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Evaluation of Entrance into New Markets

Case of

Norwegian Aquaculture

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Evaluation of Entrance into New Markets

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Norwegian Aquaculture

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Abstract

Double walled insulated reusable tubs of 440-600L in size are widely used within the wild harvesting fisheries to transport catches because they have superior qualities over other types of containers. Their use has not gained a significant foothold within the larger aquaculture sector. The purpose of this research was to present an overview of the world aquaculture and to undertake an industry analysis of the Norwegian salmon farming to evaluate the need and possible marketing of Sæplast reusable insulated tubs. The results indicate that there might be possibilities to service salmon processing facilities that are located within the EU by using the tubs to supply them with HoG salmon.

Keywords

Industry Analysis, Salmon farming, Norway, Sæplast, Porters five forces model

Útdráttur

Endurnýtanleg einangruð ker af stærðinni 440-600L hafa verið aðal umbúðirnar fyrir óunnar sjávarafurðir því þau hafa yfirburða eiginleika umfram aðrar tegundir af umbúðum. Notkun á þeim hefur hinsvegar ekki náð fótfestu innan fiskeldis. Markmið þessarar rannsóknar var að setja fram yfirlit á fiskeldi á heimsvísu og iðnaðargreiningu á norsku laxeldi til þess að greina mögulega markaðssetningu á Sæplast kerjum. Niðurstöðurnar gefa til kynna að það geta verið tækifæri á að þjónusta laxavinnslur sem staðsettar eru í ESB til flutninga á nýslátruðum laxi til þeirra.

Lykilorð
Iðnaðargreining, laxeldi, Noregur, Sæplast, Fimm krafta líkan Porters

"If we knew what it was we were doing,
it would not be called research, would it?"
— Albert Einstein

Declarations

I hereby declare that I am the only author of this thesis and it is the product of my own research.

____
Bjarni Eiríksson

It is here by confirmed that this master thesis is satisfactory to M.Sc. degree in fisheries science form the Faculty of Business and Science, department of Natural Resource Science

____
Dr. Ögmundur Knútsson

____
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Research Manager, Promens Dalvík/Tempra

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Abbreviation

APR	-	Annual percentage growth rate.
CAGR	-	Compound annual growth rate
EA	-	Ecosystem Approach
EBM	-	Ecosystem Based Management
EC	-	European Commission
EEA	-	European Economic Area
EPI	-	Elkhart Plastics Incorporated
EPS	-	Expanded Polystyrene
ESB	-	Evrópusambandið
EU	-	European Union
FAO	-	Food and Agriculture Organization of the United Nations
FDA	-	U.S. Food Drug Administration
FDI	-	Foreign direct investment (FDI)
FHL	-	Fiskeri- og havbruksnæringens landsforening / Norwegian Seafood Federation
HOG	-	Head on gutted
kg	-	Kilogram
L	-	Litre / Liter
M&A	-	Merges and acquisitions
MNC's	-	Multi national corporations
MS	-	Marine Harvest
MSC	-	Marine Stewardship Council
MT/mt	-	Million tonnes
NASF	-	North Atlantic Salmon Fund
NOK	-	Norwegian Krone
PE	-	Polyethylene
WTO	-	World Trade Agreement
WWF	-	World Wide Fund For Nature / World Wildlife Fund

1. Introduction

This thesis is a partial fulfilment for degree of Master of Science in Natural Resource Science at the University of Akureyri. The research was funded by Promens to provide information about the global aquaculture and analyse a possible market entry for Promens' product into a selected aquaculture industry or a sector. The initial perspective included a request for an analysis of aquaculture on global scale without limitation about species, geographical location or production method.

A team of professionals was put together from the marketing divisions of Promens to support the author. They were Hilmar Guðmundsson (Iceland), Dorian Xerri (Spain), Bjarki Garðarsson (Hong Kong) and Frode Urkedål (Ålesund). The team concluded that there was a need for a detailed research to provide information about aquaculture on a global scale and to develop an analytical model to evaluate a specific sector of the aquaculture industry. The purpose was to examine the possibilities of marketing Sæplast tubs and extend current base of customers.

After reviewing tentative analysis of the global aquaculture, the research team chose the salmon farming industry in Norway to be analysed further. The decision was based on the size of the industry, value creation, geographical location, high level of infrastructure within the industry and investment capabilities.

The initial plan included a development of an analytical model, specially designed for this study. However, it was found to be a barrier because the analytical model did not have significant benefits over already established models. It was vulnerable for critique or at least created the change that the outcome of this research could be undermined due to faults in the analytical model and such model is not as likely to be incorporated as an analytical tool by Promens for further research. Hence, it was decided to cancel its use and utilise an already established and well-known model.

The model chosen was created by Thompson, Strickland and Gamble (2012).

Promens is a multinational corporation (MNC) that specialises in manufacturing plastic products. The company has grown quite fast through series of merges and acquisitions (M&A). The company has shown agility when it comes to reorganising its structure. The most drastic change was when the company transformed its structure based on product category. The ownership of the company was recently[1] transferred into the hands of the RPC Group Plc, a UK based corporation. Hence, further structural changes can be expected.

The current project was done in cooperation with the division of Material Handling[2], which consists of rotational-molding manufacturing plants in Canada, Iceland, Spain, India and China (Promens, 2013c, 2013e, 2015). The division has serviced the marine fisheries for more nearly three decades with insulated fish tubs of various sizes (Valdimarsson, 2009b). The global marine industry, based on wild fisheries has stagnated around 90 million tonnes and is unlikely to increase significantly in the future. Aquaculture is however in midst of high growth period that has lasted for more than 15 year. The global aquaculture contributed nearly 42% of the world seafood production and provided almost half of all fish for human food in 2012 and there does not seem be a foreseeable end to the growth within the industry (FAO, 2009, 2012, 2014b). The development within aquaculture during the last two decades is interesting for Promens because the company has strategically increased sales within protein based food industries[3]. Therefore it is important to study the available possibilities for Promens within the global aquaculture industry.

The objective of this project is to study the global aquaculture industry, select a sector that is a possible market niche for insulated Sæplast plastic tubs and evaluate the feasibility of an entrance into the selected market segment. The outcome is meant to provide information to be used in strategic decision-making within Promens for the marketing of Sæplast tubs. There is a possibility that other aquaculture segments will be analysed in the future. Therefore it is important to continue to use the same analytical methods for the comparability of results and to build up experience in undertaking industry analysis.

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[1] 20. February 2015.

[2] Former Promens Nordic.

[3] Other than seafood based industries.

1.1 Research Questions

The research questions that are meant to answer in this research are as follows:

What is the feasibility of marketing Sæplast reusable tubs within the Norwegian salmon farming industry?

Which market niches are the most attractive within the Norwegian salmon farming industry?

Should Promens engage in the development and production of a new type of tub to service a new market segment?

2. Promens

Promens hf. is an international plastic manufacturer and one of the largest rotational moulders in the world. In 2015, Promens operated 40 manufacturing facilities in 20 countries that are located in four continents. Promens is also in partnership with numerous agencies and distributing agents around the world. The company has gone through extensive restructuring for the last years that have focused on growth and operational integration based on sharing knowledge and production skills (Promens, 2013a; Þórisson, 2009, 2015).

Figure 1. Sæplast/Promens manufacturing plant in Dalvík (Sæplast, 2004).

Promens is originated from Sæplast, a company founded in Dalvík, Iceland in 1984 around the production of reusable insulated plastic tubs for the fisheries sector (Promens, 2010a). The tubs substituted smaller and weaker plastic boxes and promoted efficiency in production through increased mechanisation. The new tubs also increased product quality due to the insulation layer that improved temperature control of its content and their larger size/footprint reduced physical damage of fish due to restacking and excessive handling. The tubs also simplified sorting and grading on-board the fishing vessels. Sæplast emphasised on designing their tubs according to the users' preferences and soon began to increase its product variety with introduction of pallets, trawl floats, septic tanks and water tanks. The sales of Sæplast products increased steadily and its market position strengthened. An areal photo of the production facilities in Dalvík can be seen in Figure 1 (H. Guðmundsson, 2008; Margeirsson, 2015; Sæplast, 2004).

The company began exporting fish tubs when the small local market in Iceland became nearly saturated and due to strengthen competition from Borgarplast, another Icelandic rotational moulder. The export grew steadily and the importance of foreign markets increased over time. Sæplast operated on niche markets and built up competitive advantages on the bases on design, innovation and quality of both its products and services. Sæplast managed to create market advantages and built up brand identity within fisheries in Northern Europe (Valdimarsson, 2009a).

Sæplast was listed in the Icelandic Stock Exchange in 1993 to increase the accessibility to capital and the company paid high dividends to investors to compensate for stable share price (Valdimarsson, 2009b). Sæplast received the President of Iceland Export Award the same year, for significant increase of its exports mostly to Denmark, Scotland, Holland and France (Promens, 2007a; The President of Iceland, 2013). Exports continued to grow and more countries were added to the list of customers, such as India. In fact, the demand from Indian shrimp producers was so high that Sæplast built up a production plant in Ahmedabad, Gujarat province in 1996. Sæplast sent Icelandic professionals to India to train employees and set up the factory to guaranty quality and efficiency. The investment was believed to be profitable in long-term perspective by reducing the cost of transportation and avoid high import tariffs into India. The venture was also meant to service nearby markets in Asia (H. Guðmundsson, 2008; Promens, 2010b; Valdimarsson, 2009b).

The production plant in Dalvík was enlarged for the second time[4] in 1997 by 4,000 m^2 to improve productivity and keep up with increased demand from foreign markets. The results were however poor, due to high

[4] The first enlargement was done in 1988.

transportation cost to foreign markets that provided 80% of Sæplast's income. Therefore, it was decided to venture further into the international scene to enlarge the company and become more interesting in the eyes of investors. Sæplast bought two rotational moulding factories in Norway and Canada from Dynoplast A/S, who had been its biggest competitor. This strategic move was made to move closer to Sæplast's main markets on both sides of the Atlantic Ocean and made the company the largest in its field. Sæplast was listed on the main list of the Iceland Stock Exchange the day after signing the deal with Dynoplast A/S. The business deal marked a new beginning for the company because it established Sæplast as the leading brand for insulated fish tubs and made it possible to enter new markets within food industries. The company also grew in size and was considered quite large within the field of rotational moulding industry (ICEX, 1999; Valdimarsson, 2009b).

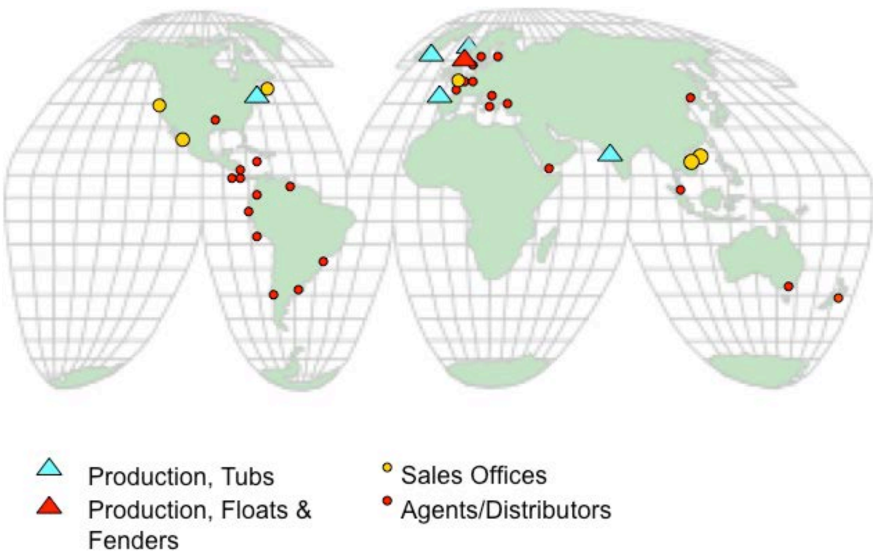

Figure 2. The location of Sæplast operation in 2004 (Sæplast, 2004).

Sæplast continued to strengthen its international operation in 2000-2003 by acquiring more competitors; Nordic Supply Container A/S[5] in Norway, Atlantic Iceland ehf[6] in Vestmannaeyjar, Icebox Plastico in Spain and Pasti-Ned in Holland. As well as adding sales and marketing offices in Hong Kong, UK and Vietnam as shown in Figure 2. The strategic goal was to strengthen Sæplast's operation in markets within the EU for insulated plastic tubs that were produced with rotational moulding. The focus was set on increasing productivity and profits by enhancing production methods, sharing expertise knowledge and experience between production facilities (ICEX, 2000a, 2000b, 2003, 2003; Promens, 2010a; Sæplast, 2004)

The ownership of Sæplast changed in 2004 when the Icelandic investment group, Atorka hf. bought 94.11% of Sæplast's shares. The new owners delisted the company from the Icelandic Stock Exchange, where the company had been listed for 11 years (ICEX, 2004). The same year, Sæplast bought Tempra, an Icelandic company specialised in producing expanded polystyrene boxes that are used to export fresh fish (Promens, 2010b).

The new owners began restructuring the company in May 2005, which had been given the name Promens and it was decided to use the Sæplast name as a brand name for its fish tubs (Gunnlaugsson, 2005). Promens took over all Sæplast's assets, which consisted of eight production facilities in Iceland, Canada, Norway, Spain, Holland and India. As well as marketing offices in Hong Kong, Viet Nam, UK, USA and Canada (Sæplast, 2005).

[5] The acquire of Nordic Supply Container A/S contained production plant that produced Poliform™ floats and buoys. That production was sold in 2009.

[6] Atlantic Iceland ehf. produced trawl floats. The production was moved to Dalvík.

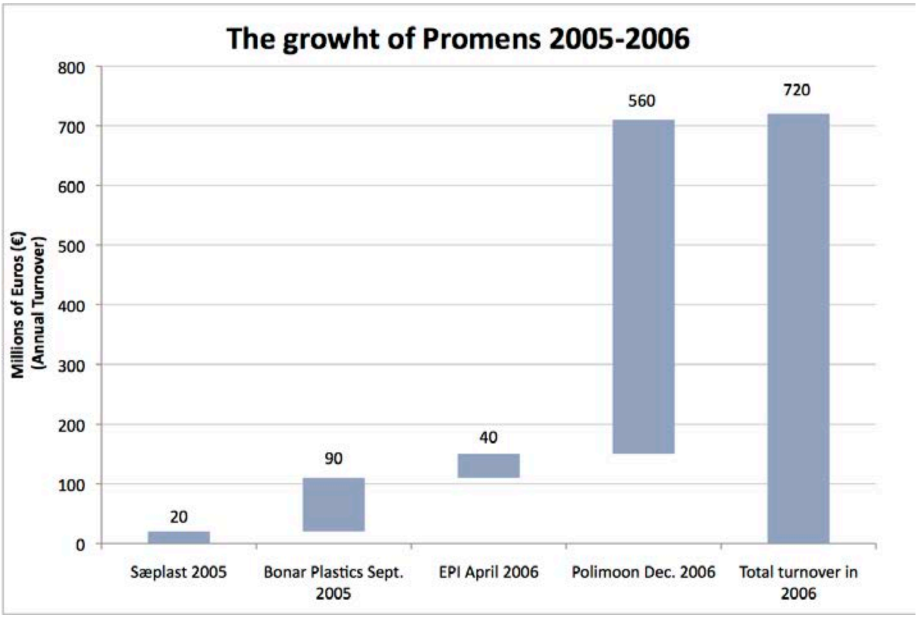

Figure 3. The growth of Promens by annual turnover (Geirsdóttir, 2007).

The strategy was set on growth and Promens bought Bonar Plastics in September 2005, a company specialised in rotational moulding that was four times the size of Promens as can be seen in Figure 3 (Geirsdóttir, 2007; Gunnlaugsson, 2005; Promens, 2010b). The acquisition of Bonar Plastics added 12 factories and 1,000 employees under Promens' management. The newly bought production facilities were located in USA, Germany, Poland, Denmark and Germany. The impetus of the acquisition was to create the world's largest rotational moulder with strong posts in Europe and N-America. Heavy emphasises was put on integrated operations that were profitable and to create economics of scale. These goals required extensive restructuring of production units and some factories were united while some were closed. The strategy was aimed at increasing specialisation of production units, expanding the product portfolio, improve efficiency and expansion into the emerging markets within Asia and Eastern Europe (Gunnlaugsson, 2005).

Promens acquired another company specialised in rotational moulding in 2006, with the purchase of the N-American rotational moulder, Elkhart Plastics Inc. (EPI). The purpose was to strengthen marketing position by entering new market sectors, increase product variety, improve technical specialty and further build up production. After the acquisition, Promens' production mainly consisted of custom moulding and automotive parts became a significant share of the companies production (Geirsdóttir, 2006, 2007).

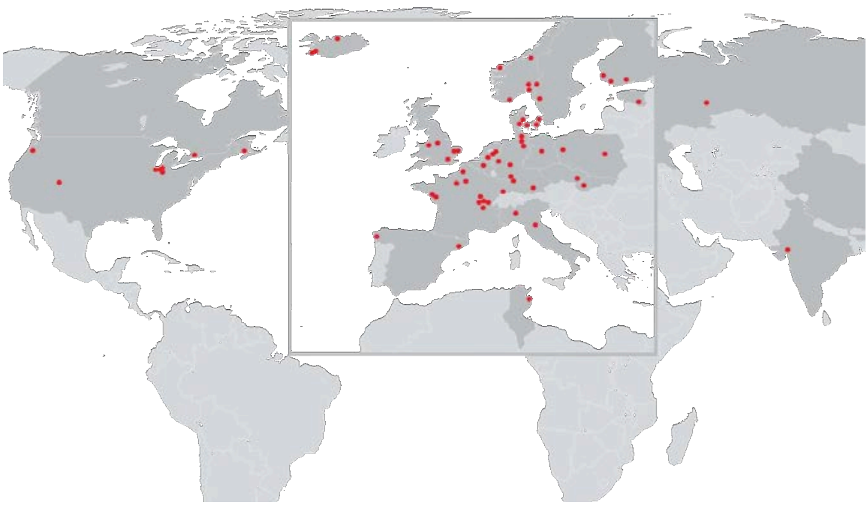

Figure 4. The location of Promens' production units in September 2007 (Promens, 2007a).

The largest step in Promens' growth was made with the acquisition of Polimoon in 2006. The deal was one of the largest that an Icelandic company had ever done when buying a foreign production company (Promens, 2007b, 2007d, 2010b). The investment was a ground-breaking event for Promens because it changed the company from being solely rotational moulder into becoming a multinational plastic producer.

Figure 3 shows the tremendous growth of Promens in 2005-2006 in annual turnover in million euros. In the end of 2006 the total annual turnover of Promens was €720 million euros. An increase of €700 million euros since Atorka hf. bought the company in 2004. The new facilities included factories that operated inject moulding, blow moulding and thermoforming. The number of production facilities increased from 20 to 62 and the number of employees increased from 1,400 to 6,000. The locations of production units that Promens operated in 2007 are shown in Figure 4. (Geirsdóttir, 2007; Promens, 2007b).

Promens continued to grow in 2007 with the purchase of three companies that produce consumer packaging for the cosmetic industry, LLC Zavod Novoplast in Russia, Decoplast in France and STE Packaging in Spain (M2 Communications Ltd., 2006; Platt, 2008; Promens, 2007d). The fourth large expansion in 2007 occurred when a brand new rotational moulding plant was opened in Miedzyrzecz, West of Poland. The plant is 10.000 m^2 and the investment also included a 60.000 m^2 piece of land, available for future additional enlargement, if needed. Another new 5.400 m^2 production facility was opened in Nitra, Slovakia in 2009[7]. It is especially equipped for injection moulding for the automotive industry and is strategically located near large car manufacturers such as Volkswagen (European Plastics News, 2008; Promens, 2007c).

Promens operated 60 production facilities in 2007 and soon after the consolidation with Polimoon a process was initiated to streamline the operation under the new operation structure (Promens, 2007a; Þórisson, 2009a). Four production units were consolidated in 2008, which was a decisive year in Promens' operation due to the global financial crisis, often called the credit crunch. Sales were severely affected (Þórisson, 2009), mostly to customers within the automotive industry that was the industry which suffered the sharpest drop in trade within the U.S.A. or by 47%. Other industries showed a significant drop in trade across major U.S.A. trading partners who all registered a double-digit percentage fall in both imports and exports (Levchenko, T. Lewis, & Tesar, 2010). Iceland experienced a total collapse of its banking system with a full-fledged currency crisis and insolvency of large segments of its business sector. The situation in Iceland was found to be the deepest and most rapid economic crisis in peacetime history, when the Iceland's three major banks collapsed in the same week in October 2008 (Daníelsson & Zoega, 2009). Promens was mostly guarded from the Icelandic crisis because 98% of company's business was outside Iceland, its loans were financed until 2012 and the collapse of the Icelandic banks did not have a direct effect on day-to-day activities. However, it was quite clear that the company faced decline in sales to key customers and the

[7] The factory in Nitra was closed the year after it was opened because the global financial crises.

management responded by cutting down costs and improving efficiency within the group. Promens' main stakeholder, Atorka Group hf. requested that its shares on the OMX Nordic Exchange in Iceland would be suspended from trading, due to unusual market situations (Promens, 2008). The years 2009 and 2010 consisted of further consolidation by merging or selling production facilities and closing down inefficient units. The largest single event was the sales of the U.S. facilities that were obtained in the purchase of Elkhart Plastics Inc. (EPI). The majority of EPI's budgeted sales in 2006 were custom moulded items for recreational vehicles of 42% and recreational boats 23%. Promens operated 52 manufacturing facilities in 24 countries in the end of 2009 and in 2010 they were 49 in 20 countries (Þórisson, 2009).

In 2009, Atorka Group hf. could not fulfil its financial obligations and was acquired by its creditors[8] whom consequentially gained ownership of Promens. Horn Invest hf., a subsidiary of Landsbankinn then acquired 99% of share capital in Promens hf. as part of the company's composition agreement with creditors (Landsbankinn, 2011; Promens, 2011; VB, 2009, 2011a, 2011b).

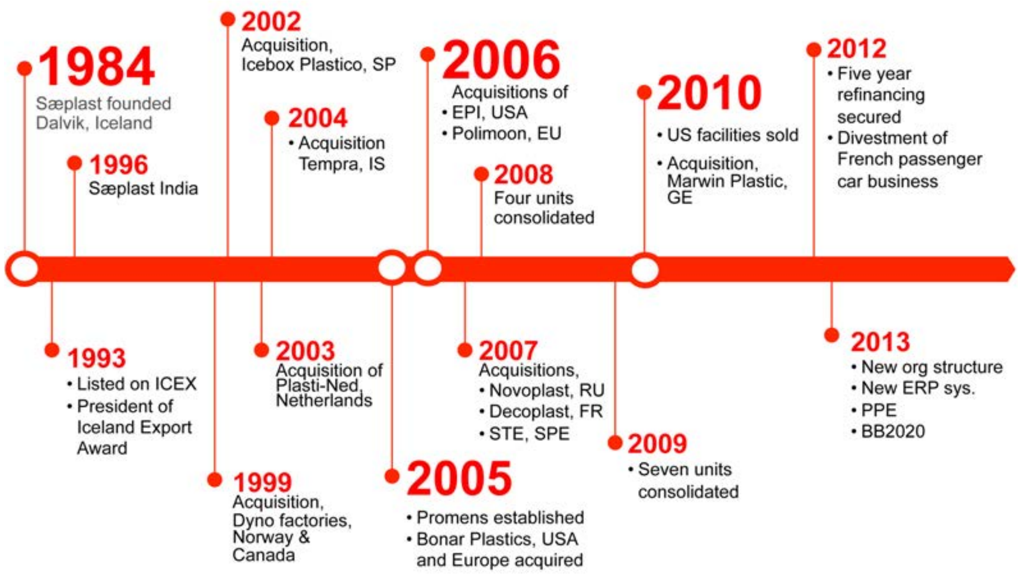

Figure 5. Integration and expansion of Sæplast/Promens (Promens, 2013e).

[8] Arion Bank, Íslandsbanki, Landsbankinn and the Resolution Committee of Glitnir owned 70%.

A 49.5% share of Promens was then sold to the Enterprise Investment Fund[9] in 2011. The remaining ownership was in the hands of the Horn Invest hf (49.91%) and 0.59% owned by managers (Promens, 2011, 2013e; VB, 2011b). The new ownership refinanced the company and continued consolidating the operation with the sale of four factories that are specialised in producing technical components for the French passenger automotive industry (Promens, 2012a, 2012b). An overview of major events in Promens' operation is shown in Figure 5.

When viewing the key financial figures that are presented in Figure 6, it is evident that the global financial crises in 2008 had a significant effect on Promens' operations. The losses in 2008 and 2009 aggregated to €87 million euros, a similar amount as the accumulated EBITDA for the same years. However, the streamlining of operations, consolidation of production facilities and increased sales regenerated profits in 2010 (Arnarson, 2013b; Promens, 2013b, 2013e). Promens renegotiated with its creditors in 2012 (Promens, 2012b). This was meant to settle the company's great expansion of 2007 and was meant to ease the major "growth pains" it caused.

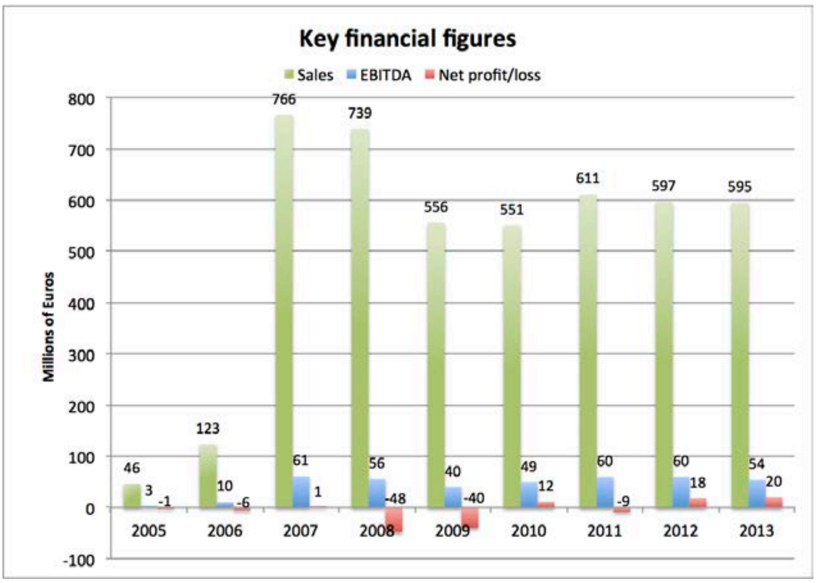

Figure 6. Key financial figures for Promens 2005-2012 (Arnarson, 2013b; Promens, 2013b, 2013e, 2014a).

9 The shares were acquired in two sessions.

The times of austerity came to an end in 2012 when Promens profited from its operations after having adjusted its operation to a post financial crises economic era and revealed plans to enlarge its business in new markets. Promens announced the establishment of new production facilities in China, which is meant to service customers in China and East Asia. At first, the facilities will be fitted with rotational moulding production and will primarily serve the food and material handling industries. The focus will primarily be on serving the food and material handling industries (Promens, 2013c; Toloken, 2013).

Two fundamental changes have been made to Promens' organisational structure. The first change was done in 2007 after the rapid expansion. Then the company was structured into three divisions; Components, Packaging and Rotational Moulding (Promens, 2007a, 2007b). The structure was changed again in 2013 by organising the company into six divisions; Chemical Packaging, Personal and Health Care Packaging, Food and Beverage Packaging, Material Handling[10], Vehicles and Medical. The divisions are supported by three supportive departments of; Finance, Operations and Procurement (Promens, 2013e). The new structure demonstrates the company's redefined strategy, how the company has been restructured and what markets it will focus on servicing.

[10] The Material Handiling division is the former Rotaional Moulding segment.

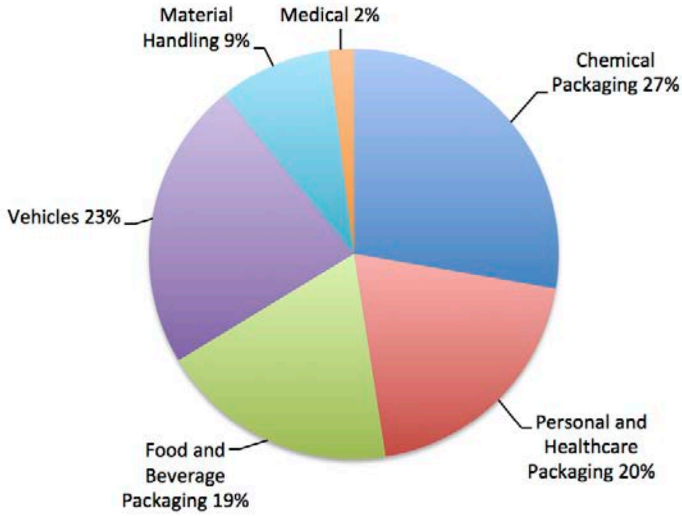

Figure 7. Percentage of Promens' gross revenues in 2012 (Promens, 2013e).

Promens has emerged from the financial crises as what seems to be a robust company that has a diverse range of income as presented in Figure 7. The majority of its customers, or about two thirds are positioned in markets that deal with consumer goods and those markets are very inelastic to economical changes. The executive team had plans to list Promens on a public stock exchange market. (Promens, 2013e; Valdimarsson, 2013). Those plans were not realized because the entire issued share capital of Promens Group AS and its subsidiaries were bought by RPC Group Plc. in early year of 2015 (Promens, 2014b).

2.1.1 Rotational Moulding

There are several different production methods used in manufacturing plastic products. The main methods are; blow moulding, injection moulding, thermoforming and rotational moulding. It is even possible to combine more than one method[11] for a single item. All these methods shape plastics by using heat. Sæplast tubs are made with rotational moulding or rotomoulding

[11] Current production methods of Promens are; CombiPac Thermoforming, Extrusion Blow Moulding (M), Injection Blow M, Injection M, Inj. Stretch Blow M, Reaction Injection M, Rotational M, Thermoforming, Vacuum Blow M and Vacuum forming.

as the process is also called (Promens, 2007a). "*Rotational molding is a high-temperature, low pressure, open-molding plastic-forming process that uses heat and biaxial rotation to produce hollow, one piece parts*" (Beall, 1998).

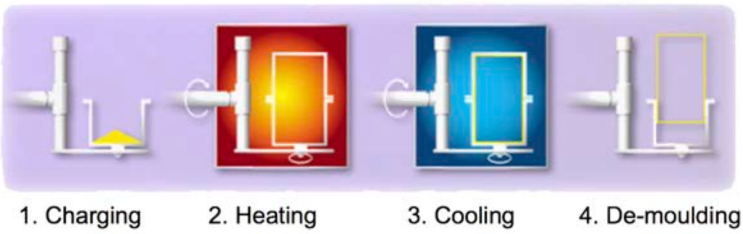

Figure 8. The process of rotational moulding (Geirsdóttir, 2006).

Sæplast tubs are made in four steps; charging, heating, cooling and de-moulding as shown in Figure 8 (Geirsdóttir, 2006). Promens buys polyethylene (PE) that comes in the form of transparent white granules. Before charging the material into the mould, the granules are grinded into powder to make it easier to melt and then it is mixed with colour pigment. The Sæplast tubs have a light beige colour as a standard, but customers can select their own if they choose to do so. In the first step of the process a specific amount of PE is put into a hollow mould, which is then closed. The quantity of the PE is determined by the size of the tub that is being produced. In the second step the mould is moved into the oven. Under biaxial rotation the mould is heated until the powder is properly molten and forms a uniform layer on the inside of the mould. The time that the mould spends in the oven varies on the size of the tub being produced. Average time is around 20 minutes at 300 °C. In the third step of the process the mould is moved to the cooler under continued rotation and the product inside is cooled until the melt is solidified. In the final step, the mould is discharged, cooled down, inspected, injected with insulation media and a new Sæplast tub has been produced. Labelling is also possible with print label or by carving the letters into the plastic[12] (Björnsson, 2013; Promens, 2013d).

[12] The third possible way to label tubs is to add a plastic marker into the mould that is melted into the tubs.

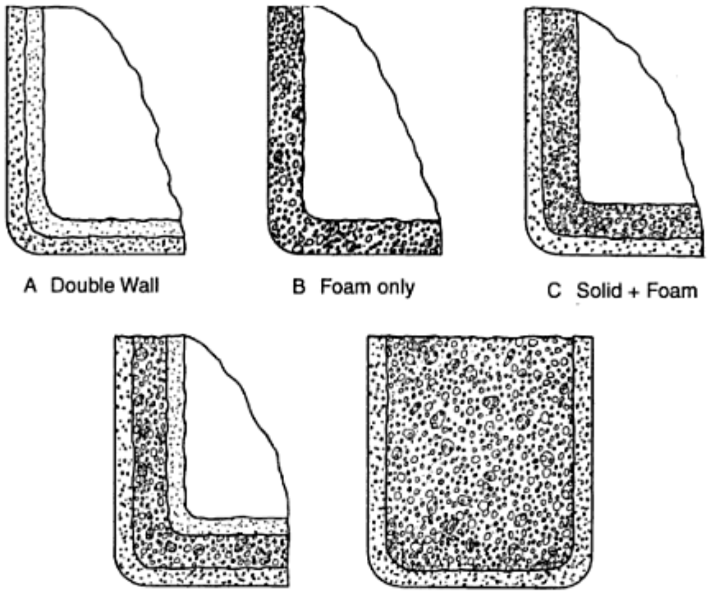

Figure 9. Different types of forming plastic with rotational moulding (Beall, 1998).

Rotational moulding is highly versatile production process that is driven by the ability to create small and large seamless, on-piece, hollow parts of extremely complex shapes. The possibilities of creating hollow parts allows the possibilities for them to be filled up with foam (Beall, 1998). Sæplast tubs are insulated in the same way as item D in Figure 9, a double walled structure that is filled up with foam.

2.1.2 Sæplast Tubs

Sæplast tubs are designed for handling alimentary items and are widely used in various food industries, particularly in protein based processing. They were designed especially for fisheries to safeguard catches on board vessels, in transit and in processing. Their outer shell contains solid polyethylene and they are insulated with polyurethane foam. It is also possible to have polyethylene foam as insulation. It gives higher impact resistance but polyurethane has higher insulation factor. The tubs made with polyethylene insulation are fully recyclable. All materials used in the tubs are approved by the European Union (EU) and the U.S. Food Drug Administration (FDA). The non-corrosive surface is made smooth to prevent microbiological growth and so they can be easily cleaned. Sæplast tubs and containers are certified ISO9001 and by the European sanitary certification. The tubs have replaced various types and sizes of containers. The advantages of Sæplast tubs are their protective ability, handling and durability.

The Sæplast tubs have replaced various types of singe wall plastic boxes and tubs. Such packaging has very limited insulating properties and thus does not prevent as well heat being transmitted from the environment (Snorrason, 2014; Snorrason, Margeirsson, Pálsson, & Arason, 2012). The smaller boxes can easily be filled excessively, so the content can be pressured from accumulated weight from the stack above. Some boxes have draining holes on their bottom, such as boxes for storing whole fish. They allow liquids to drip down into a whole stack and therefore they are open for cross contamination. Small size boxes can also be difficult to handle because they need to be stacked manually on pallets before they can be lifted or moved with mechanised devices. Especially problematic in locations where it is difficult or impossible to install conveyer belts e.g. on board vessels. Small size boxes can also have a negative effect on quality for delicate content. Because stacking and restacking and other unwanted movement can cause drip and gaping in fish flesh that significantly affects quality and yield.

Sæplast tubs have been in constant development since they were introduced in the 80's. The goal was to eliminate the weaknesses that are described above. They are equipped with drain holes on each corner allowing liquids to flow on runways that direct fluids to the outside of the tub and prevent dripping/flowing from a tub sitting above. They are stackable with four-way entry for forklift or pallet jack and have hoisting grips for mechanized handling that can support 1200 kg. They are robust and meant to withstand demanding usage and it is possible to place three to five loaded units in a stack, depending on their size. Their foot print is the same as most single wall boxes and therefore compatible with other brands (Promens, 2010c, 2010d; Valdimarsson, 2013).

Figure 10. Sæplast tub, 660L polyethylene with polyurethane insulation (Promens, 2010d).

Sæplast tubs are available in various sizes but the 460 and 660 litre (L) models that is shown in Figure 10 have become an industry standard within the fishery industry. The 660 L tubs are able to carry 420-460 kg of iced fish and the 460 L carry about 300 kg of fish on average. The average product lifetime is estimated to be 5-7 years depending on usage and treatment. The tubs are also designed in that way that a tub can be stacked into each other and another one on top. That stacking method can save space of 30% (H. Guðmundsson, 2008). Optional additions include matching lid, drain-hole plugs, customized marking, tub colour and embedded Radio Frequency Identification (RFID) tags for product traceability and real-time tracking (Promens, 2010d). Promens recently[13] introduced a new tracking system especially designed for Sæplast tubs. The system is called MIND and is a real time tracking system that has an online web interface. The tubs carry an identification chip that is also a temperature sensor and a battery pack that lasts for 8 years. The device communicates with transceivers that have a reading range up to 300 meters and are strategically located in spots within the logistic chain. The transceivers log information that is communicated with the MIND system and automatically report the GPS location and temperature measurements in the surroundings of the container (Promens, 2013e).

[13] The MIND system was introdued at the 2013 Brussels Seafood Exposition.

There has been a drastic development in mechanisation within the protein based food processing sector since insulated tubs became an industry standard. Several companies offer products that have specific automatic purpose for handling tubs. The Icelandic based company 3X Technology can be taken as an example. They offer fully automatic washing machines, tub in feed systems, aerial conveyer belts that carry tubs in the ceiling to save floor space and automatic tub dispensers as shown in Figure 11 (3X Technology, 2013). These devices have significantly increased automation and productivity within the Icelandic fish processing plants and have a fast payback period (Hauksson, 2013). The level of automation has increased steadily in Iceland and it is estimated that about 70% of all fish process facilities had some kind of mechanisation around their tubs in 2013 (Aðalsteinsson, 2013).

Figure 11. Automatic washing machine and tub dispenser from 3X Technology (3X Technology, 2013).

2.1.3 Sales

The Material handling division of Promens is responsible for production and marketing of Sæplast tubs. Figure 12 shows the sales of Sæplast products within the Material Handling division in 2012. Fish related industries were the largest group of Sæplast's customers in 2012. Their revenues valued €4.1 million Euros or 55% of the total income of the Material Handling division. Of that, were wild fisheries 50%, while aquaculture and fish farming were only about 5%. Other sectors were meat and poultry 9.9%, food processing 9.4%, Industry 5% water treatment and waste management 6%. Thus making sales to food related industries 74.3% in 2012. (Arnarson, 2013a). More detailed information can be found in Annex I – Sales of material handling division in 2011 and 2012

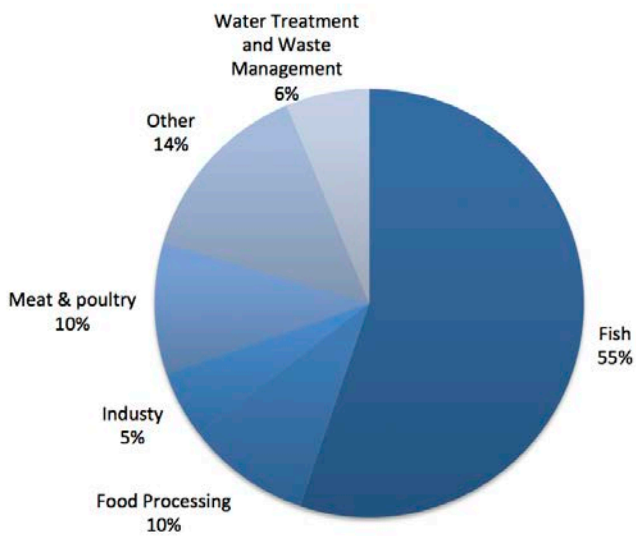

Figure 12. The sales of the Material Handling division in 2012 by market segments (Arnarson, 2013a).

2.1.4 Salmon tub

Promens has serviced the Norwegian wild fisheries for more than 20 years and has been interested to increase sales and services to the sector. The development team at Dalvík designed a prototype of a container with lid that is especially designed to transport fresh salmon within Norway. The main goal was to design a container that could be sealed tightly to hinder any leaks from the container and prevent any impurities or liquids from accessing into the container. Thus prevent bacteria like *Listeria monocytogenes* from being a risk to the raw materials inside the container. The lid itself is attached to the container with rubber straps and it is possible to equip the lids with silicon gasket upon request. More detailed drawings can are presented in Annex I – Specifications of Promens Salmon tub(Guðmundsson, 2010).

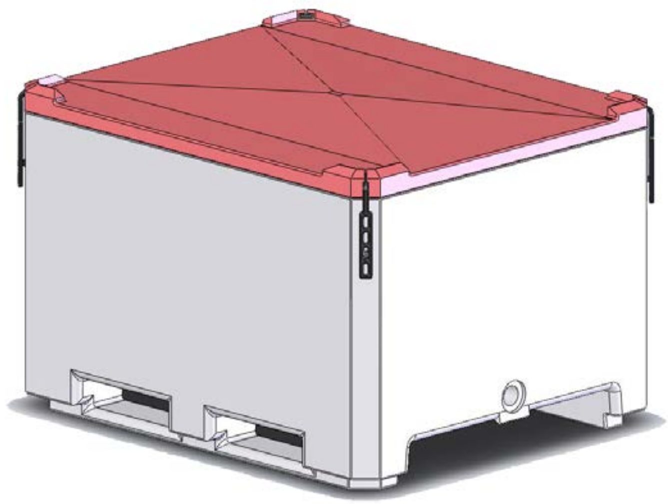

Figure 13. Drawing of a tub designed to transport fresh salmon (Guðmundsson, 2010).

The planned size of the container is 600 litres and made from same materials as standard Sæplast products, the shell from polyethylene and polyurethane for insulation. The salmon container is designed to enhance the utilisation of space compared to previous models by removing hoisting grip and making the tube more cubic, thus, increases the volume of the tub. The size of the tub is designed according to the most common size of trucks that are used within Norway, or trucks that are capable to load 26-38 European sized pallets that each carry 27 pieces of 30 litre expandable polystyrene (EPS) boxes. The containers will be equipped with one drainage hole with construction that secures complete exhaustion. They will be stackable with four-way entry for forklift of pallet jack. It is estimated that the tubs will be able to carry c.a. 405 kg iced salmon and will be able to maintain sufficiently low temperature for 4 days.

This new design of salmon tub can also be transferred to other farmed fish species. It is presented here to demonstrate a possible product for aquaculture industries (Guðmundsson, 2010; Johansen, 2009).

3. Theoretical Background

3.1 Theories of Trade

David Ricardo developed a theory of comparative advantage for some 200 years ago. It explains trade in terms of differences in technology among countries and how countries specialize in producing what they do best instead of producing wide variety of goods (Holmlund, 2008; Ricardo, 1817; Ruffin, 2002).

The Swedish economists Eli Heckscher and Bertil Ohlin developed the second fundamental theory on trade in the 1920´s. Their theory explains why countries trade goods and services with each other in terms of differences in relative access to factors of production, such as capital and labour (Holmlund, 2008). Based on the Heckscher-Ohlin theory, countries possess comparative advantage in international commerce due to unequal geographic distribution of productive resources. Hence, countries that are richer in labour than land export labour-intensive agricultural products than countries that are rich in natural resources. The Heckscher-Ohlin theory supports Ricardo's theory that countries will specialise their production based on resources and export goods that are easier and cheaper to produce than in other countries. The reverse assumption is made on imports, countries are likely to import goods that are easier and cheaper to produce in other countries (Leamer, 1995). The common element in traditional trade theory is explained as a comparative advantage in terms of differences among countries. Therefore, countries trade with those who are different from them, i.e. a country that imports non-manufactured goods and exports manufactured goods because it lacks land and natural resources but has labour and capital (The Royal Sweedish Academy of Science, 2008).

The trend in the modern global economy shows that economies can be defined as similar in size or nature, trade with each other. Such is the case with the countries within the European Union and between Canada and US (Krugman, 2008a). This tendency has been described in the gravity model of trade where the economies are emulated with planets that orbit around each other and their mass creates gravity by the laws of Newton. The gravity model of trade is used to predict flows in commerce based on the size and distance between economies and was first used by Walter Isard in 1954 (Feenstra, Markusen, & Rose, 2001; Isard, 1954). The main assumption of the model says that trade falls off with distance and large economies attract trade due to their size. The theory seems to work quite well with real world situations and is supported with empirical analysis. But it was not supported with theoretical models. So it has been concluded that the gravity model of trade is good to describe general tendencies when the modern global economy is reviewed. However, the model cannot be used to explain why similar economies should trade with each other. Nor does it explain the reasons behind the rise of intra-industry trade that increased in many industries in the last century. The reality has also indicated that the majority of world trade has been between countries that have similar characteristics and large share of commerce includes goods of the same category (The Royal Sweedish Academy of Science, 2008).

Paul Krugman explains the flow of commerce in his writings from the 1970’s and into the 1990’s (Krugman, 1979, 1980, 1991). His new trade theory explains the occurrence of trade of indistinguishable products between countries that possess the same features. A fundamental element of the theory is the economies of scale that is obtained with specialisation. That is in compliance with the reality where there has been an increase in intra-industry trade and that high-income countries trade with each other. The second assumption suggests that consumers value variety. Companies, that produce brands at a large-scale for the world market, compete with each other through trade. That enables them to replace local small-scale production and provide consumers the diversity they desire. Krugman also laid the groundwork for a new theory of economic geography that enhanced the understanding of urbanisation. Krugman’s theories can therefore be used to understand the foundation of modern trade and mobility of labour between different regions from the assumption that highly populated areas possess economics of scale and attract consumers (Krugman, 2008a; The Royal Sweedish Academy of Science, 2008).

3.2 Globalisation

The new trade theory explains the drivers and reasons of world trade in modern times, how industries gain strengths through specialisation and economic of scale that gives them the impetus to compete in the world market (Krugman, 2008a). However, the recent increase of world trade and its impact is not as entirely new phenomena as we sometime like to think it is. There have been previous periods in the history where distant societies benefited from long distance trading such as the Silk Road in the times of the Roman Empire, the Parthian empire and the Han Dynasty. Other examples are the expansions of European trade in the 16th and 17th century and the British Empire (Casale, 2006; Jones & Wale, 1999; McLaughlin, 2008; Thorley, 1971).

Trade has brought distant societies closer to each other for a long time and the effects of increased interaction has been described as globalisation. There are many different definitions of globalisation, depending on the background of the subject that is discussed at given time. Globalisation is however, often related to economics as Gupta and Govindarajan define the issue. "*Globalization refers to growing economic interdependence among countries as reflected in increasing cross-border flows of three types of entities: goods and services, capital and know-how*" (Gupta & Govindarajan, 2004). It is possible to put forward reasonable arguments that globalisation has followed trade since the dawn of civilisation and the affects came more apparent with intensified developments in technology and increased speed in transit of goods. Therefore, globalisation can be described as a process that has happened "*through its historical evolution and its connection to modernization process"(Ankara Papers, 2004)*. Nevertheless, it is the common view that the phenomenon began in the late nineteen century (United Nations, 2002). John Maynard Keynes described his surroundings in the eve of the World War I when world trade was fairly open. At that time, citizens in London could for example, enjoy new technological advantages such as the telephone and the automobile, purchase exotic goods from faraway countries and trade different goods and invest in any quarter of the world. The effects of the two World Wars forced many countries to pursue policies that promoted self-sufficiency to protect their respective industries that constricted international trade (Krugman, 2008b). The effects of globalisation have intensified for the last six decades due to technological advantages that have helped us to overcome geographical distances. People have now the possibility to transport items, products and themselves long distances within a fraction of time that was only imaginable just one or two generations ago. The access and the usage of information have also been revolutionised the service industry with the usage of information technology and computers. Companies in countries such as India are now able to service customers that are located on the opposite site of the globe through call centres by using fast internet connection (Boston Consulting Group & Knowledge Wharton, 2007). Technological advantages through channels such as telephone, radio, TV and Internet have impacted the culture of most of the world's population. The easy accessibility of communication has led to increased interactivity. The consequences are the emerging and overlapping of cultures. This trend has been described as the "hybridization" or "creolization" of cultures. It means that people or whole societies may have been stereotyped and put into some sort of universal category as a creation of globalisation that has merged down special cultural identities (Ankara Papers, 2004). The fact is that most societies have their respective social values or norms that are somewhat different from other countries. Hofstede highlights these differences when he pointed out the differences in management cultures between countries. He concludes that great ideas in science, politics and management travel between countries and become enriched by foreign influences. He also believes that standardisation of managerial practices is not desirable because there is not just one way to do things and therefore we should encourage people to do things in their own way if the results are at least as good (Hofstede, 1993).

In order to estimate the impact of globalisation on international business, it is necessary to respect the angle of the new trade theory and assume that big business gives us the possibilities of economics of scale. Therefore it is possible to yield lower prices that give increased competiveness and the chance to compete on the global market. On the other hand it should be clear that countries and societies are different and it might be difficult to approach the world market as a homogeneous entity. This has been described as the paradox of globalisation and localisation. It refers to the key questions whether international firms should adapt to the needs of individual markets or standardise in order to gain increased competitiveness based on size (Wit & Meyer, 2004). This paradox has had significant effects on the competitive environment of global companies and the strategy of their core activities. Companies that operate on global scale gain their main competitive advantages through internationally fungible resources. Diversified companies or corporations can therefore be transformed into "global specialists" that operate in increasingly tighter niche markets where they compete with few multinational- or global corporations. This development is described by Meyer (2006) as *globalfocusing,* where internationalisation is contrasted with a reduction of product diversification. This is a way for companies to develop economics of scale in the way Krugman describes in his new trade theory and has bases in economic theories (Krugman, 1979, 1980, 1991).

Another paradox has been described as the psychic distance paradox. It describes how company's operation in foreign markets can be under uncertainty that is rooted in the difference of cultures between the company's country and the host country, even though they are geographically close. The uncertainty can create diverse hindrance for the company. Because managers underestimate the cultural differences and treat the host market as their home market. Therefore, all foreign investment in geographically close range have to be prepared with the same preparation as investment in faraway countries (O'Grady & Lane, 1996).

The world is changing with ever-faster pace and the corporations that have been gaining ground in international trade are getting ever more influencing and powerful. In fact they are getting so powerful that their operations are becoming so complicated and large that it is hard to comprise them all. It has reached to a point where people are starting to doubt the benefits of the globalisation due to the consequences that globalised multi national corporations (MNC's) impose on nation states. The importance of competitiveness among nations has forced them to compete for the favour of the MNC's. Competition that should have strengthened nations states has instead, weakened them. Countries have been pressured to lower wages to gain increased competiveness and they are perhaps going too far in relaxations on labour laws, general deregulations and liberalisation of corporate practices. The consequences are a source of rising inequality between labour and capital (Rodrik, 1997). It is debatable whether the gains of globalisation are greater than the drawbacks. Such discussion will not be put forward in this text. Instead the focus will be on analysing how companies can enter markets or market segments that are distant in geographical perspective with the objective of utilising globalisation for their benefits.

3.3 The Imperatives for Expansion into New Markets

According to Gupta and Govindarajan (2004) there are five prime reasons or imperatives why companies consider expansion into foreign markets. These factors can be different depending on differences in industry and the firm's strategic position. The factors can even differ over time. The first imperative and probably the most important one is growth. Companies have a natural appetite for growth because it increases the chances of successful business and higher profits through improved efficiency. Companies that are positioned in mature markets seek ways to expand their business into emerging markets for fresh opportunities and possibilities for growth.

The second imperative is efficiency. Companies have motivations to enter foreign markets to reach more efficient scale of their activities, especially when their value chain consists of many activities. In that way it is possible to establish specific value creating operation in strategic selected location. An example is a computer company that locates research and development in U.S.A., programming in India and assembling in China. The goal is to utilise the company's resources in a manner that increases the returns of capital through economics of scale and yield maximum efficiency.

The third imperative is knowledge. This imperative is related to the paradox of globalization and localisation. Where multinational or global companies have to acquire sufficient knowledge about all of their markets so they can adopt their product to local needs and demands. An example could be a fashion company such as Benetton that has to be able to produce cloths in different sizes depending on Western or Eastern markets.

The fourth imperative is globalisation of customers. There has been increased geographical expansion and globalisation of multinational and global corporations. This trend has required many companies to follow these large corporations into new markets in order to fulfil their need for supply or service.

The fifth imperative is globalisation of competitors. The whole world is becoming one large market place where MNC´s can enter emerging markets, create first mover advantage and gain handsome profits. Then they can move those profits to compete in their home markets with more strength than their competitors (Gupta & Govindarajan, 2004). All of the reasons mentioned here above are associated with methods that companies can adopt to increase profits in one way or another. They are meant for global companies, meaning companies that operate in many countries and/or regions. Therefore, it seems that the global, at least the international market place is only available for large companies. Such presentation implies that the global marketplace is not a place for small and inexperienced newcomers. Yet, new innovated firms are somehow able to penetrate into the global market. It is interesting that some of the world's largest corporations such as Microsoft, Apple and Google are positioned in industries that did not exist two or three decades ago. Now they are deeply interlinked with the computer, software, cell phone and satellite TV industries.

The main argument is that companies do not have to be large MNC´s with global presence to be able to operate within the global market. There are literatures that support that idea and that perspective will be described in next chapter.

3.4 Overview of International Business Theories

In recent years, as international business has intensified and become more complicated, it has demanded its own theoretical framework that have grown from traditional trade theories. It can be seen from these theories how international business has developed with time and how they represent the reality from their modern times. Mtigwe (2006) categorizes the theories of international business into four groups by schools of thoughts. The groups are *classical theories, early market imperfections theories, latter day imperfections theories and internationalization theories.* Figure 14 contains a list of the more detailed list of the conceptual models behind each group or schools of thought, as Mtigwe prefers to call it. There is no need to repeat chapter 3.1. Though it is useful to be reminded that the classical theories are based on the view that international trade happens because countries are different and the differences creates advantages. In that way it is possible to use resources in one country to produce and export goods that are scarce or do not exist in other countries. The classical theories of international trade are rooted in classical economic thought. The early market imperfections theories describe international business in the post World War II era when countries started to abolish inward looking restrictions. The firm became the unit of analysis for the first time with the growth of international multinational enterprises. The theory describes how firms can pursue growth in foreign markets with foreign direct investment (FDI) and use their organisational skills to duplicate the introduction of innovation, products or service between markets. It was also believed that firms had to move endlessly between different locations to secure and maintain cost advantage in production and maximisation of prices, under the influences of product life cycle theory.

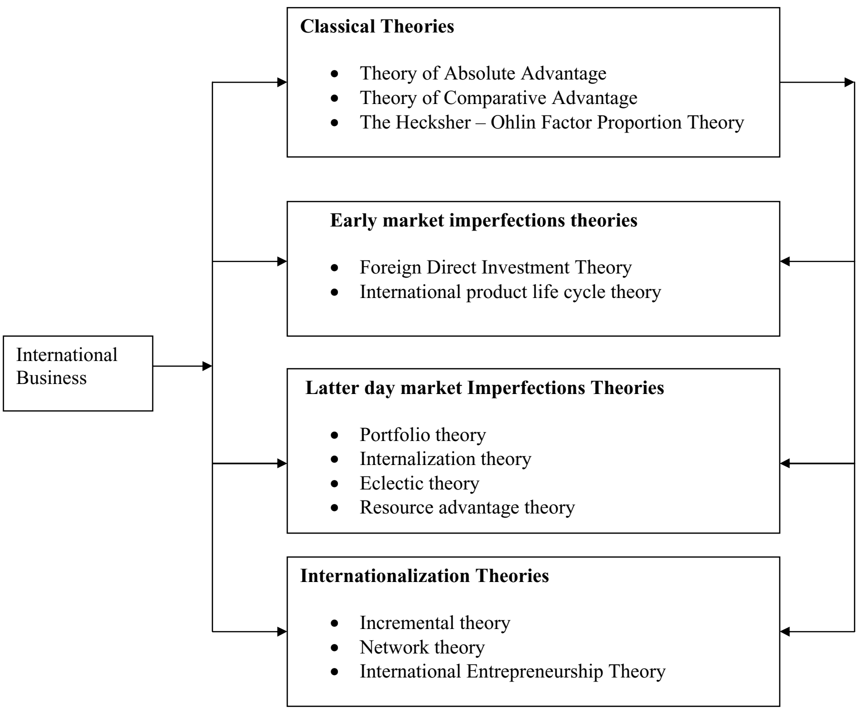

Figure 14. Conceptual model of the international business schools of thought (Mtigwe, 2006, p. 7).

The latter day imperfections theories describe international business in times of when firms increased their expansion into foreign markets. The theory can be seen as the second version of the original FDI theory with improved criterion how to succeed by diversifying operation in order to minimise their risk exposure to economic shocks with FDI and maximise their flow of profits. The theory is based on conceptual models that explain the internationalisation behaviour and underlying strategic motives. They have therefore made a valuable contribution to the understanding of international business (Mtigwe, 2006).

Mtigwe categorises the most recent conceptual models under the internationalisation theories into three partitions, incremental-, network-, and international entrepreneurship theories. They are under the influences of increased global synchronisation as the essence of firm's environment. The incremental theory is mostly based on the Uppsala model that describes gradual moves into the international market in four stages through which an internationalising firm passes "*no regular export activities, export via independent agents, establishment of a foreign sales subsidiary and establishment of a foreign manufacturing plant"* (Mtigwe, 2006). The Uppsala model assumes that companies have established a domestic market before venturing abroad (Johanson & Vahlne, 1977; Johanson & Wiedersheim, 1975). It is therefore the gradual unidirectional learning process along a continuum that is behind firm's internationalization (Mtigwe, 2006).

The network theory describes internationalisation of firms as a process of developing and establishing foreign market positions by using foreign network partner (Mtigwe, 2006). There are also views that newly founded companies have the possibilities of being "born global" (Knight & Cavusgil, 1996) and start a global entrepreneurship that does not have a specific country as a home market but target small and highly specialised global niches from the time the company is launched. Therefore, they are not constrained by geographical boundaries and do not follow the gradual process of Uppsala model (Isenberg, 2008; Mtigwe, 2006). It is also emphasised that there has to be a third party contribution in the process of internationalisation (Mtigwe, 2006). Companies that are born global have to have innovated ways to brake their ways into new markets and find suitable niches that are sufficiently profitable. Consequently they have to prepare their first move in to the global scene with care because they might not have a second chance if their plans fail.

The most recent conceptual model under the network theory is the entrepreneur theory. It represents a compromise between the two extremes of incremental theory whose primary focus is on the large multinational firm that has slow progression to international markets and the network theory whose focus is on a very rapidly inter-nationalised but dependent small firms. *"International entrepreneurship theory argues that individual and firm entrepreneurial behaviour is the basis of foreign market entry"* (Mtigwe, 2006). It depends on the company's strategy what the imperatives are when a decision is taken to enter foreign markets and how offshore operations are managed. However, it is clear that the approach should be a part of the company's core competitiveness and in line with its overall strategy. Michael Porter (1980) argues that the characteristics of company's industry and the firm's position within it determine its profitability. Therefore these two factors should also determine the firm's strategy. In order to receive higher profit margins for its products, companies should differentiate its products and apply common analytical techniques to find niches it could defend from competitors by becoming the low-cost producer or building barriers to the entry of new rivals. Porter has been criticised for being too descriptive and therefore lacking the prescriptive advisory. Meaning that he does not provide guidelines about what companies should actually do or not to do. Even if they happen to be among the lucky few that have the privileges be positioned in a profitable industry with high entry barriers and weak arrivals (Lynch, 2000).

Porters' opinion may not be encouraging for today's innovated companies that have smart plans for their foray on distant markets and limited funds. They might rather be stimulated by the opinions of Prahalad and Hamel (1990) who argue that firms should find markets after they have expanded their skills by evolving rapid product development, high-quality manufacturing service, technological innovation and service. The firm should focus on its core competencies and concentrate on the collective learning in the organisation and cherish innovative approaches (Lynch, 2000; Prahalad & Hamel, 1990).

In fact there are many theories that have been published in order to explain the reasons behind their behaviour in international business and how firms should organise themselves to prevail fierce competition. The theories about international business overlap each other and therefore it is in the hands of individual firms to evaluate their firm's structure before they find a theory that could support their strategy.

3.5 Analytical Framework

The previous chapters describe the major theories for international trade, the main reasons why companies venture into foreign markets and how they build up their new business. This chapter focuses on how companies can evaluate potential markets by analysing their external environment.

Companies that decide to expand their operation into new markets are at least recommended to gain sufficient knowledge about the respective market(s) to decrease the risks of failure. Large amount of data is available on country specific data, such as the World Bank's Doing Business report (World Bank, 2015a) and statistical information about the OECD countries (OECD, 2015). Such data is published every year and is meant to provide objective and comparative indicators for large number of countries. However, the information might not be sufficient to prepare such important decision-making. There are many other different ways to collect and analyse information about potential markets. The methods depend on the specific needs of each company or the market that is being analysed. It is therefore necessary that the analysis is done in organised manner. This calls for a pre-designed analytical framework that can be used to provide answers in organised and structured way.

The analytical framework that was chosen was created by Thompson, Strickland and Gamble (2012). The framework is a part of a larger analytical, model that is meant to analyse the business environment and then design an overall strategy for companies. The framework (Figure 15) is designed to analyse the macro-environment for companies to appraise their external environment. This same framework can also be used to analyse specific industries and/or industry sectors.

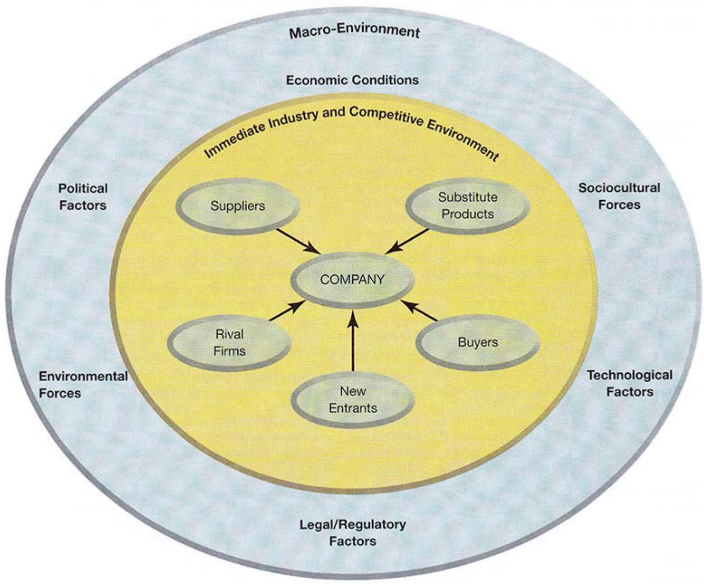

Figure 15. Companies macro-environment (Thompson et al., 2012.).

The analytical framework is structured under two dimensions i) *the micro-environment* and ii) *the immediate industry and competitive environment.* It then consists of seven components that are used evaluate the company's or the industry's environment. The components are presented in the form of questions that should be answered in specific criteria. In fact each component can include a detailed analysis that is meant to answer the given question.

The first component gives the task of answering the question, *what are the strategically relevant factors in the macro-environment?* These factors are identified with a PESTEL analysis. It has is origins in Francis J. Aguilars' "ETPS" (1967) which was designed to "*scan the business environment*" of a company by identifying factors that are important to it, but stand beyond its control or influence. The method has been modified over time and called different names such as STEP, STEPLE or PEST. The name consists of the abbreviation of the factors that are analysed. Hence the number of different abbreviations (Issa, Chang, & Issa, 2010; Morrison, 2012). The factors of PESTEL analysis are shown in Table 1, and a detailed description for each factor can be found in Annex II – The factors of the Macro-Environment.

Table 1. The factors of PESTEL analysis.

P	Political factors
E	Economic conditions
S	Sociocultural forces
T	Technological factors
E	Environmental forces
L	Legal and regulatory factors

The second question asks, *how strong are the industry's competitive forces*. The question is answered with thorough analysis using Porter's five-forces model. A detailed description of the model is presented in chapter 3.5.1.

There are two important alterations in this project to the Thompson, Strickland and Gamble framework, on how they suggest the Porters' five forces model should be used. The former relates to the fact that this project is meant to analyse an entire industry. This complies with Porter (1980) original description where he put "industry" in the centre of his original design as shown in Figure 16. While Thompson, Strickland and Gamble put "company" in the core of their analysis, as illustrated in Figure 15. It is therefore important to establish boundaries for the industry so the analysis can maintain focus. The initial request from Promens was to identify and analyse specific sector within the world aquaculture with the purpose of seeking out possible buyers for their current Sæplast tubs and/or a newly designed tub that has not yet been manufactured. The logical approach then is to define the boundaries of the Norwegian salmon-farming industry. The focus will therefore be on the whole value chain of producing farmed salmon, from fertilised eggs to the distribution of salmon products.

The second alteration was by using templates created by assistant professor Dobbs (2014) for the five forces model. This was done to respond to the criticism that Porter's model has laid under for lacking practical guidelines, quantitative measures and other reasons that will be explained in chapter 3.5.1.

Strickland and Gamble describe the model being the core of the analysis and they suggest that the nature and strength of competitive pressure should be determined the by the following three steps.

i. *For each of the five forces, identify the different parties involved, along with the specific factors that bring about competitive pressures.*
ii. *Evaluate how strong the pressures stemming from each of the five forces are (strong, moderate, or weak).*
iii. *Determine whether the strength of the five forces, overall, is conducive to earning attractive profits in the industry.*

The third question asks, *what factors are driving industry change and what impacts will they have?* This question is important to determine the industry life cycle, what trends are relevant in the industry's environment and what development affects changes in the industry. The factors are characterised as driving forces that describe the conditions within industry that can have decisive affect to its environment.

The fourth question asks, *how are industry rivals positioned in the market?* The question requires the making of the analysis of strategic group mapping that displays the position of rivals in price/quality, proportional size or market size and geographic coverage.

The fifth question asks, *what strategic moves are rivals likely to make next?* This analysis initially insists to divide rival in to three ranked groups depending on who, *has the best strategy, what competitor is likely to gain market share or defend its market and which competitors are likely to be the industry leaders in five years from now.* In order to predict the rival's future it is necessary to possess sufficient knowledge about the past and estimate their needs such as to;

- *Increase sales or market share?*
- *Have the resources and the incentive to make major strategic change?*
- *To be acquired or acquire other rivals?*
- *Be likely to enter new geographic markets?*
- *Expend product range and enter new segments?*

The sixth question asks, *what are the industry's key factors?* This requires making of an estimate on the competitive factors that can affect future success by past learning and the analysis of attributes that are likely to affect future success. General trends within an industry can also be used as an indicator on how previous trends have developed. Three additional questions are used to aid the analytical process.

i. On what basis do buyers of the industry's product choose between the competing brands of sellers? That is, what product attributes and service characteristics are crucial?

ii. Given the nature of competitive rivalry prevailing in the marketplace, what resources and competitive capabilities must a company have to be competitively successful?

iii. Given the nature of competitive rivalry prevailing in the marketplace, what resources and competitive capabilities must a company have to be competitively successful?

The seventh question asks, *is the industry outlook conducive to good profitability?* The purpose of this last question is to evaluate the industry and its competitive environment to predict future business opportunities. The question is meant to sum up the outcome of the other six questions by determining if the industry has strong prospects for competitive success and attractive profits, based on the following factors;

- *How the company is being impacted by the state of the macro-environment.*
- *Whether strong competitive forces are squeezing industry profitability to subpar levels.*
- *Whether industry profitability will be favourably or unfavourably affected by the prevailing driving forces.*
- *Whether the industry*[14] *occupies a stronger market position than rivals.*
- *Whether this is likely to change in the course of competitive interactions.*
- *How well the company's strategy delivers on the industry key success factors.*

[14] The term "company" was substituted for "industry".

The guidelines propose a discussion about the industry's growth potential, opposite competitive forces, future profitability and degrees of risk and other general issues that can have drastic effect on the industry whether they are positive or negative (Thompson et al., 2012).

Thompson's, Strickland's and Gamble's analytical framework is a schoolbook example on how to analyse the external environment for a company, an industry, a market or a market niche. It however, requires genuinely detailed information that might not be available when distant markets are being analysed or the analyser lacks experience. Such limitations can skew the analysis and create defected results. Thus, it depends on individual analyser, the data and how the respective analysis is performed.

3.5.1 Porters Five Forces Analysis

The Porters' five forces analysis was designed to evaluate the forces that govern competition within industries. Its purpose is to provide information on an industry to develop a business strategy for companies that operates within it. The framework (Figure 16) is structured around the analysis of five forces that are defined as;

- the threat of substitute products,
- the threat of the entry of new competitors,
- the intensity of competitive rivalry,
- the bargaining power of customers and
- the bargaining power of suppliers (Porter, 1980).

Porters' five forces analysis is used to determine the competitive intensity and the attractiveness of an industry. The typical steps in the analysis are to define the relevant industry and analyse what products are in it, which ones are part of another distinct industry and finding out the geographic scope of the competition. The second stage is to identify the participants and divide them into groups based on the five forces that are stated here above. Porters' five forces analysis is aimed at specific industries or sectors and therefore can one company be positioned in many markets at the same time if it has diverse operations (Porter, 1980). Porters' five forces analysis can generate thorough and specific analysis that can be used to assist companies to shape and refine their strategy. It can also be used as an industry analysis, as in this case.

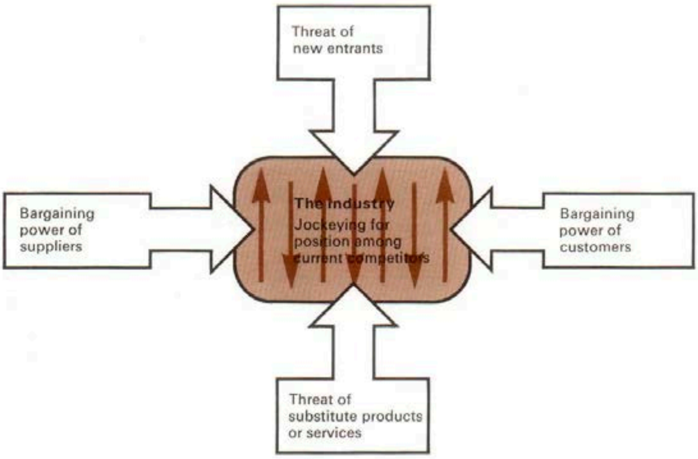

Figure 16. The five forces that shape strategy (Porter, 1980).

Porter's five forces analysis has been the prevailing framework since it was published in 1980. Before it, the SWOT-analysis (strengths, weaknesses, opportunities, and threats) used to be the most favourable tool to evaluate business. It is however week and limited in comparison with the five forces framework. There are no underlying principles for the SWOT and it likely to end up with random lists and the results highly depends on the person undertaking the analysis (Magretta, 2012, p. 86). Porter's five forces analysis has also been criticised to the point that Porter published an update to his original article in 2008 to answer some of it (Porter, 1980, 2008). There he mainly added wide range of new examples of how he evaluates the effects of the five forces, instead of answering critique on the frameworks' structure or adding tools that would assist its user. However, he highlights a short description of practical guidelines on how he recommends it should be used. Unfortunately, the guidelines are a very limited outline.

Porters five forces analytical model has been described of being "frozen in time" because the model has not been updated since it was published. It has been criticised for being hard to use. It is relatively abstract and highly analytical because it is based on micro-economic theory, rather than in terms of its practicalities. Its logic is somewhat implicit because its structure is relatively hard to comprehend (Grundy, 2006). One way of describing the problem that people are faced with when they are tasked of doing a five forces analysis is to compare it with music. It is easy for us to enjoy music just by listening. It has a simple structure because it is only built around eight base notes. Nevertheless, it takes years of practice and deep understand to create it. So, it might be enjoyable for some to read Porter's outcomes in a similar way as enjoying Neil Young's music. However, if someone puts a guitar in your hand and asks you to create a new song, how would it sound? The change of outperforming Neil Young is most likely very slim. Grundy (2006) points out that 15-20% of business school graduates are familiar with Porter's concepts. However, only less than 5% had actively used it at an explicit analytical level. While more than 50% of the graduates were actively using SWAT. Assistant professor Dobbs (2014) describes the main problems with Porters five forces model of being hard to use. The main reason is that most people only have shallow understanding of its use and consequentially get poor results that are inaccurate and unhelpful. Such analysis can even lead to poor decision making that can have severe consequences. Dobbs therefore developed templates that are meant to assist the person(s) doing five forces analysis. The templates add the possibility of quantifying the results and greatly improve the changes of continuity, i.e. that the analysis is done after a specific "recipe" so it can be repeated in time interval and the results can therefore be comparable if there is a need to repeat the analysis. It also generates documented procedure that increases the chances of maintaining knowledge and experience within companies. Therefore, companies do not have to rely on the experience and talents of individuals that might leave the company one day. Then there is a change of losing several valuables at the same time.

3.5.2 Business theories and seafood production

Globalisation has greatly affected the general way in which people do business and transformed the lives of people across the globe. The theories of international business that are described above reveal how people view the changes that occur around them and affect their ways of life. As well the way the business environment can be analysed.

The seafood industry has also been greatly affected by globalisation and the main markets are often the half a world a way form the fishing grounds or farming areas. Many larger companies have invested in high tech equipment and employ skilled personnel that have greatly advanced the industry. The development can be seen in the quality of the products that they deliver and with the introduction of modern aquaculture that is competing with the traditional wild fisheries, as will be described in the following chapters. The seafood trade has been affected by similar trends as other industries that are positioned within the domain of international trade. Hence they have developed along side other types of businesses and therefore it is possible to study the aquaculture and seafood industry with a general analytical model such as the Thompson, Strickland and Gamble model (2012) which includes Porter's five force model (Porter, 1980).

4. Aquaculture

Integrated farming systems such as aquaculture, were developed by ancient civilizations in China, India, Egypt, Rome, Central Europe and Hawaii (Costa-Pierce, 1987; Pillay & Knutty, 2005; Rabanal, 1988). It is believed that the earliest genesis of aquaculture evolved in China as far as 4000 years ago when people began to have a settled condition. The first written testimony on organised aquaculture is *The Classic of Fish Culture* by Fan Lei in 500 B.C. The record outlines a conversation where Fan Lei describes his carp aquaculture practices to King Wei as a business and praises his fishponds for being the source of his wealth (Fan Lei, 500; Rabanal, 1988). Farming of common carp (*Cyprinus carpio)* in ponds spread out from China into neighbouring Asian countries by Chinese immigrants. The farming technique reached Europe in the Middle Ages where the specie was cultured in monastic ponds and the culture flourished in most East European countries (Pillay & Knutty, 2005).

The Egyptians are believed to have raised tilapia in ponds since the beginning of written history. The harvest of tilapia is illustrated on friezes in the tomb of Nefersekheru that is dated back to 2500 B.C. (Bardach, Ryther, & McLarney, 1972; Watson, 2006). The friezes show a traditional style aquaculture method, similar to the ones that were practiced in the Northern Delta Lakes until only few decades ago, or around the introduction of modern aquaculture (Eisawy & El-Bolok, 1975; Salem & Saleh, 2010).

Other indigenous fish farming worthy of mentioning are the farming of carp and catfish (*pangasius*) that were practiced in India, Cambodia and Thailand around 11th century A.D. The earliest brackish-water farming is believed to have developed during the 15th century A.D. in the Indonesian island of Java, where milkfish (*Chanos chanos*) and other brackish-water species were farmed. Other species and culture techniques include ancient farming of oysters mussels and clams.

The most important discovery in early fish farming was made by Don Pinchot, a French monk who developed a technique to artificially impregnate trout eggs in the 14th century (Davis, 1965). The original purpose was to repopulate water bodies to improve sport fishing and pond culture. The method spread out in the course of time and later formed the base for salmon hatching (Pillay & Knutty, 2005).

Aquaculture is one of the most resource-efficient ways to produce animal protein (Ergün, 2015) and thanks to it the global fish production has been able of outpace the world population growth. “In 2012, aquaculture set another all-time production high and now provides almost half of all fish for human food. This share is projected to rise to 62 percent by 2030” (FAO, 2014b). Aquaculture is therefore a crucial source of animal protein on a global scale.

The development of industrialised aquaculture has mostly occurred in the last 2-3 decades. Before industrialised aquaculture, the main source of fish and other aquatic harvest were sourced with artisanal and industrial wild capture fisheries, both marine and freshwater. Wild capture fisheries are now considered stagnant in most areas in the world and many wild fish stocks are fully- or over exploited, which has caused a reduction in stock sizes and catches (FAO, 2012). The development has mainly been caused by technological advantages and increased effort in fishing that has been driven by continuous increase in demand from growing human population (Delgado, Wada, Rosegrant, Meijer, & Ahmed, 2003).

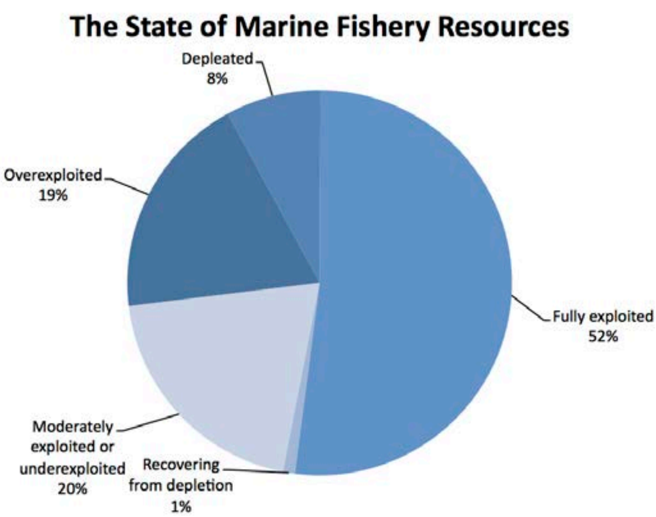

Figure 17. The state of marine fishery resources in 2007 (FAO, 2009).

FAO (2009) reported that only 20% of the world fish stocks are moderately exploited or underexploited and 1% recovering from depletion. The majority of worlds capture fisheries or 52% were fully exploited, 19% overexploited and 8% depleted (Figure 17). Thus, 79% of world marine stocks do not offer reasonable expectations of providing increased harvest in the foreseeable future. The global trends in the state of world marine fish stocks since 1974 give a little room of being optimistic. Fish stocks that were categorised of being non-fully exploited were estimated of being about 40% of the world fish stocks in the 1970's. Their share has gradually decreased and was only 12.7% in 2009 (Annex III – The state of marine fish stocks). The wild capture fisheries have thus shown clear trend of being less sustainable in the last four decades.

The stagnant supply of fish from wild capture fisheries is one of several factors that have affected the increase of aquaculture production throughout the world. The other factors are improvements in; crude stocks and growing techniques, formulated feed, logistics and access to financial capital. The growth of aquaculture production has been high and it is predicted that the majority of world's seafood, for human consumption will be grown in aquaculture within the coming years (Asche, Roll, & Tveterås, 2008).

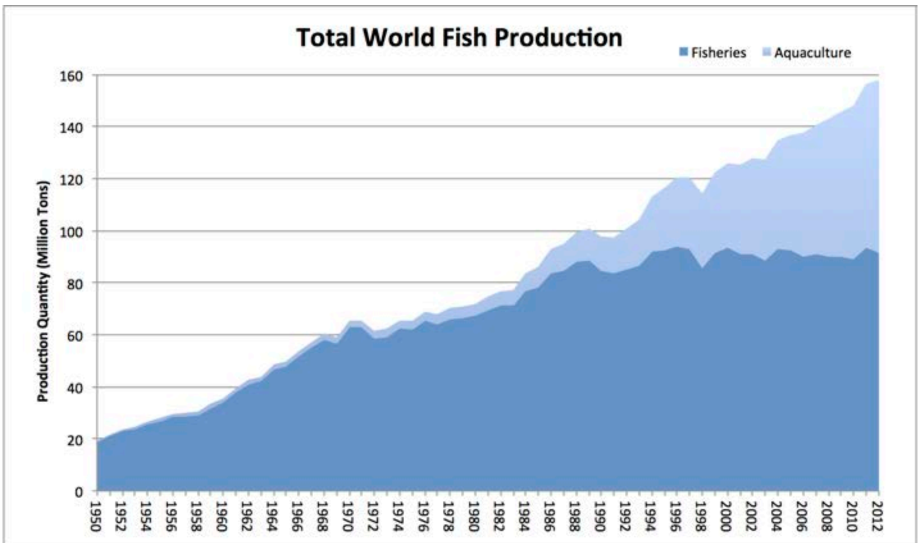

Figure 18. The total world fisheries and aquaculture production 1950-2012. Adapted from FAO (2014a).

Wild capture fisheries increased significantly in the mid 20th century, from nearly 20 million metric tonnes (mt) in 1950 to more than 60 mt in 1970, or a threefold increase in two decades, as shown in Figure 18. The total catches continued to increase at a slower pace from 1970 until the early 1980's and reached a maximum in the mid 1990's. Since then, the total wild fisheries harvest has been quite stable with an average annual output of 90 mt (FAO, 2013). The increase in the total production of seafood has increased steadily due to aquaculture production. In fact, from 1985 to 1997, aquaculture was responsible for 71% of the total growth in food fish production measured in volume (Delgado et al., 2003).

4.1 General Overview of World Aquaculture

The growth of aquaculture has been enormous. The total world aquaculture sector produced nearly 640 thousand tons in 1950 and three years later, the output exceeded million tonnes. The ten million mark was reached in 1984. Twenty years later the total production was more than 50 million tonnes, or a five-fold increase. In 2012, the total quantity of aquaculture products was 66.6 mt or 42.2% of all world seafood harvest (sold at farm gate). The value of the world aquaculture production has also increased nearly parallel to production quantity as shown in Figure 19. The total value in 2012 was $138 billion USD[15] (FAO, 2013, 2014b).

[15] Values represent prices sold at farm gate, not including aquatic plants.

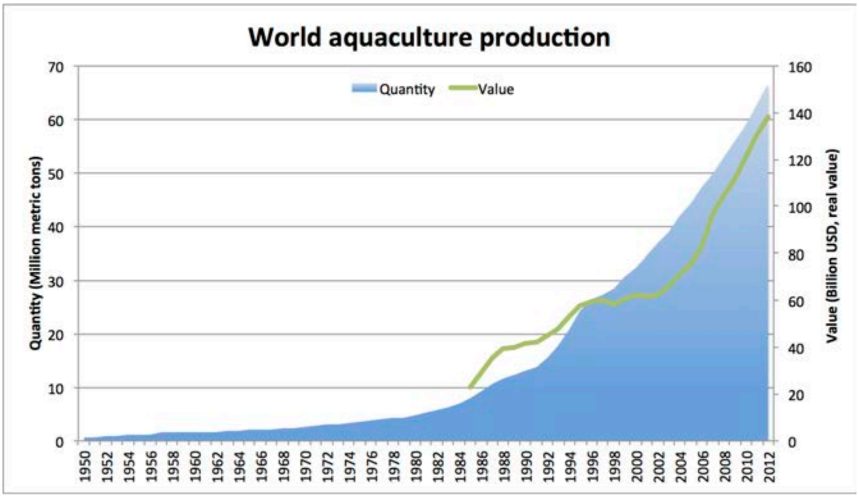

Figure 19. World aquaculture production, quantity and value in real price (FAO, 2014a).

The growth of aquaculture production has been so intense in the last three decades that it has been described as the "blue revolution" (Costa-Pierce ed., 2002; Neori et al., 2007). A reference to the "green revolution", a term used to describe the growth of agriculture in the 1940's and 1970's, particularly in the developing world. The blue revolution has been based on scientific research methods, development and technology transfer that created a massive increase in agricultural yields worldwide (Hazell, 2002). Figure 20 shows the annual percentage growth of the global aquaculture 1951-2012. The growth has nearly solely been positive. There are only three years that are exceptions, 1956 (no growth), 1958 (-3%) and 1961 (-4%). The annual growth of the world aquaculture production has been 7.2% on average since 1951. For the last 10 years or in the period of 2002-2012 the average growth has been 5.8% (FAO, 2014b).

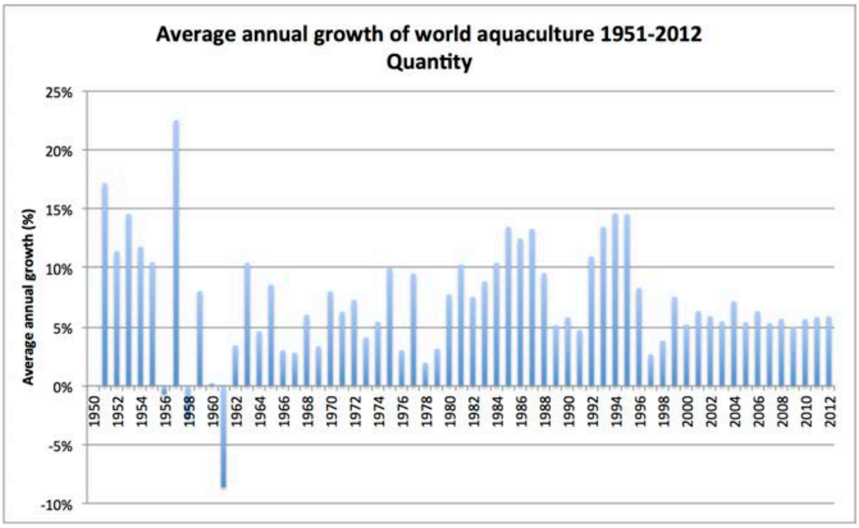

Figure 20. The growth of world aquaculture 1951-2012. Calculated of author from price (FAO, 2014a).

The world aquaculture production in 2011 is shown in Figure 21. The majority or 62% was located in freshwater environment, 30% in marine- and 8% in brackish water. The comparison between quantity and value shows a noticeable difference in value creation. The brackish water yields higher value on average or $3.5 USD/kg while the average value form freshwater environment was $1.9 USD/kg and $2.1 USD/kg from marine environment (FAO, 2013).

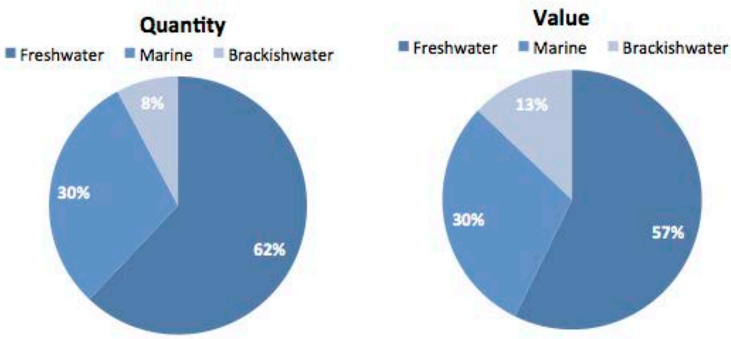

Figure 21. Quantity and Value of aquaculture production by environment in 2011 (FAO, 2013).

The majority, or 70% of the world aquaculture production in 2011 took place in inland waters and 30% are in located in marine areas (Figure 22). This corresponds to information presented in Figure 21. (FAO, 2013).

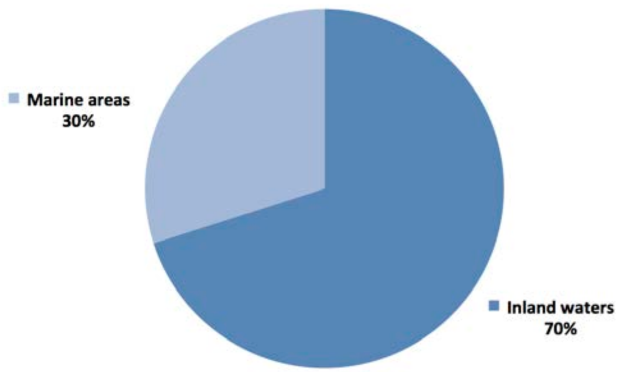

Figure 22. World aquaculture production by area and quantity in 2011 (FAO, 2013).

The most common group of species within aquaculture are freshwater diadromous fishes as shown in Figure 23. They account for 63% of the world aquaculture production that amounted to nearly 40 million tonnes in 2011[16]. Almost one third of the world aquaculture production consists of Molluscs (23%) and Crustaceans (9%). While, marine fishes are only about 4% of the global aquaculture production (FAO, 2013).

[16] Amounts in tonnes are shown in Annex IV – Aquaculture production by main groups of species in 2011

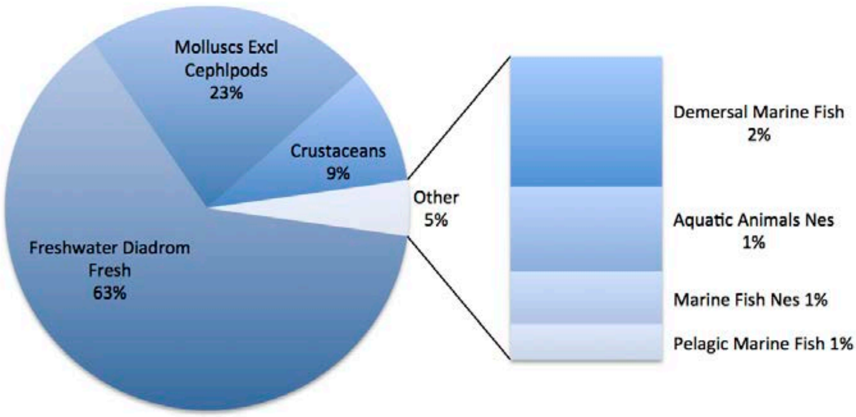

Figure 23. World aquaculture production by main groups of species and quantity in 2011 (FAO, 2013).

An overview of the volume and value for the main groups of species in 2011 is shown in

Table 2 and Annex V – The top 25 species in aquacultureOne might say that the trend seems to follow the general theory on supply and demand (Klein, 1983). That increased production in volume has created more supply within the world aquaculture and yields the lowest prices. Other factors that also have to be considered are the location of production, cost of feed and purchasing power of buyers that can have significant effect on prices. Crustaceans and demersal marine fishes are 2.5 times more valuable than freshwater fishes. Molluscs are priced significantly lower than the other groups of species because they feed by filtering the seawater. Therefore their production cost does not include feed and therefore their price reflects the low production cost (Bompais, Danioux, Loste, & Paquotte, 2000).

Table 2. Main group of species produced in aquaculture by volume, value and USD/kg in 2011 (FAO, 2013).

Main group of species	Volume (tonnes)	Value (Million USD)	USD/kg (average)
Freshwater Diadrom Fresh	39,641,065	74,941	1.9
Molluscs Excl Cephlp Fresh	14,394,807	15,265	1.1
Crustaceans Fresh	5,876,253	28,238	4.8
Demersal Marine Fish Fresh	1,197,047	5,448	4.6
Aquatic Animals Nes Fresh	779,481	3,124	4.0
Marine Fish Nes Fresh	480,526	1,128	2.3
Pelagic Marine Fish Fresh	331,117	2,090	6.3
Freshwater mussel shells	2,305	11	4.6
Cephalopods	3	0.02	7.8

The most significant species are ranked by production volume are shown in

Table 3 and Annex V . The table lists up the 16 species or groups of species that were produced in more volume than 1 million tonnes in 2011. Combined, they stand for 67.7% of the total aquaculture production. Silver carp is on the top of the list with production of nearly 5.4 million tonnes and generated $7.7 billion USD in value. Its average price was $1.4 USD/kg, which is a bit lower that the average price of freshwater diadromous fishes that are listed in

Table 2. of $1.9 USD/kg. Silver carp belongs to the family of *Cyprinidae*, as well as Grass carp, Common carp, Bighead carp, Catla, Crucian carp and Roho labeo that are also listed up in Table 3. They accounted for 22.5 mt output in 2011 or 36% of the total world aquaculture production and 24.4% of the total value with an average price of $1.4 USD/kg.

Whiteleg shrimp is the only crustacean specie that is produced in higher quantity than 1 million tonnes. It had the annual output of nearly 2.9 million tonnes and its production has increased significantly last decade. Its price of $4.2 USD/kg is quite high compared with the other species in Table 3 (FAO, 2013).

Table 3. Most significant species (more than 1 million tonnes in 2011), by quantity and value (FAO, 2013).

Species	Number of countries	Output/Volume 2011 (Milion of Metric Tonnes)	% Change 1 year	% Change 10 year	Value 2011 Billion USD (real value)	% Change 1 year	% Change 10 year	Average Price 2011 (USD/kg
Silver carp	54	5.35	23.3%	3.9%	7.7	28.4%	6.7%	1.4
Grass carp (White amur)	60	4.57	4.6%	4.0%	5.8	1.7%	5.5%	1.3
Cupped oysters nei	20	3.77	2.5%	1.9%	2.2	-0.7%	-4.1%	0.6
Common carp	102	3.73	2.8%	2.8%	5.3	6.3%	3.8%	1.4
Japanese carpet shell	16	3.68	2.1%	6.6%	3.4	-0.6%	1.0%	0.9
Whiteleg shrimp	43	2.88	5.8%	19.2%	12.2	4.8%	16.4%	4.2
Nile tilapia	87	2.79	9.0%	9.4%	4.5	8.3%	9.8%	1.6
Bighead carp	30	2.71	4.4%	6.1%	3.5	1.5%	7.3%	1.3
Catla	8	2.41	-23.5%	12.6%	4.7	-19.2%	16.0%	2.0
Crucian carp	19	2.30	3.5%	5.3%	2.5	0.5%	6.8%	1.1
Atlantic salmon	32	1.72	17.2%	4.9%	9.7	16.9%	9.1%	5.6
Roho labeo	9	1.44	21.4%	5.3%	2.2	26.4%	3.2%	1.5
Pangas catfishes nei	6	1.42	8.1%	20.7%	2.2	8.0%	19.5%	1.6
Scallops nei	7	1.31	-7.8%	4.0%	1.9	-11.2%	2.8%	1.4
Freshwater fishes nei	108	1.30	6.4%	-7.6%	1.9	7.6%	-4.1%	1.5
Marine molluscs nei	20	1.06	33.9%	-3.7%	0.7	29.2%	-2.7%	0.7

The other items in Table 3 are groups of species that might be considered harmonious markets items. However, it requires to detailed analysis to be listed here by individual species. The Atlantic salmon stands out in terms of value creation, compared with other fish species. The specie was produced in 1.7 million tonnes and generated $9.7 billion USD with an average price of $5.6 USD/kg. It was priced significantly higher than other fish species and seems to possess distinct qualities over other farmed fish species. It is impossible to conclude why salmon is so more valuable than other species, by the information stated so far. Except, the fact that Atlantic salmon is not farmed in Asia but near solely in Europe and Americas as shown in

Annex VI .

4.1.1 Regions

Asia is and has been the most productive region of aquaculture products, with 91% of total global production in 2011. China was the world's single largest production country, with 38.9 million tonnes or 62.1% of the world's aquaculture production as shown in Figure 24 and Annex VII . The Americas produced 2.9 million tonnes or about 2.6% of the total world production. Europe produced 2.7 million tonnes or 2.6%, Africa produced 1.5 million tonnes or 1.4% and Oceania produced 0.2 million tonnes or 0.2% of total world aquaculture production in 2011 (FAO, 2013).

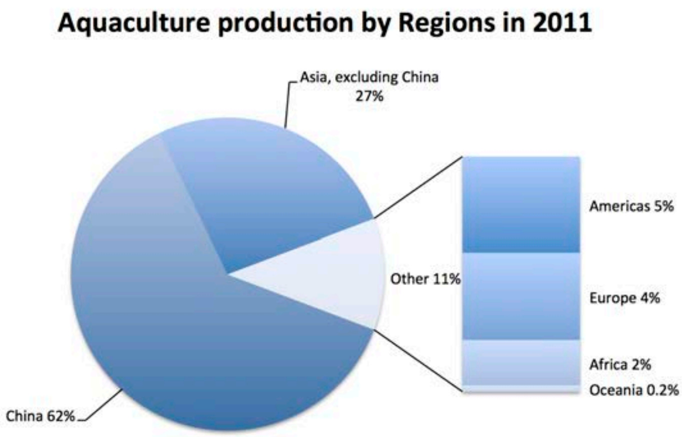

Figure 24. Aquaculture production by regions[17] (FAO, 2013).

The Chinese aquaculture production has had a long and strong growth period since the 1960's. It exceeded one million tonnes for the first time in 1975. Since then China has doubled its aquaculture production five times (Annex VIII). The average annual growth of the Chinese aquaculture since 1951 is 8.6% and in the last 30 years, there was only one year when the

[17] Data for China include China, Hong Kong SAR and Taiwan Province of China in this figure. China, Hong Kong SAR and Taiwan Province of China accounted for 322.683 tonnes in 2011 or 0.68% of total Chinese production that year.

annual percentage growth was under 3.5% and that was in 1997 when the growth was 1.7% (FAO, 2013).

The aquaculture production in other Asian countries increased steadily until the turn of last century when the growth rose significantly from 6.6 million tonnes in 2000 to 16.5 million tonnes in 2011 (Figure 25 and Annex IX).

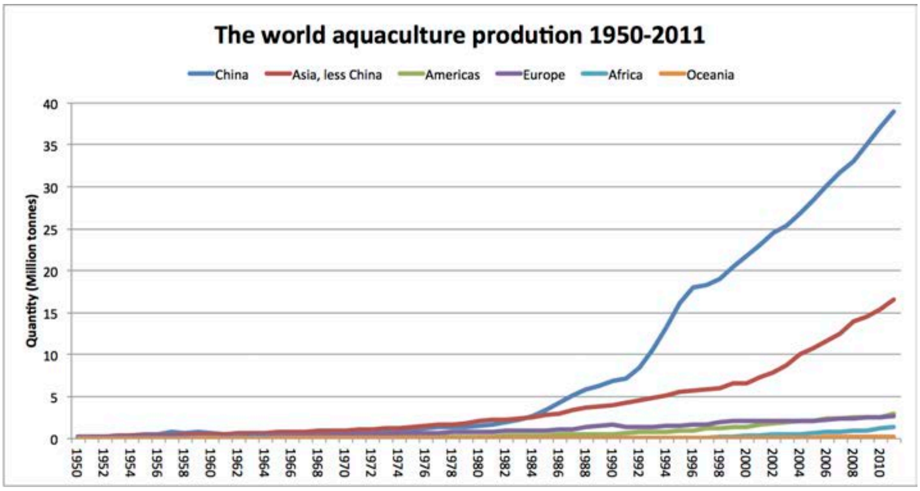

Figure 25. Development of aquaculture production by regions 1950-2011 (FAO, 2013).

The rest of the world has not been able to follow the Asian countries in terms of quantity and almost seems to have insignificant production in the comparison with Asia. If the other regions are viewed separately from Asia, as is shown in Figure 26, it can be seen that the production has grown significantly in all the regions except in Oceania. The European aquaculture reached the one million mark in production in 1985, the Americas in 1996 and Africa in 2010. However, the aquaculture in the Americas has grown at a faster pace than in Europe since the 1980's, became larger in 2005 and has been slightly larger since then. As well, the difference in volume between the two regions was only 14 thousand tonnes in 2010 and 260 thousand tonnes in 2011. The African aquaculture produced only 2,400 tonnes in 1950 and in 1975 when China had reached one million tonnes in quantity, Africa had not yet exceeded the 15 thousand tonnes mark. Despite relatively low production, African aquaculture has grown fast in recent years and reached half million tonnes in 2003 and one million in 2010. Oceania was estimated to produce 4000 tonnes of aquaculture products in 1950. The region showed a similar growth as Africa until the mid 1990's when the growth slowed down. Its total production was 192 thousand tonnes in 2011. The world aquaculture production for each region is showed/shown in Annex IX - The world aquaculture production 1985 – 2011(FAO, 2013).

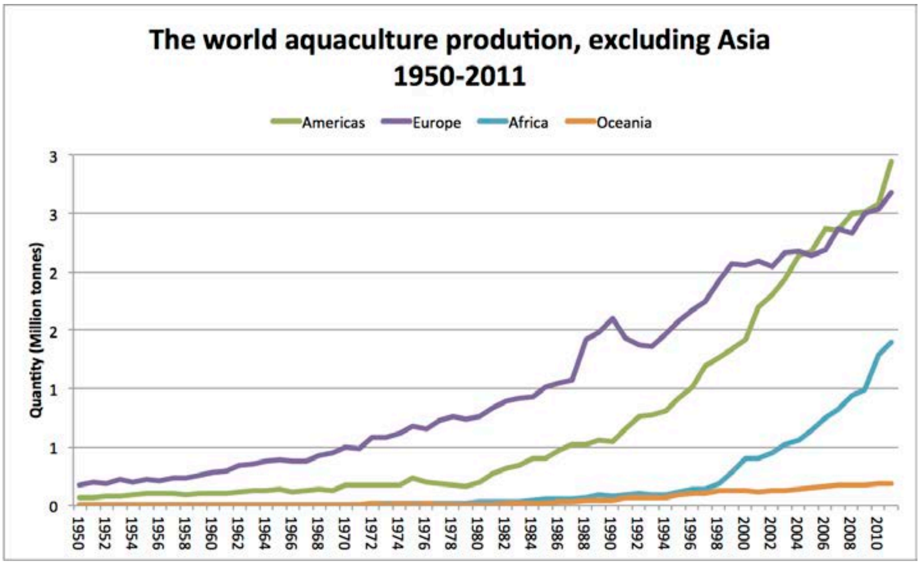

Figure 26. Development of aquaculture production 1950-2007, excluding Asia (FAO, 2013).

An overview of annual percentage growth by regions is shown in Table 4. It shows how fast aquaculture has been growing since 1961. China showed remarkable high average growth in the period between 1971-2000 and measured with 8.6% average growth since 1961. This is exceptional considering the volume that was needed to generate such growth. E.g. in 2008, China increased its production by 2 million tonnes. The net increase was similar to the total production of Europe and the Americas in 2003 (2.1 and 1.9 million tonnes) (FAO, 2013).

Table 4. Average annual percentage growth of aquaculture by regions (FAO, 2013).

Period	China*	Asia, exluding China	Americas	Europe	Africa	Oceania
1961 - 1970	1.3%	5.6%	3.9%	5.3%	3.6%	-0.4%
1971 - 1980	5.5%	7.3%	0.6%	4.4%	8.9%	2.8%
1981 - 1990	14.0%	6.3%	9.3%	5.4%	9.8%	11.1%
1991 - 2000	10.7%	5.0%	9.0%	2.2%	13.8%	9.3%
2001 - 2010	5.2%	8.0%	5.6%	2.0%	10.9%	4.0%
1951 - 2011	8.6%	6.9%	5.6%	3.8%	9.5%	5.6%

*Including Taiwan and Hong Kong

The rest of Asia has also increased its aquaculture production significantly as mentioned previously in this chapter. However, the growth has been fluctuating between periods. The Asian aquaculture production increased sharply after 2000 and the average annual increase measured in volume was about 0.9 million tonnes 2000-2010. The Asian aquaculture production grew from 5 million tonnes in 1994 to 16.5 million tonnes in 2011. (FAO, 2013).

The aquaculture production in the Americas grew slowly in the 1970's but increased significantly in the 1980's and 1990's. While the growth slowed down somewhat after 2000. The growth within the European aquaculture has shown a reduction in average growth since the mid 1980's. The African aquaculture industry has been growing quite rapidly and has an average growth rate of 9.5% since 1961. Although the African aquaculture has shown potentials of being able of increasing production even further. There are also great concerns about the sustainable fish production in Africa and the sector is still struggling to realise its biophysical potential in many places (Ayoola, 2010; Brummett, Lazard, & Moehl, 2008). The aquaculture sector in the Pacific showed a significant growth in the 1980's but its growth has slowed since then and the region is not likely to have significant effect on the global production. Especially when the total annual output of the region only counted 0.26% of the global production, or the quantity that China produced in 1.2 days (FAO, 2013).

A different perspective can be seen by analysing how much the regions have grown in terms of their relative size. Since 1985, the aquaculture in Asia has grown 8.9 times, 2.6 times in Europe, the Americas has grown 7.2 times, 8.9 times in Oceania and the African aquaculture has grown 26.2 times in the period. See further in Annex X – Growth of world aquaculture(FAO, 2013).

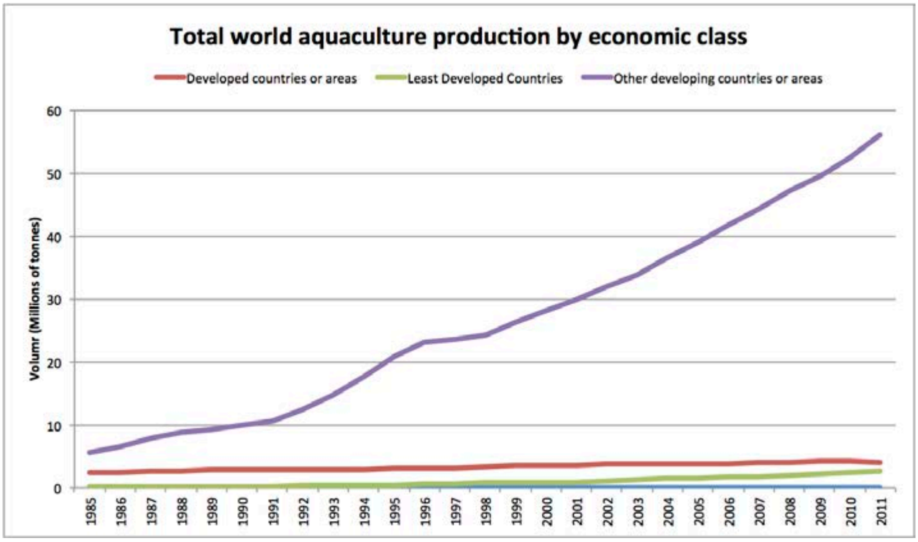

Figure 27. World aquaculture production economic class (FAO, 2013).

The majority of the world aquaculture production in 2011 or nearly 90% of the volume and 83% of the value was grown in the developing countries (Figure 27). Their production increased from 5.5 mt in 1985 to 56 mt in 2011 while the production in developed countries has only increased by 1.1 mt in the same period and nearly 300 thousand tonnes within the least developed countries. The developed countries yield higher average prices for their products or $4.7 USD/kg. While the developing countries and least developed countries got $1.9 and $2.0 USK/kg (FAO, 2013).

There are 11 Asian countries on the list that shows the top 15 largest aquaculture producers, ranked by volume and countries, Table 5. These 15 countries produced 93% of the total world aquaculture production in 2011. Chile, Brazil and the USA are the three American countries that reached the list. Norway was the sole European country and Egypt the only African country. There is a noticeable difference in the value creation depending on the region countries originate from and only three countries stood out in terms of value creation, by yielding noticeably higher average price than $3 USD/kg; Norway ($4.6), Japan ($6.3) and Chile ($6.6). Norway exports its products mostly to Europe, Japan consumes its production mostly domestically and Chile exports mostly to USA. The high prices for the Chilean products can partially be explained by the high amounts of salmon fillets compared with headed/gutted fish from Norway (FAO, 2013).

Table 5. List of top 15 largest aquaculture producers, ranked by volume (FAO, 2013).

Country	Rank 2011	Rank 2000	Output/Volume 2011 (Milion of Metric Tonnes)	% Change 1 year	% Change 10 year average	Value 2011 Billion USD (real value)	% Change 1 year	% Change 10 year	Average Price 2011 (USD/kg)	Economic class
China	1	1	96,670,975	4.9%	0.0%	63,157,592	1.7%	16.5%	0.7	developing countries
India	2	2	4,573,465	17.2%	7.1%	9,296,027	18.6%	9.8%	2.0	Developing countries
Viet Nam	3	7	2,845,600	6.1%	14.3%	5,595,925	5.1%	11.1%	2.0	Developing countries
Indonesia	4	3	2,718,421	15.2%	10.6%	6,314,654	20.0%	4.4%	2.3	Developing countries
Bangladesh	5	6	1,523,759	14.1%	7.1%	3,377,627	13.3%	8.3%	2.2	Least Developed Countries
Norway	6	8	1,138,797	11.5%	7.6%	5,240,334	1.2%	12.7%	4.6	Developed countries
Thailand	7	5	1,008,049	-27.6%	1.4%	2,564,375	-13.3%	0.9%	2.5	Developing countries
Egypt	8	12	986,820	6.8%	9.8%	1,963,569	18.8%	6.1%	2.0	Developing countries
Chile	9	11	954,845	26.6%	4.4%	6,314,493	38.7%	8.2%	6.6	Developing countries
Myanmar	10	22	816,820	-4.1%	16.4%	1,070,860	7.9%	6.5%	1.3	Least Developed Countries
Philippines	11	10	767,287	2.9%	5.4%	1,722,703	6.4%	6.4%	2.2	Developing countries
Brazil	12	18	629,309	23.8%	10.2%	1,366,049	28.3%	10.6%	2.2	Developing countries
Japan	13	4	556,761	-29.0%	-4.1%	3,506,852	-3.9%	-0.5%	6.3	Developed countries
Korea, Republic of	14	14	507,052	6.2%	4.5%	1,554,943	1.7%	7.7%	3.1	Developing countries
USA	15	9	396,841	-25.2%	-2.5%	1,102,451	4.3%	0.5%	2.8	Developing countries

Nearly all of the countries listed in Table 5 increased their aquaculture production significantly during the last decade, Japan and the USA are the only two nations that showed a reduction of -4.1% and -2.5%, respectively, in the period. Thailand, Myanmar, Japan and USA experienced a reduction in aquaculture production in the year 2011. However, Myanmar increased their production significantly during the last decade and was ranked no. 22 in 2000 but no. 10 in 2011. Thailand had only 1.4% increase in production on average in the last decade.

The countries that increased their production at the fastest pace on average in the last decade were China (18.7%), Myanmar (16.4%) and Viet Nam (14.3%). These three fastest growing countries receive lower value for their products with the average price of $1.6 USD/kg while the average price for the other countries in Table 5 was $3.2 USD/kg (FAO, 2013). The difference could somewhat be explained by the reason that the countries that receive the lowest prices mostly sell their production in their domestic markets, rather than exporting their products to foreign markets. However, the prices are not retail value, but value from farm gate. Therefore, these prices can also be used in measuring the cost/revenues of farming.

4.1.2 China

China is by far the largest seafood producer in the world as previously has been stated. China produced 45% of the total world seafood production[18] in 2011, as shown in Figure 28.

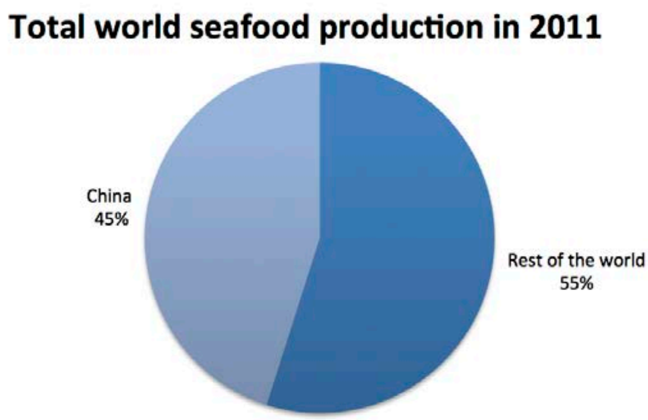

Figure 28. The Chinese- and total world seafood production in 2011 (FAO, 2013).

China harvested 17% of the total world capture fisheries and produced 61.7% of the total world aquaculture production in 2011 (Annex XI - Chinese aquaculture and capture fisheries in 2011). The most common group of species within the Chinese aquaculture in 2011 were freshwater diadromous fishes. They accounted for 56.5% of the volume and 50.2% of the value (Figure 29). Their output was 22 million tonnes (mt) and the value

[18] Fisheries and aquaculture, less aquatic plants.

was $31.6 billon USD. Thus making the average price $1.4 USD/kg. Molluscs were the second largest group of species with nearly 12 mt in volume and $10 billion USD in value. The molluscs in China, like so many other places are not as valuable as other farmed species and had the average price of $0.8 USD/kg. The third main group of species were crustaceans. They were farmed in 3.3 mt and valued $16 billion USD, or $6.1 billion UDS more than the molluscs. The crustaceans was the group of species that yielded the highest price per kilo, with an average price of $4.9 USD/kg (FAO, 2013).

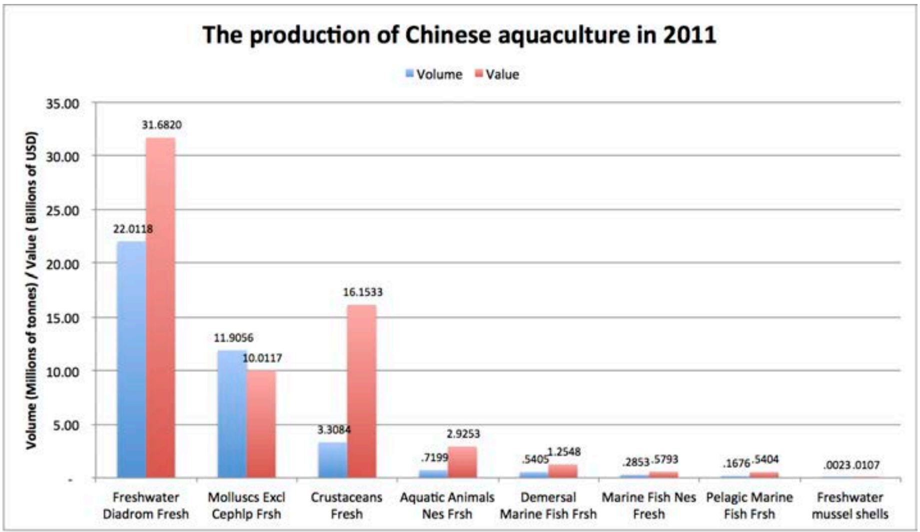

Figure 29. The production of Chinese aquaculture by species (FAO, 2013).

There are nine species within the Chinese aquaculture sector that were produced in more quantity than one million tonnes in 2011. They are listed up in Table 6. Six of the species were freshwater fishes that totalled 16.9 million tonnes and valued $20.9 billion USD. Their average price was $1.3 USD/kg. They amounted of 43.5% of all Chinese aquaculture production in 2011. There has been a noticeable growth within the fish species since the last 10 years. For example has the silver carp production increased 23.5% in the period and Bighead carp by 46.7%.

There were two molluscs species that were produced in more quantity than one million tonnes in 2011, Cupped oysters and Japanese carpet shell. Their quantity was quite significant, or 3.8 and 3.6 million tonnes. The

Cupped oysters received the lowest priced species that is listed in Table 6 with the average price of $0.6 USD/kg (FAO, 2013b). More detailed table for the top 50 species within the Chinese aquaculture in 2011 is presented in Annex XII .

The Whiteleg shrimp is the only crustacean in Table 6. Its output in 2011 was 1.3 mt and its value was $5.9 billion USD. The Whiteleg shrimp is by far the most valuable specie in the table measured in average price per kg with $4.4 USD/kg (FAO, 2013).

Table 6. The most important species within the Chinese aquaculture in 2011 (FAO, 2013).

Group of Species	Specie	Output/Volume 2011 (Milion of Metric Tonnes)	% Change 1 year	% Change 10 year	Value 2011 Billion USD (real value)	% Change 1 year	% Change 10 year	Average Price 2011 (USD/kg)
Freshwater Diadrom Fresh	Grass carp (White amur)	4.4	4.9%	35.3%	5.6	1.9%	47.8%	1.3
	Silver carp	3.7	2.9%	23.5%	4.7	-0.2%	38.3%	1.3
	Common carp	2.7	6.6%	30.0%	3.1	3.7%	41.4%	1.1
	Bighead carp	2.7	4.4%	46.7%	3.4	1.4%	55.0%	1.3
	Crucian carp	2.3	3.5%	42.4%	2.5	0.5%	52.9%	1.1
	Nile tilapia	1.1	7.6%	46.1%	1.6	4.7%	54.0%	1.5
Molluscs Excl Cephlp Frsh	Cupped oysters nei	3.8	3.0%	18.4%	2.2	0.0%	-31.8%	0.6
	Japanese carpet shell	3.6	2.1%	51.0%	3.2	-1.0%	19.6%	0.9
Crustaceans Fresh	Whiteleg shrimp	1.3	7.7%	93.0%	5.9	4.7%	87.6%	4.4

The Chinese aquaculture production towers the rest of the world's production. There were concerns that the Chinese statistical figures were over reported and therefore they were not adequate for realistic representation (The Economist, 2001; Wilson and Pauly, 2001). The concerns were addressed by FAO in 2002 (FAO, 2002). The matter was lead to a conclusion in the FAO report, The State of World Fisheries and Aquaculture 2008, where it is stated that;

> In 2008, China reported a downward revision of total fishery and aquaculture production for 2006 of more than 10 percent, corresponding to a reduction of more than 2 million tonnes in capture production and more than 3 million tonnes in aquaculture production. (p.5) (FAO, 2009)

The adjustment might not seem large in comparison with/to Chinese production but 3 million tonnes is more than the individual production of the Americas, Europe, Africa and Oceania. The adjustment almost matches the combined production of Europe, Africa and Oceania. However, it has also been pointed out that the Chinese statistics have also underreported some of their aquatic production. The weights of bivalves are for example, were normally reported as the whole live weight including the shell. But the Chinese figures used to state the amount of the eatable part (Lem, 2009).

4.1.3 Asia, Excluding China

The production of the Asian aquaculture, excluding China by main groups of species is shown in Figure 30. Similar to China, the most important group of species in 2011 were freshwater diadromous fishes. They were produced in 12.7 mt and valued $23.8 billion USD, thus yielding the average price of $1.6 USD/kg. The average prices of diadromous fishes are lower in China than in other countries in Asia, or $1.2 USD/kg vs. $1.8 USD/kg.

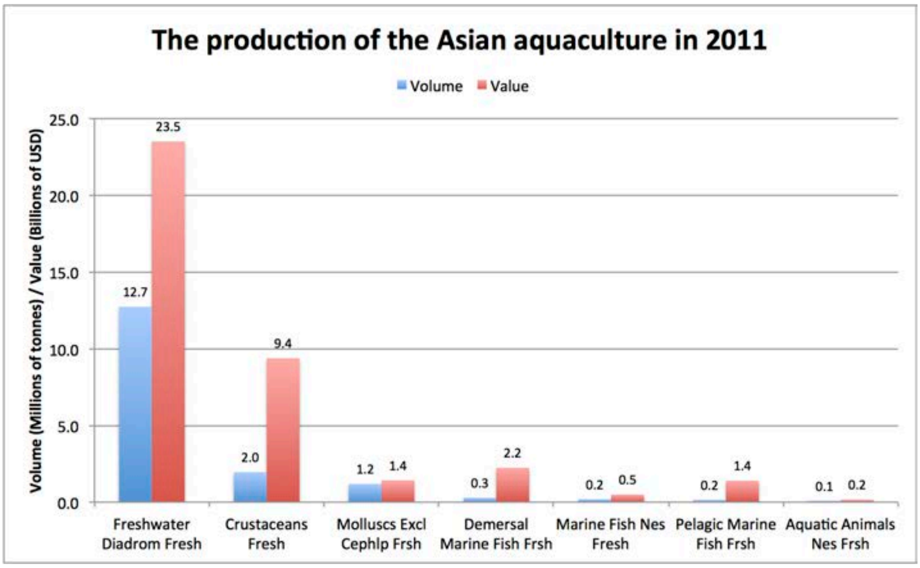

Figure 30. The production of the Asian aquaculture by groups of species in 2011 (FAO, 2013).

There is a distinguishable difference between the prices of freshwater fishes to pelagic fishes that were priced at $9.1 USD/kg at average. They are even more valuable than crustaceans ($4.8 USD/kg at average). However, they are only produced in small quantity and their total volume only reached 152 thousand tonnes in 2011. Molluscs were produced in 1.2 mt and they were priced at $1.2 USD/kg or $0.34 USD higher than the Chinese molluscs (FAO, 2013).

Table 7 shows species that are produced in more quantity than 500 thousand tonnes within the Asian aquaculture[19]. Nine species in total were produced in enough quantity in 2011 for them to make it to the list. Seven of them are freshwater diadromous fishes and two of them are crustaceans. Catla is the most common specie and was produced in 2.4 mt and valued $4,7 billion USD. Even though its production reduced significantly in 2011 or by 23.5%, the production grew 80% the last 10 years. The growth of freshwater fishes for the last decade varies. The production of Pangas (catfishes) increased by 92% and 80% for Catla. While the output for common carp increased a lot less, or by 15% (FAO, 2013).

Table 7. The most important species within the Asian aquaculture in 2011 (FAO, 2013).

Group of Species	Specie	Output/Volume 2011 (Milion of Metric Tonnes)	% Change 1 year	% Change 10 year	Value 2011 Billion USD (real value)	% Change 1 year	% Change 10 year	Average Price 2011 (USD/kg)
Freshwater Diadrom Fresh	Catla	2.4	-23.5%	80%	4.7	-19.2%	87.5%	2.0
	Silver carp	1.6	71.7%	64%	3.0	73.8%	77.9%	1.9
	Roho labeo	1.4	21.4%	58%	2.2	26.4%	54.5%	1.5
	Pangas catfishes nei	1.4	8.1%	92%	2.2	8.0%	90.2%	1.6
	Nile tilapia	0.9	10.7%	72%	1.5	14.5%	73.5%	1.7
	Milkfish	0.8	8.2%	48%	1.4	17.5%	43.8%	1.7
	Common carp	0.7	-0.9%	15%	1.5	9.1%	26.8%	2.0
Crustaceans Fresh	Whiteleg shrimp	1.0	3.2%	100%	4.0	4.7%	100.0%	3.9
	Giant tiger prawn	0.6	-4.7%	-11%	3.2	-3.2%	-54.5%	5.3

The growth within the production of the two crustacean species in Table 7, indicates that the whiteleg shrimp has become a more attractive option than the Giant tiger prawn. The whiteleg shrimp was first reported in the FAO data in 2002. That same year, tiger prawn was grown in more than 600 thousand tonnes. The growth of the whiteleg shrimp was phenomenal and its output matched the giant tiger prawn in only four years with 589 thousand tonnes. After that the whiteleg shrimp surpassed the Giant tiger prawn rapidly and its output was about 40% higher in 2011. Giant tiger prawn is the only species listed in Table 7 that showed negative growth in the last 10 years (FAO, 2013).

[19] Asia, exluding China.

Table 8. The largest aquaculture producers in Asia in 2011 (FAO, 2013).

Country	Volume (million tonnes)	Value (Billion USD)	Average price (USD/kg)	Growth 10 year
India	4.57	9.30	2.03	53.6%
Viet Nam	2.85	5.60	1.97	79.3%
Indonesia	2.72	6.31	2.32	68.2%
Bangladesh	1.52	3.38	2.22	53.2%
Thailand	1.01	2.56	2.54	19.2%
Myanmar	0.82	1.07	1.31	85.2%
Philippines	0.77	1.72	2.25	43.4%
Japan	0.56	3.51	6.30	-43.8%
Korea, Republic of	0.51	1.55	3.07	41.9%
Malaysia	0.29	0.76	2.64	44.9%
Iran (Islamic Rep. of)	0.25	0.72	2.92	74.7%
Other	0.70	2.11	3.02	53.6%

India was the second largest aquaculture producer in Asia after China with 4.6 mt in total production in 2011, as shown in Table 8. Viet Nam was in third place with nearly 2.8 mt and Indonesia fourth, with 2.7 mt.

Japan creates the most valuable aquaculture products of the Asian countries, with the average price of $6.3 USD/kg. Meanwhile, Myanmar is the country that produces the lowest priced products of $1 USD/kg at average.

As stated before, there has been high/fast growth within the aquaculture sector. The Asian countries have nearly doubled their production on average during the last decade. Myanmar is the country that has grown at the fastest pace with an increase of 85% in the last ten years, followed by Viet Nam and Iran with 79% and 75% increase, respectively. Japan is the only country in Table 8 that has shown a reduction in aquaculture production. The Japanese aquaculture production has reduced by nearly 44% during the last 10 years (FAO, 2013).

4.1.4 Americas

The most important group of species in the American aquaculture are the freshwater diadromous fishes as shown in Figure 31. Their output was 1.8 mt in 2011 and their value was $8.3 billion USD. Their average value was therefore $4.6 USD/kg, which is significantly higher than what is produced in Asia and China. The difference does not only represent the value creation but as well it can be used to compare the cost of production since the data are collected at farm gate. Nevertheless the difference in price between average price in the Americas of $4.6 USD/kg is three times higher than the price in China and 2.5 times higher than in other Asian countries. Crustaceans are the second most important group of species with 0.6 mt production and $2.6 billion USD in 2011. Molluscs were produced in 0.5 mt and it is noticeable that their price is significantly higher or about four times higher than the Chinese and Asian molluscs (FAO, 2013).

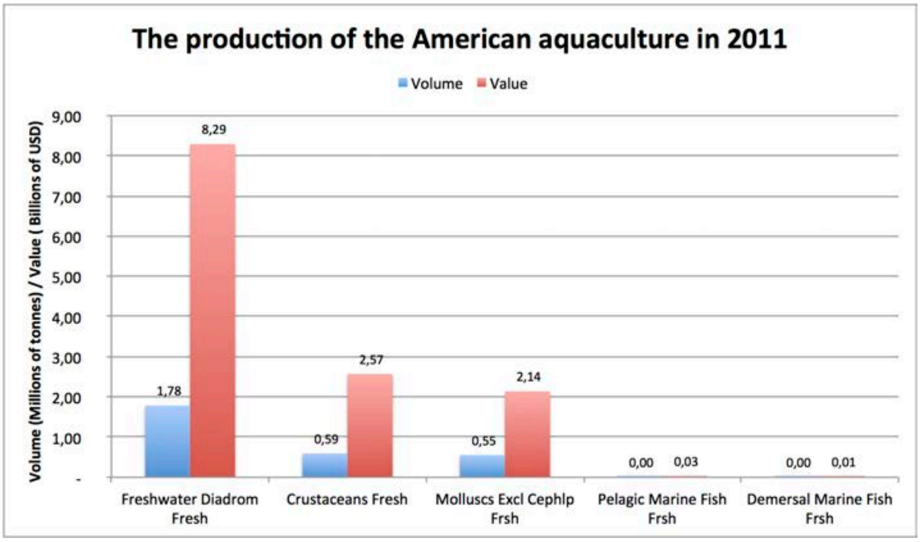

Figure 31. The production of the American aquaculture in 2011 by groups of species (FAO, 2013).

There is a significant difference between the American and the Asian aquaculture in terms of quantity. Therefore the most important species in terms of quantity are those that were produced in higher quantity than 300 thousand tonnes in 2001 (Table 9).

Salmon was the most important specie that was cultured in the American aquaculture in 2011. Their output was 385 thousand tonnes and valued $2.9 billion USD. The American farmed salmon was sold at the average price of $7.6 USD/kg, making them one of the most expensive farmed fish species. Rainbow trout is also highly valuable specie. They were farmed in 280 thousand tonnes and they are nearly as valuable as salmon and fetched $7.3 USD on average for farm gate price. Tilapias are the second most common fishes, however their value is significantly lower than salmonids, or $2.3 USD/kg. Whiteleg shrimp is the specie that is grown in the largest volume in the Americas. Their output was 524 thousand tonnes and their value was $2.3 billion USD. They were sold at the average price of $4 USD/kg. The Chilean mussel was grown in nearly 290 thousand tonnes in 2011 and its output has grown the fastest of those in table 9, or 88% in the last ten years. Its price of $4.3 USD/kg is quite high, or about four times higher compared with mussels in China and Asia.

Table 9. The most important species within the American aquaculture in 2011 (FAO, 2013).

Group of Species	Specie	Output/Volume 2011 (Milion of Metric Tonnes)	% Change 1 year	% Change 10 year	Value 2011 Billion USD (real value)	% Change 1 year	% Change 10 year	Average Price 2011 (USD/kg)
Freshwater Diadrom Fresh	Atlantic salmon	0.4	36.6%	4%	2.9	39.4%	46.5%	7.6
	Tilapias nei	0.3	32.1%	77%	0.7	26.9%	69.5%	2.3
	Rainbow trout	0.3	4.8%	44%	2.0	11.8%	71.4%	7.3
Whiteleg shrimp	Whiteleg shrimp	0.5	5.9%	66%	2.3	5.0%	50.3%	4.3
Molluscs Excl Cephlp Frsh	Chilean mussel	0.3	23.2%	88%	1.1	58.6%	97.5%	4.0

Chile was the largest aquaculture producer in the Americas in 2011 with nearly one million tonne output that valued $6.3 billion USD, Table 10. Brazil was second largest with nearly 630 thousand tonnes and the USA third with nearly 400 thousand tonnes. The USA is the only nation in the Americas that has had a reduction in aquaculture production in the last decade. The reduction was quite significant or 21%. The output of the Canadian aquaculture grew by 5.8%, which is significantly lower than the average growth of 53% for the other countries as shown in Table 10.

Peru was the country that produced the aquaculture products with the highest price of $7.3 USD/kg. Chile's average price was $6.6 USD/kg and Canada's average price was $5.2 USD/kg. The USA, surprisingly receives the average price of $2.8 USD/kg or second lowest of the countries listed in Table 10. Only Brazil received lower price for its aquaculture products, or $2.2 USD/kg (FAO, 2013).

Table 10. The largest aquaculture producers in the Americas in 2011 (FAO, 2013).

Country	Volume (million tonnes)	Value (billion USD)	Average price (USD/kg)	Growth 10 years
Chile	0.95	6.3	6.6	40.7%
Brazil	0.63	1.4	2.2	67.3%
USA	0.40	1.1	2.8	-21.0%
Ecuador	0.31	1.4	4.6	81.4%
Canada	0.16	0.8	5.2	5.8%
Mexico	0.14	0.4	3.3	44.5%
Peru	0.09	0.7	7.3	91.8%
Colombia	0.08	0.3	3.1	31.1%
Honduras	0.04	0.2	4.6	63.8%
Other	0.14	0.4	3.2	40.4%

4.1.5 Europe

Freshwater fishes were the main species in European aquaculture in 2011, as shown in Figure 32. Their output was 1.8 mt and valued $8.5 billion USD, thus accounted for 69% of the volume and 76% of the value. The average price for European farmed fresh fish was $4.6 USD/kg. Molluscs were farmed in 0.6 mt and valued $1.3 billion USD. Marine fishes were produced in 173 thousand tonnes and value was $1.1 billion USD or $6.3 USD/kg on average, which is nearly $2 USD higher per kg than the freshwater fishes yielded.

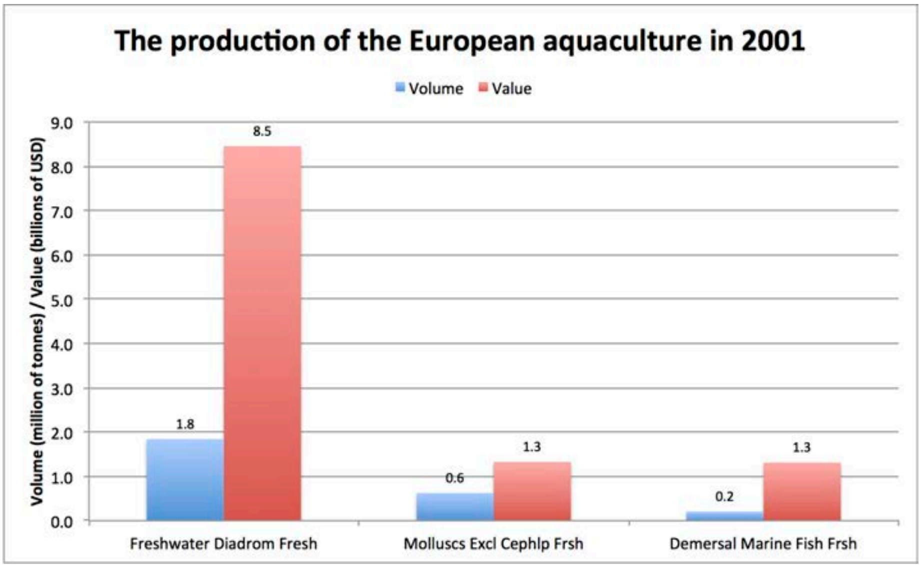

Figure 32. The production of the European aquaculture in 2011by groups of species (FAO, 2013).

Table 11 shows the species that were grown in quantity more than 50 thousand tonnes in 2011. Three species of freshwater fishes were farmed in sufficient quantity to be listed in table, salmon, rainbow trout and common carp. Salmon was by far the most important species within the European aquaculture in 2011. They were farmed in 1.3 mt and valued $6.4 billion USD. Salmon accounted for nearly half of European farming output and 56% of the total value. Their production has also grown fastest[20] or doubled in the

[20] Of species that were grown in more quantity than 50k tons.

last decade and its total annual value creation increased by 70.4%. The average price of $4.9 USD/kg in 2011 was only lower to marine fishes. Rainbow trout is the second most common specie and was grown in 244 thousand tonnes. However its production has reduced by one third in the last ten years. Common carp was farmed in 166 thousand tonnes and its average price of $2.8 USD/kg is significantly lower than the salmonids.

Four species of molluscs were farmed in more quantity than 50 thousand tonnes. All of their production has reduced in the last ten years. However, their value has increased at the same time. E.g. the output of blue mussels reduced by nearly 21% while its value increased by 15%. Similar can be said about the volume pacific cupped oyster. Its output reduced by 9% in the last ten years, while its value increased by nearly 46%.

Gilthead seabream and European seabass are the two marine fish species that were farmed in more quantity than 50 thousand tonnes. Their quantity in 2011 was quite low compared with salmonids. However, their output grew in the last ten years by 35% and 43%.

Table 11. The most important species within the American aquaculture in 2011 (FAO, 2013).

Group of Species	Specie	Output/Volume 2011 (Milion of Metric Tonnes)	% Change 1 year	% Change 10 year	Value 2011 Billion USD (real value)	% Change 1 year	% Change 10 year	Average Price 2011 (USD/kg)
Freshwater Diadrom Fresh	Atlantic salmon	1.301	11.6%	50%	6.4	6.5%	70.4%	4.9
	Rainbow trout	0.244	-5.4%	-33%	1.0	-3.3%	2.0%	4.3
	Common carp	0.166	-2.1%	14%	0.5	3.4%	6.6%	2.8
Molluscs Excl Cephlp Frsh	Sea mussels nei	0.209	9.4%	-18%	0.2	16.3%	29.3%	0.7
	Blue mussel	0.149	-20.9%	-11%	0.3	-5.2%	15.0%	2.0
	Pacific cupped oyster	0.105	0.4%	-9%	0.5	4.2%	45.9%	4.7
	Mediterranean mussel	0.102	1.5%	-38%	0.1	1.2%	0.7%	1.0
Demersal Marine Fish Frsh	Gilthead seabream	0.098	7.1%	35%	0.6	9.7%	38.6%	6.1
	European seabass	0.075	13.7%	43%	0.5	12.1%	44.4%	6.8

Norway was by far the largest aquaculture producer in Europe in 2011 with output of 1.1 mt that valued 5.2 billion USD (Table 12). The Norwegian aquaculture grew significantly, or by 55.2% during the last ten years. The volume within Greek and Russian aquaculture grew 31% and 30%. Other countries showed less growth. The output within the Spanish, France, Italic, and Irish aquaculture reduced in the last ten years.

The average prices of the European aquaculture is similar to the American. The Faroe Islands receive the highest average price of $6.8 USD/kg and the UK gets the seccond highest average price of $5.6 USD/kg. Spain produces the cheepest aquaculture products of $2.1 USD/kg (FAO, 2013).

Table 12. The largest aquaculture producers in Europe in 2011 (FAO, 2013).

Country	Volume (thousand tonnes)	Value (billion USD)	Average price (USD/kg)	Growth 10 years
Norway	1,139	5.24	4.6	55.2%
Spain	272	0.57	2.1	-13.7%
France	226	0.92	4.1	-11.4%
United Kingdom	177	0.99	5.6	3.7%
Italy	160	0.50	3.1	-36.2%
Greece	142	0.72	5.1	31.4%
Russian Federation	129	0.44	3.4	30.2%
Faroe Islands	60	0.41	6.8	18.7%
Ireland	44	0.17	3.9	-37.7%
Other	375	1.40	3.7	10.8%

4.1.6 Africa

There has been a tremendous growth within the African aquaculture in/during the last ten years. Africa nearly solely produces freshwater (87.3%) and marine fishes (11.9%). Crustaceans only account for 0.4% and molluscs 0.1% (Figure 33).

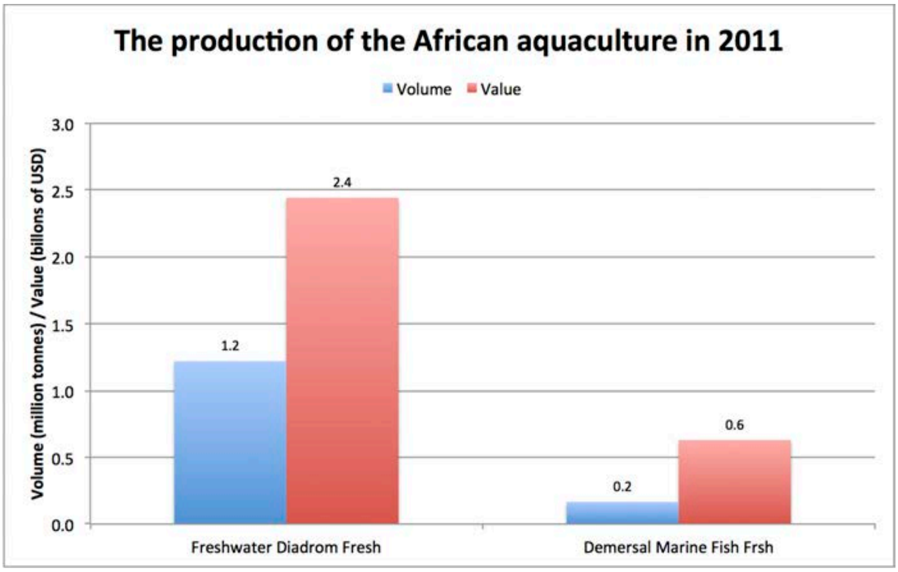

Figure 33. The production of the African aquaculture in 2011by groups of species (FAO, 2013).

Table 13 shows the species that were farmed in more quantity than five thousand tonnes in the African aquaculture, in 2011. The most important specie is the Nile tilapia that was farmed in 685 thousand tonnes and valued $1.1 billion USD. The second most important specie is the North African catfish that was grown in 187 thousand tonnes. It was most valuable freshwater fish with the average price of $2.8 USD/kg.

The farming of freshwater fishes grew significantly faster the last ten years than the farming of the sole major marine species or 76-99% vs. 15%. However, the prices of marine fishes are higher even though they have lowered in the last years.

Table 13. The most important species within the African aquaculture in 2011 (FAO, 2013).

Group of Species	Specie	Output/Volume 2011 (Milion of Metric Tonnes)	% Change 1 year	% Change 10 year	Value 2011 Billion USD (real value)	% Change 1 year	% Change 10 year	Average Price 2011 (USD/kg)
Freshwater Diadrom Fresh	Nile tilapia	0.685	9.8%	76%	1.1	7.5%	66.6%	1.6
	North African catfish	0.187	1.8%	98%	0.5	4.1%	97.6%	2.8
	Cyprinids nei	0.117	2.7%	99%	0.3	47.6%	99.2%	2.4
	Common carp	0.109	11.9%	80%	0.3	61.4%	84.8%	2.4
Demersal Marine Fish Frsh	Flathead grey mullet	0.114	-1.9%	15%	0.4	9.2%	-9.2%	3.4

Egypt was far the largest aquaculture producer in Africa in 2011 with an output of 987 thousand tonnes that valued $1.96 billion USD (Table 14). The country's aquaculture sector grew 65.3% in the last decade. The Egyptian aquaculture did not grow at as fast pace other African countries. However, it was twice the size of all other countries in Africa combined or 644 thousand tonnes vs. 348 thousand tonnes. Nigeria had the second largest aquaculture producer with 221 thousand tonnes production that valued $0.6 billion USD. Beside Uganda, Kenya, Ghana and Zambia, all other countries produced less than 10 thousand tonnes annually (FAO, 2013).

Table 14. The largest aquaculture producers in Africa in 2011 (FAO, 2013).

Country	Volume (thousand tonnes)	Value (billion USD)	Average price (USD/kg)	Growth 10 years
Egypt	987	1.96	2.0	65.3%
Nigeria	221	0.63	2.9	89.0%
Uganda	86	0.17	2.0	97.2%
Kenya	22	0.05	2.4	95.4%
Ghana	19	0.05	2.6	68.6%
Zambia	11	0.04	3.7	57.1%
Madagascar	9	0.05	5.9	12.3%
Tunisia	8	0.05	6.7	77.0%
Zimbabwe	8	0.02	2.5	69.9%
Other	28	0.14	4.9	55.9%

4.2 Salmon

The natural life cycle of salmons begins in freshwater where they spend their first 1-2 years. They are anadromous fishes so when their they are sufficiently developed, they migrate downstream, adapt their bodies to saltwater as smolt and enter the ocean as shown in Figure 34. Where they prey on smaller, most often pelagic fishes and grow to maturity normally in two years, but no longer than four years. Then the salmon returns to their natal river to spawn. Most salmons die after spawning, especially the male fish. The ones who survive recover in period of few weeks up to a whole winter and descend to the sea. There they feed and return once more to their spawning river (Cunningham, 2010; Marine Harvest, 2013a; Seymour Salmonid Society, 2013)

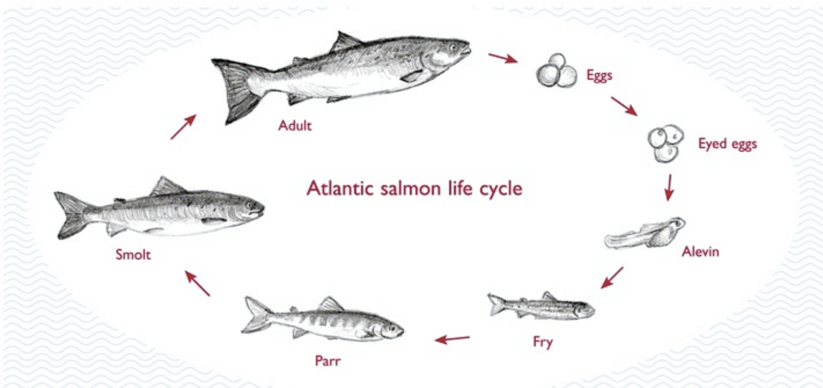

Figure 34. Lifecycle of salmon (Cunningham, 2010).

Salmons are a part of the family of Salmonidae, also referred as salmonids (Fishbase, 2013) which consists of numerous species that have been utilised by humans since prehistoric time, mostly within the Northern hemisphere (Canadian Museum of Civilization, 2013; Gould & Plew, 1996). Salmonids contributed 4.2% of the world seafood supply in 2012 (Marine Harvest, 2014). Their total supply was then 4 million tonnes, while only five years earlier the supply was 3 mt. as shown in Figure 35 (FAO, 2014a). The growth of production has mainly been caused by increase of salmon farming and favourable natural conditions for the wild salmon stocks. All salmonids species are listed up in Annex XIII – World supply of salmonids.

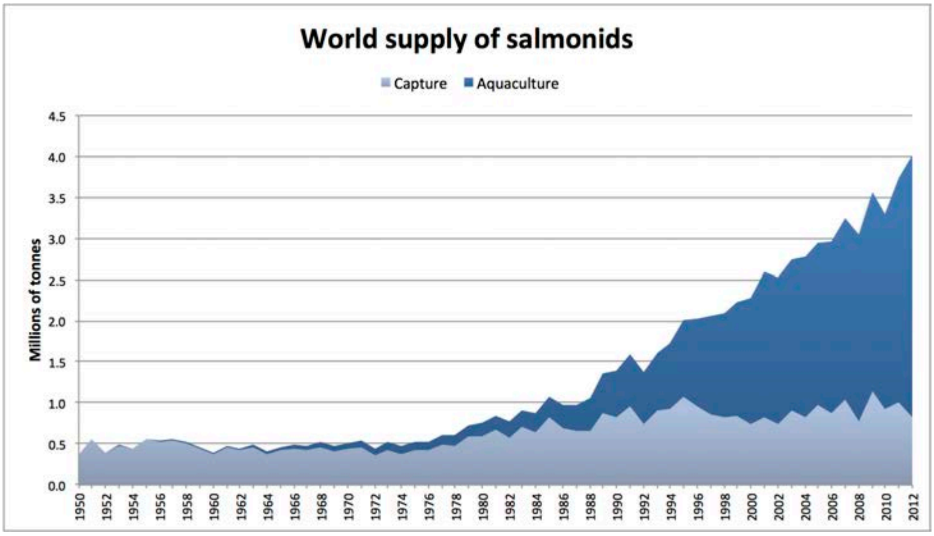

Figure 35. World supply of salmonids1950-2012 (FAO, 2014a).

Salmon, specifically the Atlantic salmon is the single most important species within North American and European aquaculture as shown in Table 9 and Table 11. The Atlantic salmon was in the 11th place in terms of total world aquaculture production by volume in 2012 (Annex V – The top 25 species in aquaculture). It is also the species that yielded the highest average farm gate price ($5.04 USD/kg) of the species that were farmed in more quantity than one million tonnes in 2012, as shown in Figure 36 (FAO, 2014a).

The majority or 79% of the world salmonoid supply in 2012 was originated from aquaculture and wild capture fisheries provided 21%. Norway and Chile were by far the largest salmon farming countries in 2012 with 1.3 mt and 0.82 mt. Countries such as the UK, Canada Iran, Turkey and the Faroe Islands farmed more than 100 thousand tonnes respectively.

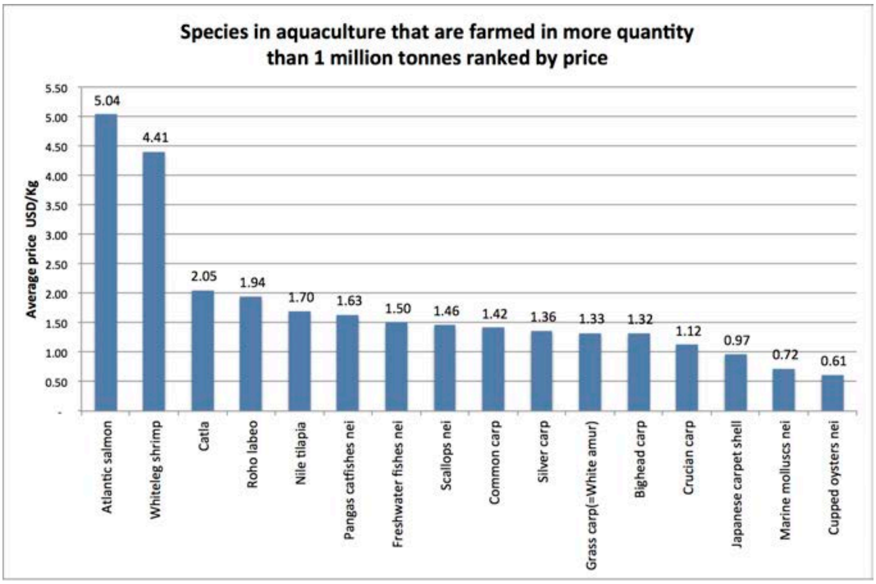

Figure 36. Species that are farmed in more quantity than one million tonnes raked by price in 2012 (USD/kg) (FAO, 2014a).

Table 15. Total production of salmonids in 2012, ranked by countries (FAO, 2014a).

Country	Rank no.	Farming / harvest of salmonids in 2012			
		Aquaculture	Wild harvest	Total	%
Norway	1	1,307,072	1,018	1,308,090	32.3%
Chile	2	817,672	0	817,672	20.2%
Russian Federation	3	33,502	453,412	486,914	12.0%
USA	4	35,827	204,556	240,383	5.9%
United Kingdom	5	174,786	252	175,038	4.3%
Japan	6	23,069	148,054	171,123	4.2%
Canada	7	131,652	9,542	141,194	3.5%
Iran	8	131,000	0	131,000	3.2%
Turkey	9	114,569	444	115,013	2.8%
Faroe Islands	10	76,564	0	76,564	1.9%
Other		381,917	10,944	392,861	9.7%
Total		3,227,629	828,222	4,055,851	100.0%

The wild capture fisheries of salmonids have been important to several societies. Their output has ranged from 800 thousand to million tonnes a year in the period of 1990 to 2012 as shown in Figure 35. Russia harvested the largest quantity of wild samonids in 2012 with nearly half million tonnes, USA was second with a bit more than quarter of million tonnes and Japan was third with nearly 150 thousand tonnes. The wild harvest of salmonids is mainly in the Pacific ocean (FAO, 2014a).

The pink (humpback) salmon contributed the largest output of the wild salmonid species with nearly half of the wild salmonid harvest and 10.1% of the total world output in 2012. Sockeye (red) supplied 18% of wild harvest and 3.8% of total supply salmonids, the Pacific salmon 15.5% of wild and 3.2% of total and the Chum (Keta, Dog) salmon 14.7% wild and 3% of total supply. Detailed informtion of the world supply of salmonids in 2012 are shown in Figure 37 and Annex XIII – World supply of salmonids (FAO, 2014a).

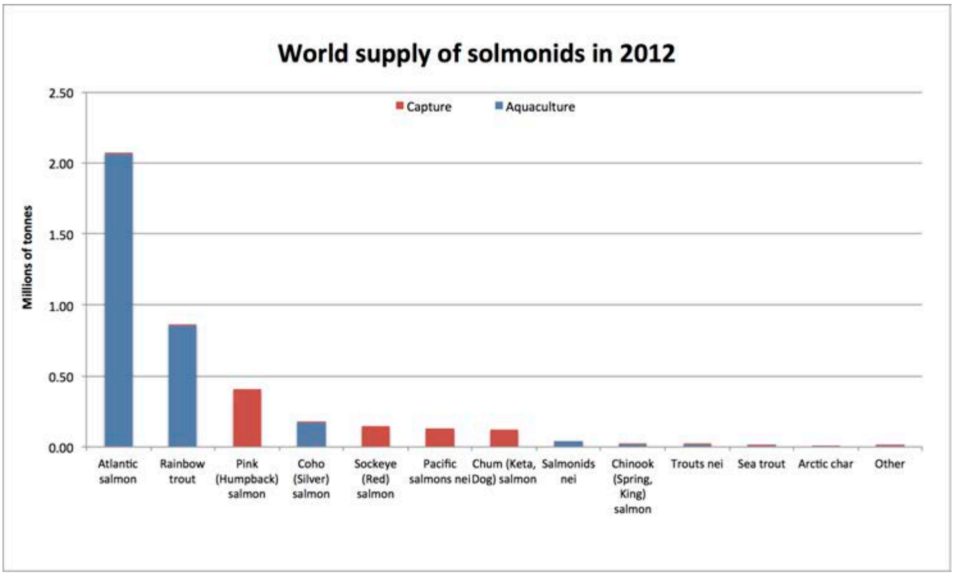

Figure 37. World supply of salmonids in 2012 (FAO, 2014a).

Even though the method for artificial culture of salmonids has been known since the 14th century and pond culture has been operated even earlier[21]. It was only in the 1960's when modern farming practices of the Atlantic salmon started on an experimental level. The practice evolved into industrial level farming in Norway in the 1980's and in Chile in the 1990's (Marine Harvest, 2013a). The farming of Atlantic salmon has increased rapidly since then. The total output exceeded 500 thousand tonnes in 1996, one million tonnes in 2001 and two million tonnes in 2012, with the total value creation of $10.4 billion USD at farm gate. Farming of Rainbow trout has also been significant. It was farmed in more quantity than Atlantic salmon until 1994 and was produced in nearly 860 thousand tonnes in 2012 (Annex XIII – World supply of salmonids) and valued $3.7 billion USD (FAO, 2014a).

The average growth of farming of Atlantic salmon was 13% a year in the period of 1986-2012. There have been a few instances where the growth of salmon farming has slowed down due to infectious diseases[22]. The first cases were detected in the early 1980's and they have followed the industry ever since. Norway suffered from an outbreak of vibrosis in 1986 and furunculosis in the early 1990's. The infectious salmon anemia (iSA) caused serious outbreak in Canada in early 2000's, Faroe Islands in 2003 and Chile in 2008-2010. The iSA cases significantly affected the salmon production of in Faroe Islands and Chile (Asche, Hansen, Tveteras, & Tveterås, 2010). The production in Chile in reduced from 388 thousand tonnes in 2008 to 123 thousand tonnes in 2010. The reduction was 265 thousand tonnes or nearly two thirds of the Chiles' production of famed salmon (FAO, 2013). The production of the salmon farming in Chile and Faroe Islands is shown in Annex XIII – World supply of salmonidsto highlight the effect that the iSA disease had. Chiles' salmon farming recovered extremely fast and the harvest of Atlantic salmon doubled in 2011 (264k tonnes) and grew by one third in 2012 to nearly 400 thousand tonnes. The total world production of Atlantic salmon grew form 1.4 mt in 2010 to more than 2 mt in 2012. Which was a new record in production quantity (FAO, 2014a). The recovery even exceeded the predictions of that the amounts would to remain the same as in 2011 or 1.7-1.8 mt (Heiberg, 2012).

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[21] As described in chapter 4.

[22] Few of the known diseases for salmon are: vibrosis, furunculosis, Pancreas disease (PD), infectious hematopoietic necrosis (ihn), and infectious salmon anemia (iSA).

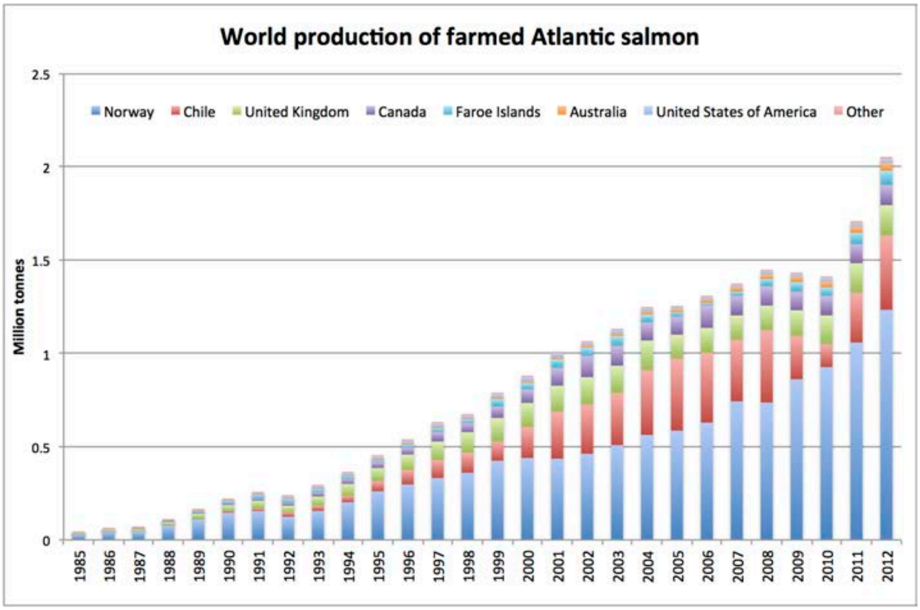

Figure 38. World production of Atlantic salmon (FAO, 2014a).

Table 16. Salmonids production in Chile and Norway 2012-2013 (Salmon Chile, 2015; Statistics Norway, 2015d)

Salmonids 2012-2013			
		2012	2013
Chile	Salmon salar	398,316	490,300
	Coho Salmon	159,756	148,100
	Rainbow Trout	262,674	153,800
Norway	Salmon	1,122,085	1,168,324
	Rainbow trout	62,142	53,267
	Char	-	234
	Total	2,004,973	2,014,025

The demand for Atlantic salmon was estimated to remain strong with an estimated increase in global consumption of 2% between 2012 and 2013 (Marine Harvest, 2013b). Norway increased its salmon production by only 46 thousand tonnes more between 2013 and 2012, while Chile increased production by 90 thousand tonnes. However the total salmonids production for the two countries remained nearly the same between the two years (Table 16) (Globefish, 2015b).

The prices of salmon are very dependent on supply and the Norwegian supply is dominant in price formulation. Almost 87% of the annual price development between 2000-2011 can be explained of change in global supply and the Norwegian FHL[23] prices (Annex XIV – Supply and nominal price of Atlantic salmon) (Marine Harvest, 2014).

The price of farmed salmon reduced with increased production until 2003 when prices started to rise and were nearly $6 USD/kg on world average[24] (Figure 39). The prices continued to rise until 2006-20007 when a sharp increase of global supply of nearly 10% caused a reduction of prices by 21%. The iSA outbreak then caused a rise in prices by 18% in 2008-2009 and 24% in 2009-2010. The prices then fell again when Chile increased its production after having recovered from the iSA infection (Annex XVI – Production of farmed fish in Norway). The current price trend started in late 2012 and in early 2014 when prices had sustained at exceptionally high levels. European producers yielded "smashing" export revenue month after month. This is especially interesting because it is estimated that global production increased by 10% in 2014. The projections for 2015 indicate that growth of total salmon production will be minimal and producers would rather focus on maintaining high prices (Globefish, 2015b; Marine Harvest, 2014).

[23] Fiskeri- og havbruksnæringens landsforening / Norwegian Seafood Federation.

[24] Annual average prices have varied between NOK 19.50 (2003) and NOK 37.45 (2010) (Marine Harvest, 2014).

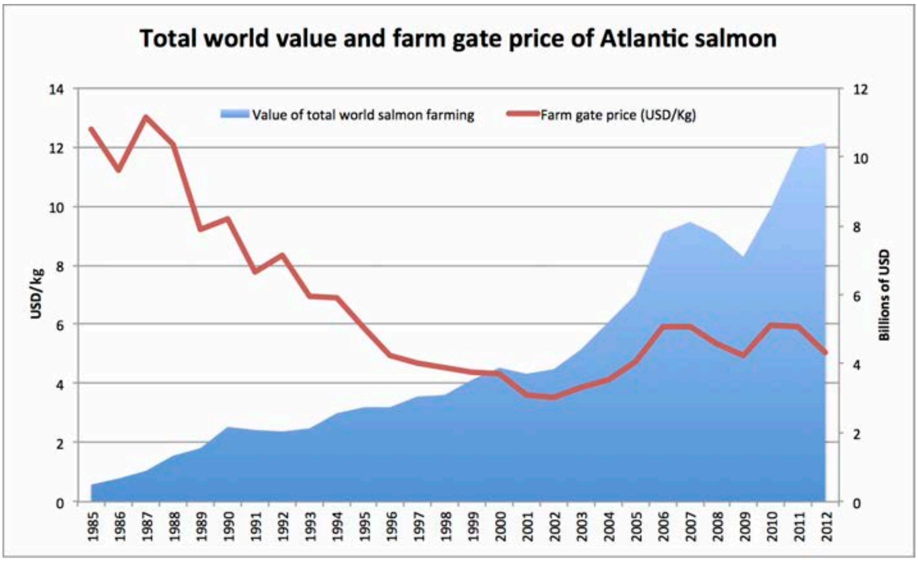

Figure 39. The total world value Atlantic salmon and price (inflation adjusted 2012=100) (FAO, 2014a).

International trade of salmonids products has changed after Russia banned seafood imports from EU, USA, Norway, Canada and Australia. Which was an answer to the trade restrictions imposed on Russia due to the annexation of Crimea in August 2014 on and the on going currency war between the nations (Hanke, 2014; Seaman, 2014; U.S. Department Of State, 2014). Even though the Norwegian salmon industry had planned to increase exports to Russia with subsequent increase production. However, the Norwegian producers were able to sell their products on other markets. Even without too much negative effects on prices (Globefish, 2015b).

5. Industry analysis

The methodology of this industry analysis is described in chapter 3.5. It might also be useful to mention that this industry analysis is focused on the Norwegian salmon farming industry and its supply chain is described in chapter 5.2.1.

5.1 Salmon farming in Norway

Norwegian seafood trade dates back to 875 when Thorolf kveldulfson sailed from Vogar in Lofoten with his ship full of dried cod to be sold in England. This was even before the Vikings started raiding the British Isles (Hjeltnes, 2015). A lot has happened since then and Norway is now the largest aquaculture producer in Europe and the 6th largest in the world (FAO, 2014a). Norway has also large wild capture fisheries and landed 1.9 mt of wild catches in 2013 (Eurostat, 2015). Every day, all year around there are 38 million meals of Norwegian seafood serviced around the globe.

Norway has the 8th largest coastline in the world of 25.148 km (15.626 mi) and it harbours numerous areas that are well suited for salmon farming (Maps of the world, 2015; Salmon from Norway, 2015). The aquaculture sector is primarily based on the farming of Atlantic salmon (93.3% in 2013) and Norway leads the salmon farming industry with an output of 1.16 million tonnes in 2013, which was 59,6% of the total world output. The value of farmed Norwegian salmon has varied between years. The prices have stayed strong in the recent years and the total export value of Norwegian salmon increased by 26.3% between 2012 and 2013 or from $4.8 billion USD to $6.5 billion USD[25], while production reduced by 5.5% (

[25] Salmon generated 28 billion NOK in 2012 and 39.9 billion NOK in 2013.

Table 17. Farmed fish in Norway in 2012 and 2013 (Norges Bank, 2015b; Statistics Norway, 2015d)

	2013			2012			Percent	Percent
	Fish for food (tonnes)	Fish for food (USD 1 000)	Share	Fish for food (tonnes)	Fish for food (NOK 1 000)	Share	Quantity 2012-2013	Value 2012-2013
Salmon	1,168,324	6,452,750	93.6%	1,232,094	4,756,781	93.3%	-5.5%	26.3%
Rainbow trout	71,552	389,616	5.7%	74,678	288,582	5.7%	-4.4%	25.9%
Char	..	..	..	309	2,808	0.0%	..	..
Cod	3,770	20,418	0.3%	10,033	35,710	0.8%	-166.1%	-74.9%
Halibut	1,385	18,189	0.1%	1,740	22,609	0.1%	-25.6%	-24.3%
Shellfish	2,363	2,230	0.2%	2,001	1,863	0.2%	15.3%	16.4%
Other fish species	..	..	..	273	3,132	0.0%	..	..
Total	1,247,865	40,479,669	100%	1,321,128	30,039,180	100%		

The Norwegian salmon farming has grown rapidly since 1985 when the output was only about 30 thousand tonnes. In 1989 the output was 111 thousand tonnes and it only took 5 years to double the output, to 202 thousand tonnes in 1994, and again to 425 thousand tonnes in 1999. The half million mark was reached in 2003 and eight years later or in 2011 the output exceeded one million tonnes (Figure 40). The sale of salmon increased in 2012 counted in volume, but the average price decreased from $4.3 to $4.0 USD/kg (FAO, 2013; Norges Bank, 2013; Statistics Norway, 2013c). The prices rose again in 2013 as already described and 2014 was a record year with an export of 999 thousand tonnes of salmon products that valued nearly $7 billion USD[26], or an increase of 11% counted in NOK compared with 2013. The export price for fresh whole salmon in 2014 varied between $5.5 USD per kg in September and $7.7 USD per kg in January. The average export price in 2014 was $6.5 USD per kg or 3.4% higher in 2013[27] (Norwegian Seafood Council, 2015b).

[26] Norway exported salmon worth of NOK 43.9 billion in 2014.

[27] Prices in NOK are shown in Annex XVI – Production of farmed fish in Norway and Chile.

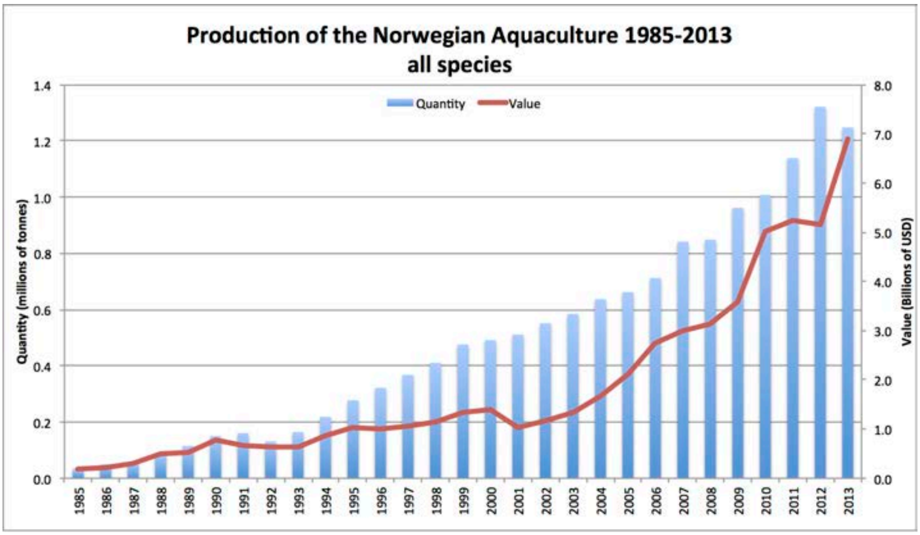

Figure 40. Production quantity and value of Atlantic salmon in Norway (FAO, 2014a; Statistics Norway, 2015d).

Norway also farms a significant amount of Rainbow trout, which amounted for 10.8% of total output of the country's aquaculture in 2012. Due to increase in salmon production the share of Rainbow trout was down to 5.7% in 2013 and 2014 as shown in Table 17 (Statistics Norway, 2013a, 2015d). Norway was the fourth largest producer of Rainbow trout in 2012 with 9% of total world production. Chile was the largest with 254 thousand tonnes or 30%, Iran with 131 thousand tonnes (15.3%) and Turkey 114 thousand tonnes (13.4%) (FAO, 2014a).

Other farmed species are listed in Table 17. They only counted 0.7% of the total output in 2013 and therefore insignificant compared with salmon. E.g. Atlantic cod was the third largest specie in 2012 with an output of 10 thousand tonnes. That amount is similar as the salmon farming industry produces in two days (FAO, 2014a; Statistics Norway, 2015d).

5.1.1 Production Regions

The Norwegian Ministry of Fisheries and Coastal Affairs controls the production of farmed fish in Norway and issues licences to those who farm salmon, either in fresh water or in the ocean. The licenses are linked to specific counties and are a strategic component within the framework of a sustainable development. They are also meant to promote profitability and competitiveness of the aquaculture industry (Directorate of Fisheries, 2013). The Directorate of Fisheries administrates the licences that can allow the maximum biomass of 780 tonnes (900 tonnes in Troms and Finnmark). The licences for salmon have only been issued in limited numbers since 1982[28] and totalled 1018 in 2013. The number licences for rainbow trout were 43 in 2012 (Marine Harvest, 2013a).

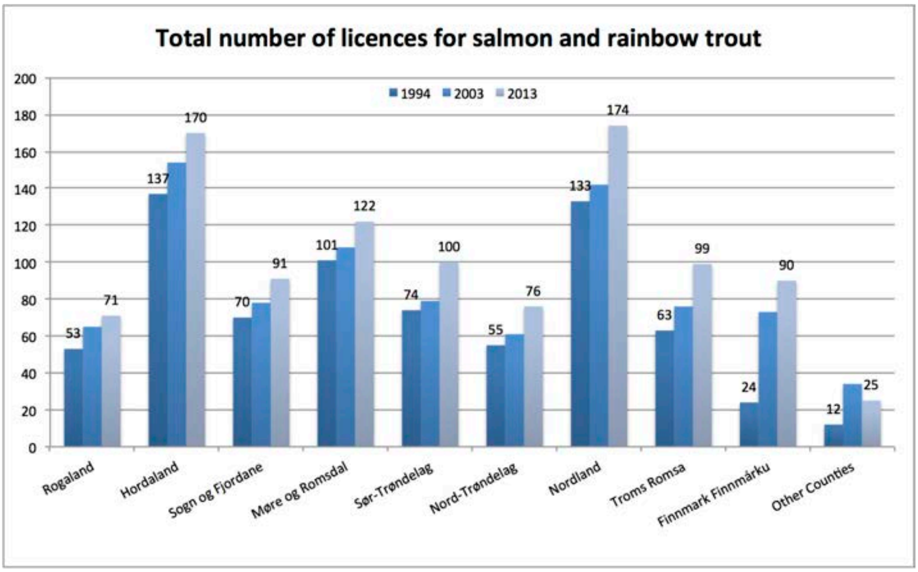

Figure 41. Number of fish farming licences for salmon and rainbow trout (Statistics Norway, 2013b)

Most number of licences in 2013 were in Nordland (174) and Hordaland (170) as shown in Figure 41 (Statistics Norway, 2015c). All of these licences are issued in counties that are open to Atlantic Ocean. To be more precise the

[28] New licenses have been issued the years 1985, 1988, 1999, 2001, 2002, 2009 and 2011.

North Sea, Norwegian Sea and the Barents Sea (World Atlas, 2013) or from Rogaland in the South to Finnmark in the North. An over view of the number of licences is shown on a map in Annex XVII – Production of farmed fish in Norway (Statistics Norway, 2013b).

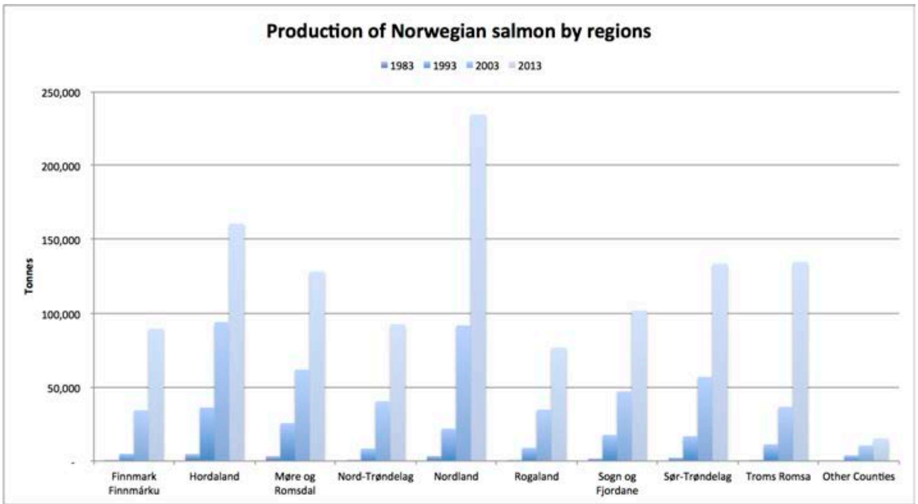

Figure 42. Production quantity of salmon in Norway by regions (Statistics Norway, 2013c)

The difference in the number of licences displayed in Figure 41 and the production quantity in Figure 42 shows how the salmon farming industry has developed. The increased output has grown fast each decade since 1980's while the number of licences have not increased that much. This shows how long time it can take to build up production and create efficient productivity from the time a licence is acquired. Or as in this case, the time that has taken to develop the salmon farming industry. A god indicator of the success of the Norwegian salmon farming is the price of salmon farming licence. They valued nearly $43 thousand USD in 1993, while the current price is in the range of $3,4-12 million USD (Marine Harvest, 2013a). The licences can be traded under specific restrictions e.g. a single company cannot hold more than 15% of total licenced biomass in Norway. A single company cannot control more than 25% of the total biomass in the country, and a single company cannot control more than 50% of the total biomass in a single county (Directorate of Fisheries, 2013). The most productive counties are also those who have the most number of licences, Nordland with 234 thousand tonnes and Hordaland with 160 thousand tonnes, or total of 33.8% of total production in 2013. Møre and Romsdal, Sogn og Fjordane, Sør-Trøndelag and Troms Romsa produced more than 100 thousand tonnes and collectively accounted for 56.4% of total production in 2013 (Statistics Norway, 2015d).

5.2 Industry Structure

The growth of salmon farming has been driven by increased productivity (Asche, 1997; Torrissen et al., 2011) up to the point that production quantity was limited by the salmon farming licences. Marine Harvest e.g. was limited by the rule that limits a single company to hold more than 25% of total biomass in Norway in 2009 (Table 18). Marine Harvest was not able to increase production for some time within Norway due to these limits. The five largest proportionally changed from producing 50.4% in 2009 to 57.4% in 2013. The largest 10 companies also increased their output in 2009 from 67.2% up to 70.9% in 2013. Other companies increased their production and slightly increased their share of the over all production of the Norwegian salmon farming, which again allowed the large companies to increase their production as well. So because the 10 largest salmon farmers have proportional limits on their growth, they might even have some incentives to assist other licence holders to increase their production for them to increase their as well

Table 18. Industry structure in Norway in 2012[29] *(Marine Harvest, 2010, 2013a, 2014; Torrissen et al., 2011)*

No.	Top 10 largest companies of farmed Atlantic salmon in Norway	2009		2013	
		Quantity (tonnes)	%	Quantity (tonnes)	%
1	Marine Harvest	201700	23.4%	264000	22.6%
2	Lerø Seafood	108500	12.6%	157000	13.4%
3	Salmar	64400	7.5%	128000	11.0%
4	Cermaq	"	"	56000	4.8%
"	Mainstream	30700	3.6%	"	"
5	Grieg Seafood	26300	3.0%	55000	4.7%
6	Nordlaks*	27000	3.1%	37000	3.2%
7	Nova Sea*	29300	3.4%	34900	3.0%
8	Alasker Fjordbruk*	20300	2.4%	29000	2.5%
"	Sjøtroll	25200	2.9%	"	"
9	Norway Royal Salmon	"	"	29000	2.5%
10	Bremnes Seashore*	15300	1.8%	25000	2.1%
	Top 5	434600	50.4%	660000	57.4%
	Others	114100	49.6%	490000	42.6%
	Top 10	794600	67.2%	814900	70.9%
	Others	388500	32.8%	335100	29.1%
	Total	1183100	100.0%	1150000	100.0%

* 2013E Volume

[29] Production quantities for 2013 are based on estimations.

There was a quite strong trend of consolidation within the Norwegian aquaculture industry in the last decade. It took 70 different entities to produce 80% of salmon and trout output in 1997. While in 2013 there were 24 entities that produced the same amount as shown in Figure 43 [30] (Marine Harvest, 2010, 2013a, 2014). The trend of consolidation slowed down after 2009. However, there are indications of further consolidations due to pressure on the Norway's fisheries and coastal affairs to lift the limits and therefore allowing the largest companies to grow even larger (Undercurrent News, 2012)

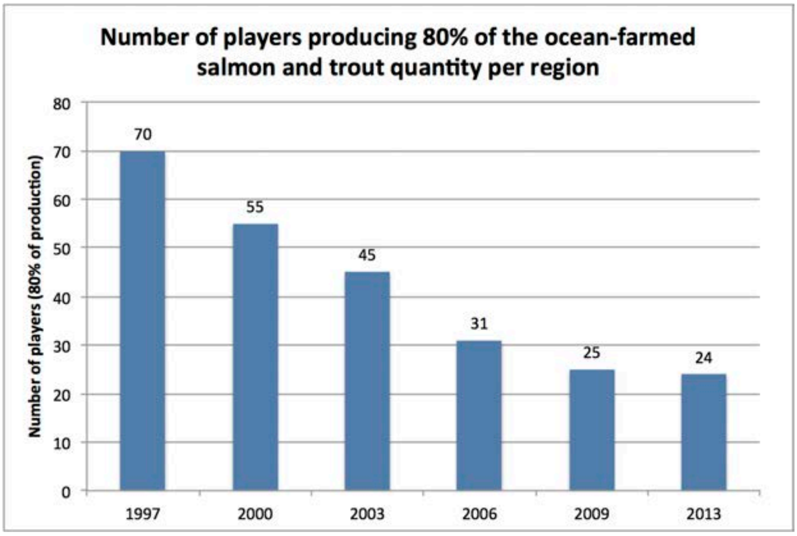

Figure 43. Number of farming licence holders in Norway producing 80% of farmed salmon (Marine Harvest, 2010, 2013a, 2014)

5.2.1 Production cycle

The process of farming salmon can be described in five steps (Laksefakta, 2015). While company such as Marine Harvest (MS), which is a vertically intergraded salmon farming company describes its production cycle in in six steps (Marine Harvest, 2014). There are some differences in how the production cycle of salmon farming is described. Some include logistic activities between production steps, other focus more on the biological

[30] Production quantities for 2013 are based on estimations.

development of salmon as shown in Annex XVIII – Production cycle of Norwegian salmon. Other differences may include activities related to the broodstock and post harvesting activities such as processing, logistic and secondary processing. Therefore it is possible to describe the production cycle up to ten steps. Here we will use the description put forward my Marine Harvest as shown in Figure 44. This means that we will not include the farming of the broodstock and focus on the main production of salmon products.

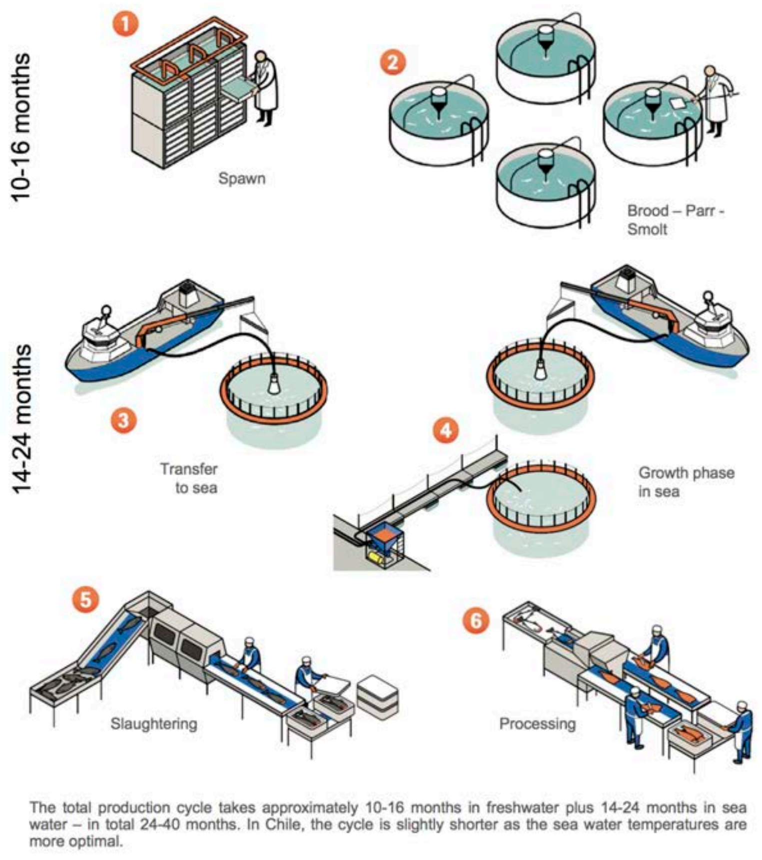

Figure 44. Overview of the production cycle of salmon (Marine Harvest, 2014)

Spawning and fertilisation - The first step is the spawning, which takes place onshore in freshwater by striping the eggs from females and mixing them with milt. The fertilised eggs or roe then mature and becomes “eyed eggs” in about 25-30 days and they hatch in about 60 days. The newly formed individuals are small (<2.5 cm) and feed on their yolk sack. Then they are called alveins. When the yolk sack is absorbed the fish starts feeding small live artemia, a small crustacean also called brine shrimp.

Fry/parr and smolts – The fry or parr as they are also called are distinguished by dark rounded patches that are evenly spaced along their sides. In this stage the fish is fed with small formulated fish feed pellets and are vaccinated to prevent diseases. As the fish grows and develops, it adopts its body to live in seawater (smoltification). At this point the process has taken about 10-16 months. The fish is graded and separated into groups depending on size.

Transfer to sea – The smots are now 60-100 grams and adopted to live in saltwater. They are then transferred by wellboats or trucks in seawater tanks with controlled environment. There the oxygen level is the most important factor. They transfer the smolts from the land based location to the site of on-growing.

Growth phase in sea – The grow out is the period when the salmon is held in cages in the sea and fjords for about 14-22 months, depending on temperature. There they grow to four to six kilograms and are ready for being slaughtered. In this stage the feeding is the most important factor. Time of year and temperature is also important for the growth rate. Other factors such as diseases and sea lice are risk factors.

Slaughtering – When the salmon has reached the size of four to six kilograms it is ready for slaughtering. Then the fish is transferred into salmon slaughterhouses where it is anesthetized, slaughtered, gutted, washed, sorted by size and quality and put on ice. The slaughterhouses often also contain processing.

Processing – Head on gutted (HoG) salmon on ice in expanded polystyrene (EPS) boxes is a finalised valuable product and is traded in substantially large market. Further processing involves steps to remove non-eatable parts of the fish by removing the head, backbone and trimmings from fillets. A sizable part of the fish can be removed to produce fillets or even smaller portions that take less space and weight in transport. Such product is also more vulnerable for bacteria contamination because the open flesh is not as resistant to contamination as the fish skin[31].

Secondary processing – Is when HoG salmon, fillets or portions are packaged in consumer packaging or processed further such as with special cuts of salmon for sushi and sashimi, smoking or marinating. Such processing is often referred as value added salmon products (Laksefakta, 2015; Marine Harvest, 2014).

The steps described here above are the general steps and might be sufficient for most cases. However, there are companies that are smaller and only operate specific farming activities or produce specific salmon products. Hence, instead of one vertically integrated company managing the whole supply chain from spawning to finalised product, there are several companies that e.g. buy smolts and specialise in the grow out or a company such as Primalaks AS[32] that bought HoG salmon to be filleted (Johansen, 2009). That means that there are companies who buy HoG salmon in EPS boxes that is only transported relatively short distances. Then the buyer has to discard the EPS boxes and pack its products in new packaging, which in some cases are new EPS boxes, such as a company that specialises in filleting. This can double the cost of packaging, compared with a retailer that buys HoG salmon that is sold whole at the fish counter.

The problem of these companies was therefore threefold. Firstly the salmon that they were buying included the price of the EPS, which can amount to the equivalent of the sales value of 1 kg of salmon per box. Secondly their operation is quite inefficient due to the time and manpower needed to unpack/unload all the EPS boxes. Thirdly they needed considerable manpower and expenses to shred and discard the EPS boxes (Gabrielsen,

[31] It is possible that actvities between processing and seccondary processing can overlap.
[32] Nordlaks AS suspended operation in 2014 (Brönnöysundregistrene, 2014).

2009b; G. B. Guðmundsson, 2010; Johansen, 2009; Kristjánsson, 2010). This led to further analysis of Norwegian companies that process salmon.

5.2.2 Areas of interests for Sæplast tubs within the Norwegian salmon farming industry

The majority of salmon products within the Norwegian farming industry are only produced by few companies (Table 18). It was therefore considered a logical approach to contact managers and other professionals to gain a better insight to the sector.

The slaughterhouse and processing plant owned by Marine Harvest (MH) in Hjelmeland was chosen to be contacted first due to production quantity, ownership and that its location is relatively close to market. The production manager Per Magne Gabrielsen was kind enough to answer our questions with follow up via e-mail. His main reply was that the large salmon farming companies in Norway have evolved nearly entirely without using tubs. While in Chile, 1000 L tubs are often used to transport fish form farming sites into slaughterhouses or the salmon is slaughtered on the farm site and then transported in tubs into processing. The Norwegian salmon industry normally transfers live salmon with wellboats from the farm sites into slaughterhouses. At the time when Per Magne was contacted, MH in Hjelmeland was changing their operation from moving the salmon from farm sites into cages that laid outside the processing plant. Into, slaughtering the salmon inside the wellboats while the boat was in transit from the site of grow out to the processing plant. This was done to reduce stress, i.e. the fish does not have sufficient time to recover after the stress it builds up during transit and adjusting new cages before it is slaughtered. The stress affects the chemical process of the rigor mortis and therefore has negative effects to quality and reduces shelf life.

The whole process of the Hjelmealand facility was built up using pipes/pumps and conveyer belts so there is no need for tubs in the general processing. However, some MH processing plants, such as Hjelmeland use 50-60 tubs to collect fish that is of the lowest quality. That is quality class three and is called production quality. Per Magne also said that they are very innovative and regularly test different solutions. In fact they had only recently undertaken a project where they bought Sæplast tubs that were used to send HoG salmon to further processing in France. Therefore they are well aware of the option of using reusable tubs. The results were quite clear. The number one factor ruling against using reusable tubs was the high transportation cost of redeeming the tubs, which amounted to NOK 30-32.000[33] for single truckload. Cost is one of two most important factors so only on that notion they would not be likely to use Sæplast tubs in large scale. The second factor is quality. The tubs that came back were dirty because the blood soaked water had dried on the way back and they were quite difficult to clean. That is, the processing in France had not made any effort of cleaning the tubs after removing the salmon. Therefore, due to the success of marketing of salmon as an essential item in sushi, it has to be able to be eaten uncooked. Hygiene is therefore at the utmost importance and bacteria contamination such as *listeria* or *salmonella* could have severe consequences to slaughterhouses and processors. Not only would their customer react to such contamination. The processing companies also have to follow the standards of the Norwegian authorities that can make punitive actions. Marine Harvest was therefore not going to use reusable tubs to transport HoG salmon to be processed outside Norway (Gabrielsen, 2009a).

Per Magne was contacted one year later and asked if he would update his responses. His answers were unchanged. Except he reckoned that increased imports into Norway due to advantageous economic conditions might make it harder to negotiate favourable transportation rate to redeem the empty tubs (Gabrielsen, 2009b).

An operation manager that at the time worked for Grieg Seafood in Finnmark, Kristján Rúnar Kristjánssson, who also has experience in using Sæplast tubs in Iceland, was also contacted. Grieg processed about 23 thousand tonnes a year and was part of the fourth largest salmon processing company in Norway at the time. The salmon that came in to the Grieg processing in Finmark was transported with wellboats and it only passed about 30-60 minutes from the time the fish was alive, until it has been filleted and the fillets were being trimmed. Such processing is called pre-rigor processing. Thus the rigor process takes place during transport. They also, occasionally produced frozen products and occasionally produced headed un-filleted salmon. Due to the distances to their main market in Europe they

[33] MH was charged double for the roud trip or about NOK 62.000.

were looking into increasing the share of frozen products. They also had invested in 3-X Technology tub lift to feed a conveyer belt. However they only owned and operated about 15-20 Sæplast tubs. Kristján thought that the Sæplast tubs might have changes in several niche markets within the Norwegian salmon industry. One such niche is to use Sæplast tubs to store newly slaughtered salmon in ice water while they go through rigor mortis. Then the salmon would be filleted and trimmed post rigor mortis.

The Norwegian salmon industry uses three quality categories *1. Superior, 2. Ordinary* and *3. Production.* Kristján suggested that Sæplast tubs could have chances for processing of production quality salmon. Because, by Norwegian laws, it is obligatory to process such fish before it is exported from Norway. That means that in some cases, production quality salmon is packaged in EPS boxes two times. First, at the slaughterhouses and then after processing. That is proportionally very high cost for packaging, because such product yields lower prices than the other quality categories. About 10-13% of the fish was processed at Grieg Seafood in Finmark ended in production quality category. That fish was collected into separate truckloads, to reduce transportation cost. Kristján said there could also be a niche market for Sæplast tubs in transporting production salmon from slaughterhouses to processors. Kristján named more examples that can be found in Annex XIX – Examples of tubs vs. EPSbut he wanted to highlight that the producers normally do what their buyer requested them to do, as a part of the service (Kristjánsson, 2010).

Prima Laks AS, a salmon processor was in the position as described in the end of Section 5.2.1. That is, having to deal with the inefficiency of buying HoG salmon in EPS boxes that were discarded with considerable cost. Then they needed to buy new EPS boxes for their products as well. The company contacted Promens after having purchased and used Sæplast tubs for some time and inquired if it was possible to create special tubs that would be better fitted to transport HoG salmon from slaughterhouses to processing, such as theirs. They were hopeful that usage of Sæplast tubs would reduce their cost of packaging and increase efficiency within their processing. They also pointed out similar examples, about individuals and companies that were using Sæplast tubs to transport HoG salmon. One example was a Finnish secondary processer who sent their own truck, loaded with their own Sæplast tubs, through Sweden and into Norway where they bought HoG salmon straight from a slaughterhouse.

The current Sæplast tubs do not fit well enough inside typical Norwegian trucks, because they are a bit larger than the ones used in Iceland. The tubs are also equipped with hoisting grips that leave valuable space and therefore they do not fit properly into the trucks. Prima Laks AS sold mostly or 80% of their products to secondary processors within Norway and 30-50% went to smoking. Transportation distances ranged from 300-500 Km and their transporting operator was Thermo Transit[34] that used trucks that could fit 33 pallets with 27 EPS boxes of 30L. Each shipment weighted about 19-20 metric tonnes. The cost of packaging per such shipments was NOK 17-18 per EPS box or NOK 14-15.500 per shipment. Thus the transportation costs was about NOK 1.3 per kg of salmon and the EPS boxes costed about NOK 0.7-0.8 per kg of salmon (Johansen, 2009).

Here it is estimated that the average salmon exporter is still paying similar price for their EPS boxes as Prima Laks AS did in 2009 or NOK 0.75 per kg of salmon[35]. Then we can approximate the price of packaging for the salmon industry by applying that cost per kg on average. In the week 13 of 2015, Norway exported 20,283 tonnes of fresh or chilled salmon. That means that we can estimate that the Norwegian salmon industry spent NOK 15.2 million for EPS packaging in that week. If that number is multiplied for a whole year, then we can estimate that the Norwegian salmon industry will spend about NOK 182.5 million in EPS packaging in 2015 (Johansen, 2009; Statistics Norway, 2015e).

The tentative results from the interviews in 2009 concluded that Sæplast tubs had potentials in niece markets by servicing processors that were located within Norway and that bought HoG salmon in EPS boxes as described above.

Third quality category, or production quality is mandatory by law to be processed within Norway. The processing of the quality category could be a potential market for Sæplast tubs. Then processors could collect and stored product quality salmon in Sæplast tubs while the higher quality fish is

[34] Thermo Transit was contacted at the time and they verified several facts, however they asked not to be referenced.

[35] That price contains the estimate of 2 kg of ice in each EPS box.

processed. Then the production fish could be stored in the tubs while going through the process of rigor mortis.

As a respond to these findings, a list of all companies that are licenced to operate fresh seafood from fish farming was acquired form the Norwegian Food Safety Authority or Mattilsynet in Norwegian (Mattilsynet, 2015). Additional information was added to the list, type of licence, number of employees, if they were part of larger group or not, location within Norway, and key financial information. The additional information that did not follow from the Norwegian Food Safety Authority, was acquired from proff.no. Quite detailed financial information are public in Norway and can easily be found, even by browsing through the online yellow pages[36]. Factors such as type of processing license, financial information and number of employees were used for the identification.

The list can be found in Annex XX – Information about Norwegian seafood processorswith location on Google maps. The original list is available in the form of webpage[37] (Eiriksson, 2010). The objective was to analyse whether sufficient number of companies could be found that are in similar position as Prima Laks AS. The goal was to evaluate if a demand for new tubs would reach or surpass 500 tubs. That is the number that was estimated to justify the production and marketing of a new tub within the Sæplst product line.

The analysis concluded that there was insufficient demand at the time and it could not be recommended to initiate production of a new special salmon tub. The list from Norwegian Food Safety Authority or Mattilsynet in Norwegian (Mattilsynet, 2015) could however be used to market already existing Sæplast tubs and other products. Likely candidate identified were; Brandsund Fiskeforedling AS (Hordland), Villa Organic (Finnmark), Coast Seafood / Sortra Fisheindustri AS (Hordland), Leines Seafood AS (Nordland) and Prima Laks AS (Nordland). The list and Google maps could then at least assist the marketing personnel at Promens.

[36] Other sites that used were finnalle.no, purehelp.no, gulesider.no, brreg.no.
[37] http://staff.unak.is/bjarnie/Salmon_Industry/Promens/Home.html

5.2.3 An example of Sæplast tub usage in Iceland

Before further analysis within the salmon farming sector were undertaken, it was decided to present an example or a benchmark of usage of Sæplast tubs within the Icelandic wild capture fisheries, a sector that has been serviced by Promens for about three decades. The company that was chosen was Bergur Huginn ehf. and they were happy to disclose all information that they were asked about. The Vestmannaeyjar Islands are located south of Iceland, which is favourable for export of fresh fish because cargo vessels stop there each week on their way to UK and mainland Europe. The distance is relatively shorter compared with most cargo harbours in Iceland. Bergur Huginn operates trawlers that catch fresh ground fish, mostly cod, haddock and redfish. The company is known for using their unique green Sæplast tubs that are well labelled with the company logo. At sea, the fish is carefully stacked belly down into the tubs with sufficient flake ice and the fish remains in it until it is processed, whether in Iceland or abroad. When landed, the tubs are weighted with ice because any extra movements and tumble affects the quality of the fish. The buyers are even trusted to re-weight the fish in their processing and confirm or correct toll papers[38] after the ice has been removed. Then the tubs are stacked into 40 ft. refrigerated containers that are sea-freighted in large vessels. The containers can carry 60 tubs of 660 L size (2x3x10) that are kept at 2-3 °C. Each tub holds 420-460 kg of fish plus ice. The total weight of fish in each container is in the range of 24-26 tonnes. The fish is therefore not touched until it arrives into the hands of the buyer, which most often is in UK. The tubs are then cleaned after the fish is removed. They are then stacked inside same size of container and shipped back to Iceland. Several buyers in UK are even equipped with 3-X Technology automatic washing machines as shown in Figure 11. Hygiene is very important for exporters of wild ground fishes because it can affect the quality and shelf life of the products, which are important factors to evacuating prices.

Each route of fishing and shipping gutted fish to the market/ processors in Europe and back, takes about three weeks. Each fishing trip takes about three to five days and due to the limited shelf life of fresh fish they try to land close to the time of the departure of the cargo vessel. Therefore the logistical planning of such shipments requires three sets of

[38] Within certain limits.

tubs: One set at sea, one set to transport fish to the market and one set for the returning shipment. Bergur Huginn has a good number of spare tubs stored in their warehouse to meet unplanned events. They also inspect and maintain their tubs themselves because pierced/broken tubs can accumulate water and become heavier, which gives them unfavourable weight measurement and the tubs lose their insulation capabilities. Then the tubs loose the ability to protect their content sufficiently and should be replaced. Well maintained tubs last longer and if they are handled properly and kept away from extended exposure of the sunlight they have been lasting Bergur Huginn for about 8-12 years.

Bergur Huginn calculated that by using 440L Sæplast tubs that are used to ship fresh fish to the Humberside in UK, or a round trip from Iceland and back would cost about NOK 0.05 for the packaging of each kg of fresh fish. That cost included the purchasing of the tub included finance cost, maintenance and depreciation The cost of the transport with sea freight that includes the round trip of 40 ft. refrigerated container costed Bergur Huginn about NOK 41 thousand from Vestmanna Islands and the price was on average about NOK 48 thousand from other export harbours in Iceland (Guðfinnsson, 2006; Kristinsson, 2009).

Simple comparison of the prices of packaging between the Norwegian salmon farming industry with the estimated cost of NOK 0.75 per kg of salmon for the use of EPS boxes and NOK 0.05 per kg of fresh ground fish in Sæplast tubs, and that each load/container/truck would include 20 tonnes of fish. Then the packaging cost for the Icelandic fisheries companies were 15 times less expensive with the use Sæplast tub. Compared with the cost of the Norwegian salmon farmers that used EPS[39]. However, to maintain balanced comparison it should be reminded that, Bergur Huginn needs to send its tubs the round trip to redeem their tubs and therefore has to pay higher cost for transport, compared by using EPS boxes that only need to be transited single trips.

[39] EPS = 20,000 kg x 0.74 NOK/kg = NOK 15,000;
Sæplast tub = 20,000 kg x 0.05 NOK/kg = NOK 1,000.

5.2.4 Sæplast tubs, pros and cons

The focus of this study is to analyse possibilities for Sæplast tubs within the aquaculture sector, especially within the Norwegian salmon farming industry. It is necessary to mention the EPS boxes, however this analysis is meant to be focused on the Norwegian salmon farming industry therefore we will only present a simple generalisation about EPS boxes because they differ in shape and sizes. However, there are several issues that have accumulated about the difference of Sæplast tubs and EPS boxes as this thesis progressed and here is a short discussion about that.

There are sectors within the Norwegian salmon farming industry that in some cases are using EPS boxes more than once in their supply chain. This happens when HoG salmon is sent from slaughterhouses to be processed elsewhere within Norway and then to secondary processing. Prima Laks AS was an example of that. This seems to be a bit wasteful, i.e. having to buy and discard EPS boxes after such short use and also having to designate manpower specifically as well.

The argument of cost has somewhat been put forward. However just to highlight the matter, the 30L EPS boxes costed about NOK 17-18 or NOK 0.7-0.8 per kg. Meanwhile Bergur Huginn calculated NOK 0.05 per kg in packaging cost when using the 440L tubs. The difference is about fifteen fold for shipments of 20 tonnes.

Hygiene is an important factor for seafood producers and the Icelandic fisheries sector fulfils the strictest criteria and standards with the use of Sæplast tubs. However, the Norwegian salmon industry has to deliver products that can be eaten raw, which imposes extra concerns about hygiene. The EPS boxes are nearly sterile, while the Sæplast tubs need to be washed after each use. However they are made with material approved by the American FDA and EU hygiene standards. Soaps and disinfectants are available that can be used to clean the tubs as well as automatic washing machines. Food grade plastic bags are also available. They can cover the interior and safeguard the content of the tubs against direct contact with the tubs. They are e.g. used within the processing of Arctic Charr in Iceland.

The cost of transportation is a crucial factor for the usage of tubs vs. EPS boxes. It is hard to put forward examples without too much generalisation. However, it seems quite logical that it is more likely that Sæplast tubs could have the best chance of being used when salmon products are transported short distances. Processing companies that are experienced in using Sæplast tubs for medium of transportation for wild catch might also be willing to consider using them for salmon as well. Such as companies that own both wild fisheries and salmon farming. The main concern is to overcome the transportation cost of retour for the tubs. That can be done by stacking tubs into each other and saving space by 30%[40]. Then the processers only needs around two trips back for the retour instead of three. Then the processor needs to allocate space to safeguard the tubs while before they are sent back.

The difference in environmental effects is debatable because there has not yet been done a thorough comparison between the CO_2 footprint of EPS boxes compared with Sæplast tubs. However just to elaborate, the EPS boxes can be recycled in several ways and burned in power plants just as a normal source of fuel (Seafish, 2015). However, if they are discarded in landfills they degrade very slowly. Similarly, if they enter the ocean they degrade slowly and small plastic particles can easily accumulate in marine animals. Unfortunately, the disposal of EPS boxes are still quite wasteful and only 42% of EPS used for packaging for seafood within Europe is recycled, 24% is incinerated and 34% ends up in landfills (PWC, 2011).

Water usage can be an issue because fish processing can demand quite a lot of it. This might be of a concern on the mainland Europe, while most places in Norway have easy access of inexpensive and clean water. Therefore, water can be an issue when cleaning the tubs. However, automatic washing machines can be a favourable option for processors that plan to receive products shipped in Sæplast tubs enough quantity for such device begins to save costs.

The usage of Sæplast tubs also requires cooperation between the buyers and sellers because their use requires organisation of logistics when the tubs are sent back. The hygiene and handling is also an issue that not only affects both seller and buyer, but also the entity that services the transportation of the tubs. The usage of reusable tubs can therefore demand strategic alliance between the seller, buyer and transportation company.

[40] See chapter 2.1.2

The issues that inhibit the usage of Sæplast tubs have so far been prevailing in the Norwegian salmon farming industry. The most important will be listed here, they were collected through the interviews (Aðalsteinsson, 2013; Arnarson, 2013b; Baldvinsson, 2013; Bjarnason, 2015; Gabrielsen, 2009a; G. B. Guðmundsson, 2010; H. Guðmundsson, 2008; Johansen, 2009; Kristjánsson, 2010; Óskarsson, 2010; Petersen, 2010).

The EPS boxes have become an “industry standard” or a unit that has merged with the salmon farming industry though its development. The whole setup of handling from processing to transportation has been setup with EPS boxes in mind and the industry has invested in infrastructure related to it. It is a commitment that is not so easily reversed. Or, at least not without strong arguments for new changes can be introduced. The large salmon slaughterhouses and producers are for example equipped with robots that stack the EPS boxes on pallets. They are highly efficient and only require one worker to add pallets under the boxes, then label the stack and remove it with a forklift.

The spot market is very large and dictates the price of salmon products. The products are therefore often sold when they are still in transit or alternatively they are sold at the market in Oslo then restacked between vehicles. The slaughterhouses or processors thus do not always know the destination of their products when they are shipped away.

Many retail stores that need to discard large quantity of expanded polystyrene have the option of sell it to be recycled or as a fuel for energy production. The EPS can be heated or dipped into acetone to remove the air and make it smaller in size and easier to transport (The BPF Expanded Polystyrene Group, 2015). Thus, the disposal of EPS boxes can generate revenue, instead of require payment for its discards as garbage.

It seems that EPS is not viewed as a too much of a problem within the retail sector or among consumers. The main reason for that is likely because the end buyer never or rarely sees the EPS boxes. Salmon products are of high value and are most often elegantly displayed to the buyer. Thus, because the normal end buyer does not realise the amount of EPS usage there is due to his/her choice of purchase, he/her does not have a reason to pressure the retailer to make changes.

A simple comparison between EPS boxes and Sæplast tubs is shown in table

Table 19.

Table 19. Comparison between EPS boxes and Sæplast tubs.

EPS	Sæplast tub
Single use	Reusable
Sterile	Easy to clean (does not have to be sterile)
Thrown away	Has to be returned back "home"
Quite strong	Very strong
Quite expensive	Cheap
Environmental issues do not yet seam an issue, at least for final consumers	CO2 footprint, accumulates in production of raw material and in fuel consumption when returened
Automated robots might not be an option for smaller companies	The tub system is widely used and you can have wide range of customization

5.2.5 iTUB AS

iTUB is a plastic tub rental that is largely owned by Promens, Norway Seafoods, Nergard and Batsfjordbruket, well know Norwegian fisheries companies. The company began its operation in spring 2010 and is located in Ålesund, Norway. It owns insulated Sæplast tubs, produced by Promens and mostly services wild fisheries companies, which have the option of renting tubs on short- or long-term bases. Other services include the washing of tubs in various locations including a certification of adequate hygiene standard that is needed for the Norwegian custom when the tubs return to Norway and logistics of empty tubs. The tubs are also equipped with MIND chip so they can be used with a traceability data system.

iTUB rented tubs that were used to export about 20 thousand tubs with fresh gutted fish from from Norway in 2014[41]. That constituted for about 5% of total export of fresh fish from Norway that year. The main destinations were Boulogne in France and Humberside in UK. iTUB‘s customers are also in Germany, Sweden, Denmark and Holland.

It took some time to establish iTUB on the market and in 2012-2013 its operation increased significantly. The main reason for the company’s success is based in the tubs them selves and their ability to safeguard their content and maintain low temperature as described in chapter 2.1.2.

The customers are well-established players in the European seafood industry and near all of the tubs are used to transport high quality gutted fish to be produced near the end consumers in order of maximising quality and productivity (H. Guðmundsson, 2015; iTub, 2015; Proff.no, 2015)

[41] Mostly cod, haddock and other traditional N-Atlantic species.

5.2.6 Salmon trade within Europe

Statistics Norway publishes quite good information about the Norwegian salmon industry as already discussed in chapter 5.1. Seafood is normally difficult to trace after it has been landed, until it is consumed. The supply chain of seafood products can be quite complicated. For example, the process on cold-smoking salmon is generally described in nine steps. The producers of cold-smoked salmon have several options of sourcing their raw material. Their products can therefore be originated from fresh Norwegian salmon, Irish, or wild Russian salmon that was partially processed in China (EUMOFA, 2013). This makes sourcing information about the sector even more complicated. The European Commission (EC) wanted to deal with this scenario by improving the collection of statistical data for seafood trade in the European Union (EU) by developing The European Market Observatory for fisheries and aquaculture (EUMOFA). The main challenge of the process was to standardise the information for seafood trade amongst the EU nations. The purpose was to increase market transparency and efficiency, analyse EU markets dynamics and support business decisions and policy-making. EUMOFA is meant to provide data from first sale to consumption and data are updated daily. Due to the large quantity of seafood being imported from Iceland and Norway, the countries were included in the project.

However, there is somewhat disconnection between their annual reports and the database because there is insufficient description on the methodology that is used and therefore it is impossible to update accumulated figures from the reports (EUMOFA, 2015b). While it is quite easy to using the available data from EUMOFA on import and export data it is possible to create a simple overview of the salmon trade within Europe. That data is also published at the same time they enter the database. Trade information is also collected by the FAO, however those information can be two years older than EUMOFA publishes. But, they go further back in time and can be useful to create historical overview (FAO, 2014a)

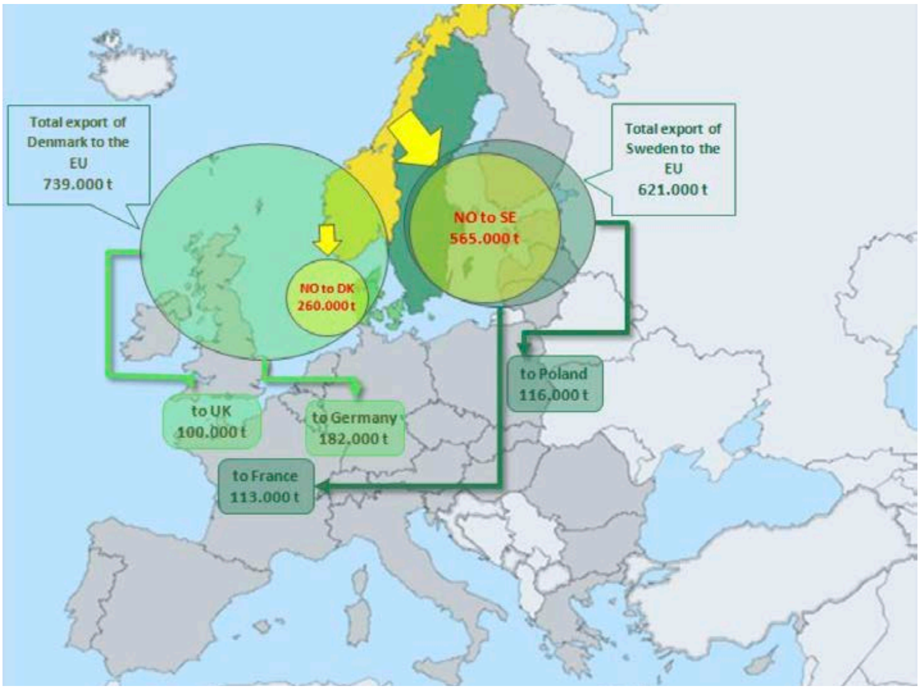

Figure 45. Flow of Norwegian seafood into Europe by volume in 2012 (EUMOFA, 2014).

The available data on the flow of Norwegian seafood into Europe is best described in Figure 45 that shows exports of seafood that mostly composed of salmon (50%), herring (12%) and cod (11%). There it can clearly be seen that Sweden and Denmark are "trade hubs" because the Norwegian salmon is re-exported into other EU countries (EUMOFA, 2014).

Annex XXI – Salmon tradedisplays information of import and export of salmonids in Sweden, Denmark, Germany, Poland, France and United Kingdom in the period of 2006-2014. Unfortunately it was not possible to distinguish salmon that was originated from Norway from the figures. However the information confirms that there is large quantity of salmonids that flow though Sweden and Denmark. The flow increased far more in Sweden than Denmark, that support the outcomes of the interviews that were taken in 2009 and 2010 that trucks are mostly used to transport fresh salmon, while frozen products can also be transported in sea freight (EUMOFA, 2014).

Due to the complex nature of secondary processing it was not possible to present detailed analysis here. However, Figure 46 shows an example of the secondary processing with the locations that were operated by Marine Harvest in 2014. Their largest secondary processed product is smoked salmon and the largest processing factory is located in Poland (Marine Harvest, 2014).

Figure 46. The location of main secondary processing operated by MH (Marine Harvest, 2014)

5.3 PESTEL analysis

Political factors

Norway is a democratic republic with population of nearly 5.2 million, headed by constitutional monarchy and ruled with parliamentary democracy. The head of government is the Prime Minister Erna Solberg (Visit Norway, 2015). Norway has had a stable governance since the country was liberated from the German occupation in the World War II and became a founding member of the NATO (NATO, 2015). The government has since then implemented social democratic policies where social equality is an important issue and Norway can thus be described as a Nordic welfare state. Norway is highly dependent on extraction of natural resources and stands out when it comes to the distribution of oil revenues with high taxations on the oil industry and collection of profits into the Government Pension Fund, or so called oil fund (Government of Norway, 1975, 2015).

The Norwegian voters have twice voted against EU membership, in 1972 and 1994. Norway is a member of the EFTA and has direct access to the internal market of the EU through the agreement on the European Economic Area (EEA) (Baur, 2015; EFTA, 2015; Statistics Norway, 2015a). The Norwegian salmon products are included in compensation quotas, however they are "*exhausted during the first part of the year and the remaining exports are subjected to tariffs between two and 13%. Exhausted quotas are binding and thus a barrier to trade*" (Sissener, 2005).

Norway shares borders with Russia in the North. There is a description of salmon trade between Norwegian salmon farming company and a Russian buyer who used Sæplast tubs in Annex XIX – Examples of tubs vs. EPS boxesSuch trade was not only stimulated by increased demand from the Russian market, but the ease of doing business better in the northern borders by being far quicker, safer and less corrupted than e.g. via St. Petersburg. This fast growing trade stopped after Russia banned seafood imports from EU, USA, Norway, Canada and Australia after the annexation of Crimea in August 2014 as described in chapter 4.2 (Hanke, 2014; Seaman, 2014; U.S. Department Of State, 2014).

Norway can over all be described as a peaceful, progressive and stabile country. Its main market is the EU for most of its exports, where oil, gas and seafood are the most important. It is therefore mostly affected by global price trends in oil and the economic conditions in the European markets.

There are two factors that can significantly affect the Norwegian salmon farming. The former is if politicians acknowledge the industry's arguments for increased number of farming licences as described in chapter 5.1 and thus allowed further growth of production. The second factor is if Norway becomes a member of the EU. Then the tariffs on salmon will be revoked and the Norwegian seafood products are likely to be processed further within Norway, instead of exporting as raw material such as HoG salmon that is sold whole or processed in mainland Europe, or whole frozen ground fish to be processed in China.

Norwegian ministers have openly expressed their opinion that, even though the EEA agreement has suited Norway well, they are not in any position of having direct effect on the EU decisions. While Norway is obliged to implement regulations set by the EU. Even, on "*occasion, Brussels has sprung surprises that the Norwegians could not predict*" (Helm, 2015).

Norway is viewed as a peaceful nation and nature plays a helpful role in the marketing of Norwegian seafood products (Hjeltnes, 2015).

Economic conditions

The Norwegian economy is one of the strongest in the world with GDP per capita of $100,898 USD in 2013, only second to Luxembourg and the GNI per capita (PPP) was $65,450[42] (World Bank, 2015b, 2015c, 2015d). The inflation in spring 2015 was close to 2.5% and the executive board of the Norwegian Central bank decided to keep the key policy rate unchanged at 1.25% (Norges Bank, 2015a). Meanwhile the Danish National Bank has kept its interest rates at 0% since May 2012 (Danmarks National Bank, 2015).

Norway is one of the main providers of the oil and natural gas that is consumed in Europe. In 2013 Norway was estimated to have been the 3rd largest exporter of natural gas in the world after Russia and Qatar, and the 12th largest net exporter of oil (U.S. Energy Information Administration, 2015). The large oil sector has strengthened the Norwegian currency (NOK), which has a negative effect on other export sectors i.e. with less return for their products. The normal Norwegian citizen also receives quite high

[42] Current international USD.

salaries, which can encourage companies to outsource export activities, as they can. That has affected the development within the salmon industry with high exports of unprocessed seafood and investments in processing in Poland, where salaries are much lower and no tariffs or import restrictions for the products that are sent to the main markets in mainland Europe.

Aquaculture is a capital-intensive industry and due to the long growth period of Atlantic salmon, the sector can only expect return on investment in about four years from initial investment is made. The farming activities therefore require significant capital that also has to be very "patient" (Marine Harvest, 2014). The Norwegian economy has been able to create the right environment for such investments with stability and low inflation.

Increased productivity within the sector has been the main driver for growth. However, after maximum efficiency has been reached the productivity slows down and demand growth becomes the main driver of production growth. Salmon farming has also supplied increasing demand for seafood as the wild fisheries are not able to grow due to limited natural conditions as discussed in chapter 4.1 (Asche, 1997; Asche, Guttormsen, & Nielsen, 2013; Asche et al., 2008; Asche & Roll, 2009; Asche & Tveterås, 2007; Torrissen et al., 2011).

Sociocultural forces

The Norwegians have traded seafood since before the Viking era. They also have strong maritime tradition, were renounced fishermen and businessmen (Hjeltnes, 2015). Even though Norway has a relatively small population compared with size, the population is quite evenly spread throughout the country with numerous small urban areas (Statistics Norway, 2015b). That has helped the industry in providing capable staff in what otherwise would be far remote areas. The Norwegian government has also implemented an active tax policy to facilitate that the whole country remains populated.

Conditions in foreign markets have also been favourable for the salmon industry due to the increased emphasise of healthy lifestyle, which promotes regular consumption of fatty fish such as salmon (Asche & Roll, 2009; Torrissen et al., 2011). Many vegetarians do not consider fish part of traditional meat products and include farmed salmon in their diet. Fish also live in water, which makes their environment different from traditional domestic animals and thus their bacteria fauna is different, i.e. normally not considered hazardous for human consumption. Salmon is also considered clean enough to be marketed as the essential ingredient in healthy and fashionable sushi, where salmon is eaten raw (Hjeltnes, 2015). Food related diseases and food poisoning plague the agriculture industry with *salmonella* that can be found in poultry, causes about 80 deaths in the UK a year (Rull, 2015) or Creutzfeldt-Jakob disease that caused 83 recorded deaths in the UK during 2012 (NHS, 2015).

The retail market has evolved from being provider of food as a raw material for cooking, into providing vide range of products and services, up to ready meals. General buying preferences have also changed from people making few large purchases a month, into a more frequent purchasing pattern. This change has been due to an increased urbanisation and changed pattern in working hours with increase in people working shifts, thereby changing the traditional daily routine. Food producers have therefore been pressured in maintaining flow of diverse range of products, where fresh and ready meals have become increasingly popular.

Technological factors

In its early years of development, the salmon farming industry was able to utilise the experience of the wild fisheries of regular delivery of high quality products that were cleverly marketed (Asche & Roll, 2009; Hjeltnes, 2015). That experience was built on decade's worth of research and development, governmental regulations, international food industry standards, business relation between fisheries sector with secondary processors and retailers, etc. Thus the salmon farming industry has utilised already existing external factors to promote and transport their product into traditional fisheries markets and used that experience to enter new and ever distant markets. Farmed salmon has become an internationally available product (Torrissen et al., 2011).

The salmon trade is modern, highly technical and requires modern business practices, tele- and Internet communication, modern cold chain logistic and warehouse facilities, as would be expected for modern business.

Environmental forces

Even though the salmon farming industry is not facing equally limiting natural restrictions as the wild capture fisheries, the environmental forces are probably the most important for its future growth and development.

The fish feed that is used to farm salmon requires marine proteins and fish oils. The fish feed is formulated from short living, high volume pelagic species e.g. Peruvian anchovy and Atlantic capelin. Such species are vulnerable to changes in their environment. The global warming which can effect changes in ocean currents and especially the acidification of the oceans, can drastically affect lower trophic level species, which they feed on and therefore can affect stock size. Changes in nature that are affected by human emissions of fossil fuels can therefore affect the availability of fish feed. This is already known in seasonal changes in the Pacific Ocean when the colder Humboldt currents from the Antarctic shy, known as la niña, shy away from the warmer tropical currents, known as el niño, can greatly affect the supply of fish meal made from Peruvian anchovy.

Increased growth of aquaculture on global scale can also caused increased competition for fish feed, which is very price sensitive. Thus the price of fish feed can become more expensive if there is a shortage of fishmeal and fish oils. The aquaculture industry has decreased its dependency of such ingredients by increasing the amount of agricultural products in fish feed, such as with beans and corn (Marine Harvest, 2014). Such ingredients are a part of the global market, which depends on fossil fuels to operate.

The salmon farming industry can affect natural salmon stocks with cross contamination from farmed salmon. This has led to the spread of diseases to wild populations by salmon that escape from cages. The effects of salmon farming are not fully known. But the North Atlantic Salmon Fund (NASF) claims salmon farming is responsible for great decline of wild stocks in areas where salmon farming is common. The salmon farming can also affect the amount of sea lice, a natural parasite that can spread from the cages times when venerable wild smolt pass by on their way to the ocean and can catch large amount of sea lice that can cause their death (NASF, 2015; WWF, 2015).

The salmon farming industry is dependent on clean environment, the Norwegian government, which also regulates the wild fisheries and the oil industry utilises Ecosystem Based Management [43] a management methodology that includes all marine related activities down to concerns of the general citizens being worried about their view over their local fjords (PAME, 2015).

Legal and regulatory factors

The Norwegian Ministry of Fisheries and Coastal Affairs controls the production of farmed fish in Norway and issues licences to those who operate salmon farming as described in chapter 5.2.2 (Directorate of Fisheries, 2013). The Norwegian food safety authority licences and inspect the processing sector (Mattilsynet, 2015). As a member of the EEA, Norway implements the EU regulations and is a member of the World Trade Agreement (WTO) (Sissener, 2005).

The regulations that mostly affect the salmon farming industry directly are laws for minimum wages in Norway, and the industry can somewhat bypass them as described earlier. As well as the tariffs quotas negotiated between the EFTA and EU, also discussed earlier.

The closing of the Russian market is also very relevant these months[44], as discussed previously. Apart from the poor political relationship with the Russians and the trade restrictions there are no particular laws or foreseeable regulations that threaten the Norwegian salmon farming industry within the domain of laws and regulations.

5.4 Competitive forces - Porters' five forces model

Further information about the Porter's five forces model and templates by Dr. Dobbs can be found in chapter 3.5. It is also useful to know that the results for the five forces model were facilitated with the use of the templates that can be found in Annex XXII – Five forces model. The following text includes a discussion about the results that were formulated by using Dr. Dobbs' templates.

[43] Also known as Ecosystem Approach to management (EA).

[44] Spring 2015.

Competition from rival sellers

Defining factors: Existing competitors and industry growth.
Medium market force (5.6)

The general structure of the Norwegian salmon farming is described in chapters 5.1, 5.1.1, 5.2 and 5.2.1. The competition from rival sellers is hard to describe because salmon products can be sold/exported from different stages within the supply chain. As well, the products that are originated in the same fish cage can end up in completely different markets (different products depending on type of processing and geographical location). However, the factor of existing competitors is a defining factor for competitive rivalry due to the importance of the spot market for price discovery, and the high share of the large companies that are presented in Table 18. The largest companies are vertically integrated and have the choice of selling their products from various stages of their supply chain, both within Norway such as HoG salmon or fully processed cold smoked, sliced in consumer packaging. The smaller entities add to the competition with innovative ways of marketing their products in both already existing and in new markets (Hjeltnes, 2015).

There has been a quite logical relationship between the industry growth and price of salmon within the salmon farming industry. When production increases with added supply, the price of salmon has decreased and in the recent two years when supply has stabilised and even been reduced, prices have increased. Thus the reduced growth can have a direct and positive impact on profitability. However, this trend might only be on short time terms and this might change if supply stabilises and buyers can plan their purchases on longer terms, and increased effect on productivity reduces (Asche et al., 2013).

Salmon farming not only requires high capital investments. The lifecycle of salmon can take up to four years and it thus requires capital in form of accumulated costs such as for feeding, salaries and etc. The fixed costs also include expensive licences and farming equipment. The capital used to invest in salmon farming also needs to be patient (Marine Harvest, 2014).

For the untrained eye, salmon products might all just be the same or at least similar. However there are sharp differences in quality and possible markets for different products e.g. fresh vs. frozen. Individual salmons that might have been raised together as smolts can end up in totally different markets and therefore be sold for different prices, as already been described.

The spot market is very important for price discovery within the salmon industry, as already mentioned (Marine Harvest, 2014) and it gives buyers the advantages of low switching costs.

It is quite hard to evaluate the strategic stakes within the Norwegian salmon farming industry. The main trends are between few large vertically intergraded companies that are competing with numerous smaller ones. Then, each "player" has different choices of selling their products in various markets and from various stages within the supply chain. However, it is logical that the larger vertically integrated companies have stronger position in negotiating their terms and prices, in long term business relationship with large retailers. While the smaller players have the option to specialise in smaller niche markets to seek higher prices, instead of competing in the general market.

It is quite hard to expand production within the Norwegian salmon farming industry due to a limited number and highly expensive licences. The long growth cycle of salmon also requires long payback period. Increased production therefore needs time to be prepared before it can be realised.

The sector requires substantial investments and long time commitment. The exit barriers are therefore significantly high.

The overall threats for competitive rivalry were found to be that the spot market plays too big role in the price development and companies might seek ways to establish closer relationship with their customer with longer term business relations with somewhat flexible price contracts. The other issue identified as a threat is the need that the sector has for constant promotion and innovation in product development. That is necessary for salmon products to maintain the current positive image in the minds of the customers in order not to become a trivial commodity item.

The opportunities lie in the positive image of salmon products that are viewed of high quality and healthy. As well there seems to be room to develop further increased strategic partnership to improve the supply chain and reduce the importance of the spot market and increase the value of planning.

Customer's/buyer's bargaining power
Defining factors: Buyer Switching Costs
High market force (7.4)

It is not possible to state, from the information that has been put forward so far, whether buyer's orders are few or in large volume. The best chance is to make an educated guess by saying that there is a wide possible range of buyers' orders and that threat level of buying orders are valued as slightly above medium, due to the few numbers of large salmon farmers.

Due to the importance of the spot market, and frequently published information from the Norwegian government, the easily available information about Norwegian companies through the official tax system and the published information about publicly traded salmon farming companies. The buyers have very good access to information about the Norwegian salmon farmers and about the status on the market for salmon products with daily updated about prices and supply.

The retailers in Europe have increased their cooperation with seafood providers. This can be done in several ways. Retailers have e.g. implemented strict quality system that their suppliers have to comply with. This also involves increased flow of information and it might say that it could almost be described as strategic alliance. Some large retailers also own shares in seafood processing plants to guarantee access of product, affect product development and to organize marketing schemes. Therefore, even though the retailers are not in total control of the processing sector they have quite a lot of influences over/on it (Ásgeirsson, 2013). The amount of HoG salmon that is exported from Norway and processed within the EU also increases the buyer's backward integration.

Even though there are several market niches for salmon at retail level, the products are highly standardized within the supply chain where products such as HoG salmon or fillets with few types of different cut are dominant in the market. Therefore it can be said that the industry's products are highly standardized.

The buyer's switching cost is quite low due to competition among salmon farmers and the importance of the spot market. Thus that creates high threat level for companies within the industry.

Salmon, especially fresh products are highly perishable and have only a limited shelf life of 12-15 days[45] (Duun & Rustad, 2008; Lerøy Seafood, 2015). They require high cost investments to control their temperature and the organisation/management requires significant effort. It can therefore been concluded that the sale of salmon products are among the most expensive non alcohol food items that are sold in normal retail stores. The overall buyer's cost is therefore quite high.

It is rather hard to estimate buyer's profitability from the information that has been presented so far. The buyers could be categorised in three types. Firstly, the processing facilities owned by the salmon farmers. They have incentive of maximising their profitability, however they might have the option of buying their raw material with discount. The second group are independent processing companies. They are squeezed between the salmon farmers and retailers. They have incentives to maximise their profits. The third group are processing companies fully or partially owned by retailers, and retailers can also be direct buyers. They might want their processing facilities to sell their products with discount to make their retail establishment more competitive. This does not fully conclude about the profitability of the buyers, however based on the fact that salmon products are highly valuable, the buyer's profitability is estimated at average.

The impact of product service can be described as increased level of processing with increased value adding activities. Thus an unprocessed HoG salmon is an example of low service product[46], while small portions in value added packaging such as with sauce is an example of high service product. The price per kg can increase significantly with such value adding properties. Value adding products require significant non tangible properties such as promotions/advertisements and other image attributes, they require significant investments that are vulnerable for competition and strategic alliances they give the buyer significant leverage in the power over the supplier.

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[45] Shelf life:
Fresh gutted salmon: packing day +15 days
Fresh fillets/portions/cutlets: packing day + 12 days (Lerøy Seafood, 2015)

[46] Although it price is based on high quality or being fresh.

The main threat is if the number of buyers reduces and each can buyer becomes large enough to gain great bargaining power over the supplier.

The main opportunity is that salmon products have the potentials of gaining new markets such as in Asia to level against the threat.

Supplier bargaining power
Defining factors: Supplier Products
Low market force (4.1)

The cost of formulated fish feed can be up to half of the cost of farming salmon. Historically the main two ingredients, fish protein and fish oils constituted more than 80% of the ingredients of formulated feed. That share has reduced down to about one fourth since the 1980's. The traditional fish protein and fish oils are also the most expensive part of the fish feed, as well being the scarcest. The salmon farming industry has therefore spent immense effort into increasing the share of agricultural commodities such as soy, sunflower, wheat, corn, beans, peas, poultry by-products (Chile and Canada) (Marine Harvest, 2014). Norway has recently also allowed the use of salmon in salmon feed, with promising results (Bjarnason, 2015).

Formulated fish feed is the main source of raw material for the salmon farming industry and is so important for the working capital of the industry that it was judged a ruling factor for threat of suppliers, one way or the other.

The main threat is that formulated fish feed still needs significant amount of marine sources ingredients that has increased significantly in price

The main opportunities are focused around the development of increase share of agricultural products for formulated fish feed.

Competition from potential new entrants to the industry
Defining factors: Supply-Side Economies of Scale; Capital Requirements and Incumbency
Medium market force (6.1)

It would be quite difficult to establish a new salmon farming company in Norway. Licences for sea cages are limited, those who become available are very expensive and it is not known in advance how many new licenses will be issued, when or where, which makes planning more difficult. The prices of new licences are also high and there is a great competition in acquiring them as discussed in chapter 5.1.1. The process of salmon farming is as well very capital intensive (Marine Harvest, 2014).

Even though the large suppliers of the salmon farming industry would be interested in entering the sector, it would be totally different type of business than fishing pelagic species, growing agricultural products or formulating fish feed. Their core activities are just too different that they would be able of transforming their specialised knowledge to become successful.

A similar story can be said from the other end of the supply chain, i.e. the fish processing companies are very unlikely from being able of positioning themselves within the farming activities to become a realistic threat of competing existing salmon farmers.

There is however a moderate threat from the switching cost of products sourced from wild harvested salmonids or from other farming regions. However, many of the largest farming companies in other competing nations such as Chile, Canada, UK, Ireland and Faroe Islands are fully or partially owned by Norwegian companies. Therefore the real competition comes from the wild harvested salmonids in Russia and Alaska.

The main threat of switching cost also comes from the wild salmonids fisheries; however they are seasonal fluctuations on supply and thus would only affect limited effect on annual bases. The wild salmonids fisheries are relatively far away from the European market and they have hard times in competing the fresh product market in Europe.

The issue of capital requirements has already been addressed and launching of new salmon farming company would require significant capital. This is due to both the initial investment in facilities and equipment and working capital while the salmon is growing and building up biomass. The barriers for new businesses are also higher because the existing companies have gained great knowledge and experience. The large existing companies were also built from a collection of merged and acquired smaller companies (Marine Harvest, 2014). This also affects the Incumbency, which is greatly in the advantages of the first movers.

New companies would be able to take advantages of the distribution channels because they are quite open and available. A similar story could be said about the governmental policy even though it is hard to acquire licences and regulations both within Norway and within the European market. The rules for the licences are designed in such way that a single company cannot be dominant in the production within counties nor the whole country as already described in chapter 5.1.1.

Even though there is a built up incentive for the Norwegian salmon farming industry to be structured by several or many large companies and no single company can become too dominant, it would be difficult for newcomers to compete with the current companies. However the current companies would continue to focus on their own growth and due to the limited number of licences they will continue to use their financial strength to bid high for new licences. Thus, the anticipated incumbent response would not be specifically or directly retaliatory, but very competitive.

The main threats of new entrants are most likely to come from aquaculture industries. However they are either still underdeveloped or not delivering sufficient quality products, such as aquaculture in Africa, East-Europe and West Asia, which is relatively close to Europe.

The main opportunities can be found in the well-established industry’s positive image, which will be difficult for competitors to compete with. The capital intensive and it is hard to acquire licenses. Therefore it is guarded with quite high barriers of entry.

Competition from producers of substitute products
Defining factors: Buyer Price Sensitivity and low Buyer Switching Costs
High market force (7.8)

As already noted in previous chapters on the world aquaculture, salmon products are expensive and buyers are willing to pay high price for quality. The most valuable factor of salmon is that it can be sold fresh. Similar story can be said about the salmon farming in Chile, which ships its products with cargo air to the U.S. The salmon is as well easily distinguishable from other seafood because of its colour and it contains high amount of healthy lipids/fat.

Most fish products that are produced in other aquaculture sectors are significantly cheaper than salmon and they have been competing in prices in the European market, such as Asian pangasius, tilapia and Nile perch (EUMOFA, 2014; Globefish, 2015a). The fact that such species have gained foothold in the European market suggests that there is a market for alterative and more economical fish products.

It is estimated that there are about 4,000 processing companies in Europe Most that are positioned within the supply chain of salmon, which then supply retailers with finalised salmon products. Therefore most of them are small or medium sized companies that do not have great bargaining power. They therefore have to rely on flexibility in sourcing raw material when prices are high (Marine Harvest, 2014). That causes buyers to be very price sensitive.

Salmon products are in the wider scale competing with all other protein-based food items, whether it is meat, fish, poultry or vegetarian. The modern end buyer has a wide variety of choices to choose from. Therefore a great pressure is put on salmon producers to make sure that they deliver high quality products, to be suited for the strong competition. The intense competition also affects the buyer’s switching cost, i.e. the end buyer is quite powerful, because he/she is the one who ultimately pays for the whole process. The end buyers have as well no switching cost. The strong competition can somewhat affect the operation of the numerous processing companies in Europe. However, they are highly specialised and although they might be able to produce products from other raw material, they have quite high switching cost.

Due to the vast number, small size and specialised production of most salmon buyers they have built in a quite high-risk profile. In spite of this, they might define their business as being traditional.

Because salmon is in the end competing with wide range of substitute products, the sector/industry is very price- and performance sensitive, which constitutes of quality factors and overall image of salmon products. On the other end of the supply chain, or in the production end, the salmon farming is sensitive to costs due to the long growing period, which greatly affect the working capital of salmon farmers.

There is one addition that is somewhat contradictorily. That is an aspect that has not been mentioned before in this analysis, and that is the fact that there is a portion of HoG salmon that is exported frozen to China where it is processed and packaged. These products are then thawed up and sold among other salmon products. The fact that these products are frozen twice reduces the quality, which might affect consumer's overall impression of salmon products.

The main threats of substitutes products are their low price. The competitors are also able of gaining experience, as well as learning from the wild fisheries and the salmon industry. They can therefore be seen as quite threatening with time.

The main opportunities are the high quality of salmon products and the positive image the industry.

5.5 Factors that are driving industry change and their impacts

Changes in an industry's long-term growth rate

FAO (2014b) established that long terms demand for food follows population growth. Therefore the demand for salmon is likely to continue to grow on a global scale with continued population growth. However not all consumers will be able to buy such expensive product. It is thus likely that the salmon farming sector will continue to marketing salmon products as premium items for the upper and middle classes. The Norwegian salmon industry will continue to supply the European market where the focus will be on high value, high quality fresh products. Second and third quality salmon, as well as frozen products will be sold to markets further away, for lower price.

The production of the Norwegian salmon farming industry will not increase significantly unless the government issues more licences.

The demand from the European market will greatly depend on the economical situation, and the current future seams bright. The continent, especially the Northern and central countries have balanced their economies after the currency crises in 2008. On the other hand, negative factors such as the diplomatic situation with Russia, the Greek debt crises or new currency crises, could have negative effect on both short term and future growth.

Increasing globalization

Salmonids were exported to 155 countries in 2012 and Atlantic salmon was exported to 98 countries (FAO, 2014a). Although several countries did not import high quantities, it can be stated that salmon products have already become global items. Therefore it is very likely that salmon exporters will be in a good position to increase exports to existing foreign markets, because they have already “laid the ground work”. From the experience of last decade it is likely that salmon products have gained foothold in several countries inhabited by salmon consumers that can be described as untraditional, such as warmer countries where salmon is not among the native species. The questions of demand and price will be decisive if and when the Norwegian salmon farmers plan to increase imports into distant markets.

It is likely that other aquaculture industries will follow in the wake of the salmon industry by copying its strategy. However, quality is a totally genuine factor, which is impossible to "copy". Therefore, if other farmed species will be considered strong contenders to salmon products, they need to compete in prices, quality, popular image, and in value added products. Such development takes a long time. The salmon industry is therefore in a good position to defend its markets into the foreseeable future.

Emerging new Internet capabilities and applications

The salmon farming industry is already relying on the information technology and the use of the Internet in the traditional terms of its business. Salmon farming is a modern knowledge based industry where multiple features of the on growing and marketing segments rely on daily collection of available information and communication. This will continue and follow general development of modern use of technology.

Further technological advancements and increased strategic alliances with customers might facilitate ordering or purchases of products and the transfer of digital data such as treatability, quality checks, veterinarian certifications and etc.

Product and marketing innovation

The most likely scenario is the continuation of current development, where the salmon farming industry focuses on delivering high quality and high value raw material, and the processing sector will continue to develop increased processed product, or ready meals. This can be done by increasing the focus on value added items such as packed portions with sauces.

All Norwegian seafood is jointly marketed by the Norwegian Seafood Council. The initiative is funded by small share or fees from all exported seafood and used in statically marketed campaigns (Norwegian Seafood Council, 2015a). This setup is unique within the European seafood industry and gives the Norwegian seafood producers significant marketing power from large disposable funds.

Changes in who buys the product and how they use

There are no significant foreseeable changes in how salmon is used in general terms. However to put forward unsubstantiated prediction, that there is a change that the numerous processing sector within Europe, where smaller companies might have hard times to compete with larger processor that are building up more productive processing with increased mechanisation. The larger companies will also have increased change of exporting processed salmon, such as packed, frozen smocked or cured. Such consolidation within the processing sector in Europe might open up the opportunity of using reusable tubs for transporting HoG salmon from Norway to the processors.

Technological change and manufacturing process innovation

There is a change that relatively newly developed machinery such as from Marel can increase the productivity within the processing sector. Machines that can process fillets and deliver different cuts with automatic water water-jet cutters that is also capable of removing pinbones and X-ray bone detectors. Such technology can replace expensive and repetitive labour (Marel, 2015). The increased technological development can increase processor's productivity and allow companies to grow from small or medium into becoming large enough to allow them to negotiate for more favourable prices of raw material. That can again increase strategic alliances and shorten the supply chain. Such development might also benefit the salmon farmers, because increased productivity that comes with servicing fewer buyers can increase productivity within sales and marketing. As long as the processors do not become too large to have dominate leverage in price negotiations.

Diffusion of technical know-how across companies and countries

Over the time there has been a significant diffusion of technical know-how between the traditional fisheries sector and the aquaculture. It can be debated whether the salmon farming has exceeded the wild fisheries with the arguments that salmon prices are higher on average than species from wild fisheries (EUMOFA, 2015a). As stated earlier, the salmon industry is positioned in the more expensive section of the European market. If other aquaculture sectors will be able to outperform the wild harvested sectors such as fresh Atlantic cod, they will also have the chance of competing with salmon farming industry. For a while, species such as tilapia was believed to continue to improve product quality and therefore increase competitive feature. This has somewhat been done in countries such as Costa Rica with organic farming of tilapia that is marketed in the U.S. (BioMar, 2015). It is not impossible that this development can occur in N-Africa, as in Egypt.

However the political situation has not been favourable for foreign direct investments (FDI).

Entry or exit of major firms
There has been a constant consolidation within the Norwegian salmon farming industry from its beginning. On the websites of the large Norwegian aquaculture companies there are often lists of M&A which show how smaller companies have been consolidated with the larger ones (Marine Harvest, 2014). However, due to the structure of farming licences within the Norwegian salmon industry, it is unlikely that larger companies that possess high productivity will be broken up and sold in smaller portions. Several of them are also publicly traded companies and the change of ownership will continue to take place within the stock exchanges.

Changes in cost and efficiency
It is likely that the salmon industry will be able to continue to reduce the price of salmon feed by increasing the share of vegetables. The industry has also drastically reduced the amount of antibiotics (Marine Harvest, 2014) and salmon cut-offs and oils were recently allowed in salmon feed with good results (Bjarnason, 2015).

Reductions in uncertainty and business risk
The salmon farming industry has a built in risk reduction mechanism, by the simple fact that producers can reduce production with short notice and keep the fish alive in their cages. An example of this was when Russia closed its borders to Norwegian salmon as discussed earlier in chapter 4.2.

The main risk factors for the sector have been diseases that caused a drastic reduction of production. The change of new epidemics in the future cannot be ruled out. Unfavourable effects caused by global warming can also have significant effect on the supply of raw material for fish feed and are also possible, as also has been discussed.

Regulatory influences and government policy changes
The regulatory influences have significant effect on the growth of the salmon farming in Norway and hold the power over the issuing new farming licences. Strict regulations can also affect possible use of reusable tubswith

the requirement of certificates for proper cleaning of reusable tubs. However, such regulations can also create opportunities for reusable tubs with available services from companies such as iTUB, by servicing all necessary transport and other operations needed.

Other general regulations for quality and food safety are also important to the sector. However, those regulations are not likely to change significantly in the coming future.

Changing societal concerns, attitudes, and lifestyle

The salmon industry has developed quite positive image of its products, although there are organisations that have been fighting against increased salmon production. Mostly to safeguard wild salmon stocks as discussed in chapter 5.3.

Several years ago, there was quite loud discussion whether food industries could prove to consumers that products were not only safe and healthy, but also environmental friendly. At least not too unfriendly for the environment. Concept such as information about product's CO_2 footprint that could be labelled on consumer packaging were developed. They were established after quite loud discussion about environmental aspects of normal consumer items and how production, logistic and consumption affected the environment. However, more industry friendly concepts such as environmental labels or so-called eco labels prevailed. Labels such as the Marine Stewardship Council (MSC) have established themselves within both wild capture fisheries and aquaculture. A discussion or critique on the eco labels is not meant to be put forward in this text. However, such labels are popular among retailers and they seem to ease down scrutiny among environmental- and consumers groups.

General quality factors and healthy image are therefore increasingly important for the Norwegian salmon farming industry. The industry's focus can therefore continue to service demand with focus on quality, increased processing and product development.

5.6 Market positions of industry rivals

It depends on the location within the supply chain what rivalry is estimated within the supply chain of farmed salmon products. It can be estimated from the production end of the chain because information is available on Norwegian salmon farmers and processing companies. Unfortunately, it was not possible to compile a holistic analysis within the time limits of this research that would add to the information that has already been put forward. For example the index about salmon farming and salmon processing companies in Annex XX – Information about Norwegian seafood processors. It can also be debated whether rivalry should be estimated by that part of the supply chain or by the sales establishment, where the competition is more present. Such analysis would be rather repetitive to the information that has already been out forward in chapter 5.2. Especially when so few companies sell the majority of all farmed salmon.

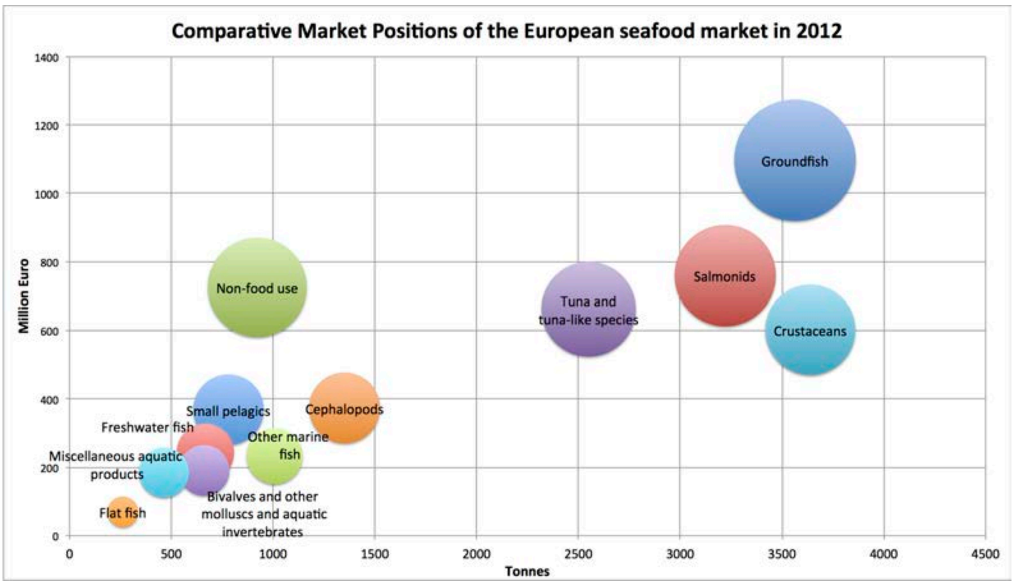

Figure 47. Comparative market position of the European seafood market in 2012 (EUMOFA, 2014).

It is more interesting to present information about the consumer market in Europe. Salmon, tuna and cod are the main species that are consumed in the European market. Cod is most often grouped with other ground fish species. That can obscure the comparison between the species, especially when much information is based on complicated analysis that can be difficult to redo or update. Such comparison can be relevant if all ground fish species are considered as a homogenous market item. However, there is a substantial difference in price depending on processing method e.g. fresh, salted or frozen (Knútsson, Klemenson, & Gestsson, 2010).

An overview of the comparative market positions of the European seafood market in 2012 is shown in Figure 47 where the size of the “bubbles” shows total value. The main competitor species are wild harvested ground fishes such as cod, haddock, hake, ling, blue whiting, pollack, redfish and saithe. The total value of salmon[47] consumption was second to harvested ground fishes, tuna species were third and crustaceans were fourth. These five groups of species are more valuable and consumed in more quantity than others. However if the other groups are split up by individual species, then farmed Atlantic salmon and Atlantic cod stand out in regards of quantity and value.

As presented earlier, the production of the salmon industry grew significantly until 2012 and after that, the prices have increased. The average European consumption accounted for 1.72 kg per capita in 2011 (Figure 48), the highest amount since 2007. Salmon was the only species that registered an increased trend between 2007 and 2011 (EUMOFA, 2014).

The prices in EUR/kg for 2009 and 2012 are shown in Table 20. All of the top five most consumed species increased significantly in value. In the period of 2009-2012, salmon and cod products were in fierce competition, especially in prices. However, as discussed in chapter 5.1, the price of salmon increased significantly since 2012.

[47] Near all or more than 99% of salmonids that are consumed in Europe are originated from aquaculture and 98% of all salmon consumed was originated from aquaculture (EUMOFA, 2014).

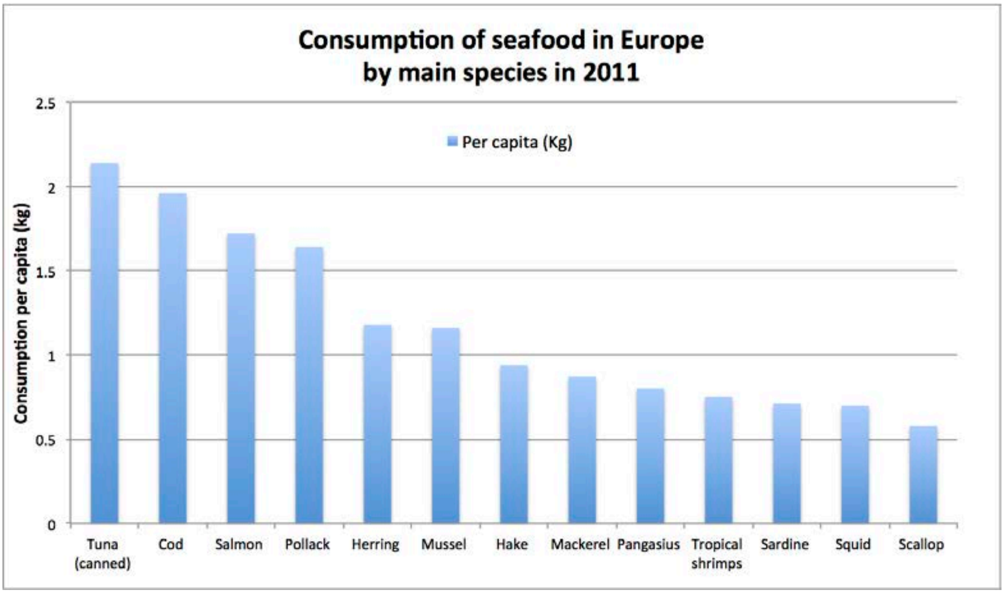

Figure 48. Consumption of seafood by main species in 2011 (EUMOFA, 2014).

Shrimps yielded the highest prices per kg of seafood species on the European seafood market in 2012 at €5.75-6.25 EUR/kg. This is somewhat similar as described in chapter 4.1. However the difference in prices between shrimp and salmon is greater on the European market, than at farm gate on world average (FAO, 2014a). Shrimp is crustacean and can be excluded from direct competition from finfishes such as salmon.

Now, in spring 2015 there is a significant difference in prices in the France market, in favour of fresh salmon products. In week 10, the kg of Atlantic cod fillet was sold for €14.12 EUR while the fillet of salmon was sold for €17.11 EUR/kg (EUMOFA, 2015a).

Table 20. Average prices (EUR/kg) of top 5 main commercial species in Europe (EUMOFA, 2014).

Main commercial species	2009 (EUR/kg)	2012 (EUR/kg)	% variation 2012/2009
Salmon	3.9	4.23	8.5%
Miscellaneous tunas	3.0	4.23	41.0%
Cod	3.8	4.39	14.3%
Tropical shrimps	4.6	5.75	24.7%
Miscellaneous shrimps	4.8	6.26	30.1%

Newer standardised comparison of prices has not yet been published by the EUMOFA and it is evident from information published by the Statistics Norway (Statistics Norway, 2015d) that the farmed salmon products have strengthened their position on the European market. It is thus very likely that salmon products can be described as the leading products in the next EUMOFA report about the European seafood market.

5.7 Possible strategic moves of rivals

To describe possible scenario for the strategic moves of rivals, one is only able to put forward a prediction based on references and text that already has been put forward. The best way is to describe a possible scenario on three different positions within the supply chain; salmon farming, processing and general scenario on the European seafood market.

Salmon farming

The current regulations on salmon farming licenses in Norway restrict drastic changes in the structure of the sector, at least in regard to ownership and production quantity. There will be a continued consolidation where smaller farmers will merge to larger groups, as the regulations allow. This is especially true if smaller firms will be able to acquire new growing licenses.

The main areas of competition will be in securing longer-term sales agreement in order to limit or deal with the fluctuations in prices from the spot market. Such agreements can shorten the supply chain by eliminating middle agents and create strategic alliances between suppliers and retailers. Thus, salmon farmers could increase their productivity and reduce the cost of marketing by servicing fewer customers. However, if the buyers become too few they can also become dominant and establish unfavourable leverage in negotiating for prices and profitability for the salmon farmers in the longer terms. Such agreements will therefore affect the competitive environment for the next link in the supply chain, or the processing sector.

Processing sector

There are potentials for consolidation within processing of salmon products in Europe. It is very likely that larger processing companies will invest in processing equipment that can increase efficiency and productivity. Such larger processing facilities might also be jointly owned by salmon farmers and retailers to securely establish long term strategic alliances.

European seafood market

Wild harvesting fisheries have been the main competitors with the salmon-farming sector. However there are indications, mostly from the high prices of salmon, which suggest that salmon products have been creating marketing advantages over other seafood products, in the form of high quality and constant supply of their products.

Other competitors will most probably need to follow the development of the salmon industry and stabilise the flow of their products and secure constant high quality. However, other aquaculture sectors might be better suited to do that. Countries such as Egypt that already have significant aquaculture might benefit from the development in Central America in farming high quality organic species that compete with species such as salmon.

5.8 Key factors for future competitive success

The Norwegian salmon-farming sector is outperforming both traditional wild harvested fisheries and other aquaculture sectors by delivering high quality and constant delivery of products on the European market[48]. The quality level has been acquired with decades long use of scientific approach and high standards within the sector. The positive image that has been built up around salmon products and can also be linked to the high quality of salmon products.

The second most important key factor is the constant availability of products with steady delivery all year around. It might be better to describe it as controlled supply[49].

The efficiency of the supply chain, i.e. the speed and competition about raw material and the produce of high quality and high value products can be considered the third key factor. This might not seem so important; however it can be a bit counteractive when it takes between three and four years to grow a salmon ready for the market. While the fish is alive it gains weight and thus value, and the salmon farmers might be able to sell their products. However, the salmon has a fast breakdown process from the time it is slaughtered and thus only possesses limited shelf life, especially the fresh products. Then it can be produced in other country and sold/consumed in the third. All of this can happen in two-three days. The spot market has dominant effects on prices, which affects the way the salmon products are sold and HoG salmon are even sold while they are still in transit.

These factors are then highlighted with a joint marketing force of the Norwegian Seafood Council that can weigh significantly in any market in the world. Then, just for the reason that the Norwegians were able to persuade the Japanese to include farmed Norwegian salmon as an essential ingredient in sushi indicates their success. Or, at reverse, the fact that the Japanese found an ingredient that was good enough to be included in their traditional style cuisine that consists of freshness, quality and style. The Norwegian salmon products have then gained similar success in other main markets around the world for similar reasons.

[48] Only shrimp has been more expensive.
[49] I.e. as production quantity can allow.

The companies that farm and sell Norwegian salmon have a mixture of companies of different sizes, although the few large ones dominate the supply. However, there will be continued increased pressure on efficiency and productivity as the industry continues to evolve. There are not many factors that can be adjusted within the farming end, unless the continuous development of fish feed and growing techniques. The large retailers have a similar story to tell, i.e. they are in fierce competition on a daily basis. That can create increased pressure on the middle part of the supply chain, or the surprisingly numerous processing sector. It is quite likely that they will be forced to consolidate into fewer and more productive units. The downside to such development is there might lose some of its specialised "touch" for market niches. Or, in other words, the European seafood market is highly segmented and includes numerous market niches that might be difficult to service with few large processors. However, while large supermarkets continue to prevail on the market, they will need similarly large suppliers to service them.

5.9 Outlook

The long-term profitability of the Norwegian salmon farming sector will first of all depend on factors that can affect the consumer purchasing power, especially in the European market and the success the salmon products will have in other more distant markets, such as in Asia. The continued competition with wild species will continue and the wild fisheries could regain their stronghold on the European market if consumers can be persuaded to the idea that wild products are superior over farmed ones and therefore should be bought at higher prices. However, there are several factors that need to be improved within the wild fisheries for that to happen. They need to strengthen their image by presenting strong evidences that fishing activities are sustainable and not destructive to the nature; the quality of their products have to match or outperform the farmed ones; the supply of products needs to be evened out to throughout the year. Furthermore, the wild fisheries could invest in substantial marketing. The factors that need improvement within the wild fisheries can also been seen from the marketing advances that the salmon products have over other species. Increased competition might therefore be from other farmed species, as long as they can outperform other products on the seafood market. However, salmon has been marketed to consumers as a particularly healthy product due to high quality of unsaturated fatty acids such as omega-3 and 6 (Gunnars, 2015). That "feature" will weigh significantly in the long-term competition in favour of salmon products.

The long term outlook therefore indicates continued increase of demand, which will also increase possible product innovation within fully processed products such as packed portions and ready meals. Such development will affect the companies that process salmon. If prices of salmon as raw material will continue to remain high, the numerous processing companies might have difficulties in competing with larger, more productive facilities that have already invested in high-tech machinery.

The main risks are connected with unfortunate events that can affect the growing of salmon are factors such as diseases, natural disasters[50] and other negative environmental features such as pollution and acidification of the ocean caused by continued global warming. Or, factors that can have significant effect on the production on salmon feed from similar sources.

The continuation of building up good "brand" identity for salmon will be in the common interest of all companies within the industry, throughout the value/supply chain. Such image can be fragile if fraudulent actives will be discovered, such as mislabelling of products, undesirable additives and other types of dishonesty. Nevertheless, such activates have not been common for salmon, or at least so rare that they have not affected the highly positive image of salmon products or their prices. Fraudulent conduct has been more common among the competitors of salmon products, both for wild harvested products and farmed species. Where mislabelling, additives and insufficient quality have been discovered in significant quantity (D. D. Miller & Mariani, 2010; D. Miller, Jessel, & Mariani, 2012).

[50] The volcanic eruption in Calbuco volcano is believed to have destroyed valuable fingerling production in land based operation with severe effects.

6. Conclusion

This research was undertaken to provide general information about the aquaculture on a global scale and a detailed analysis on the Norwegian aquaculture sector for Promens, a multinational plastics manufacturer. The purpose was to evaluate the possibilities of marketing double walled insulated Sæplast tubs within the Norwegian aquaculture sector.

Rather than designing an analytical framework specifically for Promens it was decided to use an already established model as a framework for the analysis so that the emphasis of this project could be on the analysis itself, instead of focusing on the methodological aspects of a new analytical framework.

The initial analysis considered aquaculture on a global scale and further evaluation was then done on salmon farming in Norway. The decision was based on three factors: i) The volume of global salmon farming and presence on the international seafood market, ii) The high price of salmon and the size of salmon farms means that salmon farmers are likely to have the capacity to invest iii) The geographical location. Promens has a nearly three decade long presence within the Norwegian capture fisheries and the company has defined Norway as part of its local or home market.

The growth strategy that Promens applied in expanding its business into the international scene has transformed the company into a multinational corporation. The production facilities that produce the Sæplast reusable insulated tubs are now a part of larger conglomerate. Promens has quite long experience in selling Sæplast tubs to the fishing industry in different parts of the world and the company has gained a notable experience in servicing the sector. Promens has been interested in increasing the sales of Sæplast tubs to the aquaculture industry. Their reason can largely be linked to the reasons described by Gupta and Govindarajan (2004), to grow their business, Promens has to increase efficiency of their production units by using existing and specialised knowledge to provide added service to the customers. However sales of tubs to the aquaculture sector have been low and Promens had insufficient knowledge about the Norwegian salmon farming industry to

launch a marketing campaign of Sæplast products. Hence, being among the reasons why this project was initiated.
The growth of Promens within capture fisheries and their intentions and hopes for the Norwegian aquaculture market can be described using as a combination of the network theory and the international entrepreneurship theory, which Mtigwe (2006) has categorised as internationalisation theories . The network theory describes internationalisation of firms as a process of developing and establishing foreign market positions by using a foreign network partner and the entrepreneurship theory is based on the Uppsala model, that argues that firms increased global synchronisation as the essence of firm's environment. Companies should therefore find markets once they have expanded their skills by evolving rapid product development, high-quality manufacturing service, technological innovation and service. The firm should focus on its core competencies and concentrate on the collective learning in the organisation and cherish innovative approaches (Lynch, 2000; Prahalad & Hamel, 1990).

This project delivered initial results in 2010, which indicated that there was not a feasible market for Sæplast reusable tubs within the Norwegian salmon farming industry and it could not be recommended to initiate production of a specialised tub for the industry. Severe disease was then plaguing the salmon industry, especially in Chile and farmers in Norway were still recovering. Marine Harvest had only recently tested the use of Sæplast tubs for transporting HoG salmon to France with negative results.

Now only few years later and after having evaluated the sector with quite detailed industry analysis, the situation in the industry has improved The continued demand for salmon products, which is also evident in high prices, indicates that the sector has been performing well and should be able to invest in continued improvements in productivity. Therefore it now more likely that a company could be found that would be interested of undertaking a project such as Marine Harvest did to evaluate the use of Sæplast tubs to transport HoG salmon. However such company is also likely to have already invested significantly in high tech machinery around the use of EPS boxes and might not see enough valid reasons for introducing new type of packaging.

Therefore a processing facility that is located near Norway, such as in Denmark and perhaps in Poland might offer a more feasible partnership. There might also be opportunities with cooperation of companies such as iTUB AS that is already servicing the capture fisheries companies with rental of reusable tubs, including certified cleaning and reclaim of tubs. Such service could facilitate the introduction of reusable tubs based on acquired knowledge and experience gained from servicing the capture fisheries. That would not be the first time know-how would be introduced to aquaculture from capture fisheries. Increased use reusable tubs in transporting seafood would also increase their traffic, improve the productivity of their use and could lower the cost of redeeming the tubs back to Norway. Further development might also create possibilities of using reusable tubs to transport HoG salmon to other markets such as the UK, France and Germany.

The adoption of Sæplast tubs by the Norwegian salmon farming will not happen unless there will be a demand for them within the industry. Especially when the Norwegian salmon farming sector has already invested in infrastructure around the use of EPS, which is highly productive. Therefore, it is not very likely that a general demand will come from within the Norwegian salmon farming sector, slaughterhouses or Norwegian processing facilities. It is though possible that a particular market niche such as service production of quality fish might see an advantage in introducing Sæplast tubs. However near all salmon products are exported into the EU and processed there, because of EU tariffs. Those companies are very aware of the high amount of EPS boxes that is used to provide them with raw material. They are also under pressure to increase productivity and need to find ways to lower the cost of procurements. Promens has also decade long experience in servicing such companies, although its main customers might process different species, their core activities are the same.

The Norwegian salmon farming industry serves as a raw material provider for the European seafood processing- and retail sector. Therefore it is likely that Norwegian salmon farmers might need to bow to wishes of salmon producers that are located within the EU. The question is whether it is possible to create the sufficient demand within EU salmon processors to do so.

In order to answer the research questions directly then it cannot be concluded that it is feasible to market Sæplast reusable tubs directly to the salmon farming industry within Norway. However, there are strong suggestions that it would be more favourable to market them to larger salmon processing companies within the EU that are close enough for economical return transport of tubs. The use of tubs could increase productivity by saving the time and cost EPS boxes that require significant labour for emptying the boxes and discarding the plastic.

There are some indications that Sæplast tubs can be marketed for smaller niche markets in Norway. Such as, for production of quality salmon, however that market is probably already being serviced by Promens to some degree.

So far there are no indications that Promens should initiate the production of specialised tubs to transport salmon. Nevertheless, such plans might become realistic in the future.

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So far there are no indications that Promens should initiate the production of specialised tubs to transport salmon. Nevertheless, such plans might become realistic in the future.

7. Discussion

There are not many reports available that discuss the same topic as this thesis, although similar methodology has been applied to numerous different industries. The author had therefore sometimes to tread an unbeaten path in order to present his thought on some of the matters it discuses.

Then Norwegian salmon farming industry has shown remarkable progress since it was first introduced. Farmed salmon is now a globally traded item that creates immense values. If there will be no significant setbacks that can affect its production, salmon products will continue to strengthen its position on the main markets around the world. Therefore there are great incentives for a company such as Promens to continue to seek opportunities for products that can service the sector and hopefully contribute to increased productivity of the industry. The size and importance of the salmon farming to the global seafood market, especially within European is on such scale that Promens has great incentives to continue to seek suitable market for its Sæplast products. This research suggests that there is a possible market within the salmon processing sector by transporting HoG salmon to processing facilities that are close enough for the reimbursement of the tubs could be more economical than using EPS boxes. It is therefore suggested that Promens would initiate further research to evaluate those suggestions and it such project is more likely to be more significant if it would be done in cooperation with other companies that might benefit from the results.

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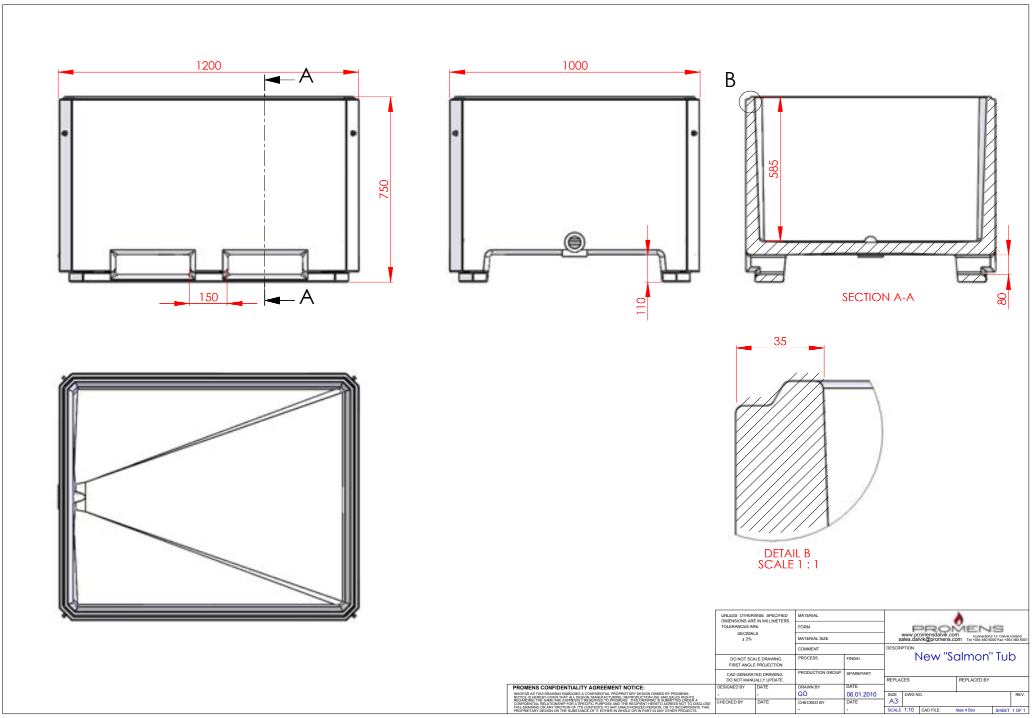
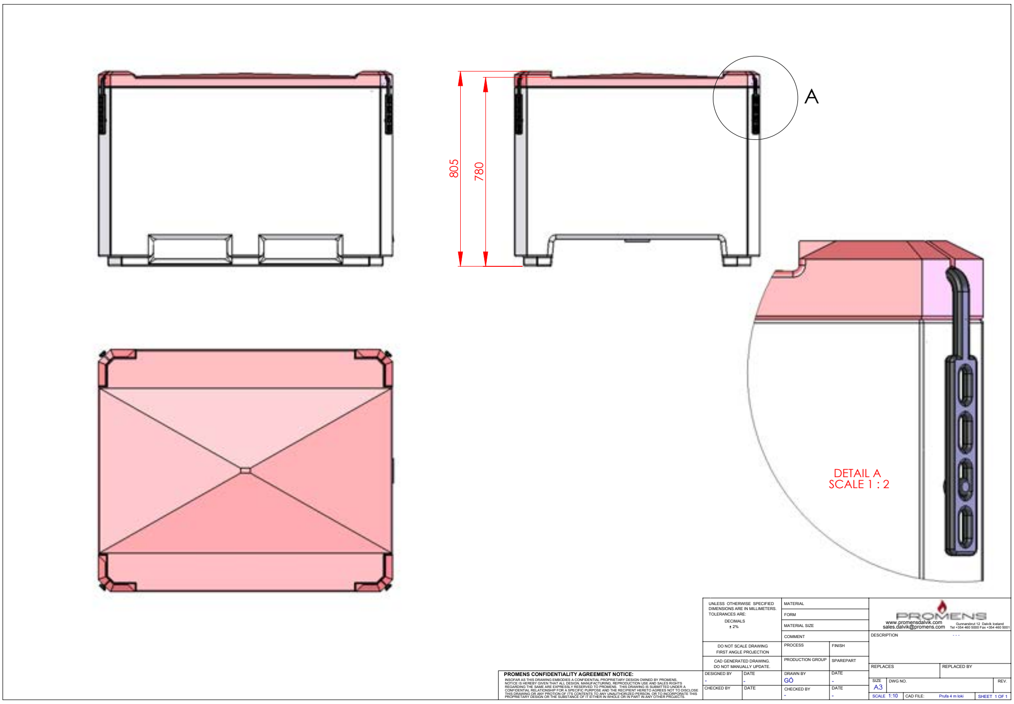
Annex I – Sales of material handling division in 2011 and 2012

Market - Level A	Market - Level B	Euros (€) 2011	Euros (€) 2012	Share (%) 2011	Share (%) 2012
Fish	Wild Fish processing	3,497,800	2,762,025	37.1%	37.1%
	Fishery Industry	1,162,931	968,084	13.0%	13.0%
	Farm fish processing	224,913	368,779	5.0%	5.0%
	Aquaculture Industry	103,531	9,889	0.1%	0.1%
		4,989,175	**4,108,777**	**55.2%**	**55.2%**
Food Processing	Wholesalers - Food & Drink Industry	1,021,170	396,569	5.3%	5.3%
	Bakery ingredients	194,174	140,714	1.9%	1.9%
	Wholesaler - Agriculture/Horticulture Industry	34,830	85,687	1.2%	1.2%
	Other	71,957	73,751	1.0%	1.0%
		1,322,131	**696,721**	**9.4%**	**9.4%**
Industy	Wholesalers - Boat & Marine Industry	175,248	246,609	3.3%	3.3%
	Collection & Recycling of industrial waste	23,781	71,330	1.0%	1.0%
	Other	55,176	56,304	0.8%	0.8%
		254,205	**374,243**	**5.0%**	**5.0%**
Meat & poultry		**357,423**	**737,336**	**9.9%**	**9.9%**
Water Treatment and Waste Management		**529,011**	**469,430**	**6.3%**	**6.3%**
	Grand total	**9,196,024**	**7,440,822**	**100.0%**	**100.0%**

Annex I – Specifications of Promens Salmon tub

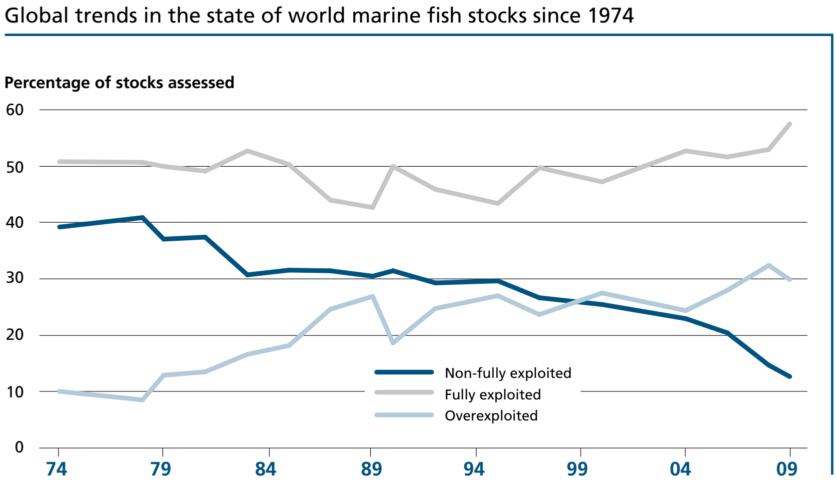



805
780
A
DETAIL A
SCALE 1 : 2
PROMENS
SCALE 1:10
A3

Annex II – The factors of the Macro-Environment

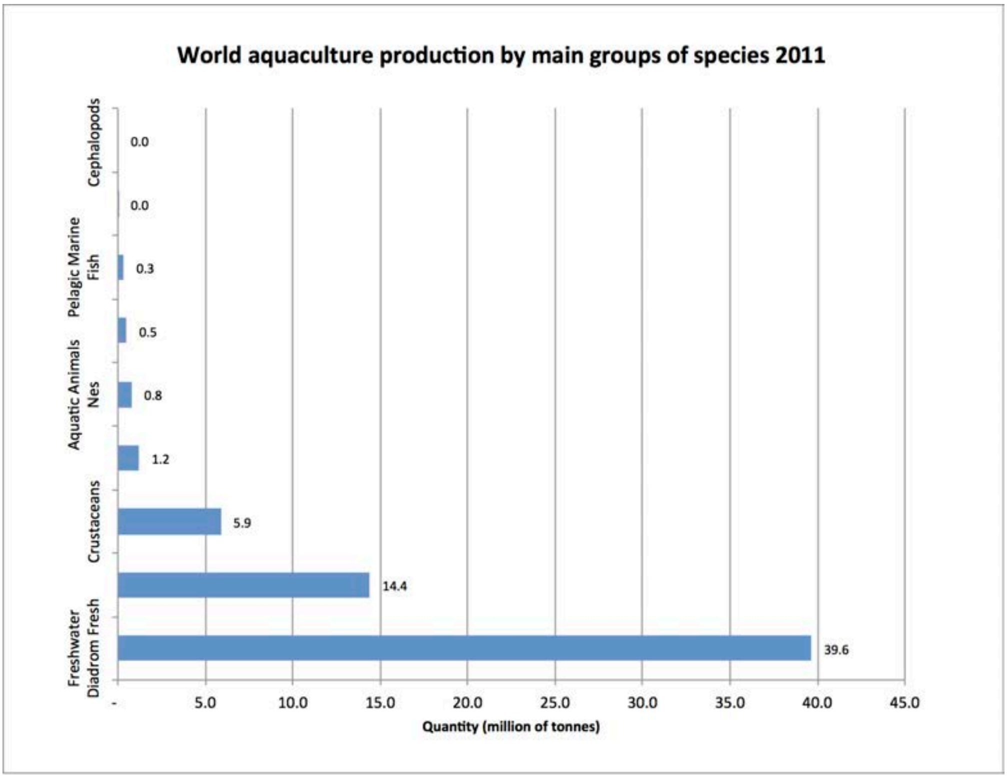
Factor/Component	Description
Political factors	These factors include political policies and processes, including the extent to which a government intervenes in the economy. They include such matters as tax policy, fiscal policy, tariffs, the political climate, and the strength of institutions such as the federal banking system. Some political factors, such as bailouts, are industry-specific. Others, such as energy policy, affect certain types of industries (energy producers and heavy users of energy) more than others.
Economic conditions	Economic conditions include the general economic climate and specific factors such as interest rates, exchange rates, the inflation rate, and the unemployment rate, the rate of economic growth, trade deficits or surpluses, savings rates, and per capita domestic product. Economic factors also include conditions in the markets for stocks and bonds, which can affect consumer confidence and discretionary income. Some industries, such as construction, are particularly vulnerable to economic downturns but are positively affected by factors such as low interest rates. Others, such as discount retailing, may benefit when general economic conditions weaken, as consumers become more price-conscious.
Sociocultural forces	Sociocultural forces include the societal values, attitudes, cultural factors, and lifestyles that impact businesses, as well as demographic factors such as the population size, growth rate and age distribution. Sociocultural forces vary by locale and change over time. An example is the trend toward healthier lifestyles, which can shift spending toward exercise equipment and health clubs and away from alcohol and snack foods. Population demographics can have large implications for industries such as health care, where costs and service needs vary with demographic factors such as age and income distribution.
Technological factors	Technological factors include the pace of technological change and technical developments that have the potential for wide-ranging effects on society, such as genetic engineering and nanotechnology. They include institutions involved in creating new knowledge and controlling the use of technology, such as R&D consortia, university-sponsored technology incubators, patent and copyright laws, and government control over the lnternet. Technological change can encourage the birth of new industries, such as those based on nanotechnology, and disrupt others, such as the recording industry.
Environmental forces	This includes ecological and environmental forces such as weather, climate, climate change, and associated factors like water shortages. These factors can directly impact industries such as insurance, farming, energy production, and tourism. They may have an indirect but substantial effect on other industries such as transportation and utilities.
Legal and regulatory factors	These factors include the regulations and laws with which companies must comply such as consumer laws, labor laws, antitrust laws, and occupational health and safety regulation. Some factors, such as banking deregulation, are industry-specific. Others, such as minimum wage legislation, affect certain types of industries (low-wage, labor-intensive industries) more than others (Thompson et al., 2012).

Annex III – The state of marine fish stocks



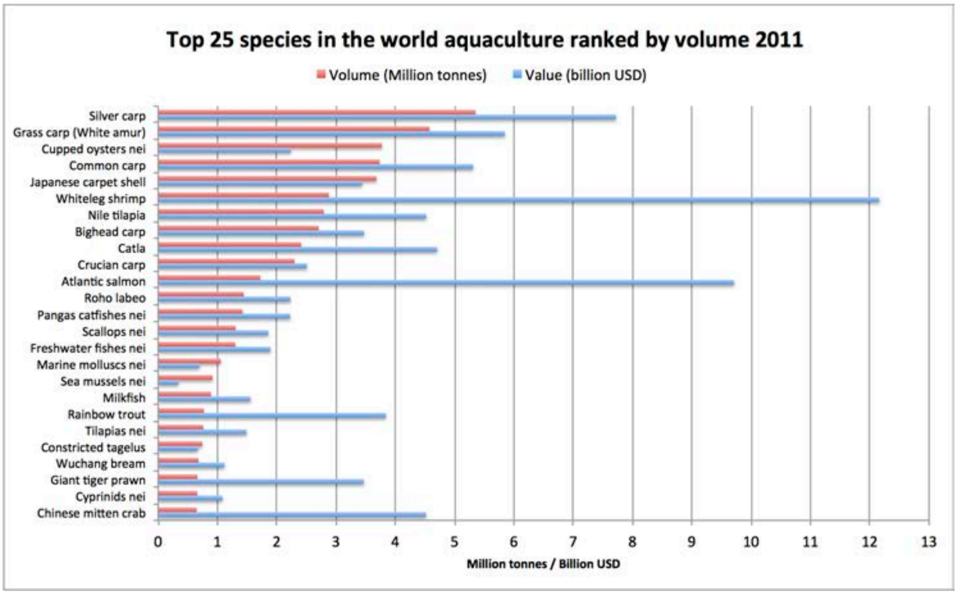
Annex III – The state of marine fish stocks shows the global trends in the state of world marine stocks since 1974. "Among the remaining stocks, 29.9% were overexploited, and 12.7 percent non-fully exploited in 2009. Overexploited stocks produce lower yields than their biological and ecological potential. They require strict management plans to rebuild stock abundance and restore full and sustainable productivity" (FAO, 2013).

Annex IV – Aquaculture production by main groups of species in 2011

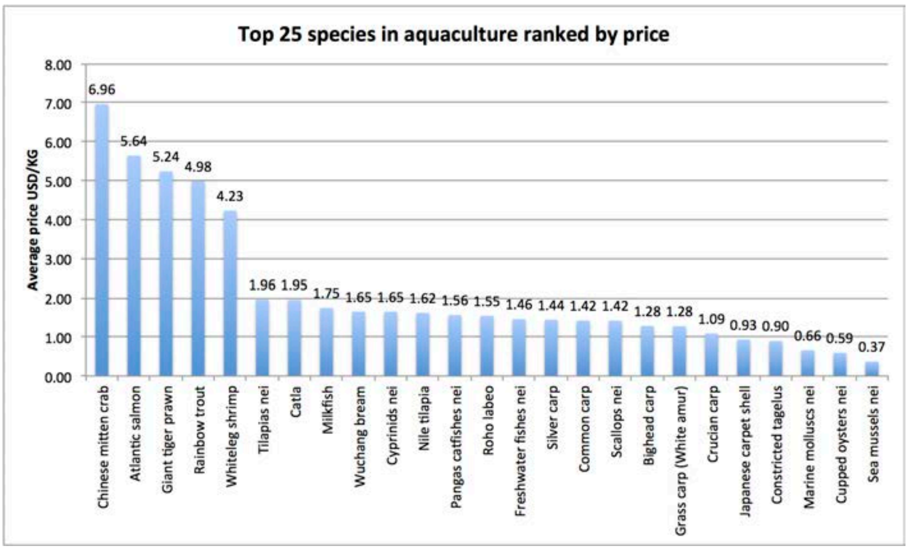


World aquaculture production by main groups of species and quantity in 2011 (FAO, 2013).

Annex V – The top 25 species in aquaculture



List of the top 25 species that are farmed in the most quantity and their value, ranked by quantity (FAO, 2013).



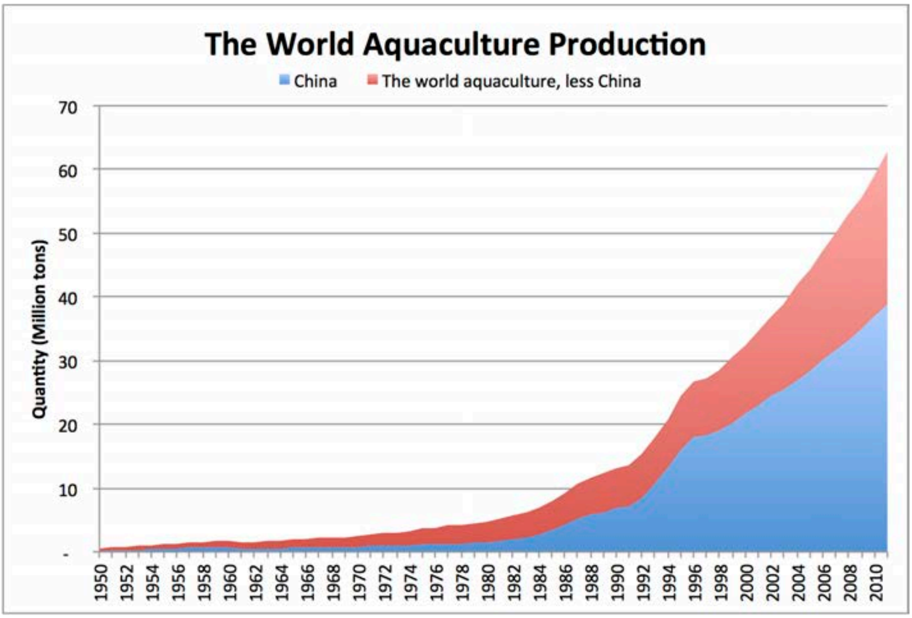
List of the top 25 species that are farmed in the most quantity and ranked by price (FAO, 2013). Nb. the Chinese mitten crab is produced in 696 thousand tonnes

Annex VI – Most significant species by regions in 2011

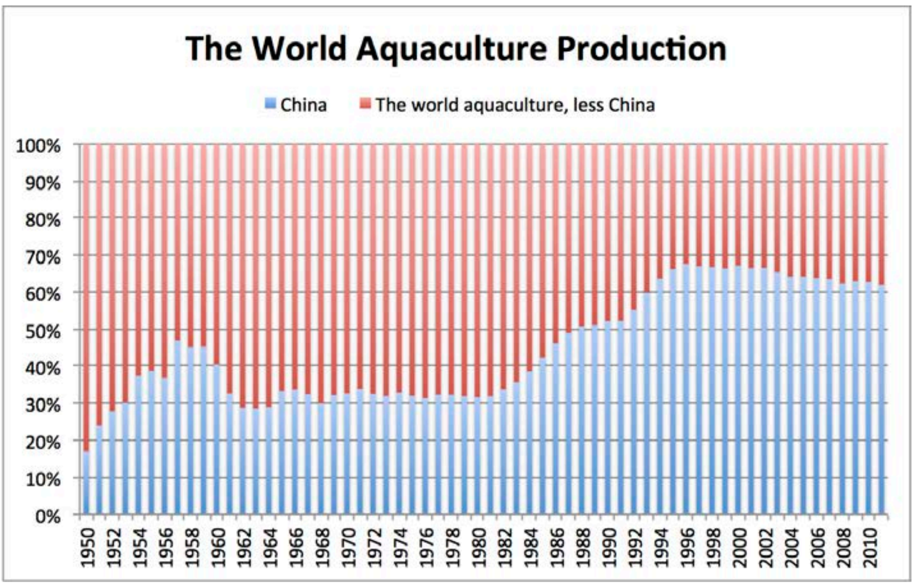
Most significant species (more than 1 million tonnes in 2011) by region (FAO, 2013).

	Asia	Americas	Europe	Africa	Oceania
Silver carp	5,309,118	14,646	25,424	400	0
Grass carp(=White amur)	4,543,120	12,089	18,984	480	0
Cupped oysters nei	3,767,226	2,571	3,503	0	0
Common carp	3,441,894	15,847	165,968	109,259	450
Japanese carpet shell	3,639,188	4,729	37,519	0	0
Whiteleg shrimp	2,353,605	523,893	0	0	45
Nile tilapia	1,991,311	112,987	160	684,579	1,313
Bighead carp	2,702,241	0	3,194	0	0
Catla	2,411,162	0	0	0	0
Crucian carp	2,297,652	0	806	2	0
Atlantic salmon	0	385,008	1,301,048	0	35,198
Roho labeo	1,442,253	0	0	0	0
Pangas catfishes nei	1,422,589	45	0	0	0
Scallops nei	1,306,124	302	0	0	0
Freshwater fishes nei	1,290,625	1,555	5,486	1,396	360
Marine molluscs nei	1,054,987	315	170	0	0
Grand Total	**38,973,096**	**1,073,986**	**1,562,262**	**796,116**	**37,366**

Annex VII – World Aquaculture Production

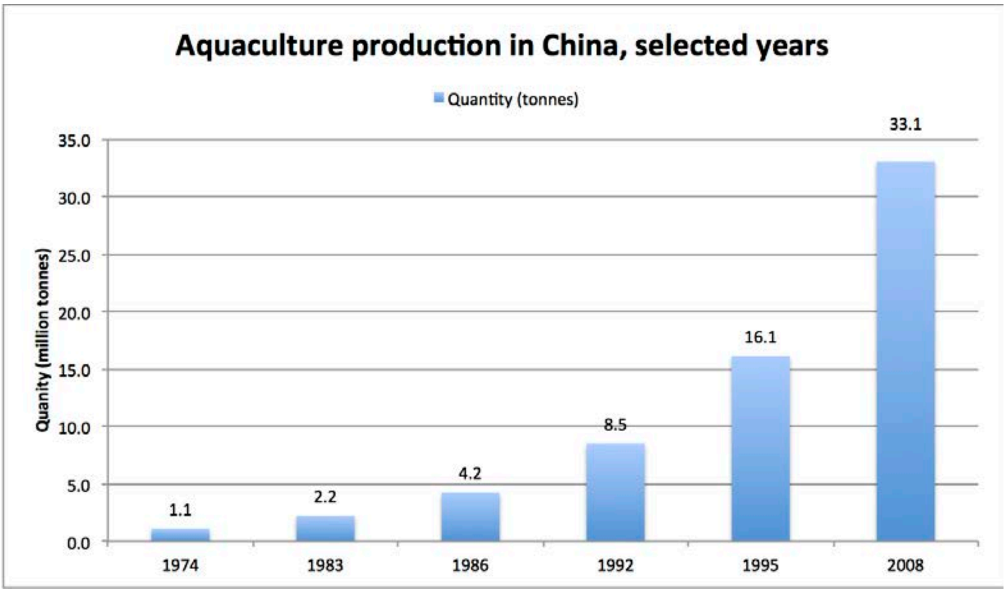


The world, aquaculture production, China vs. the rest of the world presented as quantity 1950-2011 (FAO, 2013).



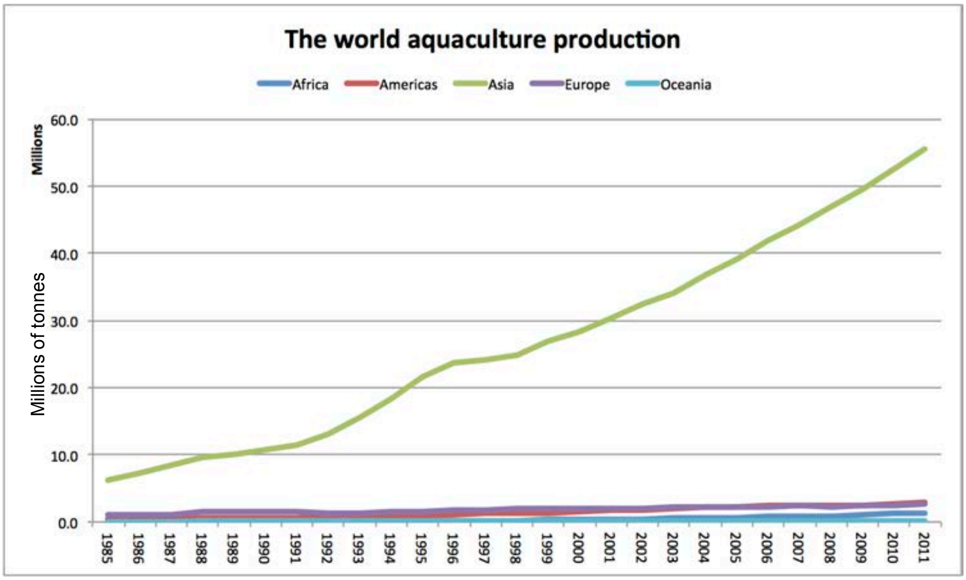
The world aquaculture production, China vs. the rest of the world as 100% share.

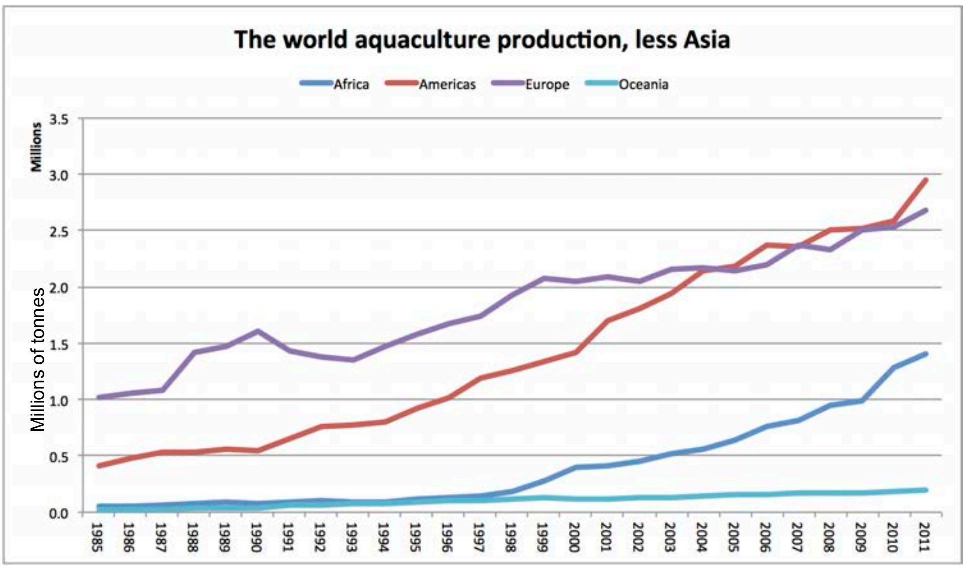
Annex VIII – Aquaculture production in China



The figure shows the rate when China doubled its aquaculture production and in what year.

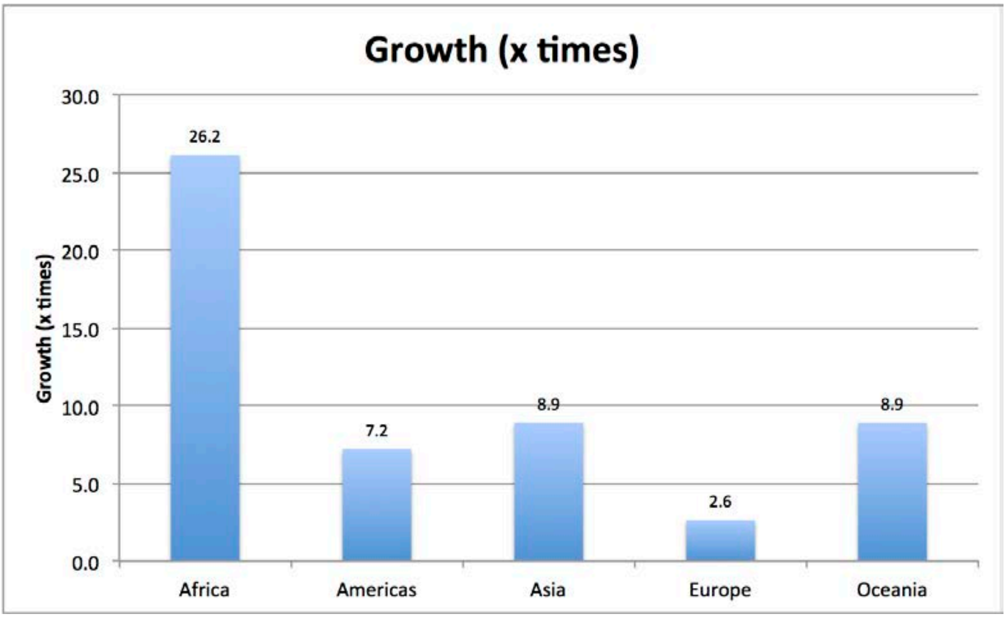
Annex IX - The world aquaculture production 1985 – 2011





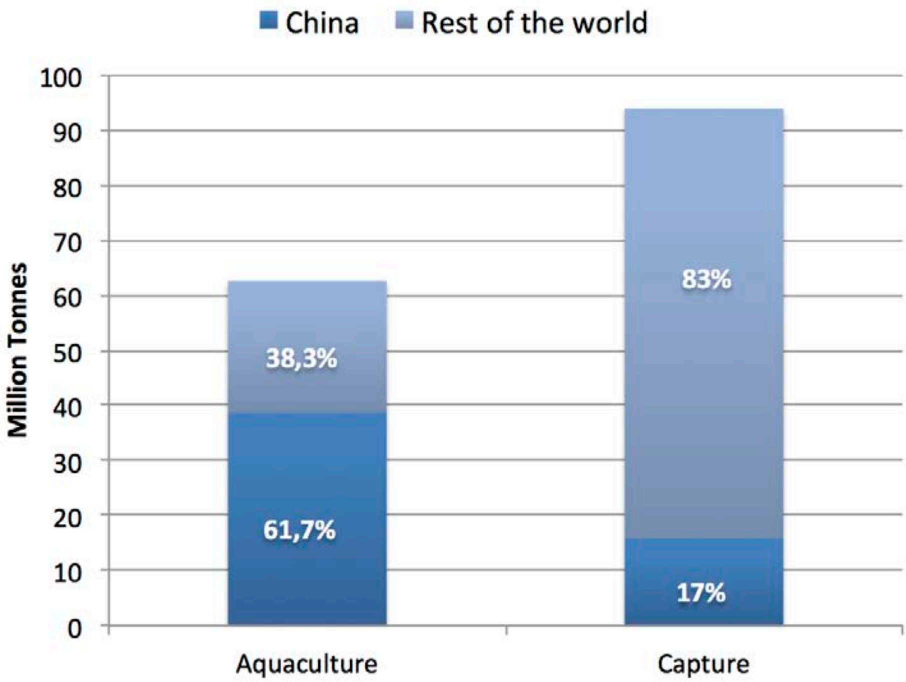
World aquaculture production with and without Asia 1985-2001 (FAO, 2013).

Annex X – Growth of world aquaculture



The growth of the world aquaculture (x times) from 1985 to 2001

Annex XI - Chinese aquaculture and capture fisheries in 2011

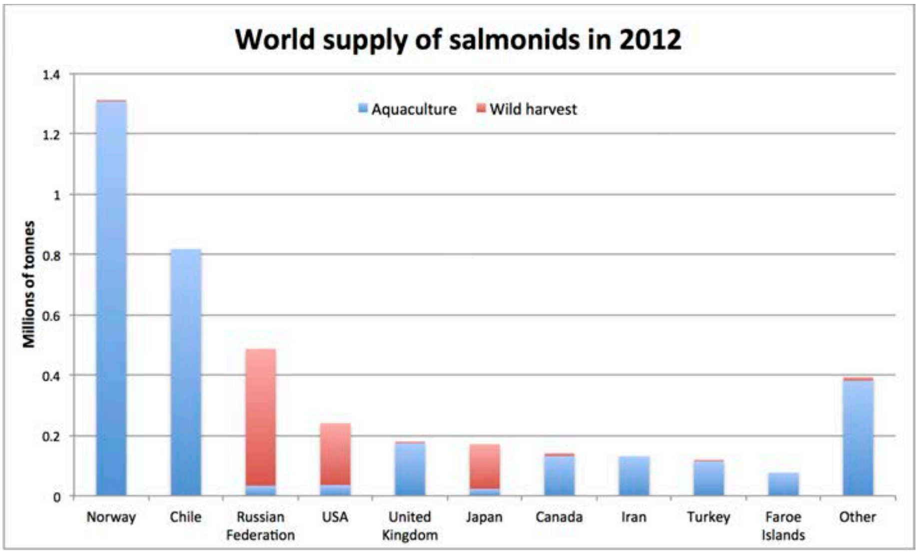


The share of Chinese aquaculture and capture fisheries of the total world seafood production/harvest

Annex XII – Chinese aquaculture top 50 species in 2011

Rank	Specie	Volume (Thousand tonnes)	Share of total volume	Accumulated volume	Growth 1 year	Growth 10 year	Value (Million USD)	Share of Value	Accumulated volume	Growth 1 year	Growth 10 year
1	Grass carp(=White amur)	4444,1	11,4%	11,4%	4,9%	35,3%	5601,5	8,9%	8,9%	1,9%	47,8%
2	Cupped oysters nei	3756,3	9,6%	21,1%	3,0%	18,4%	2216,2	3,5%	12,4%	0,0%	-31,8%
3	Silver carp	3714,0	9,5%	30,6%	2,9%	23,5%	4679,6	7,4%	19,8%	-0,2%	38,3%
4	Japanese carpet shell	3613,5	9,3%	39,9%	2,1%	51,0%	3216,2	5,1%	24,9%	-1,0%	19,6%
5	Common carp	2719,3	7,0%	46,9%	6,6%	30,0%	3099,9	4,9%	29,8%	3,7%	41,4%
6	Bighead carp	2669,7	6,9%	53,7%	4,4%	46,7%	3418,5	5,4%	35,2%	1,4%	55,0%
7	Crucian carp	2297,3	5,9%	59,6%	3,5%	42,4%	2504,9	4,0%	39,2%	0,5%	52,9%
8	Whiteleg shrimp	1334,3	3,4%	63,0%	7,7%	93,0%	5871,9	9,3%	48,5%	4,7%	87,6%
9	Scallops nei*	1306,1	3,4%	66,4%	-7,8%	35,4%	1854,7	2,9%	51,4%	-11,2%	27,8%
10	Nile tilapia	1081,3	2,8%	69,2%	7,6%	46,1%	1611,3	2,6%	54,0%	4,7%	54,0%
11	Marine molluscs nei*	812,3	2,1%	71,3%	42,0%	-35,0%	456,0	0,7%	54,7%	40,1%	-37,6%
12	Constricted tagelus	744,8	1,9%	73,2%	4,1%	29,5%	670,3	1,1%	55,7%	1,0%	20,5%
13	Freshwater fishes nei*	739,0	1,9%	75,1%	14,7%	-74,6%	904,9	1,4%	57,2%	12,0%	-27,4%
14	Sea mussels nei	707,4	1,8%	76,9%	0,7%	29,4%	183,9	0,3%	57,5%	-2,4%	31,1%
15	Wuchang bream	677,9	1,7%	78,6%	3,8%	30,8%	1118,5	1,8%	59,2%	0,8%	38,7%
16	Chinese mitten crab	649,2	1,7%	80,3%	8,6%	61,8%	4519,0	7,2%	66,4%	5,7%	65,1%
17	Red swamp crawfish	486,3	1,2%	81,5%	-15,8%	100,0%	2314,9	3,7%	70,1%	-19,5%	100,0%
18	Black carp	468,0	1,2%	82,7%	9,3%	64,6%	1086,3	1,7%	71,8%	6,4%	68,1%
19	Snakehead	446,4	1,1%	83,9%	15,7%	100,0%	544,7	0,9%	72,6%	13,0%	100,0%
20	Amur catfish	393,2	1,0%	84,9%	4,5%	99,6%	511,0	0,8%	73,4%	1,5%	99,4%
21	Blue-Nile tilapia, hybrid	360,3	0,9%	85,8%	7,6%	100,0%	536,8	0,8%	74,3%	4,6%	100,0%
22	Blood cockle	293,2	0,8%	86,6%	-5,9%	30,4%	398,8	0,6%	74,9%	-9,2%	15,5%
23	Asian swamp eel	292,4	0,8%	87,3%	6,7%	100,0%	763,2	1,2%	76,1%	3,7%	100,0%
24	Soft-shell turtle	289,3	0,7%	88,1%	7,4%	64,8%	1505,7	2,4%	78,5%	4,8%	67,9%
25	Marine fishes nei	285,3	0,7%	88,8%	18,8%	-53,7%	579,3	0,9%	79,4%	16,2%	35,4%
26	Mandarin fish	274,6	0,7%	89,5%	8,0%	63,2%	2556,3	4,0%	83,5%	5,1%	58,9%
27	Pond loach	232,5	0,6%	90,1%	12,0%	99,8%	298,3	0,5%	84,0%	9,3%	99,5%
28	Oriental river prawn	230,2	0,6%	90,7%	2,0%	62,3%	1096,0	1,7%	85,7%	-1,1%	72,9%
29	Japanese eel	218,8	0,6%	91,3%	-6,6%	22,7%	875,6	1,4%	87,1%	1,1%	27,1%
30	Yellow catfish	217,4	0,6%	91,8%	15,2%	100,0%	282,6	0,4%	87,5%	12,6%	100,0%
31	Largemouth black bass	208,3	0,5%	92,4%	10,7%	100,0%	325,0	0,5%	88,0%	7,9%	100,0%
32	Channel catfish	205,2	0,5%	92,9%	-5,9%	100,0%	266,7	0,4%	88,5%	-9,3%	100,0%
33	Sea snails	203,3	0,5%	93,4%	-2,2%	100,0%	124,0	0,2%	88,7%	-5,5%	100,0%
34	Japanese sea cucumber	137,8	0,4%	93,8%	5,4%	100,0%	478,0	0,8%	89,4%	2,4%	100,0%
35	Giant river prawn	129,4	0,3%	94,1%	-1,6%	8,7%	659,5	1,0%	90,5%	-4,0%	31,4%
36	Japanese seabass	123,0	0,3%	94,4%	13,8%	100,0%	147,6	0,2%	90,7%	11,1%	100,0%
37	Indo-Pacific swamp crab	121,6	0,3%	94,7%	4,6%	99,7%	289,1	0,5%	91,1%	1,6%	98,2%
38	Pompano	115,0	0,3%	95,0%	30,4%	100,0%	460,0	0,7%	91,9%	28,2%	100,0%
39	Aquatic invertebrates nei	109,7	0,3%	95,3%	-68,5%	71,0%	202,4	0,3%	92,2%	-90,0%	20,0%
40	Chinese mystery snail	105,3	0,3%	95,6%	-4,9%	100,0%	84,2	0,1%	92,3%	-8,2%	100,0%
41	Pirapatinga	94,9	0,2%	95,8%	10,0%	100,0%	141,5	0,2%	92,6%	7,2%	100,0%
42	Swimming crabs, etc. nei	92,9	0,2%	96,0%	2,0%	100,0%	326,1	0,5%	93,1%	-1,1%	100,0%
43	Swan mussel	90,8	0,2%	96,3%	-5,0%	100,0%	37,2	0,1%	93,1%	-8,3%	100,0%
44	Large yellow croaker	80,2	0,2%	96,5%	-7,0%	100,0%	95,5	0,2%	93,3%	-10,4%	100,0%
45	Frogs	78,1	0,2%	96,7%	-2,6%	100,0%	405,2	0,6%	93,9%	-5,8%	100,0%
46	Abalones nei	76,9	0,2%	96,9%	26,3%	96,8%	359,2	0,6%	94,5%	23,7%	87,6%
47	Penaeus shrimps nei	76,5	0,2%	97,1%	11,1%	100,0%	306,0	0,5%	95,0%	8,3%	100,0%
48	Groupers nei	73,0	0,2%	97,3%	16,8%	92,6%	246,2	0,4%	95,4%	27,7%	78,8%
49	Jellyfishes nei	69,7	0,2%	97,4%	14,5%	100,0%	164,6	0,3%	95,6%	11,8%	100,0%
50	Tilapias nei	67,2	0,2%	97,6%	-11,4%	-23,2%	110,7	0,2%	95,8%	-2,0%	-3,5%

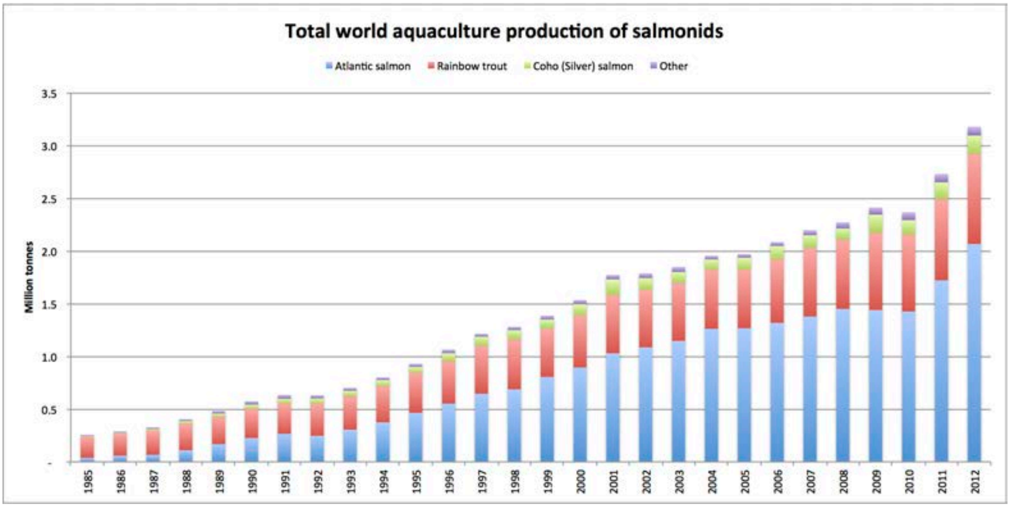
Annex XIII – World supply of salmonids

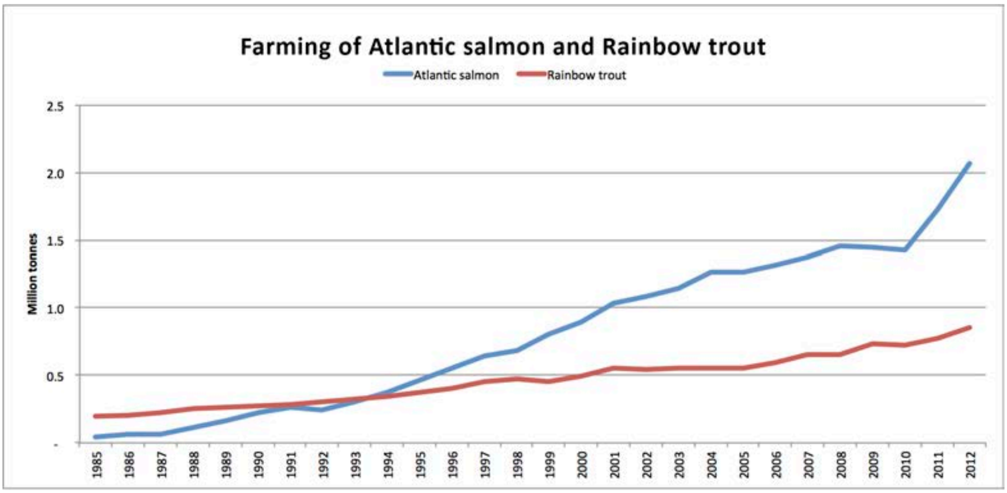


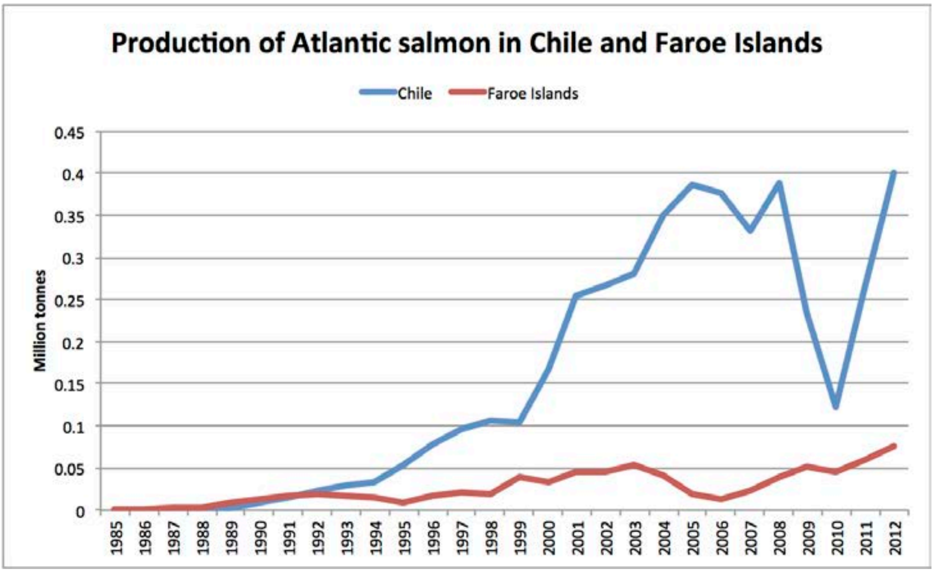
Total world production of salmonids, ranked by countries (FAO, 2013b).

Total world production of salmonids, ranked by species in 2011 (FAO, 2013b).

			Farming/Harvest 2012			
Farming/Harvest 2012	Aquaculture	%	Capture	%	Total	Total %
Atlantic salmon	2,066,561	51.6%	2,658	0.1%	2,069,219	51.6%
Rainbow trout	855,982	21.4%	5,126	0.1%	861,108	21.5%
Pink (Humpback) salmon	0	-	406,131	10.1%	406,131	10.1%
Coho (Silver) salmon	171,681	4.3%	5,424	0.1%	177,105	4.4%
Sockeye (Red) salmon	0	-	149,220	3.7%	149,220	3.7%
Pacific salmons nei	0	-	128,507	3.2%	128,507	3.2%
Chum (Keta, Dog) salmon	0	-	121,762	3.0%	121,762	3.0%
Salmonids nei	38,783	1.0%	0	-	38,783	1.0%
Chinook (Spring, King) salmon	14,085	0.4%	2,850	0.1%	16,935	0.4%
Trouts nei	15,732	0.4%	648	0.0%	16,380	0.4%
Sea trout	6,230	0.2%	3,534	0.1%	9,764	0.2%
Arctic char	3,998	0.1%	497	0.0%	4,495	0.1%
Chars nei	3,998	0.1%	20	0.0%	4,018	0.1%
Brook trout	1,035	0.0%	9	0.0%	1,044	0.0%
Lake trout (Char)	0	-	986	0.0%	986	0.0%
Masu (Cherry) salmon	0	-	842	0.0%	842	0.0%
Huchen	10	0.0%	9	0.0%	19	0.0%
Sevan trout	7	0.0%	0	-	7	0.0%
Total	3,178,101	79%	828,223	21%		
Grand Total					4,006,324	100%

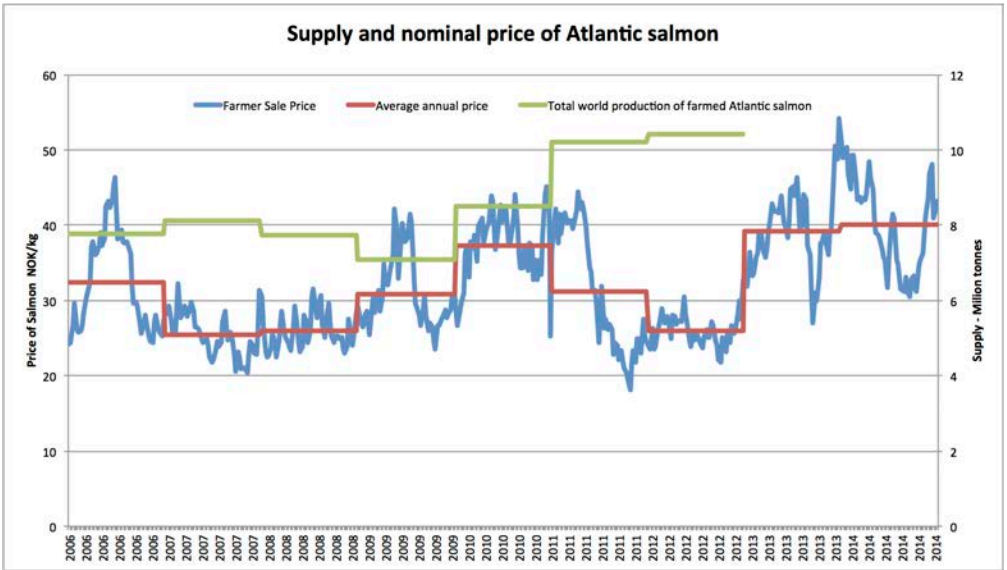

Total world aquaculture production of salmonids
Atlantic salmon
Rainbow trout
Coho (Silver) salmon
Other
Million tonnes
3.5
3.0
2.5
2.0
1.5
1.0
0.5
-
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012


Farming of Atlantic salmon and Rainbow trout
Atlantic salmon
Rainbow trout
Million tonnes
2.5
2.0
1.5
1.0
0.5
-
1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012



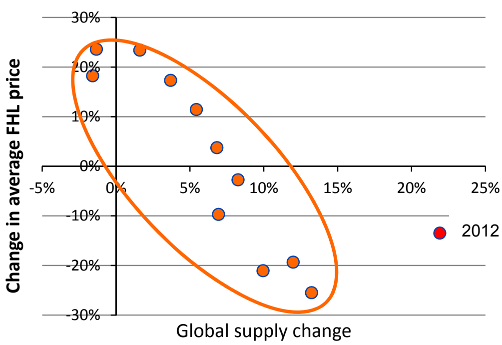
Production of Atlantic salmon in Chile and Faroe Islands
Chile
Faroe Islands
Million tonnes
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

Annex XIV – Supply and nominal price of Atlantic salmon



(FAO, 2014a; Fishpool, 2015)

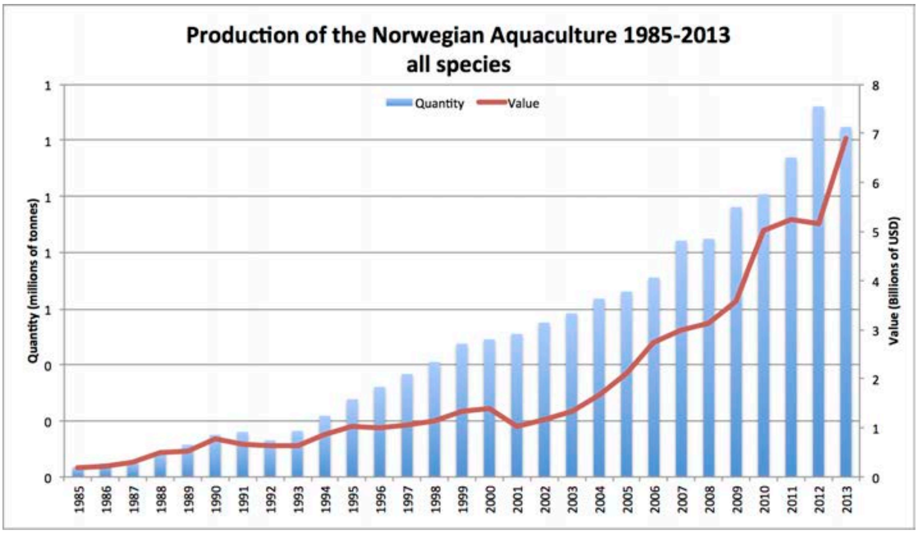
4.11 Price neutral demand growth - historically 6-7%



Y-o-Y	Global supply change	Change in av. price FHL price
2000-01	13 %	-25 %
2001-02	7 %	-10 %
2002-03	8 %	-3 %
2003-04	5 %	11 %
2004-05	4 %	17 %
2005-06	2 %	23 %
2006-07	10 %	-21 %
2007-08	7 %	4 %
2008-09	-2 %	18 %
2009-10	-1 %	24 %
2010-11	12 %	-19 %
2011-12	22 %	-13 %

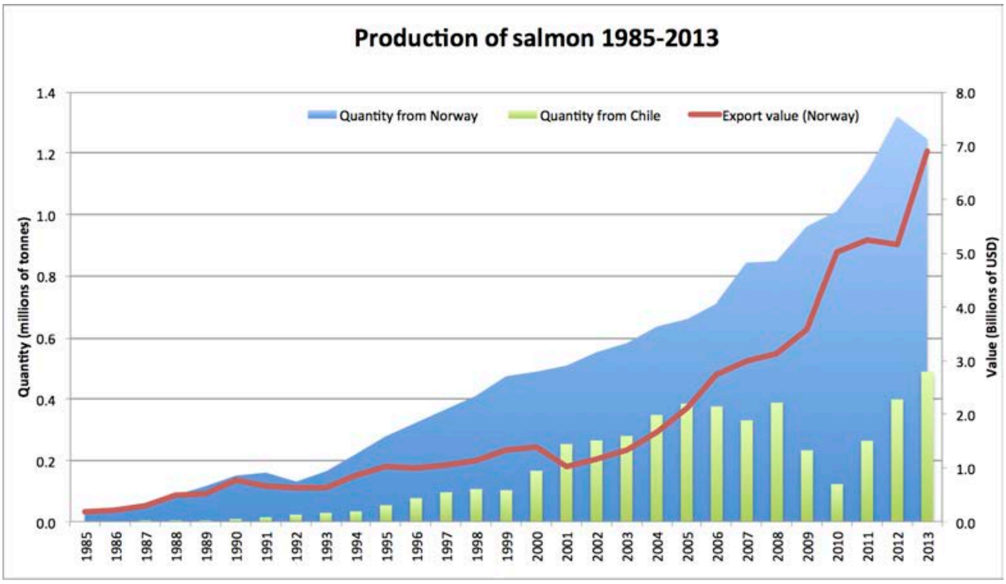
(Marine Harvest, 2014)

Annex XV – Production of farmed fish in Norway



(FAO, 2014a; Statistics Norway, 2015d)

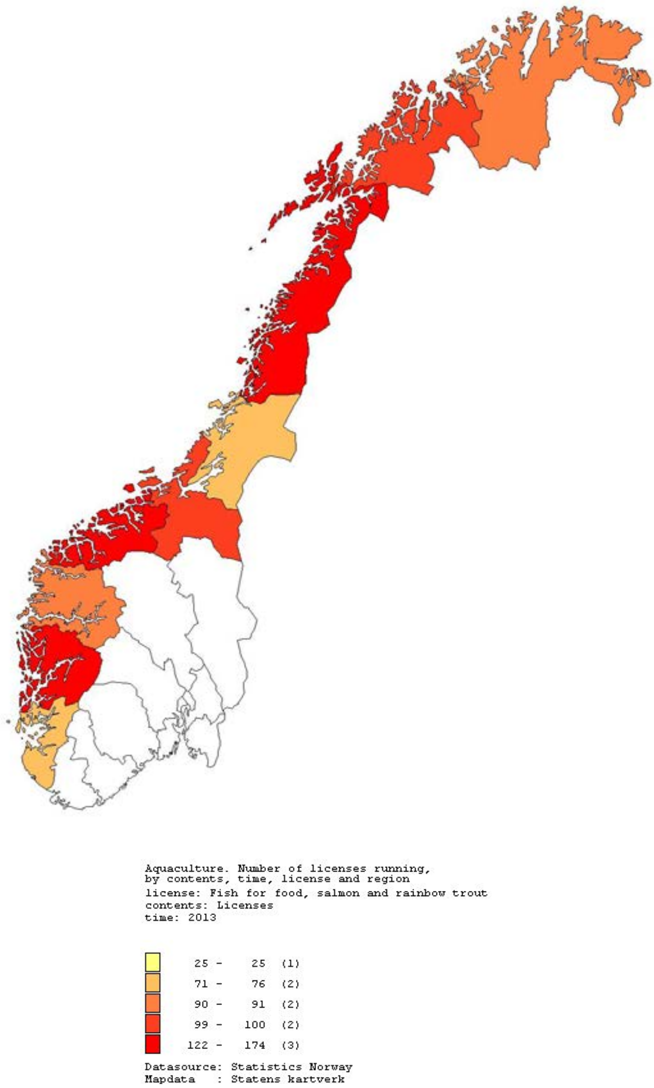
Annex XVI – Production of farmed fish in Norway and Chile



(FAO, 2014a; Salmon Chile, 2015)

The export price for fresh whole salmon in 2014 varied between NOK 34.96 per kg in September and NOK 48.88 per kg in January. The average export price in 2014 was NOK 41.06 per kg or 3.4% higher (NOK 1.35) in 2013 (Norwegian Seafood Council, 2015b).

Annex XVII – Production of farmed fish in Norway



(Statistics Norway, 2015c)

Annex XVIII – Production cycle of Norwegian salmon

(Marine Harvest, 2014)

Annex XIX – Examples of tubs vs. EPS boxes

The main customers of Grieg Seafood in Alta were:

Norsk Sjomat (http://www.norsksjomat.no/) and
Isfjord, Organization no.: 989805983.
post@isfjordseafood.no
Phone: 73837750 Fax: 73837751
Postal Address:
Utleirvegen 140 7036
TRONDHEIM

Isfjord opeated two trucks, which they used to collect production quality salmon that was transported to their processing facilities. The fish was packaged into EPS boxes to a pallet of about 600 kg. Grieg Alta could utilise larger space better by using Sæplast tubs, because they can be stacked higher than the EPS boxes. The transportation cost is about NOK 20 thousand for a truck that goes from Alta to Oslo where 1 truck carries 891 of 30 L EPS boxes, and there are 18-21 kg of salmon in each EPS box. That equals 18-20 metric tons of salmon. Each EPS box costs them 1 kg of salmon while salaries were calculated NOK 0.6 per kg. So the cost of the EPS boxes was substantial. In comparison a wellboat charged NOK 0.6 per kg to transport fish. The EPS boxes also require additional cost, energy and manpower to produce, transport, and discard the EPS boxes.

Kristján (person mentioned in chapter 5.2.2) also gave an example of a Russian buyer that bought 15 trailers of salmon per week. They used their own trucks and Sæplast boxes. So they needed to drive empty tubs into Norway. Each truckload contained 19 tonnes of salmon. In total they transported about 14.820 tonnes of salmon a year. That meant they did not need to buy EPS boxes for the estimated value of NOK 11.115.000 a year. However, they would have other expenses instead, such as driving empty tubs into Norway.

Kristján also mentioned that they had looked into sea transportation via Bodo to Trondheim. He also mentioned that they have received request to use reusable single walled tubs. However they were not found to be strong enough for the load (Kristjánsson, 2010)

Annex XX – Information about Norwegian seafood processors

Finnmark

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgr	Postno.	e-mail	Webpage
1	Altafjord Laks AS	6			NRS	Finnmark	990970602	40,516	58,206	3,819	-1,207	9%	9533		
2	Finnmark Energiverk AS		0.10			Finnmark									
3	Finnmark Fylkeskommune	1				Finnmark	974795159						9815		
4	Fiskeri og Havbruksnær Landsforen			1		Finnmark	982893380						9006		
5	Grieg Seafood Finnmark AS	24			Grieg-gruppen	Finnmark	980361306	432,592	196,367	3,048	-12,608	1%	9740		griegseafooc
6	Institutt For Akvakulturforskning	1				Finnmark									
7	Lakslefjord AS		5.00		Lerøy	Finnmark	988591599	47,729	33,740	6,635	2,554	14%	9740		
8	Mainstream Norway AS	27			Mainstream	Finnmark	961922976	810,690	591,038	102,492	92,906	13%	9536		cermaq.com
9	Polar Seafood AS		1.00			Finnmark	988964719	50	60	-587	142	-1174%	9990		
10	Tri AS	5			NRS	Finnmark	961909058	37,486	18,032	6,829	3,337	18%	9531	as-tri@online.no	
11	Troika Seafarms AS	1			Villa Organic	Finnmark	982832144						9915		
12	Villa Arctic AS	23			Villa Organic	Finnmark	989865358	31,173	0	-17,047	-10	-55%	9770		
	Sum Finnmark	**88**	**6.10**	**1**				**1,400,236**	**897,443**	**105,189**	**85,114**				
	Reell matfiskprod. (tn) og smoltutsett i 2008	35445	14.60												

References: Norsk fiskeoppdrett, nr. 9. årgang 34. See kyst.no

Red text means that there were little or no valid information to be found and therefore the company was not listed up in google map

http://maps.google.com/maps/ms?ie=UTF8&msa=0&msid=107184069642279947215.000476e7f335e089c0000&ll=69.3919

Trøndelag

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgr	Postno.	e-mail	Webpage	Antall ansatte
1	Aqua AS	2				Trøndelag										
2	Aqua Gen AS	1		1		Trøndelag	964367701	45,816	94,791	16,474	17,726	35.96%	7010		aquagen.no	63
3	Bjørøya Fiskeoppdrett AS	4				Trøndelag	932186497	71,648	78,297	8,309	14,064	11.60%	7770			23
4	Emilsen Fisk AS	5			NRS	Trøndelag	828829092	132,219	135,960	15,431	28,204	11.67%	7900			18
5	Emilsen Slakteri AS	1				Trøndelag	981690095	21,522	22,232	86	879	0.40%	7900			33
6	Ervik Laks og Ørret AS	2				Trøndelag	924895004	33,925	47,398	6,688	12,670	19.71%	7270			8
7	Ervik Settefisk AS		0.50			Trøndelag	975961370	4,241	4,385	189	246	4.46%	7270			3
8	Espnes Gunnar Fiskeoppdrett AS	1			NRS/Måsøval	Trøndelag	855255332	50	0	-926	-730	-1852.00%	7266			
9	Fiskeri og Havbruksnær Landsforen		0.50	1		Trøndelag	982893380						9006	firmapost@fhl.no	www.fhl.no	3
10	Flatanger Settefisk AS		2.50		Salmar	Trøndelag	864943632	22,695	19,789	2,807	1,697	12.37%	7770			3
11	Follasmolt AS		5.50		Salmar	Trøndelag	937543948	94,299	74,760	5,671	13,813	6.01%	7796			28
12	Haukvik Kraft-Smolt AS		1.00			Trøndelag	953000105	5,845	5,495	1,109	1,432	18.97%	7203			3
13	Høsøien Janne		0.02			Trøndelag										
14	Knutshaugfisk AS	2				Trøndelag	836881362	45,111	49,463	10,118	11,303	22.43%	7252			8
15	Kråkøy Slakteri AS	1				Trøndelag	985872406	12,741	14,228	-379	461	-2.97%	7180			33
16	Kvernviklaks AS		2.00			Trøndelag	966306831	11,238	12,108	-601	5,038	-5.35%	7817			3
17	Ianstein Fisk AS		0.80		Salmar	Trøndelag	966154241	3,252	2,497	664	-129	20.42%	7510			
18	Lernes Fiskeindustry AS	1				Trøndelag	876240912	6,829	7,150	98	119	1.44%	7200			18
19	Lernes R AS	3				Trøndelag	961047730	45,506	45,746	4,139	7,615	9.10%	7200			8
20	Lerøy Hydrotech AS		2.00		Lerøy	Trøndelag	965831436	602,663	472,657	21,541	2,844	3.57%	6512		hydrotech.n	173
21	Lerøy Midnor AS	25	8.00		Lerøy	Trøndelag	985848718	823,289	781,018	162,550	187,257	19.74%	6687			243
22	Lund Fiskeoppdrett AS	2				Trøndelag	943304947	42,437	53,935	4,469	9,495	10.53%	7818			8
23	Marine Harvest Norway AS	52	17.50	1	MH	Trøndelag									marineharvest.com	
24	Midt Norsk Havbruk AS	9	0.30			Trøndelag	963867212	213,896	264,258	33,476	64,855	15.65%	7900			23
25	Måsøval Fishfarm AS	1			NRS	Trøndelag	939811249	101	11,144	-1,126	1,140	-1114.85%	7266			
26	Måsøval Fiskeopprett AS	1			NRS	Trøndelag	933792854	86,078	128,764	-7,198	11,382	-8.36%	7266			18
27	Måsøval Settefisk AS		1.00			Trøndelag	890011632	15,437	11,910	747	3,405	4.84%	7266			
28	Namdal Settefisk AS		2.20			Trøndelag	987245069	29,505	21,691	9,355	8,719	31.71%	7819			3
29	Neptun Settefisk AS		1.40			Trøndelag	958438370	23,544	17,202	3,400	2,975	14.44%	7819		neptunsette	13
30	Nesset Fiskemottak AS	1				Trøndelag	944829466	4,877	15,908	-3,165	2,244	-64.90%	7770			3
31	Norges Teknisk-Naturvitenskapelige		0.01			Trøndelag	974767880						7034	postmottak@adm	www.ntnu.no/	
32	Olden Oppdrettsanlegg AS		0.50			Trøndelag	979993528	15,948	16,810	1,035	2,971	6.49%	7168			8
33	Pharmaq AS	1				Trøndelag	886953402	321,325	228,277	84,159	53,090	26.19%	275	customerservice@	http://www.	103
34	Refsnes Laks AS	2			NRS	Trøndelag	980649598	56	3	-3,670	-3,542	-6553.57%	7177			
35	Rørvik Fisk & Fiskmatforretning AS	1				Trøndelag	922996628	118,255	5,043	1,975	2,549	1.67%	7900			3
36	Salmar Farming AS	25			Salmar	Trøndelag	872290672	1,076,856	1,078,509	283,448	317,487	26.32%	7633			108
37	Salmar Processing AS	1			Salmar	Trøndelag	958973306	2,240,949	1,878,340	16,333	70,931	0.73%	7266		salmar.no	388
38	Sinkaberg-Hansen AS	8			Sinkab. Hans	Trøndelag	976543718	530,320	460,068	10,795	29,210	2.04%	7982			143
39	Sintef Fiskeri og Havbruk AS	1	0.00			Trøndelag	980478270	116,682	102,206	1,532	4,452	1.31%	7010			108
40	Val Vgs AS	1				Trøndelag	966819898						7970		www.val.vg	1
41	Veterinærmedisinsk Oppdragsscenter	1	0.27			Trøndelag	963201230	234,401	149,400	2,494	-131	1.06%				38
42	Vikan Settefisk AS		0.40			Trøndelag	974536463	8,691	9,875	571	3,246	6.57%	7250			3
43	Vikna Sjøfarm AS	3				Trøndelag	952662813	82,192	74,812	17,045	14,098	20.74%	7900			8
44	Willksen Nils AS	1				Trøndelag	883691822	450,321	489,099	-14,529	5,090	-3.23%	7900			68
45	Woll Henrik Hoel		0.05			Trøndelag							7660			
46	Åsen Settefisk AS		2.50			Trøndelag	964943818	22,856	22,156	5,647	5,761	24.71%	7630			8
	Sum Trøndelag	**159**	**48.95**	**0**				**7,617,616**	**6,907,384**	**700,761**	**913,936**					
	Reell matfiskprod. (tn) og smoltutsett i 2008	162614	46.70													

Red text means that there were little or no valid information to be found and therefore the company was not listed up in google map

http://maps.google.com/maps/ms?hl=en&ie=UTF8&msa=0&msid=107184069642279947215.000477750ba72ed2192c6&ll=63.539987,9.489441&spn=0.949704,2.469177&z=9

Troms

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgrad	Postno.	e-mail	Webpage	Antall ansatte
1	Aquafarm AS		3.50			Troms	957175708						9385			
2	Arnøy Laks AS	4				Troms	935767156	86,606	48,046	12,342	4,670	14%	9194			
3	Astafjord Smolt AS		0.50			Troms	958916116	6,206	6,871	-2,825	-943	-46%	9470			3
4	Berg Havbruk AS / BERG PARTNE	1			Lerøy Aurora	Troms	989161679		0		-14		9470			
5	Eidsfjord Sjøfarm AS	3			Salmon Group	Troms	958023685	131,939	146,413	8,269	14,570	6%	9395			8
6	Elevoll Settefisk AS		0.50			Troms	975862801	5,779	7,069	-8,874	-978	-154%	9046			3
7	Fiskeri og Havbruksnær Landsforen			1		Troms	982893380						9006			3
8	Fjord Smolt AS		1.00			Troms	976020618		9,948,000		-979,000		9446			14
9	Flakstadvåg Laks AS	6				Troms	858000742	134,908	97,108	21,016	22,998	16%	9389			13
10	Gratanglaks AS	3				Troms	988365777	53,034	54,759	3,742	7,214	7%	9470			8
11	Hamneidet Laks AS	2				Troms	964382751	65,016,000	38,358,000	16,972,000	5,670,000	26%	8401			5
12	Havbruksstasjonen I Tromsø AS	1	0.20	1		Troms	980900754	37,878	38,293	-381	-391	-1%	9131			33
13	Jøklefjord Edelfisk AS		0.60			Troms	952494767	6,126	5,533	-713	-1,417	-12%	9163			8
14	Jøklefjord Laks AS	7			Salmon Group	Troms	942234309	126,761	116,974	32,214	26,249	25%	9163			28
15	Jøkelsmolt AS		1.00			Troms	989314327	10,202	8,484	-414	-265	-4%	9180			8
16	Kleiva Fiskefarm AS	3			NRS	Troms	942027672	53,407	54,434	1,324	5,855	2%	9455			13
17	Lerøy Aurora AS	18			Lerøy	Troms	985940460	451,927	403,455	53,127	77,950	12%	9006			188
18	Nor Seafood AS	2			NRS	Troms	987044349	40,295	33082	5,513	5425	14%	9381			
19	Nordlaks Oppdrett AS	14			Nordlaks	Troms	955750802	871,328	828,817	139,002	105,374	16%	8409			73
20	Nord-Senja Fiskeindustri AS	3			NRS	Troms	924882212	63,895	73,368	5,708	7,662	9%	9373			18
21	Northen Lights Salmon AS	4				Troms	968984322	68,952	75,041	3,352	14,458	5%	9446			8
22	Rølaks AS	1				Troms	985279225	3,817	21,298	-3,680	-4,825	-96%	9350	jens.arne.johnsen@barlindhaug.no		
23	Salaks AS	4				Troms	936736408	23,225	81,830	3,432	3,833	15%	9350			23
24	Salangfisk / Salangfisk Odd Bekkeli		0.50			Troms	933694305						9350			
25	Salmar Nord AS / Senja Sjøfarm .	13			Salmar	Troms	951661198	273,923	169,600	23,560	18,720	9%	9392			33
26	Sjurelv Fiskeopprett AS	1			NRS	Troms	954678393	15,255	17,352	502	461	3%	9100			3
27	Skardalen Settefisk AS		1.00			Troms	990820414	6,434	4,410	842	312	13%	9144			3
28	Sørrollnesfisk AS	2			NRS	Troms	939993444	33,305	25,280	1,875	4,686	6%	9450			8
29	Troms Fylkeskommune	1				Troms	864870732						9296			
30	Troms Slakteridrift AS	1				Troms	986005161	15,915	14,062	-1,284	-1,650	-8%	9064			23
31	Troms Stamfiskstasjon AS		2.00		Salmar	Troms	944609938	13,149	11,894	2,219	134	17%	9392			3
32	Universitetet I Tromsø	1				Troms	970422528						9037			
33	Wilsgård Brødrene AS	1				Troms	965141707	0	0	-16	-9		9381			0
34	Wilsgård Fiskeoppdrett AS	2			NRS	Troms	933591530	84,811	64,258	14,081	15,239	17%	9381			18
	Sum Troms	**98**	**10.80**	**0**				**466,017**	**388,686**	**45,211**	**41,726**					
	Reell matfiskprod. (tn) og smoltu	91219	14.60													

References: Norsk fiskeoppdrett, nr. 9. årgang 34. See kyst.no

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Nordland

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgrad	Postno.	e-mail	Webpage	Antall ansatte
1	Alsvåg Fiskeprodukter AS	1				Nordland	948927241	31,462	31,428	-2,437	-1,774	-8%	8432			38
2	Aquakultur i Vesterålen AS	1				Nordland	993505005	0		-55			8400			
3	Ballangen Sjøfarm AS	1				Nordland	884141982	22,344	18,219	1,296	530	6%	8540			8
4	Bergersen Ottar / Ottar Bergersen	1				Nordland	981547349	16,480	19,934	23	817	0%	8475			8
5	Blindalslaks AS	4			Sinkab. Hansen	Nordland	960672461	103,223	89,433	14,096	16,324	14%	7982			
6	Bindalssmolt AS		2.5		Sinkab. Hansen	Nordland	977106206	24,952	22,084	7,903	7,189	32%	7982			8
7	Biomar AS	1				Nordland	937843860	2,267,407	1,824,685	24,300	60,972	1%	4262		biomar.com	178
8	Edelfarm AS	2				Nordland	947038877	42,844	41,061	6,143	9,151	14%	8250			8
9	Eidisfjord Sjøfarm AS	3				Nordland	958023685	131,939	146,413	8,269	14,570	6%	9395			8
10	Ellingsen Seafood AS	8				Nordland	991952829	234,068		27,874		12%	8320			48
11	Elvenesstrand Smolt AS		0.75			Nordland	939612424	9,721	9,420	2,856	3,348	29%	8430			8
12	Fiskekroken AS	1				Nordland	968884662	32,263	30,235	3,592	4,772	11%	5116			3
13	Fiskeri og Havbruksnær Landsforen			2		Nordland	974461021						9006		http://www.fhl.no	
14	Framnessmolt AS		0.6		Salmon Group	Nordland	987316667	10,911	9,526	1,361	1,956	12%	8313			8
15	Gildeskål Forskningsstasjon AS	2				Nordland	950912278	50,744	46,949	4,796	-254	9%	8140			28
16	Grytåga Settefisk AS		3.7			Nordland	978647103	0	0	771	-170		8656			
17	Hellfjordlaks AS	1				Nordland	969031884	8,287	6,455	2,513	303	30%	8475			1
18	Isqueen AS	2			Salmon Group	Nordland	952217860	52,557	25,096	6,171	3,423	12%	8352			
19	Klo Gunnar AS	1				Nordland	914589967	135,681	145,902	-867	220	-1%	8430			98
20	Kobbvåglaks AS	1				Nordland	954064506						8850			
21	Kristoffersen Egil & Sønner AS	5			NRS	Nordland	913601963	102,375	66,397	11,838	12,375	12%	8475			28
22	Kvarøy Fiskeoppdrett AS	3				Nordland	947672134	65,515	78,418	13,095	9,913	20%	8743			13
23	Larassen Seafood AS	1			NRS	Nordland	962321356	15,374	25,610	1,393	1,563	9%	8740			3
24	Lofoakvariet AS	1				Nordland	947790870	4,154	3,392	119	-82	3%	8310			3
25	Lofoten Salmon AS	1			Lofoten Sjøprodukter	Nordland	860513382	3,548	4,611	-1,218	-672	-34%	8370			
26	Lofoten Sjøprodukter AS	2			Salmon	Nordland	943609551	64,065	49,287	5,875	2,761	9%	8370			13
27	Group/Lofoten Sjøproducter					Nordland										
28	Lovundlaks AS	4			NRS	Nordland	940333067	95,811	83,343	18,844	19,001	20%	8764			13
29	Lødingen Fisk AS		1.5			Nordland	884625882	22,069	14,929	3,652	1,547	17%	8412			8
30	Mainstream Norway AS	18	7		Mainstream	Nordland	961922976	810,690	591,038	102,492	92,906	13%	9536			348
31	Marine Harvest Norway AS	37	8.5		MH	Nordland	959352887	5,364,340	5,595,165	657,456	1,002,800	12%	5035			1193
32	Mortenlaks AS	2				Nordland	966384379	58,328	42,983	10,355	9,087	18%	8410			8
33	Musken Laks AS	2				Nordland	984737769	51,959	20,380	12,120	3,299	23%	8320			13
34	Nordlaks Oppdrett AS	9			Nordlaks	Nordland	955750802	871,328	828,817	139,002	105,374	16%	8409			73
35	Nordlaks Produkter AS	1			Nordlaks	Nordland	976725859	291,039	403,630	-14,067	-30,699	-5%	8450		http://www.nc	223
36	Nordland Akva AS		1			Nordland	989713264	11,456	11,703	-209	2,132	-2%	8170			8
37	Nordland Fylkeskommune	1				Nordland	964982953						8005		nfk.no	
38	Norsal AS	1				Nordland	952982745	7,819	6,924	-1,164	-766	-15%	8285			18
39	Norsk Havbrukssenter AS	1				Nordland	984680228	20,419	635	201	-269	1%	8900			3
40	Norsmolt Ans		0.3			Nordland	958913478						8430			
41	Nova Sea AS	26			Nova Sea	Nordland	961056268	647,432	791,792	63,422	149,193	10%	8764			188
42	Polarkaks II AS	1				Nordland	990688494	32,686	15,322	-2,078	-7,754	-6%	8842			3
43	Pundslett Laks AS	4				Nordland	950562935	113,879	67,760	15,034	9,241	13%	8324			38
44	Ranfjord Fiskeproducter AS		5.5			Nordland	976969413	30,323	31,838	8,510	8,195	28%	8610			13
45	Salten Havbruk AS		4.25			Nordland	982671809	19,897	27,170	-985	5,162	-5%	8103			13
46	Selsøyvik Havbruk AS	2			Salmon Group	Nordland	961005957	54,119	49,669	8,764	8,253	16%	8196			3
47	Seløy Sjøfarm AS	2				Nordland	961288983	31,660	31,877	3,554	5,471	11%	8850			8
48	Silver Seed AS		2			Nordland	971129735	28,302	27,282	5,330	9,089	19%	8380			8
49	Sisomar AS		2.5			Nordland	987520507	25,262	23,258	2,934	1,988	12%	8226			8
50	Sjøblink Blokken AS		0.6			Nordland	934339533	13,910	14,316	252	1,382	2%	8400			13
51	Skottneslaks AS	1			Salmon Group	Nordland	966982705	31,434	14,076	2,826	873	9%	8373			
52	Smolten AS		11.5		Nordlaks	Nordland	991193332	49,122	37,490	5,908	7,188	12%	8260	smolten@smolten.no		22
53	Sundsfjord Smolt AS		10			Nordland	991692800	0		-403			8120			8
54	Sømna Fiskeoppdrett AS	1			Nova Sea	Nordland	982762812	24,364	22,543	5,440	1,571	22%	8920			8
55	Tomma Laks AS	1			Nova Sea	Nordland	864596592	35,146	30,414	8,531	8,479	24%	8723			3
56	Vega Sjøfarm AS	1			Nova Sea	Nordland	885228682	22,917	28,011	4,464	5,920	19%	8980			3
57	Vevelstad Fiskeindustri AS	1				Nordland										
58	Værøy Laksefarm AS	1			Pundslett laks	Nordland	971059354	2,007	1,731	1,905	1,694	95%	8300			
59	Wenberg Fiskeoppdrett AS	2				Nordland	937504446	43,735	26,535	13,426	2,141	31%	8200			3
60	Øvreskotnes A AS	1				Nordland	955030753	11,902	6,682	552	-201	5%	8373			3
61	Øyfisk AS	3			Salmon Group	Nordland	945095016	68,768	68,067	6,062	4,741	9%	8430			8
62	Åviksmolt AS		1			Nordland	964452369		13,502		3,689		8310			4
	Sum / average Nordland	**166**	**63.20**	**0**				**12,322,037**	**11,623,437**	**1,221,837**	**1,577,962**	**12%**				**56.63**
	Reell matfiskprod. (tn) og smoltuts	152682	41.20													

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Trøndelag

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgr	Postno.	e-mail	Webpage	Antall ansatte
1	Aqua AS	2				Trøndelag										
2	Aqua Gen AS	1		1		Trøndelag	964367701	45,816	94,791	16,474	17,726	35.96%	7010		aquagen.no	63
3	Bjørøya Fiskeoppdrett AS	4				Trøndelag	932186497	71,648	78,297	8,309	14,064	11.60%	7770			23
4	Emilsen Fisk AS	5			NRS	Trøndelag	828829092	132,219	135,960	15,431	28,204	11.67%	7900			18
5	Emilsen Slakteri AS	1				Trøndelag	981690095	21,522	22,232	86	879	0.40%	7900			33
6	Ervik Laks og Ørret AS	2				Trøndelag	924895004	33,925	47,398	6,688	12,670	19.71%	7270			8
7	Ervik Settefisk AS		0.50			Trøndelag	975961370	4,241	4,385	189	246	4.46%	7270			3
8	Espnes Gunnar Fiskeoppdrett AS	1			NRS/Måsøval	Trøndelag	855255332	50	0	-926	-730	-1852.00%	7266			
9	Fiskeri og Havbruksnær Landsforen		0.50	1		Trøndelag	982893380						9006	firmapost@fhl.no	www.fhl.no	3
10	Flatanger Settefisk AS		2.50		Salmar	Trøndelag	864943632	22,695	19,789	2,807	1,697	12.37%	7770			3
11	Follasmolt AS		5.50		Salmar	Trøndelag	937543948	94,299	74,760	5,671	13,813	6.01%	7796			28
12	Haukvik Kraft-Smolt AS		1.00			Trøndelag	953000105	5,845	5,495	1,109	1,432	18.97%	7203			3
13	Høsøien Janne		0.02			Trøndelag										
14	Knutshaugfisk AS	2				Trøndelag	836881362	45,111	49,463	10,118	11,303	22.43%	7252			8
15	Kråkøy Slakteri AS	1				Trøndelag	985872406	12,741	14,228	-379	461	-2.97%	7180			33
16	Kvernviklaks AS		2.00			Trøndelag	966306831	11,238	12,108	-601	5,038	-5.35%	7817			3
17	Ianstein Fisk AS		0.80		Salmar	Trøndelag	966154241	3,252	2,497	664	-129	20.42%	7510			
18	Lernes Fiskeindustry AS	1				Trøndelag	876240912	6,829	7,150	98	119	1.44%	7200			18
19	Lernes R AS	3				Trøndelag	961047730	45,506	45,746	4,139	7,615	9.10%	7200			8
20	Lerøy Hydrotech AS		2.00		Lerøy	Trøndelag	965831436	602,663	472,657	21,541	2,844	3.57%	6512		hydrotech.n	173
21	Lerøy Midnor AS	25	8.00		Lerøy	Trøndelag	985848718	823,289	781,018	162,550	187,257	19.74%	6687			243
22	Lund Fiskeoppdrett AS	2				Trøndelag	943304947	42,437	53,935	4,469	9,495	10.53%	7818			8
23	Marine Harvest Norway AS	52	17.50	1	MH	Trøndelag									marineharvest.com	
24	Midt Norsk Havbruk AS	9	0.30			Trøndelag	963867212	213,896	264,258	33,476	64,855	15.65%	7900			23
25	Måsøval Fishfarm AS	1			NRS	Trøndelag	939811249	101	11,144	-1,126	1,140	-1114.85%	7266			
26	Måsøval Fiskeopprett AS	1			NRS	Trøndelag	933792854	86,078	128,764	-7,198	11,382	-8.36%	7266			18
27	Måsøval Settefisk AS		1.00			Trøndelag	890011632	15,437	11,910	747	3,405	4.84%	7266			
28	Namdal Settefisk AS		2.20			Trøndelag	987245069	29,505	21,691	9,355	8,719	31.71%	7819			3
29	Neptun Settefisk AS		1.40			Trøndelag	958438370	23,544	17,202	3,400	2,975	14.44%	7819		neptunsette	13
30	Nesset Fiskemottak AS	1				Trøndelag	944829466	4,877	15,908	-3,165	2,244	-64.90%	7770			3
31	Norges Teknisk-Naturvitenskapelige		0.01			Trøndelag	974767880						7034	postmottak@adm	www.ntnu.no/	
32	Olden Oppdrettsanlegg AS		0.50			Trøndelag	979993528	15,948	16,810	1,035	2,971	6.49%	7168			8
33	Pharmaq AS	1				Trøndelag	886953402	321,325	228,277	84,159	53,090	26.19%	275	customerservice@	http://www.	103
34	Refsnes Laks AS	2			NRS	Trøndelag	980649598	56	3	-3,670	-3,542	-6553.57%	7177			
35	Rørvik Fisk & Fiskmatforretning AS	1				Trøndelag	922996628	118,255	5,043	1,975	2,549	1.67%	7900			3
36	Salmar Farming AS	25			Salmar	Trøndelag	872290672	1,076,856	1,078,509	283,448	317,487	26.32%	7633			108
37	Salmar Processing AS	1			Salmar	Trøndelag	958973306	2,240,949	1,878,340	16,333	70,931	0.73%	7266		salmar.no	388
38	Sinkaberg-Hansen AS	8			Sinkab. Hans	Trøndelag	976543718	530,320	460,068	10,795	29,210	2.04%	7982			143
39	Sintef Fiskeri og Havbruk AS	1	0.00			Trøndelag	980478270	116,682	102,206	1,532	4,452	1.31%	7010			108
40	Val Vgs AS	1				Trøndelag	966819898						7970		www.val.vg:	1
41	Veterinærmedisinsk Oppdragsscenter	1	0.27			Trøndelag	963201230	234,401	149,400	2,494	-131	1.06%				38
42	Vikan Settefisk AS		0.40			Trøndelag	974536463	8,691	9,875	571	3,246	6.57%	7250			3
43	Vikna Sjøfarm AS	3				Trøndelag	952662813	82,192	74,812	17,045	14,098	20.74%	7900			8
44	Willksen Nils AS	1				Trøndelag	883691822	450,321	489,099	-14,529	5,090	-3.23%	7900			68
45	Woll Henrik Hoel		0.05			Trøndelag							7660			
46	Åsen Settefisk AS		2.50			Trøndelag	964943818	22,856	22,156	5,647	5,761	24.71%	7630			8
	Sum Trøndelag	**159**	**48.95**	**0**				**7,617,616**	**6,907,384**	**700,761**	**913,936**					
	Reell matfiskprod. (tn) og smoltutsett i 2008	162614	46.70													

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Møre og Romsdal

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgrad	Postno.	e-mail	Webpage	Antall ansatte
1	Aqua Farms Vartdal AS	3				Møre og Romsdal	935509920	58,284	61,699	5,606	7,447	10%	6170			8
2	Aqua Gen AS			2		Møre og Romsdal	964367701	45,816	94,791	16,474	17,726	36%	7010			63
3	Aqua Gen AS		0.50			Møre og Romsdal										
4	Bringsvor Laks AS	2			Havdyrkerne	Møre og Romsdal	931643797	31,707	23,697	2,037	5,193	6%	6089			3
5	Eikremsvik Marius AS (AS Settefisk)	1			NRS	Møre og Romsdal	931104497	26,690	13,029	4,909	2,965	18%	6260			3
6	Erik Mareno Langset		1.00			Møre og Romsdal										
7	Ertvaag Settefisk		0.20			Møre og Romsdal	970574956						6693			3
8	Fiskeri og Havbruksnær Landsforen			1		Møre og Romsdal										3
9	Fjordlaks Aqua AS	7	1.75			Møre og Romsdal	828764292	241,782	94,223	-46,357	-116,623	-19%	6200			58
10	Follasmolt AS		3.00			Møre og Romsdal	937543948	94,299	74,760	5,671	13,813	6%	7796			28
11	Halsa Fiskeoppdrett AS	2			Salmar	Møre og Romsdal	HALSA FISKEOPPDRETT AS med organisasjonsnummer 984 633 815 ble slettet 16.12.2008									
12	Henden Fiskeindustri AS	1			Salmar	Møre og Romsdal	960740025	16,130	35,177	-2,857	-2,856	-18%	6530			18
13	Henden Fiskeindustri AS	1				Møre og Romsdal										
14	Hjelvik Settefisk AS		1.00			Møre og Romsdal	946432121	8,809	8,334	2,238	2,635	25%	6387			3
15	Høgskolen I Ålesund	2				Møre og Romsdal	971572140						6009			
16	Kraft Laks AS		1.00		Havdyrkerne	Møre og Romsdal	974531488	15,846	14,512	4,739	4,841	30%	6120			8
17	Lerøy Hydrotech AS	22	1.30		Lerøy	Møre og Romsdal	965831436	602,663	472,657	21,541	2,844	4%	6512		hydrotech.n	173
18	Lerøy Mindnor AS	6	2.50		Lerøy	Møre og Romsdal	985848718	823,289	781,018	162,550	187,257	20%	6687			243
19	Lien Settefisk AS		0.20			Møre og Romsdal	930369527	1,878	1,925	209	274	11%	6694			3
20	Marine Harvest Norway AS	37	10.35		MH	Møre og Romsdal										
21	Måsøval Fishfarm AS	1			NRS	Møre og Romsdal	939811249	101	11,144	-1,126	1,140	-1115%	7266			0
22	Nofima Marin AS	2	0.48			Møre og Romsdal	989278835	11,884	274,779	-405	-18,393	-3%	9019		nofima.no	3
23	Ramsøy Fiskeoppdrett AS	1			Lerøy Hydrote	Møre og Romsdal	RAMSØY FISKEOPPDRETT AS med organisasjonsnummer 952 167 618 ble slettet 19.01.2009									
24	Rangøy Einar AS	1			Salmar	Møre og Romsdal	EINAR RANGØY AS med organisasjonsnummer 961 441 749 ble slettet 18.12.2008									
25	Rauma Eik AS		0.50			Møre og Romsdal	979398875	7,945	9,966	1,299	2,406	16%	6265			3
26	Rauma Misund AS	5			Raumagrupper	Møre og Romsdal	948874628	106,405	46,825	-24,662	12,593	-23%	6240			18
27	Rauma Stamfisk AS		0.50	1	Raumagrupper	Møre og Romsdal	975798186	19,901	55,936	-2,826	5,884	-14%	6387			3
28	Raum Sætre AS		2.00			Møre og Romsdal	841139402	21,042	16,004	4,854	4,889	23%	6392			3
29	Romsdal Processing AS	1				Møre og Romsdal	858401852	28,427	25,365	88	-719	0%	6475			24
30	Salmar Farming AS	11			Salmar	Møre og Romsdal	872290672	1,076,856	1,078,509	283,448	317,487	26%	7633			114
31	Smøla Klekkeri og Settefiskanlegg AS		2.50			Møre og Romsdal	935701643	18,022	15,263	5,679	5,769	32%	6570			13
32	Straume Fiskeoppdrett AS	2			Havdyrkerne	Møre og Romsdal	941268706	27,841	33,513	-1,182	5,385	-4%	6120			3
33	Straumsnes Settefisk AS		0.60		Salmar	Møre og Romsdal	952982389	5,249	5,184	817	1,546	16%	6670			3
34	Torjuvågen Settefisk AS		2.00			Møre og Romsdal	959744637	8,162	12,707	-1,189	2,210	-15%	6629			3
35	Urke Fiskeoppdrett AS		1.00			Møre og Romsdal	938413789	16,683	17,566	4,672	4,827	28%	6196			8
36	Vartdal Fiskeoppddrett AS		0.80			Møre og Romsdal	929419006	17,644	22,206	3,469	5,104	20%	6170			8
37	Vikenco AS	1				Møre og Romsdal	988014036	258,151	165,109	6,209	4,297	2%	6480			33
38	Villa miljølaks AS	1			Villa Organic	Møre og Romsdal	983442404	12,232	17,422	-7,975	-13,678	-65%	6392		villaorganic.	3
39	Villa Smolt AS		0.50		Villa Organic	Møre og Romsdal	986431446	10,235	11,165	2,504	3,737	24%	6076			3
40	Western Seaproducts AS	1				Møre og Romsdal	944725520	8,648	9,392	150	126	2%	6170			18
41	Øylaks AS	1				Møre og Romsdal	918020322	32,666	18,442	16,809	-19	51%	6475			3
42	Aakvik Settefisk AS		0.40	1		Møre og Romsdal	937568460	25,303	24,200	3,968	10,302	16%	6680	aakvik-s@svorka.net		8
	Sum / average Møre og Romsdal	**112**	**34.08**	**5**				**3,680,590**	**3,546,519**	**471,361**	**480,409**	**-27%**				
	Reell matfiskprod. (tn) og smoltutsett i 2008	103249	31.80													

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http://maps.google.com/maps/ms?ie=UTF8&msa=0&msid=107184069642279947215.00047764a69ec8ec2a9ba&ll=63.595005,8.679199&spn=1.895941,4.943848&z=8

Sogn og Fjordane

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgrad	Postno.	e-mail	Webpage	Antall ansatte
1	Aqua Farms Foredling AS / Slakteriet	1				Sogn og Fjordane	979598009	27,913	32,523	968	1,388	3.47%	5961		slakteriet-as	38
2	Arnafjord Settefisk AS		1.00			Sogn og Fjordane	993096911	7,437		3,274		44.02%	6893			
3	Barlindbotn Settefisk AS		2.00		Havdyrkerne	Sogn og Fjordane	948825627	18,034	24,620	4,584	8,313	25.42%	6940			3
4	Birknes Martin E Eftf AS	1				Sogn og Fjordane	961389070	39,540	33,346	1,845	2,430	4.67%	5970			48
5	Bolstad Fjordbruk AS	3			Salmon Group	Sogn og Fjordane	966451238	149,059	129,830	2,570	22,125	1.72%	6964			18
6	Bru Fiskeoppdrett AS (Barlindbotn Settefisk A/S)		0.15			Sogn og Fjordane	929190262	308	700	191	579	62.01%	6940			
7	Firda Eiendom AS	1				Sogn og Fjordane	982205875	354,329	294,652	31,980	33,788	9.03%	5970			8
8	Firda Settefisk AS		4.25			Sogn og Fjordane	940316073	25,640	28,782	1,106	1,027	4.31%	6723			8
9	Firda Sjøfarmer As	12				Sogn og Fjordane	936678432	331,098	267,962	29,663	25,763	8.96%	5966			23
10	Fjord Forsk Sogn AS		0.05			Sogn og Fjordane	891905912	572		160		27.97%	6856			1
11	Flokenes Fiskfarm AS	2			Havdyrkerne	Sogn og Fjordane	958608837	34,838	22,128	6,713	1,663	19.27%	6983	flokenes@havdyrkerne.r		8
12	Gjølanger Settefisk AS		2.40		Salmon Group	Sogn og Fjordane	985338078	18,187	21,752	2,126	10,738	11.69%	6967			3
13	Hyen Fisk AS		0.80		Havdyrkerne	Sogn og Fjordane	939530185	11,862	13,316	1,599	5,682	13.48%	6829			3
14	Hyen Laks AS	1			Havdyrkerne	Sogn og Fjordane	941696031	13,882	16,749	-2,589	-3,010	-18.65%	6829	hyenlaks@online.no		3
15	Karma Havbruk AS	2			E. Karstensen/	Sogn og Fjordane	986363076	15,925	10,523	4,406	-1,963	27.67%	6914			
16	Karstensen E. Fiskeoppdrett AS	1			Havdyrkerne	Sogn og Fjordane	935730724	22,561	15,998	4,406	-3,536	19.53%	6917			3
17	Landøy Fiskeoppdrett AS	2			Salmon Group	Sogn og Fjordane	931967061	33,026	22,541	1,046	2,712	3.17%	6986			8
18	Lia Laks AS		0.60		Salmon Group	Sogn og Fjordane	942273266	5,637	3,725	1,725	1,083	30.60%	6924			3
19	Marine Harvest Norway AS	39	5.43		MH	Sogn og Fjordane										
20	Marø Havbruk AS	1			Havdyrkerne	Sogn og Fjordane	939064893	21,941	16,077	3,537	-1,704	16.12%	6914			3
21	Nordfjord Havbruk AS	1			Havdyrkerne	Sogn og Fjordane	976583531	16,296	19,085	661	-6,383	4.06%	6713			3
22	Norevåg Fisk AS		0.30		Salmon Group	Sogn og Fjordane	982851653	3,877	4,164	280	539	7.22%	6928			3
23	Osland Havbruk AS	5	1.30	1	Havdyrkerne	Sogn og Fjordane	920002218	62,518	64,682	960	-10,697	1.54%	5962			13
24	Rakmarkaren Ans		0.25			Sogn og Fjordane	886030002						6715			
25	Sande Settefisk AS		1.00		Havdyrkerne	Sogn og Fjordane	957896650	13,677	9,388	4,445	3,102	32.50%	6823			3
26	Sandnes Fiskeoppprett AS	2			Salmon Group	Sogn og Fjordane	935415039	35,414	43,405	7,031	18,526	19.85%	6967	postmaster@sandnes-fis		3
27	Skjerdal Settefisk AS		1.00		Havdyrkerne	Sogn og Fjordane	992257555	1,656		-1,914		-115.58%	6828			
28	Slakteriet AS	1				Sogn og Fjordane	988408905	288,516	219,665	-283	5,594	-0.10%	6900		slakteriet-as	43
29	Sol Smolt		0.50		Salmon Group	Sogn og Fjordane	936768148	8,105	6,934	1,188	838	14.66%	6924			3
30	Solund Ferie AS	1				Sogn og Fjordane	974527553	54	77	-23	0	-42.59%	6924			3
31	Steinvik Fiskefarm AS	6			Havdyrkerne	Sogn og Fjordane	958123701	157,115	169,672	14,202	5,768	9.04%	6940			13
32	Steinvik Fiskefarm Visningssenter AS	1				Sogn og Fjordane	991295119	0	0	-120	-21		6940			
33	Strømmen K. Lakseoppdrett AS	5	0.09			Sogn og Fjordane	825923772	50,651	46,906	-3,256	-504	-6.43%	6734			13
34	Sulefisk AS	4			Salmon Group	Sogn og Fjordane	935307724	38,386	48,925	8,156	-987	21.25%	6924			8
35	Svanøy Havbruk AS		0.12	2	Havdyrkerne	Sogn og Fjordane	988718181	19,416	16,495	-2,522	630	-12.99%	6914			3
36	Vilnes Falk og Magnar Ans	1				Sogn og Fjordane	984095694						6985			
	Sum / average Sogn og Fjordane	**93**	**21.24**	**3**				**1,827,470**	**1,604,622**	**128,115**	**123,483**	**8%**				
	Reell matfiskprod. (tn) og smoltutsett i 2008	68,865	20.40													

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Hordland

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgrad	Postno.	e-mail	Webpage	Antall ansatte
1	Al Nordsjø AS	2				Hordland	914725739	44,066	41,398	4,230	3,500	10%	5430			8
2	Alsaker Fjodbruk AS	1				Hordland	979494009	16,465	17,111	329	37	2%	5694			13
3	ASk Dambruk AS		0.40			Hordland	928925129	1,259	1,127	-1,286	-1,124	-102%	5307			3
4	Austefjorden Smolt AS		1.20			Hordland	951790850	40	0	-1,475	-3,634	-3688%	5381			
5	Austevoll Fiskefarm AS	1			Melaks-Havdyrkerne	Hordland	959473706	19,644	23,054	3,448	4,877	18%	5384			13
6	Austevoll Fiskeindustry	1				Hordland	980536378	241,114	117,105	-28,059	-12,785	-12%	5392			98
7	Bjølve bruk AS		2.50		Alsaker	Hordland	979724551	18,700	32,574	4,655	7,274	25%	5614			3
8	Blom Fiskeoppdrett AS	6	0.15			Hordland	840215512	89,609	74,831	12,144	10,155	14%	5337			18
9	Bolaks AS	9	0.30	1		Hordland	930391328	202,345	161,937	13,585	17,557	7%	5640		bolaks.no	28
10	Bolstad Fjordbruk AS	3			Salmon Group	Hordland	966451238	149,059	129,830	2,570	22,125	2%	6964			18
11	Bolstad Settefisk AS		0.90		Havdyrkerne	Hordland	982326435	8,206	8,191	3,530	3,902	43%	5640			3
12	Brakedal AS		1.00			Hordland	958716796	10,609	10,307	1,301	3,193	12%	5420			3
13	Brandsund Fiskeforedling AS	1				Hordland	943020035	115,637	117,636	2,394	2,163	2%	5423			98
14	Bremnes Seashore AS	6	3.70			Hordland	836597702	475,528	372,513	31,303	57,599	7%	5430			218
15	Brilliant Fiskeoppdrett AS	2			NRS	Hordland	961238900	15,330	21,735	-31,007	-2,302	-202%	5444			3
16	Drageid Laks AS		0.39		Trombe/Havdyrkerne	Hordland	933889750	6,070	5,314	746	783	12%	5640			3
17	Dåfjorden Klekkeri AS		0.17		Salmon Group	Hordland	990930783	1,061	1,994	-212	429	-20%	5416			3
18	Eide Fjordbruk AS	3			Salmon Group	Hordland	866751242	73,166	79,579	3,437	9,685	5%	5640	knut-frode@eide-fjordbruk.n		8
19	Eide K. J. Fiskeoppdrett AS		1.10			Hordland	936830315	73,641	79,939	5,796	10,835	8%	5636			
20	Eidesvik Settefisk AS		2.50		Salmon Group	Hordland	985191840	19,609	18,472	4,257	5,896	22%	5443		eidesvikhavfis	8
21	Eingesund Fiskeoppdrett AS	1			Salmon Group	Hordland	944819967	11,570	8,273	-2,277	1,004	0%	5419			3
22	Espevær Fiskeoppdrett AS	2				Hordland	937047304	39,377	34,548	3,517	-3,687	9%	5420			3
23	Espevær Laks AS	1				Hordland	973190954	35,851	39,402	-3,037	807	-8%	5443		espevaer.no	33
24	Ewos Innovation AS	3	1.00			Hordland	911501252	129,491	136,886	8,849	1,983	7%	4335			63
25	Femangerlaks AS		1.00		Havdyrkerne	Hordland	939377697	11,210	7,607	2,819	1,869	25%	5647			
26	Firda Settefisk Aløen AS		1.10			Hordland	966950153	9,487	10,259	453	3,840	5%	5179			8
27	Fiskekultur AS	1				Hordland	925963232	222	20,721	-535	-6,026	-241%	5984			
28	Fiskeri og Havbruksnær Landsforen			1		Hordland	974461021	77,136		-2,938		-4%	8006			
29	Fjelberg Fjordbruk AS	4			Alsaker	Hordland	940887836	56,327	58,833	-564	-10,487	-1%	5459			8
30	Fjon Bruk AS		5.00		Alsaker	Hordland	983664490	30,559	24,213	8,581	4,336	28%	5550			8
31	Fjord Drift AS	1				Hordland	871596832	15,131	22,578	278	758	2%	5947			
32	Fjordfarm AS	1				Hordland	877347672	30,356	9,104	681	-3,745	2%	5337			
33	Fylkesnes Fisk AS	3			Salmon Group / NRS	Hordland	861034852	63,216	36,719	3,429	1,069	5%	5430			3
34	Fyllingsnes Fisk AS	1			Havdyrkerne	Hordland	930387215	40,305	27,938	196	-4,620	0%	5913			3
35	Handelsforeningen Fremskridt AS	2			Havdyrkerne	Hordland	811833452	43,224	38,216	5,290	8,611	12%	5430			8
36	hardanger Fiskefordling AS	1				Hordland	942395701	35,775	27,274	1,399	335	4%	5630			33
37	Hardingsmolt AS		5.00		Havdyrkerne	Hordland	989867202	14,334	6,174	-4,838	-3,847	-34%	5620			3
38	Havforsksningsinstituttet	1	0.80	1		Hordland	971349077							havforsknings	http://www.imr.no	
39	Hennco Laks AS	2			Salmon Group	Hordland	981694090	44,817	31,007	11,484	-2,494	26%	5335			3
40	Hordaland Fylkeskommune	2				Hordland	938626367							hfk@post.hfk.	http://www.hordaland.no	
41	Høgskolen I Bergen		0.01			Hordland	974652366								hib.no	
42	Igland Bruk AS		0.72		Alsaker	Hordland	946109614	6,835	5,431	-90	885	-1%	5640			3
43	Kobbevik og Furuholmen Oppdrett AS	7			Salmon Group	Hordland	947607855	147,786	127,630	7,089	-13,964	5%	5392			13
44	Langøylaks AS	2			Salmon Group	Hordland	939538992	41,626	33,503	4,859	4,975	12%	5387			3
45	Lerøy Fossen AS	1			Lerøy	Hordland	917056595	175,648	242,587	9,130	26,541	5%	5281		fossen.no	113
46	Lerøy Vest AS	34	10.50		Lerøy	Hordland	886813082	556,389	320,863	-31,418	-22,519	-6%	5392		dof.no	118
47	Lindås Fiskeoppdrett AS		2.50			Hordland	937314337	10,571	16,866	-291	4,610	-3%	5956			3
48	Linalaks AS	6			NRS	Hordland	960900626	130,039	86,526	11,687	23,037	9%	5630			18
49	Ljones Fisk AS		1.50		Havdyrkerne	Hordland	838159362	7,979	13,245	-2,083	4,504	-26%	5620			8
50	Lone Alf		0.08			Hordland										
51	Marine Harvest Norway	11	11.00	2	MH	Hordland	959352887	5,364,340	5,595,165	657,456	1,002,800	12%	5035			1193
52	Marøy Salmon AS	2			Salmon Group	Hordland	934904990	26,354	33,693	3,337	5,243	13%	5937			3
53	Melaks AS	1			Havdyrkerne	Hordland	992847972	19,579		3,340		17%	5384			
54	Nordvik Fiskeoppdrett AS		0.10			Hordland	983459730	0	0	-44	-97		5014			
55	Onarheim Bruk AS		0.60		Alsaker	Hordland	992259418	11,908		1,557		13%	5694			3
56	Quatro Laks AS	2			Trombe/Havdyrkerne	Hordland	963666721	44,685	38,166	4,918	4,334	11%	5640			3
57	Sagvåg Settefisk AS		0.00			Hordland	990011702	0	0	-417	-358		5003			
58	Salar Smolt AS		5.00		Alsaker	Hordland									www.salarsmolt.no	
59	Sekkingstad AS	1				Hordland	963950837	632,177	621,492	4,844	9,068	1%	5382			43
60	Sildolje og Sildemelindustriens Forskningsin:	1				Hordland	941710824	1,614	1,539	-717	-398	-44%	5141			
61	Sjøtroll Havbruk AS	23	10.80	1	Sjøtroll	Hordland	929363833	751,646	728,484	-15,571	56,325	-2%	5397		sjotroll.no	118
62	Skjørgårdsfisk AS	1			NRS	Hordland	938124426	24,677	11,651	3,689	-15,141	15%	5937			3
63	Sotra Fiskeindustri AS	1				Hordland	963079699	126,294	117,202	7,387	4,921	6%	5381			68
64	Sotra Yngel AS		0.25			Hordland	955149157	0	0	-42	-11		5381			
65	Steinvik Fiskfarm AS	1				Hordland	958123701	157,115	169,672	14,202	5,768	9%	6940			13
66	Strømsnes Akvakultur AS		2.50		Salmon Group	Hordland	936100112	22,462	9,845	6,726	2,702	30%	5307			8
67	Sunnhordland Fjodbruk AS	2			Alsaker	Hordland	928801373	64,465	58,086	4,064	7,808	6%	5593			3
68	Sævareid Fiskeanlegg AS		5.72			Hordland	924931671	59,576	46,994	9,645	12,829	16%	5645		sevareid.no	13
69	Sørvest Laks AS	1				Hordland	983970400	0	0	-3	-3		4770			
70	Telavåg Fiskoppdrett AS	1			Salmon Group	Hordland	939174508	8,666	11,783	529	2,411	6%	5380			3
71	Tombre Fiskeanlegg AS	3	0.72		Havdyrkerne	Hordland	941541240	77,026	42,551	12,043	5,877	16%	5640			3
72	Treca AS		0.05			Hordland	971169257	61	70	-122	-176	-200%	5593		safisk@online.no	
73	Troland Lakseoppdrett AS	1			Salmon Group	Hordland	956876354	24,988	27,593	1,691	5,760	7%	5384			3
74	Tysnes Fjordbruk AS	4			Alsaker	Hordland	979495358	82,051	70,416	898	12,216	1%	5694		alsaker.no	13
75	Vik Settefisk AS		0.50			Hordland	987723459	4,655	1,440	136	-620	3%	5337			3
76	Viking Fjord AS	1			Alsaker	Hordland	979700121	47,305	49,026	-326	1,471	-1%	5450			38
77	Økland Egil N. / Lier Fiskeoppdrett AS		0.50			Hordland	974278812	2,501	2,917	526	645	21%	5551			3
78	Ølve Bruk AS		0.05			Hordland	989878344	0	35	-282	-242		5637			
	Sum / average Hordland	**168**	**81.31**	**6**				**10,900,564**	**10,338,870**	**782,820**	**1,281,072**	**-60%**				
	Reell matfiskprod. (tn) og smoltutsett i 2008	141,151	46.40													

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Rogaland

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgr	Postno.	e-mail	Webpage	Antall ansatte
1	Bremnes Seashore AS	7				Rogaland	836597702	475,528	372,513	31,303	57,599	7%	5430			218
2	Centre for Aquaculture Competence	1				Rogaland	984080115	52,661	3,906	2,347	2,713	4%	4130			
3	Eidane Smolt AS		3.40			Rogaland	964830355	23,583	18,962	7,327	5,878	31%	4110			8
4	Eidesvik Laks AS	3			Salmon Group / NRS	Rogaland	938354286	46,274	53,540	-390	5,905	-1%	4182			3
5	Eidsund Fisk AS		0.16			Rogaland										
6	Erfjord Stamfisk AS	1		1		Rogaland	943706573	72,059	60,459	3,554	3,747	5%	4233		erfjord.no	23
7	Ewos Innovation AS	1	0.60			Rogaland	911501252	129,491	136,886	8,849	1,983	7%	4335			63
8	Feøy Fiskeopprett AS	3			NRS	Rogaland	939817735	65,918	74,830	10,206	8,299	15%	5548			8
9	Finnøy Fisk AS	2				Rogaland	944663002	20,526	13,526	9,098	4,138	44%	4130			
10	Fister Smolt AS		2.40			Rogaland	981979583	15,279	13,346	2,880	2,082	19%	4139			3
11	Frøfisk AS		0.4			Rogaland	939817646	6,860	6,610	1,747	2,740	25%	5574			3
12	Fåra Invest AS		0.15			Rogaland	968412965	0	0	-23	-20		5566			
13	Grieg Seafood Rogaland AS	15	2.00		Grieg-gruppen	Rogaland	838065392	178,446	301,326	-20,419	22,833	-11%	5561			93
14	Gåsland Torleif		0.03			Rogaland	969084554						4389			
15	Ilsvåg Holding AS	1	1.50			Rogaland	938233535	24,743	30,343	13,330	19,060	54%	5585			8
16	Lerøy Vest AS		2.49		Lerøy	Rogaland	886813082	556,389	320,863	-31,418	-22,519	-6%	5392		dof.no	118
17	Lysefjodsenteret AS	1				Rogaland	977249600	5,523	5,363	638	581	12%	4110			8
18	Marine Harvest Norway AS	17			MH	Rogaland	959352887	5,364,340	5,595,165	657,456	1,002,800	12%	8130			1193
19	Nina Froskningsstasjon		1.00	1		Rogaland	950037687	210,684	174,312	225	-6,600	0%	4308			188
20	Parmaq AS	1				Rogaland	886953402	321,325	276,894	84,159	69,259	26%	213		http://www.	103
21	Rogaland Fjordbruk AS	6			Alasker	Rogaland	938567697	105,730	92,334	9,387	27,291	9%	4235			13
22	Rogaland Fylkeskommune	1	0.00			Rogaland	971045698						4001	irmapost@rogfk.no		
23	Røvær Fjordbruk AS	1			Alasker	Rogaland	977203740	50,493	36,605	3,892	10,983	8%	5549		alsaker.no	2
24	Sjernarøy Maritime AS	1				Rogaland	957169295	2,394	2,458	185	480	8%	4170			3
25	Skretting Arc AS	1	0.10			Rogaland	929729161	90,248	78,490	4,549	-2,174	5%	4016			63
26	Suldalssmolt		0.20			Rogaland	993401919						4234			
27	Svihus Damfisk Svein Svihus		0.10	1		Rogaland	870444192						4308			
28	Sølvfisk AS		2.50			Rogaland	978669700	0	0	-49	-22		4230			
29	Toftøy Fjordbruk AS	2			Alasker	Rogaland	935443881	32,508	111,079	-1,656	11,499	-5%	5560			8
30	Vågafossen Settefisk AS		2.00			Rogaland	938233446	16,138	15,897	2,586	3,188	16%	5583			8
31	Åmøy Fiskeoppdrett AS	1				Rogaland	ÅMØY FISKEOPPDRETT AS med organisasjonsnummer 947 202 014 ble slettet 17.09.2009									
32	Åmøy Fjordbruk AS	1			Alasker	Rogaland	966740124	500	0	493	-8	99%	4152			
	Sum / average Rogaland	**67**	**19.03**	**3**				**7867640**	**7795707**	**800256**	**1231715**	**16%**				
	Reell matfiskprod. (tn) og smoltutsett i 2008	52,407	18.70													

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Adger

Tall i hele tusen. Valutakode: NOK

	Selskap	Matfisk-kons.	Till.kap. setterfisk	Stamfisk-kons	Gruppering	Fylke	Org nr	Sum driftsinntekter 2008	Sum driftsinntekter 2007	Driftsresultat 2008	Driftsresultat 2007	Resultatgrad	Postno.	e-mail	Webpage	Antall ansatte
1	Havforskningsinstituttet			1		Agder	971349077						5004	havforsknin	http://www.imr.no	
2	Hellesund Fiskeoppdrett AS	1			NRS	Agder	951375772	15,843	20,557	1,016	6,568	6%	4770			3
3	Korshavn Havbruk AS	1				Agder	994224514						4586			
4	Marine Harvest Norway AS	15			MH	Agder	959352887	5,364,340	5,595,165	657,456	1,002,800	12%	8130			1193
5	Hjelleseth Sigmund		0.05			Agder							4436			
6	Kvås Terje A.		0.2			Agder	970552790						4588			
7	Marine Harvest Norway AS		1			Agder										
8	Norsk Institutt For Vannforskning	1				Agder	855869942	273,392	245,783	-3,791	1,349	-1%	4544			108
	Sum / average Agder	**18**	**1.25**	**1**				**5,653,575**	**5,861,505**	**654,681**	**1,010,717**	**6%**				
	Reell matfiskprod. (tn) og smoltutsett i 2008	10,752	3.05													

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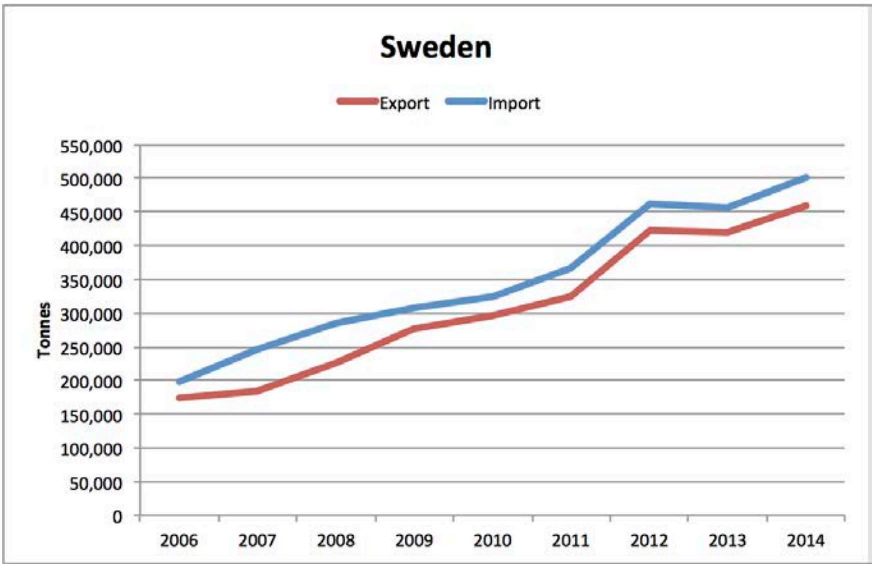
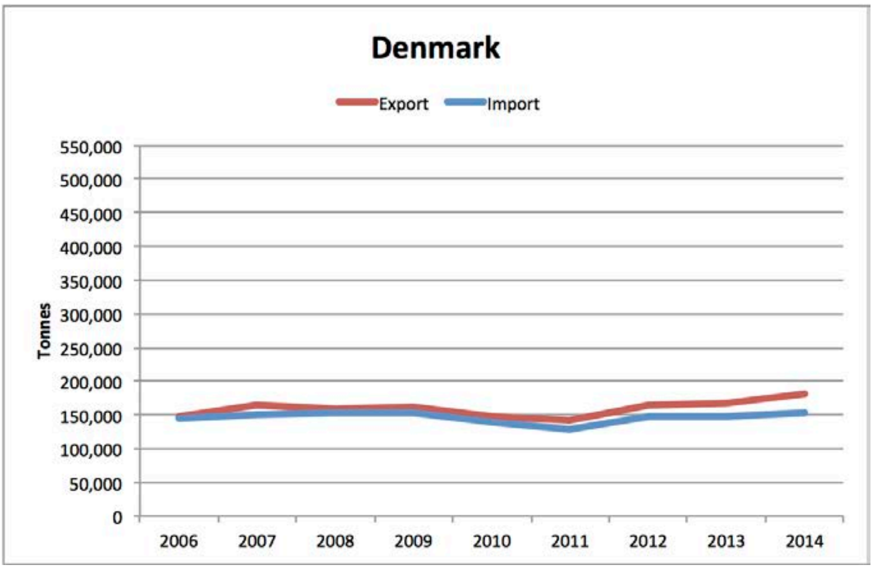
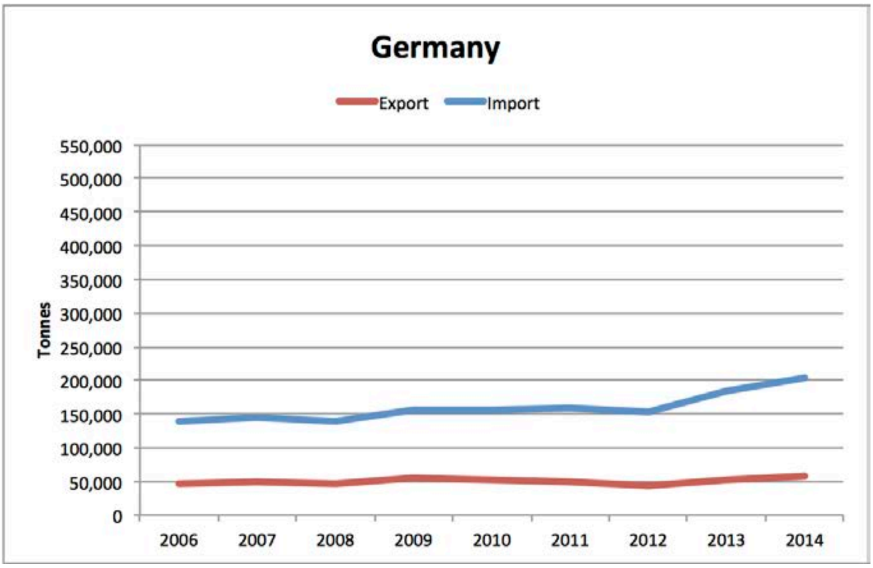
http://maps.google.com/maps/ms?hl=en&ie=UTF8&msa=0&msid=107184069642279947215.0004781932925db0c7a51&ll=58.539595,7.46109&spn=0.278093,0.617294&z=11&iwloc=00047819532427a13399e

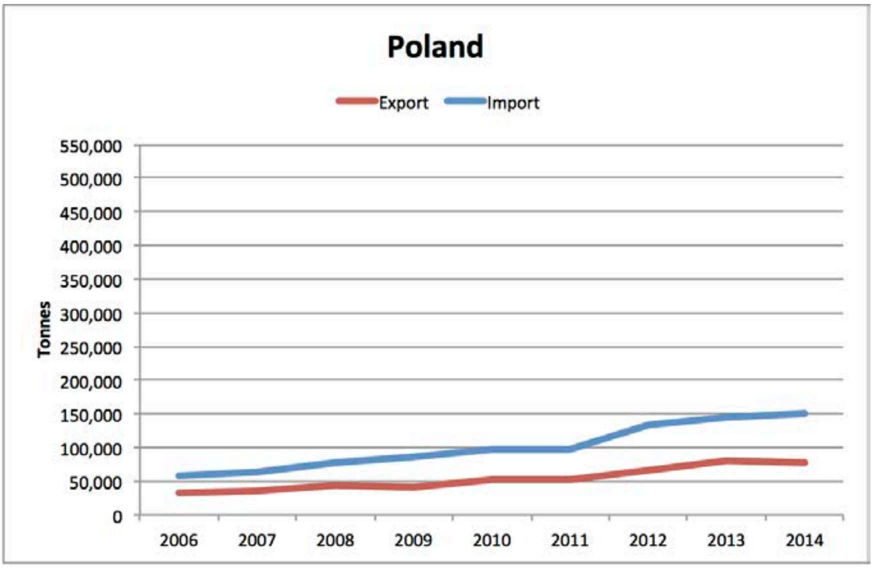
Annex XXI – Salmon trade



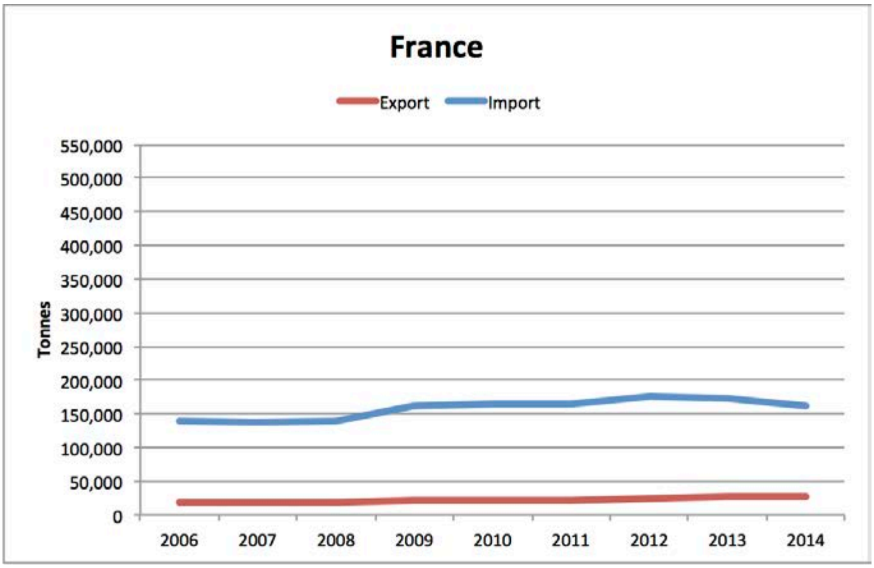


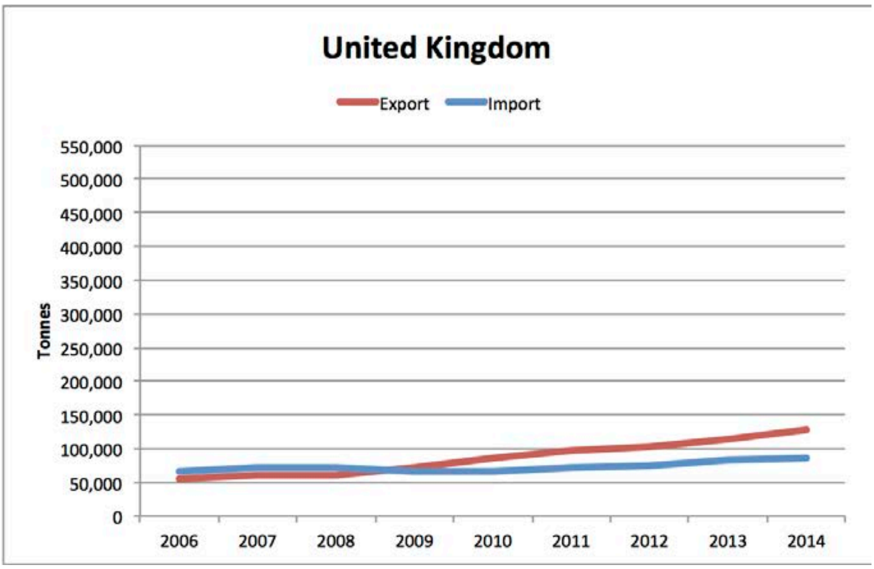
(EUMOFA, 2015a)





(EUMOFA, 2015a)





(EUMOFA, 2015a)

Annex XXII – Five forces model templates

Threat of Competitive Rivalry

Low | Threat Levels | High

DF†

[X] Few/Leader — *Existing Competitors* — Numerous/Balanced

Existing competitors consists of few large and numerous smaller ones

[ ] Slow/Negative — *Industry Growth* — High

The production of Norwegian salmon has stabilised in the recent two years.

[X] Low — *Fixed and/or Storage Costs* — High

Salmon farming requires large amounts of patient capital

[ ] Low — *Product Differentiation* — High

Products are very price sensitive, due to different quality and condition on the spot market

[ ] Low — *Switching Costs* — High

The importance of the spot market, gives buyers the low switching costs

[ ] Low — *Strategic Stakes* — High

The salmon farming industry is quite layered with vertically integrated companies vs smaller

[ ] Small Increments — *Capacity Expansion* — Large Increments

Expensive licence and long growth period

[ ] Low — *Exit Barriers* — High

Investment intensive sector thus high exit barriers

THREATS
1. The spot market plays too big role in the price development.
2. The sector needs constant innovation in product development and promotions so salmon products do not become trivial commodity item.
OPPORTUNITIES
1. Positive image of salmon products that are viewed high quality and healthy
2.There is still room for increased strategic partnership to improve the supply chain

Notes: *Rivalry necessitates price cuts, new product development, advertising campaigns, service improvements depending on the intensity and basis of competition between rival organizations; †DF – driving factors of industry dynamics to be indicated with check marks.

Threat of Buyers/Buying Groups*

Low	Threat Levels	High

DF†

☐ Single/Few — *Buyer Orders* — Large Volumes

It is quite hard to evaluate this dimension so slightly above average!

☐ Low — *Buyer Information* — High

Buyers have easy access of information for the salmon market

☐ Not Feasible — *Buyer Backward Integration* — Credible Threat

Many retailers are cooperating with processers and even own their own

☐ Highly Differentiated — *Industry Products* — Standardized

Even though salmon is sold in several different markets the min share is standardized

☐ X Low — *Buyer Switching Costs* — High

The spot markets gives buyer high bargaining power

☐ Low % — *Overall Buyer Costs* — High %

Salmon is highly perishable item

☐ Operating Losses — *Buyer Profitability* — High Profits

Happy customers come again

☐ Low Impact — *Buyer Product/Service* — High Impact

Buyers, especially retailers

THREATS
1. If buyers become to few and large they can gain great bargaining power
2.
OPPORTUNITIES
1. Salmon has still potential of gaining new markets such as in Asia
2.

Notes: *Powerful buyers (the first five) and/or price sensitive buyers (the last three) force down prices, demand better quality/service, and play competitors off one another; †DF – driving factors of industry dynamics to be indicated with check marks

Threat of Suppliers/Supplier Groups*

Low	Threat Levels	High

DF†

☐ Many Organizations — *Supplier Concentration* — Few Organization

The salmon farming industry has increased the share of non-fish items in formulated fish feed

☐ Low % — *Supplier Volume/Profit* — High %

The importance of marine proteins and fish oils is still essential

☐ Not Feasible — *Supplier Forward Integration* — Credible Threat

The suppliers are not likely to start enter

X☐ Standardized — *Supplier Products* — Highly Differentiated

☐ Low — *Industry Switching Costs* — High

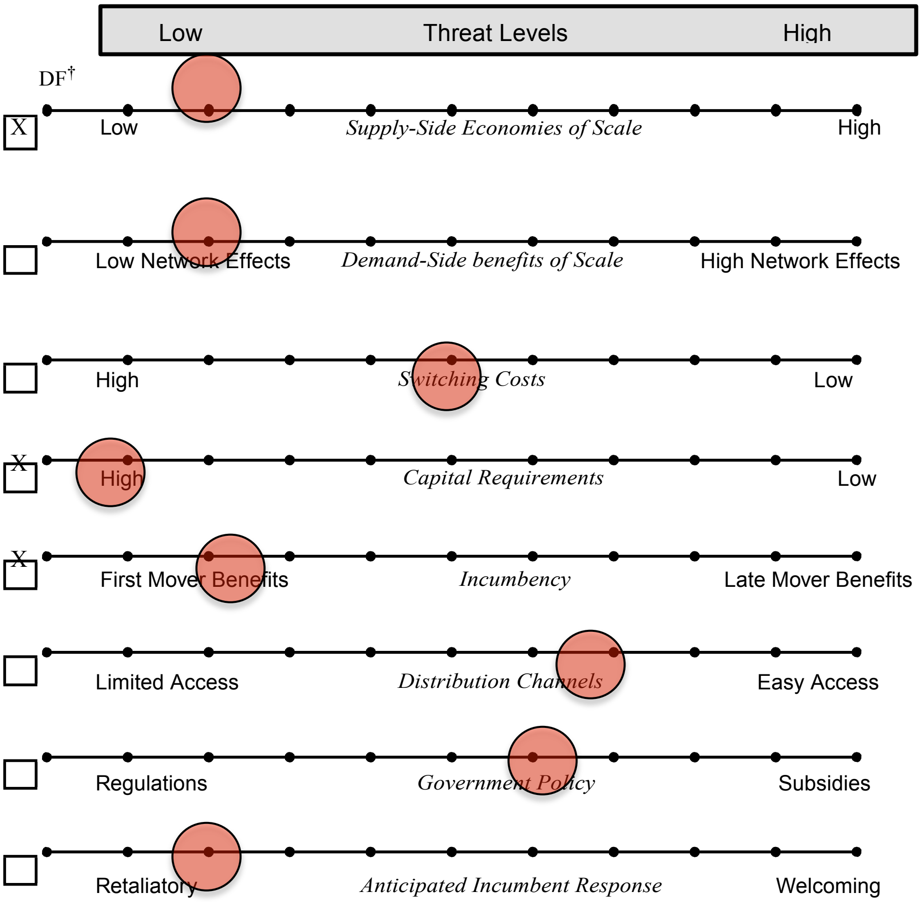
☐ Many Viable Options — *Supplier Substitutes* — No Viable Options

THREATS
1. Formulated fish feed still needs significant amount of marine sources ingredients
2.
OPPORTUNITIES
1. The salmon farming industry has increased the share on vegetables in formulated fish feed

Notes: *Powerful suppliers charge higher prices, limit product/service feathers/quality, and/or shift costs to other industry players; †DF – driving factors of industry dynamics to be indicated with check marks

MM

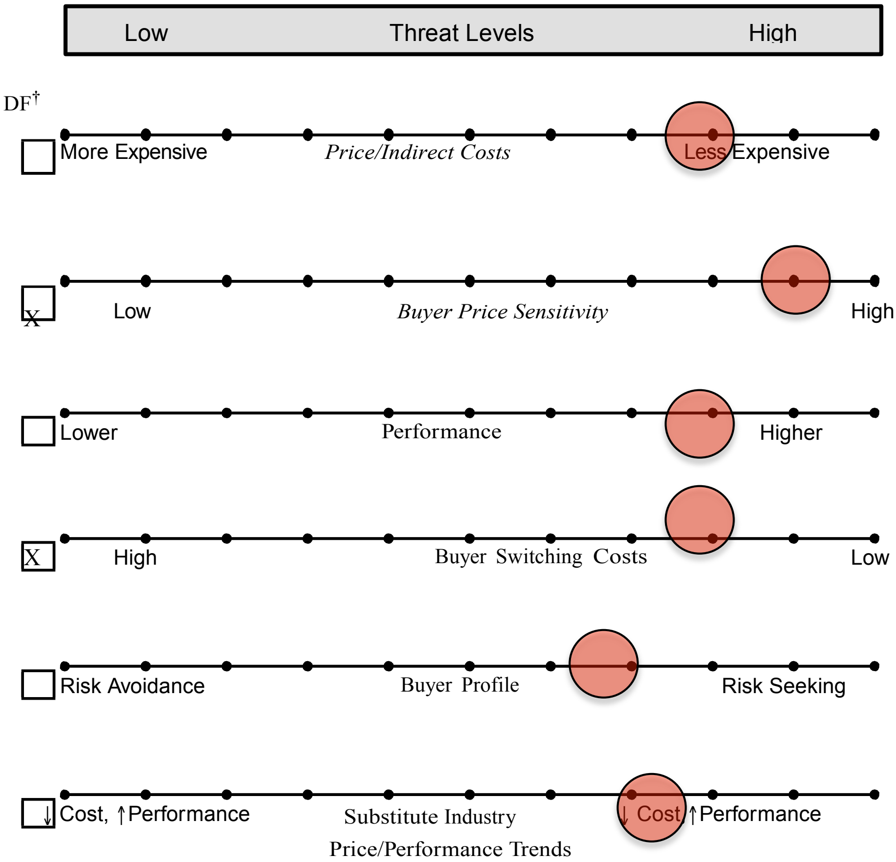
Threat of New Entrants*



THREATS
1. Other type of farmed species from other regions
2.
OPPORTUNITIES
1. Well established industry with positive image. 2. The industry is very capital intensive and it is hard to acquire licenses

Notes: *The threat of new entry puts downward pressure on prices, and upward pressure on costs/rate of investment necessary to keep new entrants out of the industry; †DF – driving factors of industry dynamics to be indicated with check marks

Threat of Substitutes*



THREATS
1. Lo price
2.
OPPORTUNITIES
1. Quality and strong image
2.

Notes: *Substitutes perform the same/similar function as products of the industry but by different means. Viable substitutes place a ceiling on prices and drive up costs related to product performance, marketing, service, and R&D; †DF – driving factors of industry dynamics to be indicated with check marks