity. No cultural sites recorded on adjacent land.</td>
<td>outstanding landscape; Moderately high natural character</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking 1–5</td>
<td>Physical Attributes</td>
<td>Ecological Attributes</td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>---------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------------</td>
<td>-----------------------------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| 22 – Outer Pelorus Sound (Nth Tapipi Bay) | CMZ1 Zone. Conservation Zone along foreshore with Rural Zone beyond | Coastal Natural Character:  
- Very high natural character – no modification to coastline. Rugged, with small cliffs/slips and rocky shore and characteristic of the outer sounds. Occasional gravel beaches. | Coastal Ecology:  
- Good currents with a relatively steeply sloping seabed;  
- No significant communities identified at deeper depths;  
- MSRMP ecology area 1/11 - extensive areas of nationally significant king shag feeding habitat nearby. | Operative MSRMP: Not Outstanding  
Current site assessment: Not Outstanding | Visual Amenity:  
- Visual amenity landscape;  
- House visible on Tui Nature Reserve (approximately 3.8km to the west), and houses in Waitata Bay also evident (approximately 4.5km distant). | Good potential for salmon farming | Moderate ecological values | ✓ |
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking</th>
<th>Physical Attributes</th>
<th>Ecological Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 – Outer Pelorus Sound (Nth CMZ1 Zone, Coastal Natural Character)</td>
<td>Coastal Ecology</td>
<td>Operative MSRMP: Not Outstanding</td>
<td>Visual Amenity: 3 Good</td>
<td>Moderate potential for salmon</td>
<td>Low – Moderate ecological</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking</td>
<td>Physical Attributes</td>
<td>Ecological Attributes</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>-------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td>---------------------</td>
<td>----------------------</td>
</tr>
</tbody>
</table>
| Richmond Bay          | along foreshore with Rural Zone beyond | - Very high natural character – no modification to coastline. Rugged, with small cliffs / slips and rocky shore characteristic of the outer sounds. Occasional gravel beaches. | - Reasonable currents with currents improving in deeper water further from shore; 
- Steeply sloping seabed; 
- Seabed appears to have been dredged and consequently less hydroids are evident; 
- Low densities of scallops observed; MSRMP ecology area 1/11 - extensive areas of nationally significant king shag | Current site assessment: Not Outstanding | amenity landscape; 
- House visible on Tui Nature Reserve (approximately 3.8km to the west), and houses in Waitata Bay also evident (approximately 4.5km distant). 
**Recreational Activity:** 
- Little recreational boating, fishing or diving; 
- Fishing for scallops in Richmond Bay; 
- Potential for cumulative visual amenity | currents with steeply sloping seabed; 
Seabed appears to have been dredged, consequently, less hydroids evident; 
Scallop fishing occurs in vicinity; 
Not outstanding landscape; 
High natural character; 
Visible from house on opposite side of Reach; 
Potential for cumulative visual amenity effects for recreational boaters | farming | values | |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>24 - Outer Pelorus Sound</td>
<td>CMZ1 Zone. Conservation Zone along foreshore with Rural Zone</td>
<td>Coastal Natural Character: Coastal Ecology: - Variable natural character - Strong currents; Significant reef</td>
<td>feeding habitat; Adjacent Land Ecology: - Full cover of regenerating indigenous shrubland with more wilding pines present than at site 22 above.</td>
<td>effects for recreational boaties in conjunction with the White Horse Rock salmon farm. Navigation: - Boating route up Waitata Reach; Bay used for commercial scalloping. No recorded cultural sites nearby.</td>
<td>3</td>
<td></td>
<td></td>
<td>Site not assessed further</td>
<td></td>
</tr>
</tbody>
</table>

[^1]: [1] Physical Attributes:^1^

<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes ¹</th>
<th>Ecological Attributes²</th>
<th>Site Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>beyond</td>
<td>ranging from very high to low due to presence of nearby mussel farms – No other modification to coastline. Rugged, rocky outcrops with a few small beaches.</td>
<td>community down to 18m depth with a variety of sponges, hydroids, anemones, and fish which are sensitive to marine farm deposition; MSRMP ecology area 1/15 – near buffer zone for nationally significant king shag roosting ground; MSRMP ecology area 1/11 - extensive areas of nationally significant king shag feeding habitat</td>
<td>(approximately 3.8km to the west), No other houses evident.</td>
<td>Recreational Activity: - Little recreational boating, fishing or diving. Navigation: - Boating route up Waitata Reach.</td>
<td>No recorded cultural sites nearby.</td>
<td>relation to reef habitat) Significant reef structure with numerous sensitive organisms and anemones and hydroids; King Shag roosting area nearby; Not an outstanding landscape; High natural character; Visible from house on opposite side of Reach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking 1 – 5³</td>
<td>Physical Attributes ¹</td>
<td>Ecological Attributes²</td>
<td>Site Selected</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------------------------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------</td>
<td>-----------------------------</td>
<td>------------------------</td>
<td>------------------------</td>
<td>-------------------------</td>
</tr>
</tbody>
</table>
| 25 – Outer Pelorus Sound | CMZ2 and CMZ1 Conservatio n Zone along foreshore with Rural Zone beyond | Coastal Natural Character:  
- Very high natural character – no modification to coastline and free of marine farms. Rocky shore.  
Adjacent | Coastal Ecology:  
- Diverse benthic habitats with a high abundance of sensitive species present including hydroids, bryozoans, and tubeworms; MSRMP ecology | Operative MSRMP: Outstanding  
Current site assessment: Outstanding | Visual Amenity:  
- Outstanding visual amenity landscape;  
- House located above site.  
Recreational Activity:  
- Potential for fishing.  
Navigation:  
- Diverse benthic habitats with sensitive species; Outstanding landscape; Very high levels of natural character; Very close proximity of nearest house | 1 | Site not assessed further | x |
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes</th>
<th>Ecological Attributes 2</th>
<th>Site Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>26 – Pelorus Sound</td>
<td>CMZ1 Zone, Conservatio n Zone along foreshore with Rural Zone beyond</td>
<td>Coastal Natural Character: - Low - very high natural character due to presence</td>
<td>Coastal Ecology: - Low currents may pose issues for existing benthic community</td>
<td>Operative MSRMP: Outstanding</td>
<td>Visual Amenity: - Visual amenity landscape; - No houses visible.</td>
<td>2</td>
<td>Insufficient current and depth are likely to pose depositional problems to existing benthic</td>
<td>Site not assessed further</td>
<td>Site not assessed further</td>
</tr>
</tbody>
</table>
**Initial Assessment (mid-2010)**

<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes</th>
<th>Ecological Attributes²</th>
<th>Details</th>
</tr>
</thead>
</table>
|      |                        |                  |         |                                           |                                                  |                           |                   |                     | Adjacent Land Natural Character:  
  - High natural character – farmland across peninsula, low grazing. Some tussocks and scattered clumps of seaweed from marine farm deposition; MSRMP ecology area 1/11 - extensive areas of nationally significant king shag feeding habitat; MSRMP significant sub-tidal marine site in vicinity. | 3 | 3 | 1 – 5² | 1 – 5² | 1 – 5² |
|      |                        |                  |         |                                           |                                                  |                           |                   |                     | Adjacent Land Ecology:  
  - Mostly farmland with some tussocks and patches in gullies; Scattered native shrubs in amongst the grassland. | 3 | 3 | 1 – 5² | 1 – 5² | 1 – 5² |
|      |                        |                  |         |                                           |                                                  |                           |                   |                     | Navigation:  
  - Limited recreation activity;  
  - Potential for fishing particularly for snapper. | 3 | 3 | 1 – 5² | 1 – 5² | 1 – 5² |
<p>|      |                        |                  |         |                                           |                                                  |                           |                   |                     | No recorded cultural sites nearby. | 3 | 3 | 1 – 5² | 1 – 5² | 1 – 5² |
|      |                        |                  |         |                                           |                                                  |                           |                   |                     | Adjoins a CMZ2 Zone | 3 | 3 | 1 – 5² | 1 – 5² | 1 – 5² |</p>
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5</th>
<th>Physical Attributes ¹</th>
<th>Ecological Attributes²</th>
<th>Site Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>27 – Pelorus Sound</td>
<td>CMZ2 and CMZ1. Conservatio n Zone along foreshore with Rural Zone beyond</td>
<td>Coastal Natural Character:</td>
<td>- Moderate high natural character – no modification to coastline but mussel farm nearby.</td>
<td>Coastal Ecology: - Good currents; with steeply sloping seabed; - Benthic environment already affected by existing mussel farm nearby; - Dolphins Operative MSRMP: Not Outstanding Current site assessment: Not Outstanding</td>
<td>Visual Amenity: - Visual amenity landscape; - No houses visible. Recreational Activity: - Limited recreation activity; - Recreational snapper</td>
<td>5 Good currents with deep water; Site shows good potential for fin fish farming; Not outstanding landscape; High natural character to the land side; Good potential for salmon farming in terms of current speed and depth. However, temperature profile considered warm, with some risk for salmon</td>
<td>Moderate – High ecological values Reef habitat nearby; Unique pocket of large red sponges in close proximity; Careful farm site location may be able</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking 1 – 5</td>
<td>Physical Attributes 1</td>
<td>Ecological Attributes 2</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>------------------------</td>
<td>-------------------</td>
<td>------------------------------------------------------------------------</td>
<td>---------------------------------------------</td>
<td>------------------------------------------------</td>
<td>-----------------------------</td>
<td>----------------------</td>
<td>------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rock and sand shores.</td>
<td>observed;</td>
<td>fishing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>High natural character – regenerating indigenous bush, with relatively mature and consistent coverage. Wilding pines evident. No structure or tracks evident on the land.</td>
<td>- Seals on nearby rocks;</td>
<td>Navigation:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- MSRMP significant sub-tidal marine site in vicinity.</td>
<td>- No moorings;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Navigation already limited by nearby mussel farm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>No recorded cultural sites nearby.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Immediately adjoins an existing mussel farm.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Adjoins a CMZ2 Zone;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reduced overall site ranking from initial assessment to avoid or minimise effects to these communities.

Reduced overall site ranking from initial assessment.
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5³</th>
<th>Physical Attributes ¹</th>
<th>Ecological Attributes²</th>
<th>Site Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>28 – Outer Pelorus Sound</td>
<td>CMZ2 Zone, Conservation Zone along foreshore with Rural Zone beyond</td>
<td>Coastal Natural Character: - High natural character – No coastal structures evident. Rocky foreshore and small gravelly beach.</td>
<td>Coastal Ecology: - Strong currents with steeply sloping seabed; - Significant reef structure with high numbers of juvenile crayfish; - In the vicinity of Duffers Reef King Shag breeding colony; - MSRMP ecology area 1/11 - extensive areas of nationally outstanding natural character</td>
<td>Operative MSRMP: Not Outstanding - Current site assessment: Outstanding - Exposed and rugged coastal landform, characteristic of the outer sounds and highly legible; Regenerating indigenous bush.</td>
<td>Visual Amenity: - Outstanding visual amenity landscape; - No views from any houses. Recreational Activity: - Potential fishing and recreational boating. Navigation: - No navigation issues; - No moorings. No recorded cultural sites</td>
<td>2-3 Steeply sloping seabed with strong currents; Significant reef structure in area; Outstanding landscape; Moderate land natural character; Very wild and exposed location; Adjacent land privately protected for regeneration; Zoned CMZ2 site, although no mussel farm developed on site</td>
<td>Good potential for salmon farming</td>
<td>Moderate – High ecological values - reduced overall site ranking from initial assessment</td>
<td>x</td>
</tr>
<tr>
<td>Site</td>
<td>Operative MSRMP Zoning</td>
<td>Natural Character</td>
<td>Ecology</td>
<td>Outstanding Natural Features &amp; Landscapes</td>
<td>Amenity, Recreation, Navigation, and Other Comments</td>
<td>Overall Site Ranking 1 – 5</td>
<td>Physical Attributes</td>
<td>Ecological Attributes</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>------------------------</td>
<td>------------------</td>
<td>--------</td>
<td>------------------------------------------</td>
<td>-----------------------------------------------------</td>
<td>--------------------------</td>
<td>-------------------</td>
<td>---------------------</td>
<td></td>
</tr>
</tbody>
</table>
|      |                        | land on lower slopes with some areas of pine plantation on mid and upper slopes. No evidence of any further modifications. | significant king shag feeding habitat. | Adjacent Land Ecology:  
- Land is subject to active replanting;  
- Pest eradication programme in place;  
- Pine plantation and shelterbelt on upper slopes with some wilding trees;  
- Farmland on ridge above site;  
- High level of regeneration of native species on steep lower slopes nearby. | | | |

**Initial Assessment (mid-2010)**

**Additional Physical and Ecological Assessment (late 2010)**

**Site Selected**
<table>
<thead>
<tr>
<th>Site</th>
<th>Operative MSRMP Zoning</th>
<th>Natural Character</th>
<th>Ecology</th>
<th>Outstanding Natural Features &amp; Landscapes</th>
<th>Amenity, Recreation, Navigation, and Other Comments</th>
<th>Overall Site Ranking 1 – 5&lt;sup&gt;3&lt;/sup&gt;</th>
<th>Physical Attributes ¹</th>
<th>Ecological Attributes&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Site Selected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papatua</td>
<td></td>
<td></td>
<td>______________________________________________________________________</td>
<td></td>
<td></td>
<td></td>
<td>Moderate potential for salmon farming</td>
<td>Low – Moderate ecological values</td>
<td>✓</td>
</tr>
<tr>
<td>Ruaomoko</td>
<td></td>
<td></td>
<td>Navigation:</td>
<td>- Likely to be navigation constraints in relation to ferry route.</td>
<td></td>
<td></td>
<td>Moderate potential for salmon farming</td>
<td>Moderate ecological values</td>
<td>✓</td>
</tr>
<tr>
<td>Whitehorse Rock - Waitata</td>
<td></td>
<td></td>
<td>Navigation:</td>
<td>- Boating route up Waitata Reach.</td>
<td></td>
<td></td>
<td>Good potential for salmon farming</td>
<td>Low – Moderate ecological values</td>
<td>✓</td>
</tr>
</tbody>
</table>
APPENDIX 5: BIOLOGY AND HISTORY OF KING SALMON IN NEW ZEALAND

Salmon is the common name for several species of fish in the family Salmonidae. Typically, salmon are anadromous; that is they are born in fresh water, migrate to the ocean, then return to fresh water to reproduce. However, there are populations of several salmon species that are restricted to fresh water throughout their lives.

Species of salmon are generally divided into two main groups: the single Atlantic Ocean species and a number of Pacific Ocean species (e.g. King Salmon, Cherry, Chum, Coho, Pink and Sockeye salmon).

DESCRIPTION OF KING SALMON

King Salmon, Oncorhynchus tschawytscha from the Greek words onkos (hook), rynchos (nose) and tschawytscha (pronounced shaw-witch-shaw) comes from the Kamchatka Peninsula in Russian where, as in Alaska, it is the common name for the species and is thought to refer to their distinctive black gums. King Salmon are the largest of the Pacific salmon and are also referred to as ‘Quinnat’ or ‘King’ salmon.

Native to the northwest coast of North America and northeast Asia, King Salmon range from Kotzebue Sound, Alaska, to Santa Barbara, California to north Asia from Japan to the Kamchatka Peninsula in the Russian far east and the Chukchi Sea. They have not spread into the Arctic drainages, nor are they found in the warmer waters south of the Sacramento River. It is likely that their range is limited by water temperature.

The King Salmon is blue-green or purple on the back and top of the head with silvery sides and white ventral surfaces. It has black spots on its tail and the upper half of its body. Its gums are often black/dark purple. Adult fish typically range in size from 840 to 910mm and the average size range is from 4.5 to 23kg.

LIFE CYCLE

The optimum water temperature range for King Salmon is 6-17°C, with maximum growth achieved in temperatures between 12-17°C. Rapid changes in temperature within this range can cause death, and most fish adapt to a narrow temperature and salinity range.

In the wild, King Salmon may spend one to eight years in the ocean (averaging three to four years) where they grow to maturity, before returning to their home rivers to spawn. The fish tends to lose condition as they migrate upstream.

In all species of Pacific salmon, the mature individuals die within a few weeks of spawning, a trait known as semelparity. Salmon that are not killed by other means, show greatly accelerated deterioration (phenoptosis or “programmed aging”) at the end of their lives. Their bodies rapidly deteriorate right after they spawn as a result of the release of massive amounts of corticosteroids.

King Salmon spawn during autumn in larger and deeper waters than other salmon species and can be found on the spawning redds (gravel nest) from September through December in their northern hemisphere native habitat. In New Zealand the main salmon runs into the rivers occurs in March with spawning occurring in April/May.

After laying eggs, females guard their redd for four to 25 days before dying, while males seek additional mates. King Salmon eggs hatch, depending on water temperature, 90 to 150 days after deposition. Spawning is timed to ensure that young salmon fry emerge during an appropriate season for survival and growth. In the northern hemisphere, young fish can live
in freshwater for three to 18 months before travelling downstream to estuaries, where they can remain as smolt for several months. In New Zealand, by far the majority of juvenile King Salmon pass directly to the ocean at the relatively young age of three to six months.

**HISTORY OF KING SALMON IN NEW ZEALAND**

Following several unsuccessful attempts in the 1870s to introduce King Salmon for a recreational fishery by various Acclimatisation Societies, they were successfully introduced to New Zealand by the Marine Department, who hoped to initiate commercial rod fishing and canning industry (although this never eventuated).

A hatchery was built on the banks of the Hakataramea River (a tributary of the Waitaki) and between 1901 and 1907 salmon were imported from the Baird Fish Station, located on a tributary of the Sacramento River in California. That operation was a success with, not only fish being successfully released but the fish adopting the Waitaki River and returning there to spawn.

King Salmon became established, with sufficient numbers of adults returning that the population was self-sustaining in rivers on the east, and to a minor extent west, coasts of the South Island. Since 1907 imports of salmon ova into New Zealand have not been permitted, so all King Salmon in New Zealand are the descendants of those original fish.

In the wild King Salmon are restricted to the South Island, the major runs being on the east coast in the Clutha, Waitaki, Rangitata, Rakaia and Waimakariri Rivers, although smaller runs occur in many East Coast rivers such as the Hurunui, the Ashley and the Ashburton. Other small stocks of sea-run King Salmon are found on the South Island’s West Coast, particularly in the Taramakau, Hokitika and Paringa Rivers. There are also a few landlocked stocks of King Salmon in some South Island lakes. Although juvenile fish have been caught in some North Island rivers, there are no consistent runs of King Salmon in the North Island.

Since the early days of salmon introductions, the Government, anglers and acclimatisation societies have operated hatcheries which boosted stocks in rivers where runs had been established and from whence attempts were made to stock new rivers. Even today, the so-called ‘wild’ fishery is supplemented by these operations.

**DIFFERENCES BETWEEN KING SALMON AND ATLANTIC SALMON**

Atlantic salmon, as the name suggests, are the species of salmon which reproduce in northern rivers on both the coasts of the Atlantic Ocean. Atlantic salmon (*Salmo salar*), are also generally anadromous; however unlike Pacific species, they are iteroparous, meaning they can spawn more than once.

Atlantic salmon accounts for over 99% of all farmed salmon and is the predominant species farmed in Norway, Chile, and Scotland. While attempts have been made to farm this species in New Zealand, these were unsuccessful.

Of all the salmon species King Salmon are the most difficult to grow. In their native range in the northern hemisphere they suffer from a range of serious diseases such as bacterial kidney disease (BKD). King Salmon can be difficult to handle without causing damage to the fish and subsequent fish losses, in addition they tend to panic easily, especially if crowded, scales are easily lost and secondary infection can set in.

King Salmon do not convert feed as efficiently as for example Atlantic salmon. The New Zealand farmers achieve a feed conversion ratio (FCR) of ~1.8 in seawater, compared to reported FCR’s of 1.0 to 1.4 in Atlantic salmon. This primarily occurs for a number of reasons, as follows:
a. King Salmon have higher flesh oil (typically 25% at harvest in the fillet) than Atlantic salmon (17%). Because the tissue of King Salmon contains more energy than Atlantic salmon, they require more feed energy to build each kilogram of tissue.

b. Atlantic salmon diets are manufactured to contain more energy (>35% oil is common) than King Salmon diets (26% oil maximum). This is because King Salmon are naturally oily fish, and too much oil in the diet can cause flesh quality problems in this species.

c. Energy partitioning calculations show that the points noted in (a) and (b) above account for at least 80% of the difference in FCRs between Atlantic salmon and King Salmon.

d. Despite the higher FCR of King Salmon, because they use lower-oil diets and retain more oil in the flesh, the efficiency with which Atlantic salmon and King Salmon retain oil and energy is similar.
APPENDIX 6: SALMON AQUACULTURE PRODUCTION – GLOBALLY AND THE
NEW ZEALAND SITUATION

GLOBAL SALMON AQUACULTURE

Salmon aquaculture can be defined as the farming and harvesting of salmon under
controlled conditions; in contrast to wild caught salmon which is captured using commercial
fishing techniques. However, the concept of “wild” salmon often includes fish produced in
hatcheries and released into the wild to be captured on the return of the fish to their ‘home’
streams; known as “ocean ranching” (a form of stock enhancement). A significant
percentage of Atlantic salmon harvest results from ocean ranching, the precise amount
depending on the species and location; however, it is all marketed as “wild Atlantic salmon”.

Salmon aquaculture originated in the late 19th century, with fertilisation trials in Europe.
In the late 20th century, salmon hatcheries were utilised in Europe, North America, as well as
New Zealand. The contemporary technique of farming using floating sea pens, as employed
by NZ King Salmon, originated in Norway in the late 1960’s.

Approximately two million tonnes of farm raised salmon is grown world-wide. Norway and
Chile are the world’s leading aquaculture producers of salmonids, accounting for 36.4% and
28% of the world production respectively. Other European countries produce another 18.9%
while Asia and North America contributed only 7.9% and 7.4% respectively in 2008. Atlantic
salmon production in Chile was hit hard by a disease outbreak in 2009, leading to the loss of
half of their annual production.

The FAO State of World Fisheries and Aquaculture report\(^{22}\) records that in 2008 1.5 million
tonnes of Atlantic salmon were grown, along with 0.58 million tonnes of rainbow trout (also
members of the salmonid family). By contrast only approximately 12,000 tonnes of King
Salmon was produced globally in 2008 (this has now increased to approximately 13,500
 tonnes). Of this, well over 50% is produced in New Zealand (see next section for recent
production figures), with the remainder primarily produced in Chile by Trusal
(www.trusal.cl/compania_esp.htm), and in Clayoquot Sound, Vancouver Island, British
Columbia by Creative Salmon (www.creativesalmon.com/), with very little grown elsewhere.

AQUACULTURE PRODUCTION IN NEW ZEALAND

During the Waitangi Tribunal’s enquiry into aquaculture, evidence was given that Māori
practiced forms of aquaculture prior to contact with Europeans. The Ahu Moana Report
dated 2002 (WAI953) recounted a number of methods whereby oysters, paua, kina, mussels
and scallops were farmed. The Waitangi Tribunal Report states:

“If that is correct, marine farming may have been a feature of life in New Zealand practiced
by Māori for hundreds of years.” (Page 9).

The first ‘modern’ aquaculture enterprise, an inter-tidal oyster farm, was established in the
early 1960’s in Northland. Oyster farming involves growing oysters on sticks, or in bags in
the inter-tidal area. Commercial mussel farming began in the 1970’s in the Hauraki Gulf.
Mussel farming involves the seeding of mussels onto ropes suspended from a floating long
line which is anchored at each end to the seabed. The first salmon farm (as opposed to
hatchery) was established in 1976 at Wai Koropupu Springs in Golden Bay, and the first sales
of salmon reared in freshwater were made in 1978. By the late 1980’s there were well over

---

\(^{22}\) FAO Fisheries and Aquaculture Department. 2010. The State of World Fisheries and Aquaculture 2010.
http://www.fao.org/docrep/013/i1820e/i1820e00.htm
400 consented marine farms in New Zealand, the majority of which were used for Greenshell™ mussel production.

The first serious attempts at sea pen rearing of salmon took place in Big Glory Bay on Stewart Island, with the first experimental farm being constructed in 1981. Sea pen farming was legalised in New Zealand in 1983 enabling fish harvested from the Big Glory Bay farm to be sold and in 1984 the first salmon farms were established in the Marlborough Sounds.

In the 1990’s there was a sharp acceleration in the growth of aquaculture activity in New Zealand. The Resource Management Act, which came into force on 1 October 1991, enabled numerous applications to be made. As a result of a deluge of applications for water space to establish marine farms, in 1996 a moratorium was placed on aquaculture in Marlborough; this was lifted in 1999, and a second moratorium was put in place from 2001-2004. There has been no new aquaculture space applied for in New Zealand since 2004.

King Salmon is now farmed in New Zealand in seafarms located in the Marlborough Sounds; Stewart Island; and Akaroa Harbour. King Salmon is also farmed in freshwater in Golden Bay, the hydroelectric power canals in the McKenzie Country and by other small producers in the South Island.

New Zealand salmon production has broadly followed a pattern of growth of more recent times, as shown in Figure 1, which shows NZ King Salmon production in relation to total NZ King Salmon production.

The most recent industry statistics available show NZ salmon production tonnages for 2010 and estimates for 2011, as well as export percentages and FTEs employed (Table 1). This table shows that while the percent of fish exported is likely to stay relatively static, production figures for King Salmon are likely to continue to increase, as illustrated by Figure 1.
Table 1: Summary of King Salmon production in New Zealand by company.

<table>
<thead>
<tr>
<th>Company</th>
<th>Tonnage (G&amp;G)</th>
<th>Export (%)</th>
<th>Staff Directly employed in Aquaculture</th>
<th>Staff Directly employed in Processing and other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akaroa Salmon Co. Limited</td>
<td>214.49</td>
<td>195.00</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Benmore Salmon (Aoraki/White Cloud)</td>
<td>326.65</td>
<td>430.00</td>
<td>7.50%</td>
<td>7.50%</td>
</tr>
<tr>
<td>Sanford (Bluff) Limited</td>
<td>2769.17</td>
<td>3300.00</td>
<td>85.00%</td>
<td>80.00%</td>
</tr>
<tr>
<td>Isaac Salmon Farm Limited</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The New Zealand King Salmon Co Limited</td>
<td>7476.30</td>
<td>8036.00</td>
<td>50.00%</td>
<td>50.00%</td>
</tr>
<tr>
<td>Leslie Salmon</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mt Cook Salmon</td>
<td>44.83</td>
<td>330.00</td>
<td>50.00%</td>
<td>50.00%</td>
</tr>
<tr>
<td>Anatoki Salmon</td>
<td>27.22</td>
<td>29.22</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>High Country Salmon</td>
<td>70.04</td>
<td>70.00</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Pacifica Salmon Limited</td>
<td>500.28</td>
<td>590.00</td>
<td>83.00%</td>
<td>95.00%</td>
</tr>
<tr>
<td><strong>NEW ZEALAND</strong></td>
<td><strong>11428.98</strong></td>
<td><strong>12980.22</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>