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The State of the Chilean Salmon Industry

Exploring opportunities for Belgian companies

Felix Victor

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Tikkarinne 9
80200 JOENSUU
+358 13 260 600 (switchboard)

Author(s)

Félix Victor

The State of the Chilean Salmon Industry

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Abstract

Chile is the second biggest salmon producer in the world after Norway. Its abundant fjords in the south of the country offer ideal conditions to farm salmon species. A growing production has helped Chile, and in particular the southern regions to advance economically.

This thesis was prepared for Flanders Investment and Trade (FIT), the Flemish agency that helps Belgian companies export abroad. In this precise context, the thesis was written for FIT Santiago to get an overview of the state of the Chilean Salmon industry.

The purpose of the research is to analyze the competitiveness of the industry, get an overview of the industry's global positioning and identify both the potential opportunities and risks that the industry presents for Belgian companies.

The research included both qualitative and quantitative approaches, in order to understand the market and identify the current conditions for making investments. These market conditions were analysed using SWOT and Porter's five forces tools.

The results show that the industry has reached consolidation. There lie opportunities in optimizing the production process and improving fish health. A renewed trade agreement with the European Union is set to boost exports of salmon to Belgium. However, government regulations and climate change can still impact the industry negatively.

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Appendix 1 List of salmonid aquaculture concessions grouped by concessions in the regions, June 2023

Appendix 2 List of Plants Authorized to Slaughter and/or Process Salmonids 2022

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1 Introduction

Chile is the longest country in the world. It has a coastline of 6,435 kms and the Andes Mountain range, which extends the entire length of the country. The South American nation is known for its remarkable natural diversity, as there are many different ecosystems. The north is characterized by the driest desert in the world with unique geological formations. The central region, including the capital Santiago, has a Mediterranean climate that produces many reputed wines. Even more to the south, the country is home to the Valdivian rainforest with many lakes and forests. These landscapes gradually change into the eighth wonder of the world, Chile's Patagonia. (Gobierno Chile 2023.)

As a result of this natural abundance, the country has large reserves of many important metals such as copper, gold and silver. These raw materials make up large parts of Chilean exports. Furthermore, Chile has the third largest lithium reserves in the world. This mineral is often referred to as the white gold, as it is a crucial element in energy transition. (Invest Chile 2023.)

After years of dictatorship, Chile became a democracy on March 11, 1990. Since then, the country has experienced strong economic growth thanks to political stability and the openness to international commerce (Gobierno Chile 2023.). This allowed key export industries to develop, such as mining, the food industry and fish farming, among others (Fundación Chile 2023). For this reason, Chile is considered an example for Latin American countries as it has successfully handled its abundant resources.

This thesis will specifically focus on the development of the salmon industry. The main purpose is to provide the reader a global picture of the sector and find market opportunities for Belgian companies. In addition, the conditions to import salmon from Chile to Belgium will be studied.

The following sections provide an introduction to the background of the study and describe the reasons behind the author's selection of this particular subject. These segments outline the primary goal of the thesis, along with the research objectives and sub-questions.

1.1 Research aim and objectives

The goal of the thesis is to answer the question “What are the current growth prospects and market trends within the Chilean Salmon industry?” Additionally, the following questions were raised to give Belgian companies useful insights on the industry:

- How do these trends impact Belgian companies willing to enter this market?
- What trade agreements and tariffs are present between the European Union and Chile?
- What risks and opportunities should Belgian companies consider?
- How competitive is the industry internally and globally?

The objective of the thesis is to provide useful information to Belgian companies who have activities related to fish production and aquaculture and have an interest in expanding to the Chilean market. Secondly, the thesis provides information about the conditions to import Chilean salmon to Belgium.

This work can be used for future research, as the thesis includes characteristics of international trade, such as global trends, trade agreements and potential challenges and opportunities.

1.2 Outline

The objective of the research is to study the state of the Chilean salmon industry and gain market insights to identify the main risks and opportunities for Belgian companies. For this reason, an overview of the global aquaculture industry has been performed as an introduction to the salmon industry, as salmon farming is a branch of the aquaculture practices.

The overall framework of the thesis consists of six chapters. The first chapter is an introduction to present the country of Chile. In this chapter questions are raised about the opportunities, challenges and the current market environment, all of which are used to analyse the salmon industry throughout the market research.

The second chapter is dedicated to the description of the aquaculture sector, to gain a better understanding of the context in which the salmon industry operates and demonstrate why it is a relevant topic. This is followed by a full analysis of salmon production in Chile, including relevant statistics and data.

The third chapter is devoted to the research methods of the thesis and introduces the structure of the practical part of the thesis.

The fourth chapter assesses the competitiveness of the industry through a Porter's Five Forces analysis. It reveals the major players of the industry and identifies the main challenges confronting the industry as well as its predominant strengths. In addition, Chile's trade relations with its key export destinations is studied, and the competitive positioning of the industry is compared to its major competitors around the world.

The fifth chapter unveils the market opportunities and trends within the industry that could be of interest to Belgian companies and concludes with a strategic assessment through a SWOT analysis.

The sixth chapter summarizes the previous chapter and provides an overview of the main points of the study. The most interesting ideas are cited together with recommendations for future research.

To conclude, the first three chapters focus on the theoretical base and the detailed description of the market research, whereas Chapters 4, 5 and 6 include the empirical parts of the research. The content of this thesis serves as a source of guidance and suggestions for Belgian companies.

1.3 Background

This thesis is part of an internship at Flanders Investment and Trade (FIT), the agency that helps Flemish companies export abroad and internationalize. Furthermore, it encourages foreign companies to invest in Flanders. FIT has 93 offices around the world. In 2022, exports from Flanders were worth 479 billion euro. The most important export products were chemicals and pharmaceuticals, mineral products and transport equipment. (Flanders Investment and Trade 2023.)

This market research will give insights to Belgian companies about the Chilean salmon industry, which has remained relatively unfamiliar. This can be attributed to the great distance between the countries and language barriers. Apart from the goals and research objectives for this research mentioned in the previous chapter, the author's aspired outcome is a rise in interest from Belgian companies to expand into the Chilean salmon industry and consider imports of salmon to Belgium.

2 Market Analysis

This chapter gives an overview of the global aquaculture industry and unveils trends within the sector. This is followed by a comprehensive analysis of the global salmon industry and an in-depth look at the Chilean salmon industry itself.

2.1 The global Aquaculture industry

In 2019, 20% of salmon species were caught, while the other 80% came from aquaculture (Ziegler & Hilborn 2023, 2). The practice of aquaculture is often referred to as fish farming. In simpler terms, it is the controlled production of animals and plants, making it the counterpart of classical agriculture on land. The practice can be done in fresh water (lakes and rivers), brackish water and seawater. (National Oceanic and Atmospheric Administration 2023.)

Edward and Demain (1988), two experts of the food and agriculture organization, provided an accurate definition of aquaculture, referring to it as "the farming of aquatic organisms, including fish, molluscs, crustaceans, and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc." (Edward & Demain 1988).

Although fish farming has only been developing and growing the past couple of decades, is a century old practice. It dates back to 4000 years in early China, where common carp were farmed (Rabanal 1988). Accordingly, aquaculture serves primarily as food production for human consumption and offers an important alternative to industrial fishing. However, fish farming can also have other purposes, such as rebuilding fish populations of threatened species, restoring habitats and producing bait fish, among others. (National Oceanic and Atmospheric Administration 2023.)

For the past couple of decades, aquaculture has become a crucial sector in the supply of fish. It offers an alternative to industrial fishing, which has been facing criticism due to overfishing and damaging of marine ecosystems. Industrial fishing peaked in the 1990s and has since stagnated. Nevertheless, pressures on fish stocks have continued to increase, and many species are considered highly vulnerable. FAO calculated that about one-third of marine fish stocks are overfished, and 60% of fish stocks worldwide are at maximum sustained levels (Figure 1). (Searchinger, Waite, Hanson, Ranganathan, Dumas, Matthews & Klirs 2019, 285-290.)

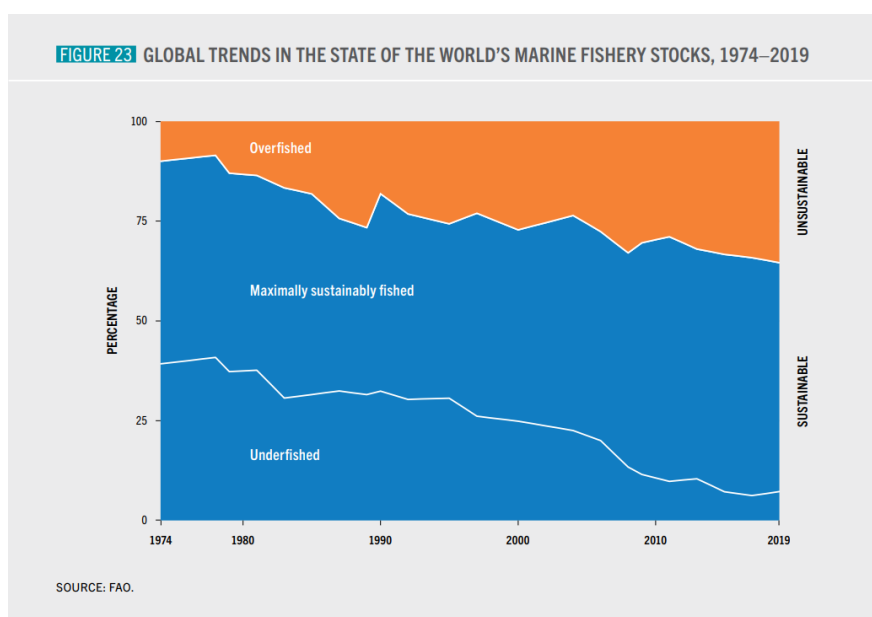


Figure 1. Global trends in the state of the world's marine fishery stocks, 1974–2019 (FAO 2022, 47).

Despite the fact that commercial fishing has remained stable, global fish consumption has continued to increase. This can be clarified by the additional supply of fish by aquaculture producers. Accordingly, the aquaculture industry has seen its annual output expand by 609 % between 1990 and 2020, or 6.7 % on a yearly basis (Figure 2). This growth was significantly achieved by finfish inland aquaculture and marine and coastal aquaculture (Figure 2). Salmon and trout species fall under these categories. (FAO 2022, 26.)

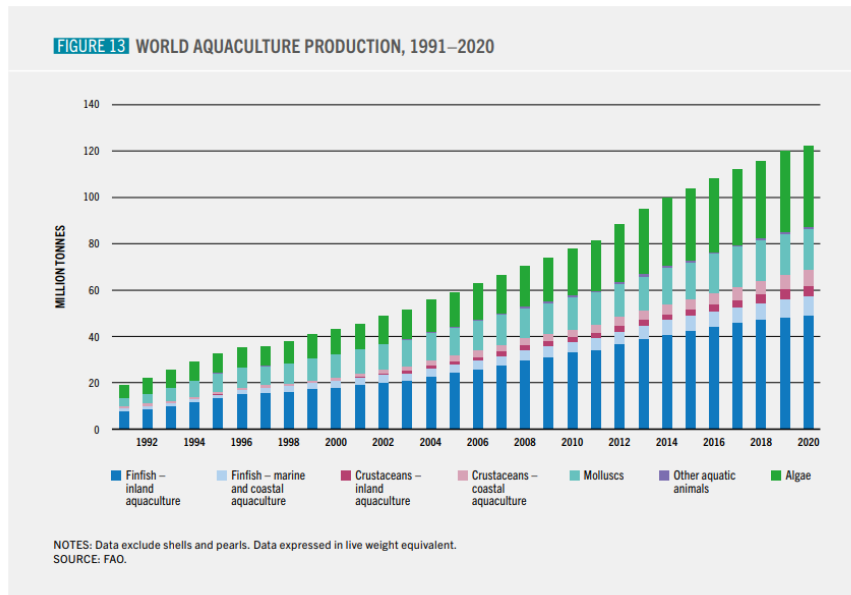


Figure 2. World Aquaculture Production (FAO 2022).

Correspondingly, aquaculture has responded to an increase in demand, countering the stagnation of wild fish captures, and has become the main source of fish production. Furthermore, the future holds good prospects, as an additional increase of production will be required to further push commercial fishing to sustainable levels and satisfy the growing fish demand worldwide owed to the growing population (Searchinger et al. 2019, 6, 285-290).

The world population is expected to grow to 9.7 billion by 2050 (United Nations 2022). This will expectedly trigger a rise in food demand of about 50% and a rise in fish consumption of about 58% by that same year (Searchinger et al. 2019, iv, 290). Considering the high pressures and limits of commercial fishing, aquaculture will need to meet the increase in demand. Researchers of the World Resources Institute projected that aquaculture should reach 140 Megatonnes by 2050 to meet demand (Figure 3). This figure more than doubles the total output of aquaculture in 2010 which was 60 megatonnes. Consequently, there are substantial challenges in store to achieve this goal in a sustainable and responsible way. (Searchinger et al. 2019, 297.)

Figure 23-2 | Aquaculture production must continue to grow to meet world fish demand

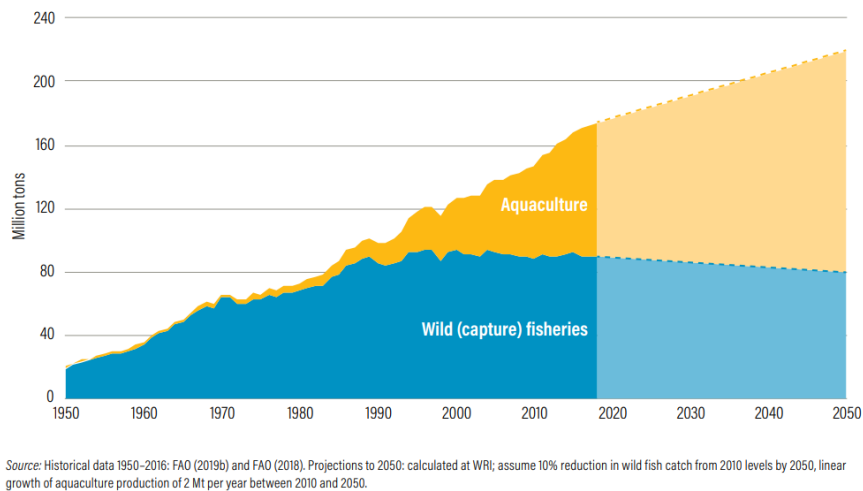


Figure 3. Evolution of Industrial fishing and aquaculture production including future projections (Searchinger et al. 2019, 295).

In this thesis, the focus will be on salmon and trout production. Hereby, the production of other aquatic organisms will not be studied in this thesis. However, it is important to note that there is a wide variety of organisms that is farmed worldwide, including molluscs, crustaceans, seaweed, algae, prawns and other fish species, among others (National Oceanic and Atmospheric Administration 2023).

In 2020, the total aquaculture production worldwide yielded a production of 122.6 million tonnes in live weight (FAO 2022, 26). According to Eurostat 2023, liveweight is the actual weight of the fishery product as it was taken from the water and before being subjected to any processing or other operations (Eurostat 2023). Finfish reached 57.5 million tonnes. It accounted for 66% of total production of aquatic animals in aquaculture, which reached 87.5 tonnes. The remaining 35.1 million tonnes of aquaculture production were attributed to algae. (FAO 2022, 26.)

In 2020, Asian countries were the largest suppliers of aquatic animals, both in commercial fishing and aquaculture. They accounted for 70% of production

globally. The Americas followed with an output of 12%. Europe, Africa and Oceania accounted for 10%, 7% and 1%, respectively. (FAO 2022, 8.)

In 2019, China was by far the biggest aquaculture producer, followed by Indonesia, India and Vietnam (Table 1). Chile only comes in 13th place, yet it occupies an important role since it is the second largest salmon producer in the world (European Commission 2019).

Main world producers (2019)
(catches and aquaculture)
(volume in 1000 tonnes live weight and percentage of total)

| Country | Catches | Aquaculture | Total production | % Total |
|---------------|---------|-------------|------------------|---------|
| China | 14 169 | 64 423 | 82 593 | 38.66% |
| Indonesia | 7 524 | 15 893 | 23 418 | 10.96% |
| India | 5 477 | 7 800 | 13 277 | 6.22% |
| Vietnam | 3 429 | 4 455 | 7 884 | 3.69% |
| EU-28 | 4 824 | 1 366 | 6 191 | 2.90% |
| United States | 4 803 | 490 | 5 293 | 2.48% |
| Russia | 4 983 | 248 | 5 231 | 2.45% |
| Peru | 4 851 | 153 | 5 005 | 2.34% |
| Philippines | 2 056 | 2 358 | 4 414 | 2.07% |
| Bangladesh | 1 895 | 2 488 | 4 384 | 2.05% |
| Japan | 3 230 | 943 | 4 174 | 1.95% |
| Norway | 2 472 | 1 453 | 3 925 | 1.84% |
| Chile | 2 376 | 1 407 | 3 783 | 1.77% |
| South Korea | 1 366 | 2 406 | 3 773 | 1.77% |
| Myanmar | 1 951 | 1 082 | 3 033 | 1.42% |
| Thailand | 1 542 | 964 | 2 506 | 1.17% |
| Others | 26 563 | 8 167 | 34 731 | 16.26% |
| Total | 93 519 | 120 103 | 213 623 | 100% |

Table 1. Fisheries and aquaculture production worldwide 2019 (European Commission 2019).

2.2 The global Salmon and trout industry

In this chapter, we will take a deeper look at the global salmon and trout production coming from aquaculture. Wild salmon catches will not be included in this thesis, as its share in global supply is small.

As previously stated, the aquaculture industry is concentrated in Asia with a market share of 70% (European Commission 2019). However, none of these countries have a foot in salmon production as they do not possess the natural conditions to produce salmon. These conditions entail cold water temperatures and sheltered coastlines (fjords). Accordingly, the biggest salmon producers are Norway, Chile, UK (Scotland), Canada and the Faroe Islands. (Global Salmon Initiative 2023.)

The supply of Atlantic salmon in 2022 was 2,863,700 tonnes. In 2022, Norway was the largest exporter of salmonids with 1,255,851 tonnes (FAO 2023). Salmonid is a term that refers to salmon and trout species (Merriam Webster 2023). This term will frequently appear throughout this thesis.

Meanwhile, Chile accounted 751,000 tonnes of salmon and trout in exports. Atlantic Salmon alone made up 692,800 tonnes (FAO 2023).

The United Kingdom produced approximately 205,393 tonnes of salmon in 2021 and forecasted a production for 2022 of about 189,693 tonnes (Scottish Government 2022). Canada does not have production or export figures for 2022. For 2021, it reported the production of salmonids to be 129,552 tonnes (Gouvernement du Canada 2023). Lastly, the Faroe Islands reported a harvest of 89,0801 tonnes of Atlantic salmon in 2022 (Faroese Seafood 2023). The remaining production came from other nations with neglectable outputs. In total, around 81% of the supply salmon came from Norway and Chile in 2022 (Figure 4).

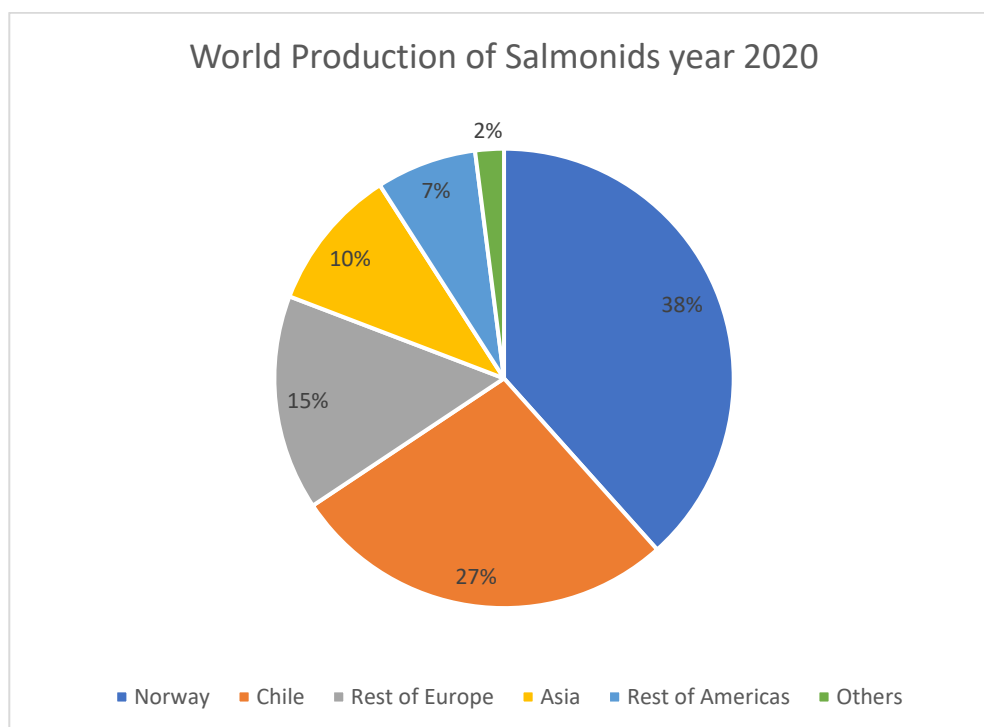


Figure 4. Distribution of world production of salmonids in 2022 (Consejo del salmón 2020).

To conclude, none of these countries has a significant production of fish compared to the world's biggest fish producers situated in Asia. Nonetheless, their role in the salmon industry is pivotal as the required ecological conditions are only present in a select few regions in their territories. Norway and Chile are the leading countries in producing salmonids.

2.3 Salmon and trout industry in Chile

The following sections provide an analysis of the Chilean salmonid industry starting with a historical overview. This will be followed by a description of salmon production to better understand the full process. Subsequently, different sections will cover the current status of the industry based on recent data, including the regions of production, the impact of the salmon industry on these regions, yearly production statistics and exports.

2.3.1 Historical Overview

To better understand how salmon came to Chile, two government agencies will be described that have played crucial roles in the development of the industry. Firstly, CORFO is the agency of economic development, responsible for supporting entrepreneurship, innovation, and competitiveness in Chile. The agency's goal is to strengthen human capital and technological capabilities of Chile with the ultimate aim of contributing to the country's economic growth. (CORFO 2023.) Secondly, Fundación Chile is a public-private agency that supports the development of industries in Chile, by the transfer and implementation of foreign technologies. In some cases, it has founded companies to help the industry grow. The aim of Fundación Chile is to promote the transformation of Chile towards sustainable development. (Fundacion Chile 2023.)

With a deeper understanding of CORFO and Fundación Chile, we can move on to the history of salmon production in Chile. The rise of the aquaculture industry in Chile is characterized by public-private partnerships, cooperation with other nations and "learning by doing". Salmon was first introduced in 1921 by CORFO. The aim was to study the viability of production in Chile. Later, Chile started to collaborate with universities in the United States, and exposed Chilean scientists to Japanese technologies, to transfer knowledge on fish farming to Chile with the ultimate objective of developing the industry. (Montero et al. 2006, 5.)

After a few failed attempts, a Chilean company named Llanquihue Ltd successfully farmed trout with support of CORFO in the 1970s. At the same time, Fundación Chile set up various aquaculture companies. The agency implemented technology from Norway, Scotland and Canada, to prove the feasibility and financial viability of production in Chile. (Montero et al. 2006, 6-10.) Salmones Antártica is the most famous company that originates from Fundación Chile. Both events generated an interest among many investors. Thus, the industry started to expand through the installments of new private companies. (Montero et al. 2006, 6-10.)

The firms of Fundación Chile were later sold to private firms. By 1991, Chile became the second biggest salmon producer after Norway with 56 firms and around 1000 salmon farms. (Montero et al. 2006, 6-10.) Presently, Chile's salmon industry has reached consolidation. It started reaching the state of maturity in the 90s, with the entries of big foreign firms and the exits of smaller firms who saw their profits plunge as a consequence of falling salmon prices. (Montero et al. 2006, 6-10.) That line was continued with the financial crisis and the appearance of the ISA virus in 2007, causing thousands of salmon to be unsuitable for human consumption. These incidents caused dramatic decreases in profitability and obliged small firms to cease activities or merge together. (Oliva, Concha & Araya 2009, 115.)

Nowadays, the industry only counts a few powerful firms with international exposure. Moreover, Chile has attained technological autonomy. To elaborate, the country comes with own innovations for the salmon industry through local research centers and universities. This showcases the progress the industry has made in only a few decades and the transition it has made from dependency on foreign technologies to being self-reliant. (Montero et al. 2006, 6-10.)

2.4 Industry Structure (salmon production...)

The industry counts a few big producers who own the large share of salmon production in Chile. They have vertically integrated their businesses to achieve economies of scale and are important producers globally. A more detailed investigation of the current situation and competitiveness between companies will be elaborated upon chapter 4, covering Porter's Five Forces.

2.4.1 Understanding the salmon production

To better understand the salmon industry, a clear picture of each step in the production process should be put forth. Importantly, production processes between different species may vary, but the methods remain the same. In Chile, three species are produced: Atlantic salmon, Pacific salmon and rainbow trout (Salmón Chile 2023).

1. Atlantic or Salar salmon



Picture 1. Atlantic Salmon (Salmón Chile 2023)

2. Pacific or Coho Salmon



Picture 2. Pacific Salmon (Salmón Chile 2023)

3. Salmonidea Trout



Picture 3. Salmonidea Trout (Salmón Chile 2023)

The Atlantic or Salar salmon is the most commonly produced in Chile, making up 75 % of total salmonids production in 2021 (Figure 5). Pacific salmon followed with a share of 19% and trout constituted 6% of the output. (Consejo del Salmón 2023.)

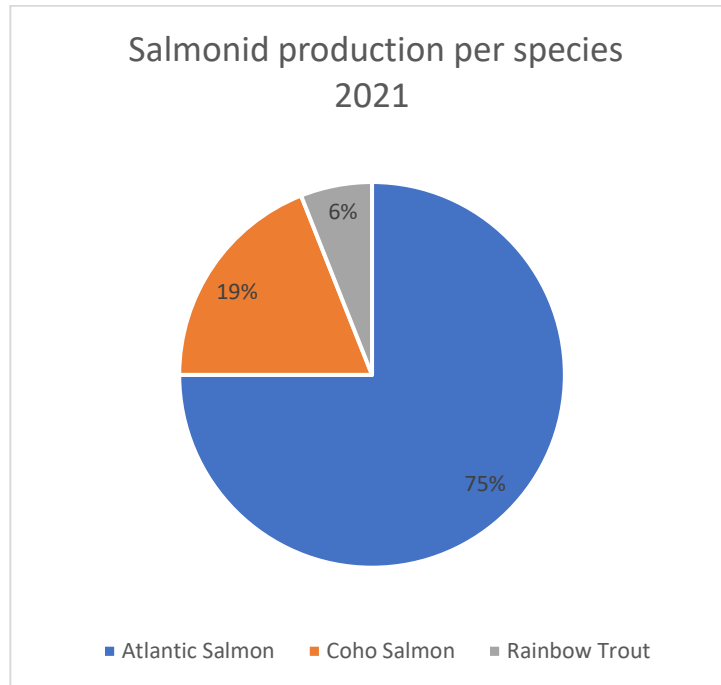


Figure 5. Salmonid production per species 2021 (Consejo del Salmón 2023).

With the three main species identified, we can proceed to a simplified overview of the salmon production cycle (Figure 6). It all starts with the artificial fertilization of salmon eggs. This practice is done under controlled conditions in freshwater incubators. This stage is called the hatchery phase. Once the salmon have grown enough, they are transferred to cultivation tanks in fresh water, and later to saltwater tanks, to adapt to ocean conditions. Finally, they are put in cages in the open ocean, where the farming phase initiates. The salmon stay in these farms until they reach market size. The time to reach market size depends on the salmon species (Montero et al. 2006, 13-14). For instance, Atlantic salmon stay in the sea pens, also known as sea cages 12 to 22 months (Arctic Seafoodexport 2023).

Once they are considered mature, the fish are harvested and transported to facilities to be processed. The transformation that salmon undergo differs, depending on the desired end product. Final products include boneless salmon, smoked salmon, fresh salmon and frozen salmon, among others. Timing and quality control are primordial in this final stage to guarantee the quality and safety of consumption of the salmon. (Montero et al. 2006, 14.)

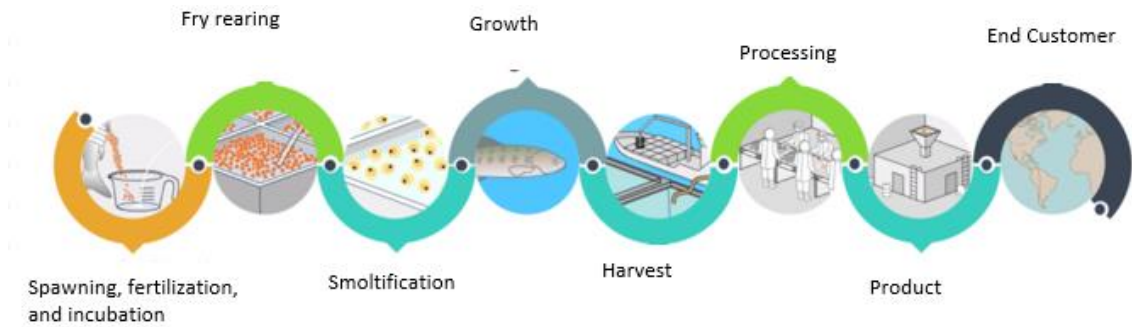


Figure 6. The Salmon cycle (Salmón Chile 2023).

The process of salmonid production is long and complex, spanning several years. In addition, the efforts to raise salmon are considerable. (Arctic Seafoodexport 2023.) For instance, salmon require an important amount of fish feed to grow and fatten up (Mowi 2023, 66-67). In some cases, antibiotics are needed to battle diseases. Moreover, the salmon stay in the same basins for months, meaning that these have to be strong enough to contain them in the cages and prevent escapes (Mowi 2023, 34). Lastly, the chain of activities after the harvest is very technical, as the salmon have to be processed and shipped within a limited timeframe. This is especially the case with fresh salmon. (Montero et al. 2006, 14-15.)

In the case of Chile, these aquaculture related sectors, such as fish feed production and fish oil production, were established simultaneously with the development of the salmon industry to meet local demand. However, as the industry grew, they became independent sectors and started to export outside of Chile too (Montero et al. 2006, 27). Presently, both sectors rank as some of the largest producers worldwide (Figure 7). In addition, producers of industrial equipment emerged, including producers of cultivation tanks and well boats, together with service-related sectors such as maintenance and logistics. (Montero et al. 2006, 1,7.)

Figure 3: WORLD FISHMEAL AND FISH OIL PRODUCTION BY PRODUCING COUNTRIES
(fishmeal, left; fish oil, right)

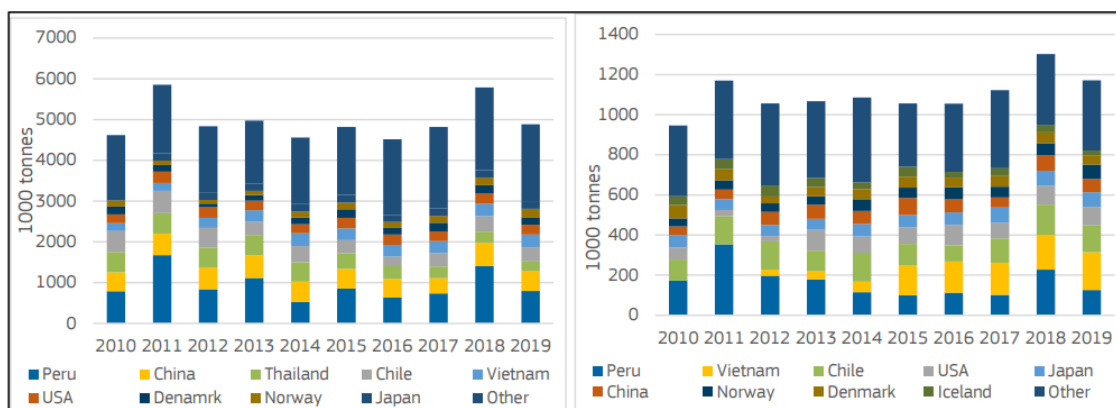


Figure 7. World fishmeal and fish oil production by producing countries (EUFOMA, 2021, 6).

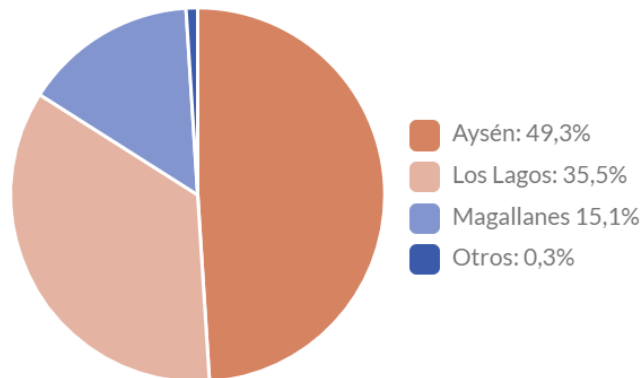
2.4.2 Production by region in Chile

In Chile, there are currently about 3300 aquaculture concessions, aimed to farm aquatic species including salmonids, mussels, algae and abalones (sea snails) (Subpesca 2023). About 1353 concessions are intended for salmonid production (Sernapesca 2023).

According to FAO 2023, an aquaculture concession in Chile is the right to use and benefit from state property (marine beaches; public coastal areas; water-column and seabed lots; navigable rivers and lakes for vessels over 100 gross tons) for an indefinite period of time by allowing the concessionaire to establish an aquaculture facility (FAO 2023).

The vast majority of the salmon concessions are situated in the south of Chile, notably in the provinces of Aysén, Los Lagos and Magallanes (Figure 8). These provinces are often referred to as the Austral region (Figure 9). A very small

part of the production (0.3 %) is located in the provinces of Maule, Biobío, La Araucanía and Los Ríos. (Consejo del Salmón 2023.)



Fuente: Consejo del Salmón, con datos de Sernapesca

Figure 8. Salmon harvests by region in Chile (Consejo del Salmón 2023).

The Austral region offers environmental conditions that are very favorable to salmonid production, even though salmon is not native to this region. These conditions encompass an optimal water temperature, between 8 and 14 degrees Celsius, the right amount of water movement and high levels of oxygen. Without these conditions, good health of salmon cannot be assured. These unique conditions can only be found in archipelagos and fjords. (Mowi 2023, 28.)

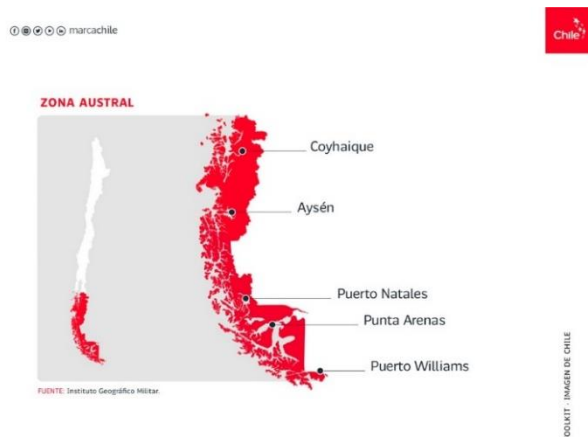


Figure 9. A map of Chile and the Austral region marked in red (Marca Chile 2023).

2.4.3 Impact of Salmon production on the Austral Region

Salmon production has impacted the austral region positively. The standard of living of the region increased through the years thanks to investments in infrastructure, a greater availability of labor and by consequence, a drop in poverty rates.

In Los Lagos, the primary region for aquaculture, poverty rates dropped to 13% from 40%, between 1990 and 2000. (Montero et al. 2006, 2.)

In 2020, the poverty rate in Los Lagos was slightly lower at 11.3%. Meanwhile, in Aysén and Magallanes the rate was only at 6.6% and 7.7% respectively (Ministerio de desarrollo social y familia 2021). The salmon industry accounts for about 21,000 direct jobs and 41,000 indirect jobs in the Austral region.

Therefore, the salmon industry is a fundamental source of employment (Salmon Chile 2023).

In terms of infrastructure, major investments have improved these regions substantially (Oliva et al. 2009 112). This has been crucial to the development of the industry as it has contributed to more efficient logistics and guarantees a consistent quality of salmon, from the harvesting phase to the final customer.

At the present time, logistics are still transforming. To illustrate, salmon normally has to move through cities situated in the North like Puerto Montt and even Santiago to be shipped internationally. However, Chilean companies have recently started to transport salmon directly from the Airport of Natales, a local airport in the region of Magallanes, to the United States. This has been a milestone for the local industry and shows that export techniques are still changing. Especially the delivery of fresh salmon to the United States requires a robust value chain. (Salmon Expert 2020.)

2.4.4 Exports of Salmon and Trout and export destinations

The exports of salmonids have been growing year over year in Chile. It has become one of the major contributors to Chilean exports. Therefore, it is considered a key sector for the country, alongside other sectors like the mining sector or the emerging energy and hydrogen sector. (Invest Chile 2023.)

Salmon and trout exports reached a total of 751,259 tons in 2022, an increase of 3.8% over 2021 (Figure 10). The value of these exports totaled USD 6,606 million, an increase of 27.3% over 2021. In 2022, Salmon and trout were the third largest export products behind copper and lithium. When excluding copper from Chilean exports, salmon and trout exports represented 12.3% of total Chilean exports. (Consejo del Salmon 2023, 1-3.)

Annual exports of salmon and trout, in tonnes and millions USD (2015-2022)

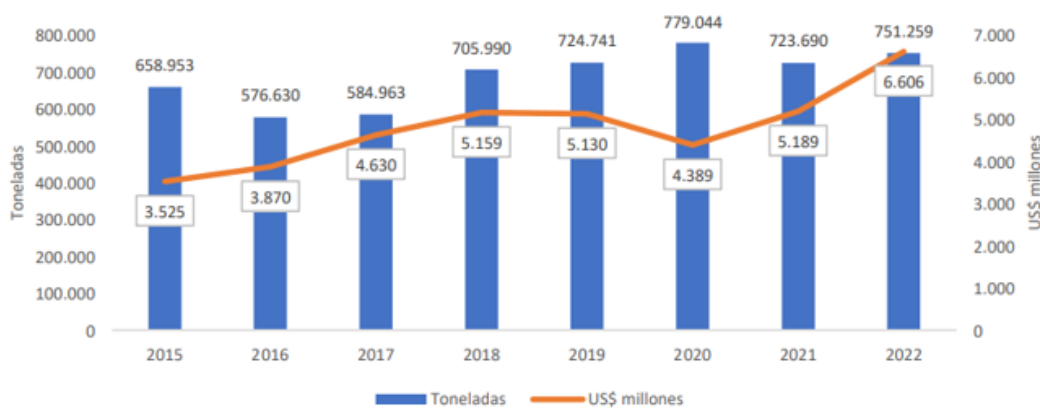


Figure 10. Annual salmon and trout exports, in tons and USD millions (2015-2022) (Consejo del Salmón 2023, 2).

Chile exported salmon and trout to 100 countries in 2022 (Salmón Chile 2023). Its major markets in 2021 were the United States, Japan, Brazil, Russia, China and Mexico (Figure 14).

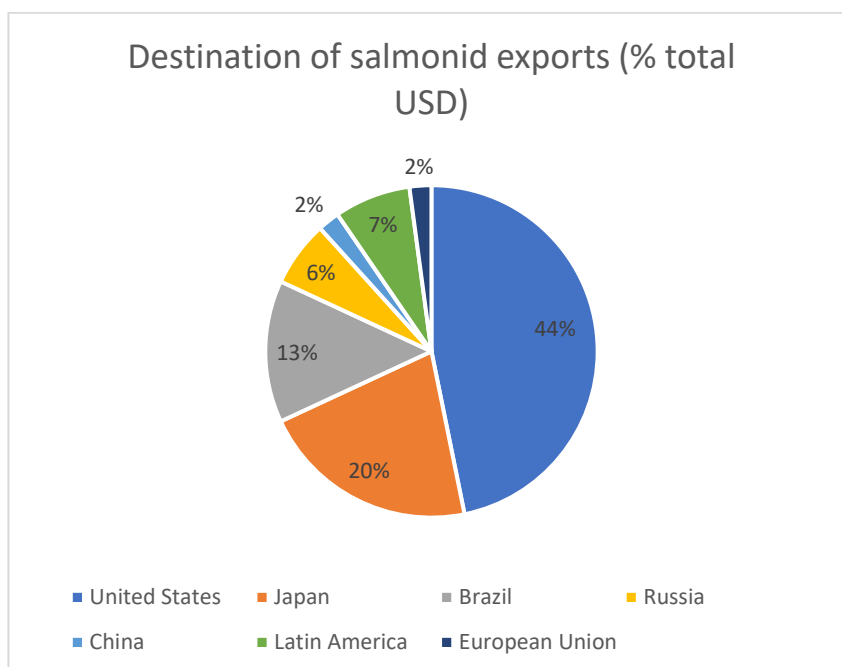


Figure 11. Destination of salmonid exports (% total USD) in 2021 (Consejo del Salmón 2023).

2.4.5 Export trends

As for most commodities, Chile exports salmon in US dollars. This is a rational choice considering the stability and value of the US dollar. By consequence, companies are subject to exchange rate fluctuations between the dollar and the peso. Thus, a weak dollar would imply a lower export figure in Chilean pesos, while a strong dollar would increase profitability for Chilean companies.

Although there are many benefits to trade in US dollars, it should be noted that there exist exchange rate risks, including changes in American politics, economic policies, or global economic conditions. (Allianz 2023.)

In 2022, exports to the United States, Japan and China increased. In the United States, the growth in tonnes was 4.8%, driven by demand in the retail channel (Table 2). Japan had a 0.6% increase, while Brazil, despite a 3.7% drop, remained the third largest destination. Exports to Russia fell by 30.2% due to

the war in Ukraine. China experienced a 58% increase and became the fifth most important destination, displacing Mexico, which had a 27% decrease. (Consejo del Salmon 2023, 1-3).

| Country | Millions USD | | | Tonnes | | |
|--------------------------|--------------|--------------|---------------|----------------|----------------|---------------|
| | 2021 | 2022 | Annual Change | 2021 | 2022 | Annual Change |
| United States of America | 2.281 | 2.845 | 24,7% | 239.576 | 251.132 | 4,8% |
| Japan | 1.032 | 1.209 | 17,1% | 159.498 | 160.400 | 0,6% |
| Brazil | 668 | 804 | 20,4% | 127.293 | 122.567 | -3,7% |
| Russia | 292 | 276 | -5,3% | 50.689 | 35.386 | -30,2% |
| China | 103 | 188 | 82,8% | 16.090 | 25.416 | 58,0% |
| Mexico | 141 | 195 | 38,4% | 24.438 | 17.674 | -27,7% |
| Others | 673 | 1.089 | 61,8% | 106.106 | 138.685 | 30,7% |
| Total | 5.189 | 6.606 | 27,3% | 723.690 | 751.259 | 3,8% |

Table 2. Exports of salmon and trout by market, in tonnes and value in USD in millions (Consejo del Salmón 2023, 3).

For the first semester of 2023, Salmón Chile estimates that the value of Chilean salmon exports has reached USD 3.788 million, which represents 7% of total Chilean exports. This shows an increase of 3% over the same period of the previous year. (Salmón Chile 2023.)

At the same time, Consejo del Salmón, estimates that exports of salmonids during the first half of 2023 totaled more than 373,734 tons, or USD 3.307 million. This implies a growth of 2% over the first semester of 2022. Although a clear figure is not available yet, we can say that salmon and trout production had a satisfactory first half-year, based on these figures. Importantly, the main export countries have remained the same. (Consejo del Salmón 2023.)

2023 and 2024 are expected to be beneficial periods for the Chilean salmon industry. Prices are expected to remain high thanks to high demand, and this despite concerns about inflation and economic uncertainty (Carcés 2023).

3 Research methodology

3.1 Research methods

The research focuses on the investigation of the state of the Chilean salmon industry. This analysis determines the industry's competitiveness, alongside the opportunities and needs of the industry and the current conditions to import salmon to Belgium.

The thesis uses both quantitative and qualitative research approaches. Quantitative research included collecting secondary data from reliable online sources, reports and official documents. These sources include government institutions such as the World Bank, FAO, Consejo del Salmón, salmon companies and the European Union, but also news articles originating from reliable and niche-specific news reports. The qualitative research methods include interviews with industry experts. Finding relevant contacts was facilitated by Flanders Investment and Trade and its extensive network in Chile. The questions can be found at the end of the thesis (Appendix 3).

More specifically, one interview was conducted with a Belgian company that has been importing salmon into Belgium since 2003. The aim of this interview was to confirm the viability of importing to Belgium and to get information about the threats of substitutions for salmon. Additionally, questions were raised about the use of antibiotics and the awareness of Belgian customers on this issue. Moreover, information was sought about the opportunities of the modernized

trade agreement. In this thesis, the company will be referred to as Company A, as anonymity is requested.

The second interview was conducted with a general manager of INTESAL, a technical institute of salmon. This agency is enrolled in providing technical and scientific information in Chilean salmon farming, facilitating the integration of R&D and innovation, and transferring technologies for the responsible development of the industry (Intesal 2023). The main goal was to find the current needs and challenges of the industry to identify market opportunities. This interview facilitated the analysis of Porters 5 forces through questions about the industry structure. The use of antibiotics was highlighted to compare the answers with the answers from Company A.

3.2 Study limitations, reliability and validity

The most obvious study limitation of this market research is the fact that the author never travelled to the south to witness the salmon production firsthand. Both a shortage of time and budget limited the possibilities to do so. Furthermore, the reliability of the content can be questioned considering that only two people were interviewed. Hence, a higher sample size would have been better. However, it should be noted that the chosen interviewees were experts on the topic. In addition, planning meetings with Chilean salmon producers proved to be quite tough because of the controversial side of topics that the author wanted to address, including the use of antibiotics, sustainable production and ocean pollution. Intesal provided really valuable insights on these topics, but the information was of a general nature. By consequence, the specific needs of individual companies were not detected. The last limitation about the study pertains to the size of the industry. Therefore, there are continuous developments and new findings, whereby information quickly becomes outdated and in some cases irrelevant.

4 Chile's domestic competitiveness and global positioning

In this chapter, an extensive analysis of the competitiveness of the Chilean salmon industry will be conducted through the analysis of Porter's 5 forces, along with an analysis of Chile's global positioning. By doing so, it will be possible to assess the attractiveness of the industry, as the model provides insights into the intensity of competition, the power of buyers and suppliers, and the threat of new entrants and substitute products. In addition, different challenges facing the salmon industry in Chile will be examined, including environmental concerns, political risks and climate change related risks.

4.1 The competitive landscape of salmon production in Chile

In these following sections, an intensive analysis will be conducted to identify the competition among salmon producers in the Chilean salmon industry.

4.1.1 Rivalry among existing producers

The salmon industry in Chile is a concentrated sector, with production primarily controlled by a limited number of companies. There are about 1353 concessions for salmonid production in Chile (Sernapesca 2023). Mowi, the biggest salmon producer in the world, estimates that only 385 of these concessions are currently in operation and that the top 10 largest firms hold 82% of total concessions in Chile. (Mowi, 2023, 49).

Sernapesca publishes yearly a list of companies who hold concessions (Appendix 1). Although there are 61 different names, most of the companies are subsidiaries of other companies. For instance, Aquachile, the biggest producer of salmon in Chile with 320 concessions, owns Los Fiordos, Salmones

Magallanes, Salmones Frisur and Aquachile (Table 3). Other industry giants include Cermaq, Mowi, Salmones Multiexport and Salmones Blumar and australis seafoods (Sernapesca 2023).

| Company | Concessions |
|-------------------------------------------------------------------|-------------|
| AQUACHILE (AQUACHILE, SALMONERA LOS FIORDOS, SALMONES MAGALLANES) | 320 |
| MITSUBISHI (Cermaq and Salmones Humboldt) | 95 |
| MOWI Chile | 161 |
| MULTI X | 69 |
| AUSTRALIS SEAFOODS | 69 |
| TRUSAL S.A. | 45 |
| CULTIVOS YADRAN S.A. | 44 |
| SALMONES CAMANCHACA S.A. | 44 |
| SALMONES BLUMAR S.A. | 42 |
| PRODUCTOS DEL MAR VENTISQUEROS S.A. | 37 |

Table 3. The ten biggest salmon producers in Chile (Subpesca 2023).

To conclude, most salmon producing companies can be considered conglomerates as they own multiple companies. Moreover, salmon producing companies often choose to do both farming and salmon processing for reasons of economies of scale and productivity growth (Appendix 2). Some companies even have their own fish feed plant (Aquachile 2023). Accordingly, companies try to be as cost effective and efficient as possible through the creation of fully developed supply chains. (Iversen, Asche, Hermansen & Nystøyl 2020, 1-3).

Hence, Chile's salmon production has achieved consolidation. The competition between companies concerns primarily local efficiency and cost control. On a global scale, these companies compete against producers of other nations. (Oliva, et al. 2009, 101-102.) Companies are subject to global supply and demand and therefore internationally determined prices; this is especially the case for fresh salmon sales on the spot market (Intesal 2023). According to the

Cambridge dictionary, the spot market is a market for currencies or commodities in which they are sold and given to the buyer immediately, rather than being sold forward (Cambridge Dictionary 2023).

4.1.2 Threat of new entrants Chile

The threat of new entrants is very low. This can be explained by two reasons. Firstly, the industry comes with high entry barriers to produce salmon. Substantial investments are needed to acquire specialized systems (salmon pens, boats...) and to train workers. Furthermore, there is a number of high fixed costs preventing quick profits. In addition the existing companies have achieved economies of scale that are hard to accomplish. (Johansen, 2021.)

Secondly, to farm salmon a concession is needed. These licenses are not easily awarded by the Chilean government. Besides, there are many restrictions and requirements to farm salmon, and the locations where salmon can be farmed are more and more constrained due to environmental concerns. Hence, the creation of new production sites is currently rather low. This will be discussed in depth in the conclusion of the competitive landscape. (Iversen et al. 2020, 1-3.)

4.1.3 Threat of substitution of salmon

In this section, the probability of substitution by similar products will be studied. These products can be offered by external competitors or other industry competitors. The substitute product must satisfy the same customer need to be considered an alternative. (Long Island University 2022.)

In theory, wild-caught salmon is the closest substitute for farmed salmon. However, considering the limited supply of wild caught salmon and the

projected future demand of fish products, it can be argued that wild salmon can only satisfy a small part of demand. Consequently, other types of fish and protein-rich meat sources including pork, chicken and beef, are the closest substitutes for farmed salmon. (Irgens & Gjølme 2021, 46-47.)

If the price of salmon rises sharply, these sources may be the alternative for consumers on the short term. However, on the long term, meat is not a proper substitute. Accordingly, salmon is rich in omega-3 fatty acids, a substance with several health benefits. High concentrations can only be found in some fish species, nuts and plant oils. (Harvard 2023.)

Therefore, only other fish products rich in omega-3 fatty acids can be considered as substitutes for salmon. Nevertheless, during an interview with an undisclosed Belgian company that imports salmon from Chile, it has come to light that consumers will continue to choose for salmon even in the face of elevated prices. To be more precise, demand for salmon in Belgium in 2022 remained stable despite record-high prices (Company A 2023).

4.1.4 Supplier Power

The power a supplier has depends on how important the product is for the buyer. For instance, if the product represents a significant part of the buyer's costs or in case it is critical to the production process, the supplier usually has higher bargaining power. (Long Island University 2022.)

In Chile's scenario, the situation is quite similar to other salmon producing countries. The cost share of fish feed in salmon production is about 50 % (Iversen et al. 2020, 2). In the world, the salmon feed industry is very concentrated, as four producers control the majority of production, that is to say Mowi, Skretting, Ewos and Biomar. Hence, given the powerful position of the manufacturers, the bargaining power should be high. However, the reality is that

their power is only moderate. Fish feed shows low differentiation between products of different suppliers, and the expenditure involved in changing to an alternative producer is rather low, except when working with long term contracts. (Irgens & Gjølme 2021, 43-44.)

Additionally, many salmon producers have vertically integrated fish feed plants to obtain fully integrated value chains. This holds true for Mowi (Mowi 2022). On top of that, Aquachile (Aquachile 2023) and Blumar (White 2018) recently acquired feed companies to further reduce dependency.

Other suppliers in the industry include chemical producers, equipment producers and electrical power suppliers, among others. Their bargaining power is low as their share in cost structure is not as determined as fish feed producers. (Irgens & Gjølme 2021, 43-44.)

4.1.5 Buyer Power

Powerful buyers are well positioned to negotiate favourable prices and quantities of products if alternative products or suppliers are easily found (Long Island University 2022). In this section, an analysis of the power of salmon purchasers will be conducted. It is important to note that they serve as intermediates between the salmon producers and the final consumers.

In the salmon industry we can identify different buyers. The main group is retailers, followed by other entities that import and export salmon, and other food service entities such as restaurants. In recent decades, supermarkets and retailers have experienced an increase in buyer power through acquisitions and mergers. In other words, the industry has reached an extreme level of consolidation and only counts a handful of dominant players. (Irgens & Gjølme 2021, 45-46.)

Salmon can be sold in two different ways, Firstly, on the spot market salmon is sold in bulk with instantaneous delivery to retailers.

In this case, the primary focus is on the sale of fresh salmon. The secondary approach involves long term contracts. These are more accustomed to sell frozen and smoked salmon for example. (Company A 2023.)

The bargaining power of retailers can be considered high as these companies are very big. On the spot market the companies can easily change from one supplier to another. In the past this has happened with Walmart and Costco in light of disease outbreaks and use of antibiotics. In 2009, Walmart abruptly stopped buying Chilean salmon when the ISA virus was detected in Chilean farms (Diario Financiero). Also, in 2015, Costco switched to buying Norwegian salmon instead of Chilean salmon, due to concerns about the high usage of antibiotics (Esposito 2015).

At the present time, the Chilean industry has reached maturity and does not experience the production shocks that occurred in the past anymore. In addition, the use of antibiotics nowadays is much lower, and continuous efforts are made to further reduce the use of them. Given the demand that continuously surpasses the available supply, and the quality of Chilean salmon that is much higher than in the past, it can be argued that Chilean companies can sell salmon without any issues and at attractive (high) prices. (Intesal 2023.)

4.1.6 Conclusion of the Porter's 5 forces analysis of the salmon industry in Chile

To summarize the competitive analysis in Chile, it is possible to conclude that there is a high competition between companies, as they pursue efficiency and low costs for a better positioning in the global market. This is also reflected in the vertical integration that the companies employ to obtain full value chains. The threat of new entrants is low, since big investments are needed, and the

competitors already have significant outputs and economies of scale. The threat of substitution is low, as other meat sources do not have the same abundance of omega-3 fatty acids as salmon. The supplier power is equally low, as most suppliers only have a little share in the cost structure of salmon producers. Fish feed suppliers are the exception with a cost share of 50%. However, fish feed lacks differentiation to impact producers. Moreover, some salmon producers are self-reliant with their own fish feed plants. Lastly, the buyer power is moderate, as demand exceeds supply and salmon is easily sold at high prices.

4.1.7 The sustainability concerns in the Chilean Salmon Industry

With a more profound comprehension of the competitive landscape, the next step is the analysis of the biggest challenge for Chilean salmonid producers, which is not related to competitiveness of the industry. The divergence in interests between the government, the salmon companies and conservationists is the major threat for producers. Namely, there is a major clash of interests regarding fish farming in protected areas. On the one hand, salmon producers want to renew their concessions in these areas. In addition, they want to expand production to new ocean areas. On the other hand, the government, under supervision of the ministry of the environment, is trying to tighten its policies and regulations to protect these national reserves.

More than 400 salmon concessions are located in protected areas. For instance, the Kawésqar National Reserve situated in the province of Magallanes counts about 120 concessions. (Greenpeace 2023.) These territories are home to indigenous communities, who consider these fishing grounds as their ancestral right. As a result, the topic is a very sensitive matter involving many parties.

In May 2023, the Ministry of the Environment released a proposal to change the law of fisheries and aquaculture by incorporating a second paragraph that indefinitely excludes the cultivation of exotic hydrobiological species, such as

salmon, in all categories of protected areas. In the end, the law did not pass through and got rejected by the Congress. This was largely the result of the controversial side of the matter, as the law would have implied a considerable shrinkage of the industry, estimated at 60% by the union of salmon workers. Furthermore, this law would result in thousands of jobs losses in the Austral region. (Garcés 2023.)

In recent weeks, the Ministry of Environment has come up with a new plan to try to limit production in protected areas. At the end of September, it issued a directive that aims to curb the granting of aquaculture concessions in protected areas in Chile. It will try to accomplish this through the suspension of the granting process in case companies do not have a management plan. This management plan, or in other words an environmental impact assessment, should be approved by the ministry, otherwise the concession will not be granted. The goal of the suspension is to evaluate the compatibility of proposed activities with the protection objectives of the area. (Cárdenas 2023.)

Within the salmon industry, the directive is seen as a new interpretation of the law that was not approved in May. Thus, the news has yet again caused discontent in the Austral region, as many people are afraid of losing their jobs in case the directive comes through. Furthermore, it would imply a big downturn of salmon production in Chile, hence reducing exports to other countries. (Cárdenas 2023.) With the current high demand for salmon, a government intervention in Chile would further augment the prices for salmon, leading to benefits for Norway and other salmon producers.

To summarize, the rivalry in the industry is more between the government and the industry than between individual companies. Both parties have different interests concerning the expansion of concessions in protected areas. Hence, stricter policies will reduce Chile's salmon output and market share, with negative economic impacts on the Austral region as a consequence.

4.2 Chile's position on the global scale

Chile became the second largest producer of salmon in 1981 (Oliva et al. 2009 112). Since that year, it has not lost that position and has continued with a strong growth trajectory. However, it must be mentioned that the industry experienced shocks in production caused by virus outbreaks and algal blooms. Despite these shocks, the industry has proved to be resilient with quick recoveries and becoming Chile's third most important export sector. In the next sections, an analysis will be conducted on Chile's global competitiveness. Just as in the previous analysis of Chile's internal market analysis, sustainability and environmental concerns will be highlighted.

4.2.1 Threat of new entrants globally

The threat of new salmon producing countries is fairly unrealistic, considering the special environmental conditions that are required to produce salmon. All countries possessing these conditions are already present in the industry. The only existing threat lies in the possibility of other countries to increase their output. This holds true for Norway, the primary competitor of Chile, as the government plans to increase production in salmon by five-fold production between 2010 and 2050 (Norsk Industri 2017, 5).

4.2.2 Chile's cost advantage

The salmon industry has known a long period of increasing productivity and declining production costs thanks to new technologies and supply chain development. However, in recent years, costs have started to rise due to stagnating productivity and higher feed prices. Moreover, the risk of bad harvests due to disease outbreaks has increased with climate change. This can substantially impact costs and harvests for salmon producers on the short term. (Iversen et al. 2020, 3-8.)

Chile has historically been the producer with the lowest cost out of the five biggest producing countries. This can be explained by the lower labor costs in Chile. However, Chile has also had periods of higher production costs than its competitors. This was the case during the ISA virus outbreaks between 2007 and 2010 and the algae bloom in 2016 (Figure 12). Additionally, tighter regulations and more sustainable salmon practices in recent years have pushed costs further up for producers. In spite of these events, Chile has kept competitive cost levels compared to countries like Canada and Scotland, who have historically the highest costs.

To conclude, when excluding these external factors, such as the risks coming forth from climate change and disease outbreaks, it can be argued that Chile is well positioned to keep increasing its market share in virtue of costs, considering these are lower than in other countries. Furthermore, the quality of salmon has increased thanks to improved practices of the main producers. Other than costs, Chile possesses a comparative advantage through the counter-seasonality of the Southern hemisphere. All the other big salmon producers are located in the Northern hemisphere (Institute for European Environmental Policy 2023, 4). This means that Chile can offer abundant salmon in periods that the output is lower in the Northern hemisphere. This is however no longer fully relevant, because Atlantic salmon can be produced year-round, it remains an important factor. Companies will likely focus more on production and harvest in winter, as the conditions are better and more predictable than in summer, when there is a risk of heat waves and warmer oceans (Intesal 2023).

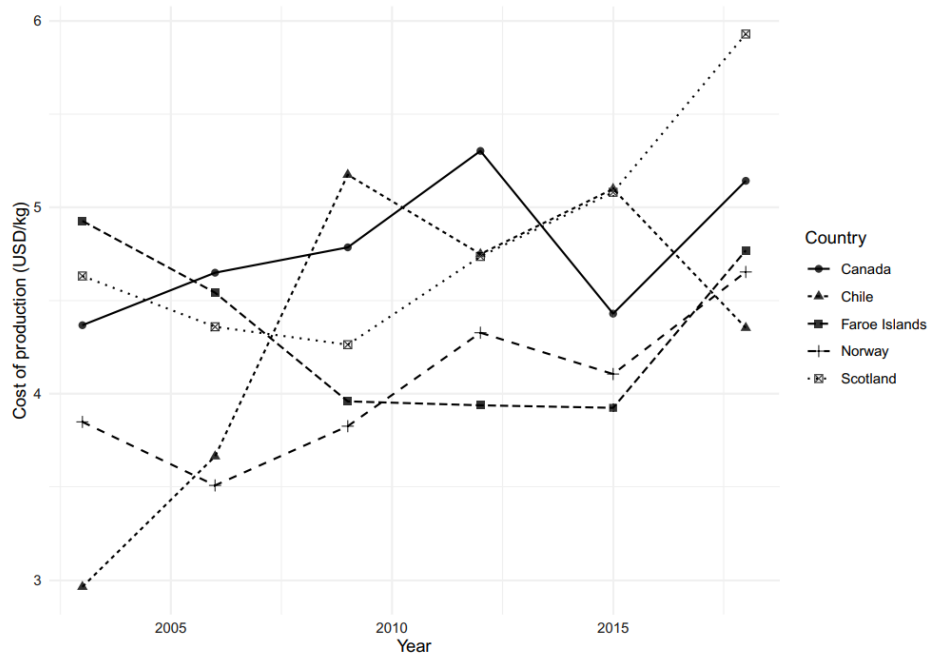


Fig. 3. Real production cost incl. Harvesting and packing costs, USD/kg gutted weight (2018-USD).

Figure 12. Real production cost incl. Harvesting and packing costs, USD/kg gutted weight (2018-USD) (Iversen et al. 2020, 5).

4.2.3 Chile's International trade agreements and relations

For Chile, creating favorable conditions for free trade has been considered primordial in recent decades to support economic and social development of the country (Invest Chile 2023). In 2021, it was estimated that international trade represented 64.4% of the country's GDP (Santander Trade 2023). This can be explained by the numerous trade agreements involving Chile. These agreements have facilitated exports of salmon and the development of the industry through the termination of quotas and tariffs (Table 4).

| Trade agreements top 5 export destinations | | |
|--------------------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Country | Agreement Year | Tariffs |
| United States of America | 2004 | 0 |
| Japan | 2.007 | 0 |
| Brazil | 2018 | 0 |
| Rusia | No TA | 2,5% |
| China | 2005 | 0 |
| European Union | 2002 with modernization in 2022 | 0 % for fresh and frozen salmon, other products had tariffs: 9,5 % for smoked salmon and, salted or in brine salmon had tariff of 11.5 %, the new trade agreement will eliminate these tariffs |

Table 4. Summary of Trade agreements.

United States of America

The USA-Chile Free Trade Agreement took effect in 2004. This trade agreement eliminated a specific 5% tariff that was previously applied on salmon imports. The agreement has been vital to Chile's salmon industry, as the United States are Chile's main export destination for salmon. (Oliva, et al. 2009, 102-103.)

Japan

The trade agreement with Japan was signed in 2007. Both parties agreed to a gradual tariff elimination of salmon and trout within 10 years (Customs Japan 2023). Accordingly, Chilean salmon doesn't have any remaining customs tariffs since April 2017 (Department for international trade UK 2020).

Apart from these trade agreements, the relationship between these two countries has been very good for a long time, as Japan supported Chile in farming salmon in the early stages. They exposed Chilean scientists to

Japanese technologies, and the Japanese International Cooperation Agency donated a fish exploration boat (Montero et al. 2006, 5-6.)

Russia

There is no trade agreement between Chile and Russia. Therefore, Chile is subject to import tariffs. World Bank data of 2018, shows that trade tariffs on salmonid species are 2.25% (Worldbank 2018). Nonetheless, these tariffs do not hinder salmon exports to Russia, as import quantities have historically been important. In 2021, Chile exported 50,689 tonnes to Russia. The export quantity dropped sharply to 35,386 tonnes in 2022 due to the Russia Ukraine war, but exports are set to recover in 2023. (Consejo del Salmón 2023.)

Brazil

Brazil and Chile have been two close commercial partners for a long time, but a trade agreement only came in 2018. This agreement has subsequently facilitated the bilateral flow of goods and services. Thus, Chile has strengthened its position as primary supplier of salmon to Brazil. (Apex Brazil 2023.)

China

In 2005, a free trade agreement was signed between Chile and China. However, the final reductions for seafood only came in 2015 (Ministry of Commerce, People's Republic of China 2023). The Chinese market is of growing importance for Chile, as it became the fourth largest export destination in 2022, and is set to become even more important in the future (Consejo del Salmón 2023, 3).

Trade relations between Chile and the European Union

Chile and the European Union concluded a trade agreement in 2002 which came into force in 2003. Since coming into effect, bilateral trade has grown

substantially, as trade grew by 142% between 2003 and 2021 (European Commission 2023). Despite this excellent growth, salmon exports to the European Union have not predominantly contributed to this growth. In 2021, salmon exports to the European Union were only 2% of Chile's total salmon exports (Consejo del Salmón 2023). The large majority of salmon exports to Europe concern frozen salmon, since the distance between Chile and Europe is too big to sell fresh salmon.

Additionally, the salmon industry did not fully benefit from the trade agreement, as there remained tariffs on some salmon products. Fresh salmon and frozen salmon had zero tariffs, whereas smoked salmon and salted or in brine salmon had 9.5% and 11.5% import duties, respectively (European Commission 2002, 85-88). Besides, Chile underwent heavy production shocks due the ISA outbreak in 2007 and the algal bloom in 2015 (Figure 13). These events made Chile focus more on selling fresh salmon on the spot market in the United States and other core markets, as this business has proved to be more profitable.

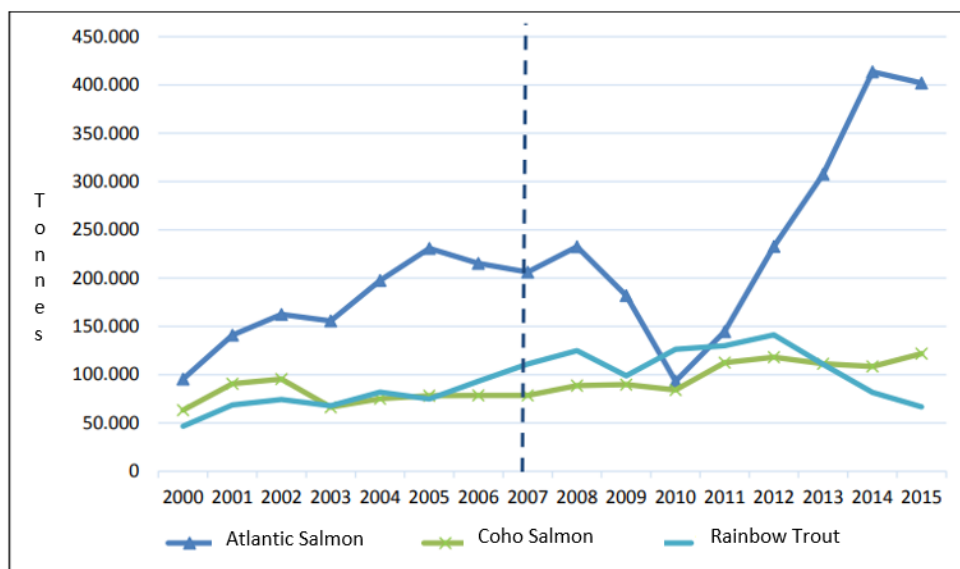


Figure 13. Volume of national exports of salmonids (tons) by species (2000-2015) (Dresdner et al. 2015, 169).

In 2022, the 20-year-old trade agreement between Chile and the European Union was modernized. Important steps were made in support of the salmon industry. More precisely, tariffs for salmon imports have been reduced to zero for other salmon products, too. However, this agreement still has to be ratified and is not yet in use. (Ministerio de Relaciones exteriores Chile 2023.)

This tariff reduction has been successful with the help of stricter policies by the Chilean Government to make the industry more sustainable. Between 2015 and 2020, the usage of antibiotics decreased by 44%. In addition, the industries' goal is to decrease usage 50% by 2025 to achieve a Seafood Watch Good Alternative rating. (Consejo del Salmón 2023.)

Alongside these reductions, the agency for fisheries and aquaculture Sernapesca introduced a programme called *Programa de Optimización del Uso de Antimicrobianos* (PROA) which can be translated into English as the Antimicrobial Use Optimization Program. The aim is to issue certificates to salmon farms that have a usage of drugs that meet the PROA requirements. Moreover, these centers are subject to stricter and more frequent inspections. Currently, 138 centers have been recognised by Sernapesca to meet these requirements. (Garcés 2023.)

While antibiotics continue to be utilized, the actual usage of antibiotics in Chile has decreased to a very little amount. However, the industry is still haunted by a reputation from the past where salmon producers used excessive amounts of antibiotics. Company A assured that the imported salmon had never been exposed to antibiotics (Company A). This statement is likely to hold true, as there are already centers in Chile who do not use any antibiotics and sell their salmon at a premium price (Intesal 2023).

In other cases, the use of antibiotics in Chile is very limited. The rate of antibiotic use in Chile is still slightly higher than in Norway, but the difference has reached a negligible point. The antibiotics are used curatively rather than

preventively, and a waiting period is applied before the salmon can be slaughtered so that no traces of antibiotics can be found. The general market also requires the certification ASC, which stands for Aquaculture Stewardship Council (Company A). This certification encompasses socially responsible farming, with criteria such as minimizing the use of wild fish in feed, ensuring traceability to responsibly managed sources, maintaining water quality within specified limits to prevent pollution, implementing measures to minimize disease outbreaks, a maximum density in salmon pens, consulting with local communities, and so forth (ASC 2023).

In summary, Chile's position in international trade is beneficial for salmon producers, as it holds many trade agreements with different countries, resulting in low to zero import tariffs for Chilean salmon. This facilitates exports of Chilean salmon and solidifies Chile's position as second biggest salmon producer in the world. The recent efforts to reduce drugs and environmental impacts will help strengthen Chile's position, as it closes the gap with Norway, which barely uses antibiotics (Norwegian Veterinary Institute 2023). On top of that, the recent changes in the free trade agreement with the European Union offer opportunities to export higher quantities to Europe.

Aside from these positive notes, we should not forget that Chile's position could still be negatively affected by the pressures of the Ministry of the Environment, which looks to put a halt to concessions in protected areas. A significant drop in salmonid output would occur in case this reform takes place. As a result, the future of Chile in this regards remains uncertain due to the internal political insecurities.

Moreover, in the section "export trends", a positive outlook was given for Chilean salmon producers in 2023 and 2024. This outlook does not take into account the weather pattern *el niño*, which has started to appear again this year (United Nations 2023). Hence, it is to be seen how a warmer Pacific Ocean will affect the salmon harvests in Chile during the upcoming quarters.

5 Results

This chapter describes the market opportunities in the salmon industry. These were identified during the course of the thesis study and the interviews that took place. Furthermore, a SWOT analysis summarizes the main strengths, opportunities, weaknesses, and threats of the industry that were discussed throughout the thesis.

5.1 Where lie the market opportunities in the industry for the Belgian companies?

Within the context of market opportunities, a distinction should be made between traditional equipment, including clothing, basins, and machinery, and state-of-the-art technology. Many providers of equipment are located within the country itself, in proximity of the salmon producers. This makes exporting those products from Belgium to Chile more challenging considering the distance between the countries and the fact that industry is highly self-reliant. An exception to this are fish feed ingredients. While the production of fish feed takes place in Chile, the ingredients are sourced internationally. These ingredients include a variety of ingredients from plant, marine, and terrestrial animal sources. Some of the most well-known ingredients include fish meal and oil, wheat, soy, rapeseed meal, sunflower meal, and peas (Skretting 2023).

The main market opportunities lie in state-of-the-art technology, and innovations for the salmon industry, as these are not directly available in Chile. In the following section, different solutions and needs are discussed. Many of these solutions are already in use or being researched. However, there is a need for improvement and further incorporating these technologies.

5.1.1 Market opportunities

Fish health

Disease management.: Solutions against diseases like sea lice, ISA virus and Salmonid Rickettsial Septicemia (SRS). There is a need to strengthen salmon resistance through vaccines and improved feeding while proceeding to reduce antibiotics. Companies are also looking for methods to sustainably accelerate the rate at which salmon grow. Therefore, there are still plenty of opportunities to improve salmon feed, through new supplements, probiotics and omega-3s, for healthy growth and disease resistance. In Belgium, many companies could contribute enhancements or insights to the industry as biotechnology and vaccine development is one of the most leading sectors in Belgium. Lastly, LiDAR technology can help detect outbreaks of diseases, changes in water quality and provide information on fish populations and habitat quality. (Intesal 2023.)

Optimizing production and reducing the environmental impact

There is a need to pursue technologies and innovations to reduce the environmental impact of salmon production. For instance, the ocean grounds are very polluted due to salmon production. Raw waste from salmon farming infiltrates open waters in significant quantities. The Norwegian Pollution Control Authority (SFT) estimates that a medium-sized fish farm with open net pens with a production of 3000 tons, generates sewage equivalent to that of a city housing 50,000 people. (NASF 2023.)

The global salmon industry needs solutions for this urgently. Data processing and artificial intelligence are already in use to monitor and optimize production. However, these technologies are still very new. As a result, there are still numerous opportunities to enhance AI solutions that lead to higher energy-efficiency and streamlined production. For instance, technology to detect the amount of available food in salmon sea cages can enhance productivity as it

optimizes the timing of feeding and reduces waste. This data should be recorded and analyzed carefully. (Intesal 2023.)

As previously mentioned, LiDAR drones can provide accurate data on salmon production. Additionally, they can also be used for mapping to obtain geographical data, study water flow and determine if a location is suitable for a concession. European countries are forerunners in the utilization and analysis of LiDAR data. (Intesal 2023.)

Another issue that has to be addressed urgently is salmon escapes. In theory, the ocean net pens should be strong enough to retain the salmon for months to come. However, on too many occasions, escapes do occur. This has impacts on local fish species, as salmon are predatory fish. In addition, these escapes can impact wild salmon populations in areas where salmon are indigenous. To elaborate, contact between wild salmon and farmed salmon can lead to the transmission of diseases or breeding. This reduces the chances of survival of wild salmon as they mature earlier and are less prepared for a life in their natural habitat. This is not problematic for Chile as salmon are native to the northern hemisphere, but it is still relevant to mention, as resolutions are needed imperatively. (Intesal 2023.)

Water reuse and innovations in pisciculture

Currently, water reuse in the smolt phase is about 35%, whereas water reuse in freshwater piscicultures is about 17% (in the hatching phase) As a result, there lie many opportunities in creating technologies and strategies for water reuse in smolt and freshwater fish farms to improve water management. (Intesal 2023.)

A Swedish company is also experimenting with fully land-based salmon production. This practice completely excludes production in the ocean and has the advantage that the environment can be fully controlled by humans. Hereby, the risk of sea lice and other diseases becomes insignificant. (European Investment Bank 2023.) Diversifying production into land-based production

would imply heavy investments and the need for new infrastructure related to water flow and mimicking the ocean. Although this technique is currently not in use in Chile, it could offer be an interesting option for companies, considering the threats of stricter policies in Chile in regard to concessions in protected areas and risks related to climate change.

Emissions reduction and electrification

Most ships are still high emitters of carbon dioxide. The adoption of electric motors on ships would reduce emissions drastically. Furthermore, most salmon farms have pontoons that act as a place to shelter for the workers and for storing salmon feed. These pontoons are often powered by gasoline. The implementation of batteries would reduce the carbon footprint. In addition, these pontoons should change from gasoline as an energy source to gas or even electricity and green hydrogen. Lastly, advances in logistics vehicles, such as electric trucks, can improve efficiency and reduce environmental impact and emissions. (intesa 2023.)

Salmon Processing

Robotization and advanced processing techniques can optimize the salmon processing stage and further reduce labor costs. There is a need for better preservation techniques to increase shelf life of fresh salmon to assure that salmon remains fresh throughout the journey to reach the final customer. As in previous examples, AI can be used to optimize processing techniques. (intesa 2023.)

5.2 Risk Analysis (SWOT)

The key findings of this thesis can be summarized in a SWOT analysis (Table 5). The industry has many strengths and opportunities, but counts with important weaknesses related to sustainability and threats related to government regulations. The impact of climate change on the production must not be underestimated as it can cause bad harvests, but Chile's main competitors face this threat, too.

| Strengths | Opportunities |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Counter seasonality with Northern Hemisphere</p> <p>Strong competitive position worldwide</p> <p>High quality salmon</p> <p>Competitive prices</p> <p>Mature industry</p> | <p>Incentives to further reduce antibiotics</p> <p>Modernized trade agreement with Europe</p> <p>Need for technologies to optimize production, limit impacts on environment and increase health of salmon through better salmon feed and vaccines</p> |
| Weaknesses | Threats |
| <p>Although to limited extent, antibiotics are still used in salmon farms</p> <p>Pollution of salmon in ocean grounds is a concern, as well as the conflicts with local communities</p> | <p>New regulations by the Chilean government</p> <p>Bad harvests due to disease outbreaks, warmer oceans...</p> |

Table 5. SWOT Analysis.

6 Conclusions

In this final chapter a summary of the responses to the tasks set in the thesis will be performed. Secondly, the key findings of this study will be brought forward. Thirdly, based on the practical studies, including the PORTER's analysis, an overview of recommendations will be presented, continued by potential topics for forthcoming research. Lastly, the main challenges and learnings of the writer's learning path will be listed.

6.1 Answer to research questions change to key findings

In this thesis, the state of the Chilean salmon market was studied to give valuable insights to Belgian companies interested in diversifying into this market. The main questions for this thesis were as follows:

- What are the current growth prospects and market trends within the Chilean salmon industry?
- How do these trends impact Belgian companies willing to enter this market?
- What trade agreements and tariffs are present between the European Union and Chile?
- What risks and opportunities should Belgian companies consider?
- How competitive is the industry internally and globally?

Chile has a very robust salmon industry that has experienced decent growth in recent years. Macro-level demographic trends, such as the worldwide population growth, will have positive effects on the aquaculture industry as the need for fish supply will increase substantially, and commercial fishing has reached its limits. Chile can benefit from the higher fish demand by increasing its supply of salmon. However, recent events have shown that these growth projects are at risk. The government, led by the Ministry of the Environment,

wants to put limits on the expansion of salmon producers into unexploited regions that have the statute of a protected area. Thus, renewed legislation by the government could lower future growth of Chile and cause a shrinkage of the industry.

Putting the political risk aside, it should be said that the market conditions of Chile have become increasingly favorable for importers. The new trade agreement with the European Union has made salmon exports to Belgium more attractive, as tariffs will reach reasonable levels for all types of salmon. However, the agreement has not yet been ratified. Furthermore, the efforts of Chilean companies to make the industry more sustainable and use less antibiotics will further close the gap with Norway. In parallel, the efforts to control costs and develop fully integrated value chains will help maintain Chile's strong position globally and put pressures on smaller producers with higher costs like Canada and Scotland.

In summary, the research has shown that importing salmon from Chile is more alluring than in the past. The sale of equipment to Chile is more complex, considering the consolidation of the companies and the supply that comes primary from local companies. However, disrupting technologies that improve production processes and bolster sustainable efforts have high potential in the Chilean market. These technologies aim to make the industry more circular through water recycling, renewable energy sources, the reduction of the impact on ocean floors, the decrease in antibiotics usage, and improvements of salmon feed and salmon health.

6.2 Recommendations and suggestions for future research

With a more profound comprehension of the salmon industry, companies can proceed to design business plans to prepare a market entry in the Chilean salmon industry to satisfy the needs. Moreover, Belgian retailers can consider

drafting a business plan to import Chilean salmon to Belgium, as the import tariffs will reach attractive tariffs for all kinds of salmon (Table 4).

On top of that, the future market conditions must be analyzed to evaluate whether market entry is still as suitable and interesting as it is today. Surely, new government regulations can severely restrict the industries' growth and investment. In addition, the import of Chilean salmon may become less appealing if the Chilean industry is confronted with diseases or algal outbreaks.

6.3 Reflection of the learning process

This research has helped me increase my knowledge and skill in drafting reports. This competence is highly important in my current internship, since research reports have to be written on a regular basis for Belgian companies. I was surprised about the abundance of available sources for Chile and more broadly the international salmon industry. This arises from the fact that Chile has a very open economy and that the government highly values open communication and the availability of data. Nevertheless, this resulted to be a challenge too, as I had to continuously choose and evaluate which source was most reliable and relevant. Hence, the rapid advancements in this thesis were achieved thanks to the available information in combination with a present personal interest in the topic and perseverance.

I am satisfied with the results of my thesis and the work process. At last, I hope that this report will be of value for companies interested in investing in Chile and that the content is interesting and can be used for future research.

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List of salmonid aquaculture concessions grouped by concessions in the regions, June 2023

| COMPANY | NUMBER OF CONCESSIONS |
|--------------------------------------------|------------------------------|
| MOWI CHILE S.A. (Marine Harvest Chile) | 161 |
| EXPORTADORA LOS FIORDOS LTDA. | 133 |
| EMPRESAS AQUACHILE S.A. | 85 |
| CERMAQ CHILE S.A. | 76 |
| AUSTRALIS MAR S.A. | 69 |
| MULTI X S.A. | 69 |
| TRUSAL S.A. | 45 |
| CULTIVOS YADRAN S.A. | 44 |
| SALMONES CAMANCHACA S.A. | 44 |
| SALMONES BLUMAR S.A. | 42 |
| PRODUCTOS DEL MAR VENTISQUEROS S.A. | 37 |
| INVERMAR S.A. | 34 |
| SALMONES ANTARTICA S.A. | 29 |
| NUEVA CERMAQ CHILE S.A. | 28 |
| NOVA AUSTRAL S.A. | 27 |
| AQUACHILE MAGALLANES SPA | 26 |
| AQUACHILE SPA | 26 |
| AQUACHILE MAULLIN LTDA. | 25 |
| SALMOCONCESIONES S.A. | 24 |
| SALMONES PACIFIC STAR S.A. | 24 |
| FIORDO BLANCO S.A. | 22 |
| COOKE AQUACULTURE CHILE S.A. | 21 |
| GRANJA MARINA TORNAGALEONES S.A. | 21 |
| SALMOCONCESIONES XI REGION S.A. | 21 |
| SALMONES TECMAR S.A. | 20 |
| SALMONES HUMBOLDT SPA | 19 |
| SOCIEDAD DE INVERSIONES ISLA VICTORIA LTDA | 17 |
| INVERSIONES AQUACHILE SPA | 15 |
| MULTIEXPORT PACIFIC FARMS S.A. | 13 |
| ACUICOLA CORDILLERA LTDA. | 10 |
| ACUICOLA PUYUHUAPI S.A. | 9 |
| CALETA BAY MAR SPA | 9 |
| FRÍO SALMÓN SPA | 8 |
| SALMONES AYSÉN S.A. | 8 |
| SALMONES BLUMAR MAGALLANES SPA. | 8 |
| SALMONES ISLAS DEL SUR LTDA. | 8 |
| MULTIEXPORT PATAGONIA S.A. | 7 |
| AQUAINNOVO SPA | 6 |

| | |
|---------------------------------------------------|---|
| FIORDO AZUL S.A. | 6 |
| GLACIARES DOS S.A. | 6 |
| DELIFISH FARMING SPA | 5 |
| PROCESADORA CAILIN SPA | 4 |
| SALMONES ALPEN LTDA. | 4 |
| ACUICOLA PUNTA VERGARA S.A. | 3 |
| AUSTRALIS AGUA DULCE S.A. | 3 |
| GANADERA DEL MAR DECIMA REGION S.A. | 3 |
| YADRAN CISNES S.A. | 3 |
| INVERSIONES DE DESARROLLO INMOBILIARIO S.A. | 2 |
| PACIFIC SEAFOOD S.A. | 2 |
| PISCICULTURA PALQUI LTDA | 2 |
| PROCESADORA DE ALIMENTOS ASF SPA. | 2 |
| SEA SALMON LTDA. | 2 |
| BARRIA GUNCKEL, CARLOS MARCELO | 1 |
| CAMACHO SANTIBAÑEZ, GONZALO ALEJANDRO | 1 |
| CULTIVOS MARINOS LINGUAR SPA | 1 |
| INSTITUTO DE FOMENTO PESQUERO | 1 |
| PATAGONIA SALMON FARMING S.A. | 1 |
| PESQUERA YADRAN S.A. | 1 |
| PRIMAR S.A. | 1 |
| SALMONES FRIOSUR S.A. | 1 |
| SALMONES ICE VAL LTDA. | 1 |
| SEAMAG S.A. | 1 |
| SERVICIOS MARITIMOS OXXEAN S.A. | 1 |
| SOC. INDUSTRIAL COMERC Y PESQUERA MALOMACUN LTDA. | 1 |
| SOCIEDAD COMERCIAL CANAL PEREZ LTDA | 1 |
| SOCIEDAD DE INVERSIONES EL MEMBRILLO LIMITADA | 1 |
| UNIVERSIDAD DE LOS LAGOS | 1 |
| ABARCA CASTELLI, OCTAVIO AGUSTINO | 1 |

List of Plants Authorized to Slaughter and/or Process Salmonids 2022



Listado de Plantas Autorizadas para Faenar y/o Procesar Salmónidos

09-09-2022

| N° | Código | Planta | Zona | Empresas de Cultivo | Realiza Matanza | Tipo | Tipo Desinfección | Lugar de Descarga |
|----|--------------|---------------------------------------|--------------------------|---------------------------|-----------------|-------------------------------|-----------------------------------------------------------------|---------------------|
| 1 | 8271 | Pesquera Friosur S.A. | Coronel | Pesquera Friosur S.A. | No | Primaria | Cloración y Decoloración Secundaria; Dióxido de Cloro Terciaria | Mar Fuera ZPL |
| 2 | 8323 | Congelados Pacifico | Talcahuano | Congelados Pacifico | No | Secundaria | Cloración y Decoloración | ESSBÍO |
| 3 | 8384 | Salmones Camanchaca S.A. | Tomé | Camanchaca | No | Secundaria | Cloración y Decoloración / Ozono | ESSBÍO |
| 4 | 8396 | Blumar S.A | San Vicente - Talcahuano | | No | Secundaria | Cloración y Decoloración | ESSBÍO |
| 5 | 8130-8148 | Camanchaca Pesca Sur | Talcahuano | Camanchaca Pesca Sur | No | Secundaria-Terciaria | Cloración y Decoloración | ESSBÍO |
| 6 | 8163/8288 | Congelados Blumar S.A | Talcahuano | Blumar S.A. | No | Secundaria | Dióxido de Cloro | ESSBÍO |
| 7 | 10064 | Pesquera del Mar Antártico | Puerto Montt | Mar antartico | No | Secundaria | Cloración y Decoloración | ESSAL |
| 8 | 10067 | Agroindustrial Santa Cruz | Puerto Montt | Agroindustrial Santa Cruz | Sí | Primaria-Secundaria | Cloración y Decoloración | Mar Fuera ZPL |
| 9 | 10156 | Planta Fitz Roy | Calbuco | Mainstream Chile | No | Secundaria | Cloración y Decoloración | Mar Fuera ZPL |
| 10 | 10160 | Aguas Claras | Calbuco | Aguas Claras | Sí | Primaria-Secundaria-Terciaria | Cloración y Decoloración | Mar Fuera ZPL |
| 11 | 10231 | Invertec | Castro | Invertec | No | Secundaria | Dióxido cloro | Río La Chacra |
| 12 | 10256 | Salmones Cailin S.A. | Quellón | AquaChile | Sí | Primaria-Secundaria | Cloración y Decoloración | Mar Fuera ZPL |
| 13 | 10636 | AquaChile | Puerto Montt | AquaChile | No | Secundaria | Cloración y Decoloración | ESSAL |
| 14 | 10655 | Salmones Aysén | Puerto Montt | Salmones Aysén | No | Secundaria | Cloración y Decoloración | ESSAL |
| 15 | 10658 | Ludrimar Sociedad Jimenez y Gutierrez | Puerto Montt | Pesquera Ludrimar Ltda | No | Secundaria | Ozono | Fosa de Decantación |
| 16 | 10673 | Los Fiordos | Quellón | Pesquera Los Fiordos | Sí | Primaria-Secundaria | U.V. Asoc a ESSAL | ESSAL- Quellón |
| 17 | 10678 | Antarfood | Chonchi | Aguas Claras | Sí | Primaria-Secundaria | Cloración y Decoloración | Mar Fuera ZPL |
| 18 | 10681 | Salmones Pacific Star | Quellón | Pesquera Pacific Star | Sí | Primaria-Secundaria | Cloración y Decoloración | Mar Fuera ZPL |
| 19 | 10692 | Río Dulce | Quellón | Río Dulce | Sí | Primaria | Dióxido de Cloro | Mar Fuera ZPL |
| 20 | 10708/500032 | Salmoproceso | Chonchi | Salmoproceso S.A. | Sí | Primaria-Secundaria | Dióxido de Cloro | Mar Fuera ZPL |
| 21 | 10718 | Sea Flavors S.A | Puerto Montt | Sea Flavors S.A | No | Secundaria | Cloración y Decoloración | ESSAL |
| 22 | 10722 | Yadrán Quellón | Quellón | Yadrán | Sí | Primaria-Secundaria | Cloración y Decoloración | Mar Fuera ZPL |
| 23 | 10778 | San José | Calbuco | Camanchaca | Sí | Primaria | Cloración y Decoloración u Ozono | Mar Fuera ZPL |



Listado de Plantas Autorizadas para Faenar y/o Procesar Salmónidos

09-09-2022

| N° | Código | Planta | Zona | Empresas de Cultivo | Realiza Matanza | Tipo | Tipo Desinfección | Lugar de Descarga |
|----|--------|--------------------------------------|------------------|-------------------------------------|-----------------|----------------------------------------------------|---------------------------------|------------------------------------------------|
| 24 | 10788 | Surprocesos | Quellón | Surprocesos S.A. | Si | Primaria | Cloración y Decloración / Ozono | Mar Fuera ZPL |
| 25 | 10810 | Alimentos Bahía Chincui | Puerto Montt | Productos del Mar Ventisqueros S.A. | Si | Primaria-Secundaria | Dióxido de Cloro | Mar Fuera ZPL |
| 26 | 10695 | Roxana | Puerto Montt | Roxana | No | Primaria/Secundaria/Terciaria | Dióxido de Cloro | Pozo infiltración |
| 27 | 10735 | Salmones Antártica | Chonchi | Salmones Antártica | Si | Primaria | Cloración y Decloración | Mar fuera ZPL |
| 28 | 10748 | Procesadora Hueñocoihue | Chonchi | AquaChile | No | Secundaria | Cloración y Decloración | Mar fuera ZPL |
| 29 | 10751 | Granja Marina Tornagaleones | Quellón | Granja Marina Tornagaleones | No | Secundaria | Dióxido de Cloro | ESSAL |
| 30 | 10862 | Caleta Bay | Puerto Montt | Caleta Bay | No | Secundaria | Cloración | ESSAL |
| 31 | 10823 | Salmones Multiexport | Puerto Montt | Salmones Multiexport | No | Primaria-Secundaria | Cloración y Decloración | ESSAL |
| 32 | 10863 | Caicaen | Calbuco | Marine Harvest Chile | Si | Primaria | Ozono / Cloración y Decloración | Mar Fuera ZPL |
| 33 | 10884 | Chamiza | Puerto Montt | Trusal | No | Secundaria | Cloración y Decloración | Río Chamiza |
| 34 | 10933 | Planta Trapen | Puerto Montt | Operada por ACME Chile SPA | No | Secundaria | Dioxido cloro | ESSAL |
| 35 | 10954 | Planta Abick | Dalcahue | Abick S.A. | Si | Primaria | Cloración | Mar Fuera ZPL |
| 36 | 500052 | Abick | Puerto Montt | Abick | Si | Primaria | Cloración y Decloración | Mar Fuera ZPL |
| 37 | 500095 | Compu | Quellón | Invermar | Si | Primaria | Cloración y Decloración | Sanitaria |
| 38 | 500142 | Marine Harvest Chile S.A | Puerto Chacabuco | Marine Harvest Chile S.A | Si | Primaria | Cloración y Decloración | ZPL |
| 39 | 11012 | Marine Harvest Chile S.A. | Pto. Chacabuco | Marine Harvest Chile S.A. | No | Secundaria | Cloración y Decloración | ZPL |
| 40 | 12030 | Planta Pesquera Torres del Paine S.A | Punta Arenas | Cermaq Chile - Australis Mar | No | Secundaria | Cloración y decloración | Aguas Magallanes S.A. |
| 41 | 12054 | Pesquera Edén Ltda. | Puerto Natales | Acuimag | No | Secundaria | Ozono -Cloración y Decloración | Aguas Magallanes S.A. |
| 42 | 12079 | Nova Austral S.A. | Porvenir | Nova Austral | No | Secundaria | Cloración y Decloración | Aguas Magallanes S.A. |
| 43 | 12084 | Bakkovar Chile S.A | Porvenir | | No | Secundaria | Cloración y Decloración | Aguas Magallanes S.A. |
| 44 | 12109 | ELDAP | Porvenir | Australis Mar | No | Secundaria | Cloración y Decloración | Aguas Magallanes S.A. |
| 45 | 12103 | Pesquera Alvarez & Alvarez Ltda | Puerto Natales | Australis Mar | No | Secundaria | Cloración y Decloración | Aguas Magallanes S.A. |
| 46 | 12141 | Chile Seafoods Comercial SpA | Punta Arenas | Australis Mar | No | Secundaria | Cloración y Decloración | Aguas Magallanes S.A. |
| 47 | N/A | Frigorífico Simunovic S.A. | Punta Arenas | Presta servicios a terceros | No | Sólo desinfección de riles (no proceso salmónidos) | Dióxido de cloro | Emisario submarino descargando fuera de la ZPL |
| 48 | 10664 | Quemchi | Quemchi | Cermaq Chile S.A. | Si | Primaria - Secundaria | Cloración y Decloración | Mar Fuera ZPL |
| 49 | 10086 | Ilque | Puerto Montt | Abick | Si | Primaria | Cloración | Mar fuera ZPL |



Listado de Plantas Autorizadas para Faenar y/o Procesar Salmónidos

09-09-2022

| | | | | | | | | |
|----|-------|-----------------------------------------|--------------|----------------------------------------------------------|----|-----------------------|-------------------------|-----------------------|
| 50 | 12085 | Unicorns de Soc. Com. Low Triviño Ltda. | Punta Arenas | Cermaq Chile S.A. | No | Secundaria | Cloración y Decloración | Aguas Magallanes S.A. |
| 51 | 12152 | Entrevientos S.A. | Punta Arenas | Multiexport/Bluriver | No | Secundaria | Dióxido de cloro | Aguas Magallanes S.A. |
| 52 | 8115 | Soc. Pesquera Landes S.A. | Talcahuano | | No | Reductora | Dióxido de cloro | ESSBIO |
| 53 | 10135 | Cooke Aquaculture | Puerto Montt | Cooke Aquaculture | No | Secundaria | Cloración y decloración | Río El Mañío |
| 54 | 10946 | Chinquo | Puerto Montt | Caleta Bay | No | Primaria - Secundaria | Cloración y decloración | ESSAL |
| 55 | 10034 | Trans Antartic | Puerto Montt | PESQUERA TRANS ANTARTIC LIMITADA | No | Secundaria | Cloración y decloración | Mar fuera ZPL |
| 56 | 10975 | Ancud | Ancud | Salmones Aysén | No | Secundaria | Cloración y decloración | Mar fuera ZPL |
| 57 | 10949 | Marlebu | Puerto Montt | Sociedad Comercializadora de Productos del Mar Lebu SpA. | No | Secundaria | Cloración y decloración | Essal |

Questions of interviews

Questions for interview with Company A

1. What are the threats of substitution for salmon?
2. How is demand impacted by a rise in price?
3. What types of salmon are imported to Belgium?
4. What is your point of view on the use of antibiotics in Chilean Salmon?
5. Do you think the modernized trade agreement will boost your salmon imports positively?
6. How has the ISA virus impacted your imports?
7. How is the price of salmon determined?

Questions for interview with INTESAL

1. How likely are the threats of new companies in the salmon industry in Chile?
2. Do suppliers have power in the salmon industry, e.g. salmon feed suppliers, given that they represent a significant part of the costs?
3. How do powerful retailers, such as Walmart and Costco, impact the salmon industry? Given their size, can they negotiate more effectively?
4. What is the competitive situation among salmon companies, and is it based primarily on efficiency and lower production costs? And, in that sense, is the competition more between Chilean companies and foreign companies (from Norway)?
5. What are the main (urgent) needs of the salmon industry? In other words, where are the market opportunities?
6. To what extent does the salmon industry use renewable energy sources, such as solar panels?
7. According to your observations, what measures have been taken in Chile's salmon industry to achieve sustainability goals?"

8. Innovation in salmon feed: What opportunities exist for innovation in salmon feed, such as developing healthier and more sustainable feeds for aquaculture?
9. What opportunities exist in the optimization of production through the use of artificial intelligence and the Internet of Things (IoT)?
10. To what extent is water reuse being implemented in the salmon industry and what do you think could be the market opportunities associated with a more efficient and sustainable use of water resources?
11. What role does innovation play in improving salmon health and disease prevention in fish farms?
12. How is climate change affecting the salmon industry (in Chile) and what measures are being taken to mitigate its impacts?
13. Is there a growing demand for salmon products with sustainability certifications and how are you adapting to this demand?
14. The Clean Production Agreement aims to establish a strategy for climate change and circular economy in salmon farming, what measures are being taken?