

Chilean Blue Revolution: the Rise of Salmon Aquaculture and the State

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Abstract

In less than two decades, Chile moved from a nonexistent salmon aquaculture production to become a world leader. This research examines the role of state institutions in fostering a non-traditional export-led industry in Chile from 1969 to 2016. During this period, Chile experienced a forced transition towards a neoliberal economic model imposed by General Pinochet's brutal dictatorship and maintained by subsequent democratic governments. The institutional framework set during the dictatorship of the 1970s and 1980s shaped actors and processes related to salmon aquaculture and continue to structure the industry. The history of salmon aquaculture development in Chile is marked by a paradox in which the Chilean state, the same that advocates for a neoliberal economy with a minimum state presence, continues to support, promote, finance and define the salmon aquaculture industry direct and indirectly.

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Table of Contents

Abstract.....	ii
Acknowledgements.....	iii
List of Tables.....	vii
List of Figures	viii
List of Abbreviations	ix
Chapter 1 – Introduction.....	1
1.1 Background	2
1.2 Importance of the study	4
1.3 Objectives of the Study	6
1.4 Research Question and Hypothesis	7
1.5 Limitations.....	8
1.6 Structure	8
Chapter 2 – Literature Review and Theoretical Framework.....	11
2.1 Aquaculture as a concept.....	12
2.2 Salmon aquaculture in the world.....	13
2.3 Salmon Aquaculture in the Literature	15
2.4 Gaps in the literature	20
2.5 Theoretical Framework.....	22
2.6 Methods and Data	25
2.7 Conclusion.....	27
Chapter 3 – History of Salmon Aquaculture in Chile	28
3.1 Exploratory phase (pre-1960s).....	30
3.2 Preparatory phase (1960 to 1975).....	34
3.3 Establishment phase (1976 to 1989)	36
3.4 Expansion phase (1990 to 2009).....	40
3.5 Current phase (2010 to ongoing).....	43
3.6 Conclusion.....	45

Chapter 4 – State Institutions and the Chilean Blue Revolution	47
4.1 Exploratory phase (pre-1960s).....	50
4.2 Preparatory phase (1960 to 1975).....	52
4.3 Establishment phase (1976 to 1989)	55
4.4 Expansion phase (1990 to 2009).....	60
4.5 Current phase (2010 to ongoing).....	67
4.6 Conclusion.....	76
Chapter 5 - Conclusion	79
5.1 Contributions to the Literature.....	82
5.2 Future Research	83
5.3 Final Thoughts.....	84
References	86
Appendix.....	96

List of Tables

Table 1 Development phases of salmon aquaculture in Chile	10
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List of Figures

Figure 1 World capture fisheries and aquaculture production from 1950-2015	12
Figure 2 Number of farming concessions in Los Lagos region from 1982 to 2009	63
Figure 3 Aquaculture Production of Salmonids in Chile from 1990 to 2007	66
Figure 4 Aquaculture Production of Salmonids in Chile from 2006 to 2017	69
Figure 5 Institutional changes proposed after the modification of the LGPA in 2010	72
Figure 6 Production of Atlantic salmon from 2005 to 2017	73

List of Abbreviations

APSTC	Association of Producers of Salmon and Trout in Chile
CORFO	Production Development Corporation
FAO	Food and Agriculture Organization
HI	Historical Institutionalism
IADB	Inter-American Development Bank
IFOP	Fisheries Development Institute
INTESAL	Salmon Technology Institute
ISA	Infectious Salmon Anemia
ITT	International Telephone and Telegraph Corporation
JICA	Japanese International Cooperation Agency
LGPA	General Law of Fisheries and Aquaculture
NSA	National Society for Agriculture
SAG	Agricultural and Livestock Service
SERNAPESCA	National Fisheries and Aquaculture Service
SUBPESCA	Undersecretariat of Fisheries
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development

Chapter 1 – Introduction

Salmon is not an indigenous species to Chile, yet in less than two decades, Chile moved from an inexistent salmon aquaculture production to become a world leader. Salmon farming in Chile started its development in the 1970s, and by 1992, the country was the second largest producer in the world after Norway (Bjørndal and Aarland, 1999: 238). The 1990s and 2000s saw a boom in Chilean exports of salmon. From less than US\$50 million in 1989, the value of exported salmon reached US\$1.7 billion in 2005, representing almost 5 percent of all Chile's export at the time, to US\$4.65 billion in 2017 (Chandra, 2006; Ministry of Foreign Affairs, 2018). National institutions played a significant role in the development of the salmon aquaculture industry in Chile in a context of neoliberal trade policies, a period of democratic transition and deregulation in the capture fishery (Barrett et al., 2002). The purpose of this study is to achieve an understanding of the key institutional factors that explain the rise of salmon farming in Chile and the industry's environmental impact.

Systematic institutional interventions in the aquaculture sector from the Chile state played a fundamental role in structuring the aquaculture industry in Chile. It is important to examine this development in light of the historical institutional context, as it influences outcomes and goals that actors pursue (Steinmo et al., 1992). According to Sven Steinmo, institutions exist in a context; they influence and are influenced by it (1989). As will be presented in Chapter 2, this study uses Historical Institutionalism as its

theoretical framework to analyze how, when and why national institutions helped to shape the processes and political outcomes that directly influenced the creation of the salmon aquaculture industry in Chile.

1.1 Background

Attempts to introduce salmon to Chile date back as early as 1885, with the first import of salmonid eggs (Soluri, 2011; TechnoPress and SalmonChile, 2003). However, it was not until the 1960s that the first attempts to develop salmon farming as an industry appeared with the agreement between Chile and Japan to introduce Pacific salmon in Chilean waters (Chapter 3). One of the motivations for this agreement was Chile's rugged unpopulated coastline that offers sheltered sites with ideal water temperatures and salinity for salmon farming (Bjørndal and Aarland, 1999: 239). However, to look only at the geographical and climatic aspects of Chilean salmon aquaculture in a vacuum is to miss an opportunity to understand the political process behind this development.

From an economic and political perspective, the short presidency of Salvador Allende (1970-1973) and the coup d'état by General Augusto Pinochet on 1973 that led to a 17-year dictatorship in Chile are the background to an emerging industry. The neoliberal economic model based on export-oriented production of natural resources initiated in 1973 reshaped the Chilean economy by privatizing national industries, opening the markets, facilitating foreign investments and reducing regulations (Latta and Aguayo, 2012). According to Barret et al., a direct consequence in the fisheries sector of the

deregulation imposed by Pinochet's dictatorship was an overfishing crisis (2002: 154). The privatization and industrialization led to overexpansion and overcapitalization of the salmon farming industry.

Other authors argued that the Chilean state provided institutional conditions for the industry to succeed (Bustos-Gallardo and Irrázaval, 2016; Rainbird and Ramirez, 2012; Iizuka, 2004). There is a gap in the literature in exploring the historical context and institutional processes changes, which led to the development of the salmon aquaculture industry in a short period of time. The literature focuses more on technological transference, comparative advantages, economic impacts, and less on the role of state institutions (see Literature Review in Chapter 2). A compelling case is the Fundación Chile (Chile Foundation). Created in 1976 as a joint venture by the Chilean government and the United States' International Telephone and Telegraph Corporation (ITT), the foundation had a stated goal to foster the Chilean economy and become self-financing by selling services, providing expertise and transferring technology to the private sector (Huss, 1991). It was created with 50% of capital provided by the Chilean government and 50% by ITT, as a form of compensation for the nationalization of an ITT subsidiary during the presidency of Salvador Allende (Huss, 1991: 107). Although advertised as a non-profit private organization, Fundación Chile was a quasi-autonomous non-governmental organization funded with 50% of public money.

One of the first projects of the Fundación Chile, under the direction of ex-ITT engineer Wayne Sandvig, was to explore the feasibility of establishing salmon aquaculture in

Chile. An initial step was to acquire Domsea (later renamed to Salmones Antártica), a US-owned hatchery, to demonstrate the technical capabilities and commercial possibilities of salmon farming (Huss, 1991: 110-111). Other institutions were involved with the creation of the salmon aquaculture in the country, and this work will examine their role. Government institutions such as the Fisheries Protection Division of the Agricultural and Livestock Service (SAG or Servicio Agrícola y Ganadero, in Spanish) and the Chilean Production Development Corporation (CORFO or Corporación de Fomento de la Producción) also facilitated and helped the development of salmon farming.

1.2 Importance of the study

Despite the tremendous growth that salmon aquaculture had in Chile in the past decades, the industry expansion and its influence in the global food chain keep growing. In recent decades, aquaculture is in the spotlight as the solution not only to solve the increase in fish consumption but mainly as "the best opportunity to increase food production" (Noakes, 2018: 20). The world's population is expected to increase to almost 10 billion people by 2050 according to a report published by the United Nations (2017). Some authors argue there is a necessity to double global food production to meet the increasing demand (Ray et al., 2013; Tilman et al., 2011), while others argue that it only needs to increase at historical production levels might be enough to meet sustainable production goals (Hunter et al., 2017). Whichever scenario, competition for land and water, climate change, the environmental damages of agribusiness, and

overexploitation of fisheries might present a challenge to increase food production and meet food security, and sustainability (Godfray et al., 2010).

Aquaculture can have several environmental consequences that go from the intensive use of fungicides, pesticides, and antibiotics, to fecal matter and unconsumed feed that can contaminate fresh waters (Barton, 1997: 316; Swanson, 2015). The industry requires constant use of fishmeal and fish oil harvested from wild fish to feed carnivorous farmed salmon, which creates more pressure on wild stocks of pelagic fish (Péron et al. 2010). In the case of Chile, it had two major environmental crisis related to salmon farming. The first was the infectious salmon anemia (ISA) disease in the mid-2000s, which devastated salmon production and raised many questions regarding the impact the industry is causing (Asche et al., 2009). The next crisis happened in early 2016 after a toxic algae boom emerged in the coast of the Chiloé archipelago causing the death of mussels, penguins, and whales, and killing up to 25 million salmon resulting in US\$800 million of economic loss (The Guardian, 2016). The Chilean government and the industry claimed it was caused by a strong El Niño, a natural phenomenon that can warm the waters and create microalgae, while fisher workers accuse a Chilean Navy operation authorized by the government that dumped dead fish into the sea weeks earlier (Pfeiffer, 2016).

In a widely cited article, the Economist anticipated that aquaculture offered great hope for the future food and compared the “blue revolution” to the agricultural “green revolution” of the twentieth century (Special Report: The Promise of a Blue Revolution – Fish Farming, 2003). Aquaculture is the fastest growing food production sector in the

world, and since the 1960s, the annual global growth in fish consumption has been twice as high as the population growth, with aquaculture the main responsible for the increase in the supply of fish (FAO, 2018). One of the key drivers of this growth is the stagnation in the levels of captured wild fish and the increasing demand for fish (Iizuka and Katz, 2015).

Of all the farmed fish, salmon farming is among the most successful. Trade in salmon has increased at an average of 10 percent per year in value terms since 1976, and since 2013 it is the largest single fish commodity by value in the world, with the four largest producers of farmed salmonids being Norway, Chile, Canada and Scotland (FAO, 2018; Asche et al., 2013). Norway and Chile have been the main producers and exporters of salmon since 1997. By 2006 Chile contributed to 38% of the world's salmon volume just behind Norway that produced 39% of it (Little et al., 2015). In the case of Chile, the influence of national institutions played a major role in the early stages of the salmon aquaculture growth in the country (Iizuka and Katz, 2015: 144). It is important to determine the role state institutions had and still have in the development of the salmon aquaculture in Chile to understand how and why the phenomenon has occurred.

1.3 Objectives of the Study

This study began with a puzzle: how did Chile become the second largest producer of farmed salmon in the world if salmon was not a native species in the country? The purpose of this study is to examine this question by looking at the role state institutions

had in the creation and development of the aquaculture industry in Chile. This work is interested in how political processes develop over time through institutional interventions. According to Pierson and Skocpol, this approach – temporal argument, attention to context and substantive agenda – enables an understanding of government, politics, and public policies (2002: 3). Furthermore, this research is interested in how state institutions address the environmental problems associated with aquaculture. The Chilean head of the State Department for Aquaculture coined the term “explosive growth” to describe the rise of salmon farms in Chile (quoted on Barton, 1997: 314). Nonetheless, this growth creates tensions between a desire for more profit from private companies, a necessity for sustainable development to protect the environment and the local population, and a regulatory framework defined by the government to oversee it.

1.4 Research Question and Hypothesis

This thesis’s main research question will be as follows: what is the role of state institutions in fostering the salmon aquaculture industry in Chile from 1969 to 2016? In this timeframe, Chile went from a democracy with a socialist president, to a dictatorship with a neoliberal agenda, and back to a democracy that kept the main aspects of this economic model. Furthermore, Chile went from not having salmon farming as a relevant economic activity to become the second largest producer in the world. To answer this question, it is essential to identify the institutional actors behind its growth and to investigate the historical context in which this development took place. The hypothesis

is that national institutions played a significant role in the development of the aquaculture industry in Chile by creating policies and frameworks, providing subsidies and tax exemptions, promoting the transfer of technology from other countries, and allowing foreign investment in the sector.

1.5 Limitations

Due to the focus of this study on state institutions, access to senior-level stakeholders in the Chilean government is limited. It is a challenge to find government officials willing to respond to all questions or accept to participate in an interview. This research also assumes that current government employees might be biased in their answers regarding the state participation in the development of the salmon industry in Chile or might be constrained to provide a critique, if that is the case, to their current employer. A significant number of key stakeholders inform this research. A goal for future work to tackle this limitation is to include more voices with institutional knowledge and from distinct backgrounds to enhance the analysis.

1.6 Structure

The structure of this thesis is divided into five parts. The first chapter provides an introduction to this paper. It outlines the background, research question and hypothesis, presents the importance of the study, the objectives it is trying to achieve, and the limitations. The second chapter reviews the literature and research related to broad topics of salmon aquaculture in Chile and the world. It also defines concepts used and

presents the theoretical framework, the methodology that guided this work and includes the research design, and data analysis procedures. The third chapter is focused on the historical background of salmon aquaculture in Chile. It divides this development history into five phases (see Table 1). First, an exploratory phase that goes from the first experiments in the nineteenth century until the 1960s. Second, a preparatory phase that goes from 1960 to 1975. Third, an establishment phase that goes from 1976 until the end of the 1980s. Fourth, an expansionist phase that began in 1990 until the ISA crisis in the late 2000s. Fifth, the current phase that began in 2010, after the ISA crisis. As we can see in Table 1 below, despite a forced transition from democracy to dictatorship and back, and a neoliberal economic model adopted at that time, the state never stopped supporting salmon aquaculture.

The fourth chapter discusses the role of state institutions in light of the Chilean salmon farming boom. It examines the active role of the state institutions with an emphasis on the historical context, policies, and regulatory frameworks created by these actors to oversee, influence, but ultimately to help the industry to succeed. This chapter uses the interviews done during fieldwork in Chile to answer the research question and test the hypothesis regarding the role of state institutions. Chapter 5 concludes this work by discussing the presented research and reflects on future perspectives for the salmon aquaculture in Chile.

Table 1 Development phases of salmon aquaculture in Chile

	Exploratory Pre-1960s	Preparatory 1960-1975	Establishment 1976-1989	Expansion 1990-2009	Current 2010-ongoing
Main Characteristics	State support Foreign know-how and experts Public financing First attempts of introducing salmonids Attempts to introduce salmonids in lakes and rivers	State support International cooperation agreements Feasibility surveys and new hatcheries Pioneer entrepreneurs Focus on ocean ranching	State support Foreign capital and firms New government agencies Technological innovations Focus on ocean farming using net pens	State Support Expansion to new markets Consolidation of the industry First aquaculture Regulations Atlantic Salmon becomes the main species ISA crisis	State Support Reform of regulatory framework Salmon farms expands further south Financialization of the industry Local firms open capital in stock markets
Institutional Actors	National Government Private Pioneers	National Government Private Pioneers JICA	National Government Government Agencies International companies JICA Fundación Chile APSTC (Later renamed SalmonChile)	National Government Government Agencies International companies Intesal SalmonChile	National Government Government Agencies International companies Banks SalmonChile Salmon Roundtable
Main Policies and Regulations	Fishing Law (N° 1949)	Marine Concessions (DL 340)	General Law of Fisheries and Aquaculture (LGPA) (N° 188892) Creation of Fundación Chile (DL 1528) Regulation of Fishery Activities (DS 175)	Modifications to LGPA (N° 19079 and N° 19080) Concessions (DL 290) Sanitary and Environmental (DL 319 and DL320) National Policy of Coastline usage (DL 475) National Register of Aquaculture (DS 499)	Aquaculture Law (N° 20434) New modifications to LGPA (N° 20583, N° 20597 and N° 20657) National Commission of Aquaculture (N° 20597)

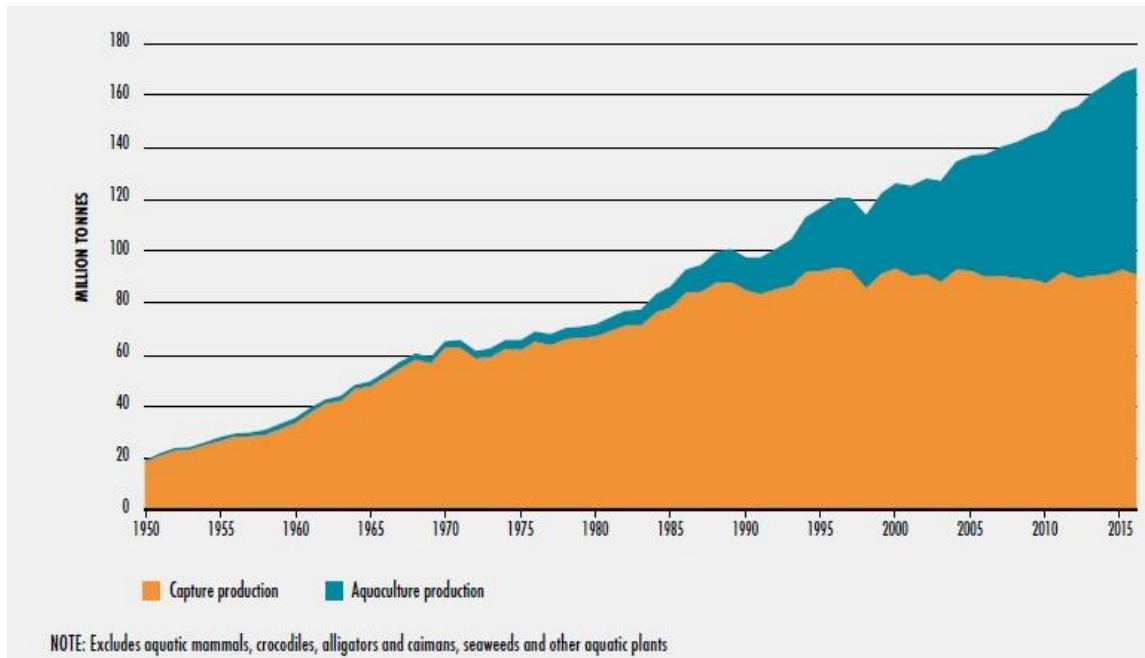
Source: Adapted from Hosono et al., 2016.

Chapter 2 – Literature Review and Theoretical Framework

The controlled farming of fishes and aquatic organisms is an old practice. The earliest known records of some aquaculture go as back as three thousand and five hundred years in China (Heen et al., 1993). Scholars believe that the initial development is connected to the Chinese emperor desire to have carp served on demand all-yearlong (Ibid.: 2). It is difficult to have precise details of how this production took place and the actors involved, but as an autocratic government, it is possible to assume that institutions from the empire were in charge of such production. Moreover, as we will see later in Chapter 3 and Chapter 4, government institutions are usually present at the beginning of aquaculture enterprises around the world, and their policies can have a defining impact in the industry.

Despite being an old tradition, the practice of aquaculture as a global agribusiness seeking to maximize production and profit is relatively new. In the past 50 years, aquaculture has become the world fastest growing food industry. Back in the 1970s, only 6% of the world's food fish and shellfish came from aquaculture. By 2009, that proportion had risen to almost half. Aquaculture continues to grow although it no longer enjoys the high annual growth rates of the 1980s and 1990s. The average yearly growth declined from double digits to 5.8 percent during the period 2000–2016 (FAO, 2018: 5). Figure 1 shows the tremendous growth of aquaculture production from 1950-2015 compared to world fisheries.

Figure 1 World capture fisheries and aquaculture production from 1950-2015



Source FAO 2018.

2.1 Aquaculture as a concept

Renowned Norwegian scholar Trond Bjørndal defines aquaculture broadly as “distinguished by other aquatic production by the degree of human intervention and control that is possible” (1990: 1). The author adds that aquaculture is more similar to animal husbandry than to traditional capture fisheries due to the focus on stock raising and not on hunting. In this early definition, aquaculture is understood as a fully controlled industry, including harvesting, environmental, and genetic conditions. In the late 1980s, the United Nations Food and Agriculture Organization defined aquaculture more specifically as:

“the farming of aquatic organisms, including fish, mollusks, 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. Farming also implies individual or corporate ownership of the stock being cultivated" (FAO, 1988).

FAO's definition introduced a criteria that implies stock ownership throughout the rearing period. However, there is no mention of state or government institutions in any widely used definition of aquaculture. In the case of Chile, there is a constant involvement of the state in the early stages of the aquaculture industry (see Chapter 4). State institutions are behind the creation of the salmon industry, but the definition of aquaculture above does not mention the state as a factor in this equation. Does the term need to be redefined or the role of the state must be examined in light of its importance? This work pursues the latter. There is not an intrinsic need to add state institutions to define what aquaculture is. Nonetheless, if there is an attempt to include corporate institutions in the definition of aquaculture, as it was the case with FAO, then state institutions should also be included given their relevance to the development of aquaculture.

2.2 Salmon aquaculture in the world

While forms of fish farming have existed for centuries, salmon aquaculture is a relatively new branch of a traditional activity. Humans have tried different methods to enhance salmon production in different parts of the world, but the industrial-scale of salmon aquaculture was spearheaded by the emergence of commercial salmon farming in

Norway in the 1960s. Even though anadromous salmon¹ were kept in saltwater confinement for cultivations purposes more than 150 years ago, the artificial cultivation of salmon only took off after experiments with floating cages began in the late 1950s in Norway (Lien, 2015: 34). An experiment by two brothers in 1959 led to the first Atlantic salmon reaching maturity three years later, which is considered the first time an Atlantic salmon completed an entire life-cycle in captivity. It was not until the late 1960s that smolt production was established in hatcheries and the salmon aquaculture industry had almost everything it needed to grow.

As we will see later with Chile, Norwegian state institutions created the first regulations to structure and formalize the industry, but most importantly, to support and legitimize. According to Lien, the regulatory measures and local social structures are the two factors that shaped the social formations of the early years of the salmon industry in Norway (2015: 36). This could explain its relative success compared to other countries that also have salmon aquaculture but did not have a strong state presence and local ownership of salmon farms.

In the beginning, salmon farming had the objective of increasing wild stocks through artificially breeding and releasing the fish back into the rivers. This practice evolved after the floating pens became the pattern for the industry and new technologies to develop smolts were introduced. The entire life cycle of the salmon is controlled in an industrial-

¹ An anadromous fish divides its life between freshwater and the ocean. In the case of salmon, they are born in fresh water, spend most of their adult live at sea, and then return to fresh water to spawn.

scale resembling agriculture. It is a process that starts in the fertilization and incubation of eggs and goes to the freshwater cages and to net pens in open seas to resemble a life-cycle of a wild salmon. The so-called "blue revolution" is the transformation of a wild fish into an industrial commodity farmed according to the needs of the market. This growth does not come without consequences. Salmon farming requires massive use of fish meal and fish oil from wild-caught fishes (Naylor et al.: 2000). Some critics correlate the blue revolution with increasing pressure on global marine fisheries (Lien, 2015: 4). According to Lien, if someone from the future tries to pinpoint the exact moment when Atlantic salmon underwent changes and expanded from a seasonal wild fish into an global farmed commodity, that moment would be right now (2015: 166)

2.3 Salmon Aquaculture in the Literature

This literature review takes a critical look into the salmon aquaculture literature, examining a range of studies by academics and researchers, as well as multilateral organizations as they understand the practice of salmon farming and the changes in this practice throughout time. Most of the scientific research associated with salmon aquaculture development until the early 1990s was mainly done by biologists concerned with nutrition, rearing process, diseases, genetics and water quality (see Stickney, 1991). In 1990, Bjørndal published the first book to analyze the salmon aquaculture industry systematically. Based on Norwegian data, the author was interested in creating an economic overview of salmon farming. Despite having a clear focus on market and

production, the author also analyzed the physical and biological system of salmon, following a trend at the time of giving importance to the hard science aspects of the industry (1990: 2-3). In the same sense, but starting to bring some concern on environmental issues, the book "Salmon Aquaculture" was published looking at the geographical distribution, economics and biological aspects of salmon farming (Heen et al., 1993). The book had a chapter on the environmental factors for salmon aquaculture, but the intent was to outline the ways that the activity affects the environment and vice-versa, and not to understand or criticize the industry's environmental impact.

Aquaculture research with a social science and anthropology focus started to gain momentum from the 1990s onwards. An essential step in that direction was made by Bailey et al. in *Aquacultural development: social dimensions of an emerging industry* (1996). The co-edited book has its origins in a World Congress of Rural Sociology workshop in 1992. It aimed to develop hypotheses and identify concerns to fill a literature gap on the social dimensions of aquaculture development. Until that moment, there was a general optimism surrounding aquaculture (Heen et al., 1993: 127-129). As Bailey et al. states, the focus of social science research concerning aquaculture should be "on the extent to which the technology has developed as a result of particular social conditions and the extent to which it refashions power relations among classes, genders and ethnic groups" (1996: 7).

Up until the late 1980s, literature was more interested in technology and biology developments to increase production and profits. Despite their effort to bring social

science and anthropology to the literature, aquaculture was still seen as an "opportunity to become more independent of nature" due to its capacity to "provide a predictable supply of farmed fish of controlled size, quantity, and moment of delivery" (see van der Schans in Bailey et al., 1996: 148). It was a step to create more awareness of the social aspects of aquaculture, yet scholars portrayed a sanitized version of aquaculture without problems, a clean solution to the growing fish demand and the stagnant fish stocks. The point to be made is not that aquaculture is intrinsically a flawed industry, but one should not look at it without assessing the environmental, cultural and social impacts.

The literature started to fill gaps related to environmental impacts, and the economics of aquaculture was also beginning to attract more attention from researchers (Bjørndal, 1990). The interest kept growing, and it is reflected in the amount of research published in the late 1990s and early 2000s about the various aspects of aquaculture. Economic and technological aspects of aquaculture, like the cost of production, returns, profitability are relatively well studied. There is a vast amount of literature produced around this time about technological and scientific aspects of aquaculture (Gjøen and Bentsen, 1997), farming practices (Tveteras, 2002) and resource potential (Naylor et al., 2000; Anderson, 2002). Many authors also started publishing about the environmental constraints (Folke et al., 1994; Barton, 1997; Naylor et al., 1998; Costa-Pierce, 2002), cultural and social aspects of salmon farming (Barret et al., 2002; Phyne and Mansilla, 2003); labor relations (Amtmann & Blanco, 2001) and gender relations on aquaculture

production (Marshal, 2001). Scholars have also suggested that aquaculture can boost farm food production and income and can provide farm families with an additional source of dietary protein (Irz et al. 2007)

The increase in the range of topics that researchers started to examine correlates to the years of constant expansion of salmon production and the intensity of operations of this industry. Salmon was no longer an exotic fish produced in a few countries of the Northern hemisphere. It had become a global commodity with several countries involved, and multinationals companies investing large sums of money on this activity. Several scholars traced the development of salmon farming as a technological miracle and a result of entrepreneurship vision (Anderson, 2002; Ibieta et al., 2011). But these narratives tend to look only at the positive aspects (Wells, 2009). Some authors say that despite any problems related to overexploitation of wild stocks to produce fish feed or damages to natural ecosystems, the industry is new and has a "potential for innovation" and can become more sustainable (Diana, 2009).

This optimism started to change in late 2000s, after a massive outbreak of Infectious Salmon Anemia (ISA) virus in Chile, a country considered to be almost free from diseases in the industry (Bjørndal, 1990), created economic losses, widespread unemployment and forced several companies to go bankrupt (Wells, 2009: 10). The excessive concentration of net pen cages and lack of environmental regulations are considered to be the root of the problem (Ibid.). Chilean state institutions had to intervene and provided US\$120 million in financial rescue. After this, some authors started to look

more closely to environmental, social and ethical issues related to salmon farming (Asche et al., 2009; Soluri, 2011, Olesen et al., 2011; Lam, 2016).

The world fisheries and the interconnectedness between wild stocks and aquaculture have also got some attention from scholars. DeSombre and Barkin published an overview examining the geopolitics of fish as a resource (2011). The study is interested in the structure and current situation of world fisheries and the problems associated with the development of the global fishing industry, including aquaculture. According to them, the interrelationship of politics and economics plays a vital role in the depletion of international fisheries (Ibid.: 18). The authors point that salmon aquaculture is necessarily industrial and generally done on a large scale, due to its capital intensive nature (Ibid.: 132). They also forecast that in one or two decades the majority of seafood consumed by people will be farmed.

In one of the most innovative views on the topic, Lien uses the concept of domestication to make connections between salmon farming and people in which human and animal are shaping one another (2015). With a background in Social Anthropology, the author is more interested in the biosocial dynamics of salmon aquaculture than the more frequent economic or scientific focus. Rather than seeing salmon as a passive figure locked in a cage, Lien observes salmon farms, salmon slaughterhouses, and various administrative locations associated with the salmon farming industry to explore the idea of the salmon as a sentient being in a state of “becoming” (2015: 166-167). This is a unique piece that shows that the literature on salmon aquaculture is expanding to

embrace different fields and points of view. In her conclusion, Lien raises the question, albeit briefly, if farmed salmon should not be gradually replaced by non-carnivorous fish stocks to reduce demand for feed resources.

2.4 Gaps in the literature

Some authors point that Chilean state provided institutional conditions in the early stages for the industry to succeed (Barton and Roman, 2016; Bustos-Gallardo and Irarrázaval, 2016; Iizuka and Katz, 2015; Ramirez and Paulina, 2012). Still, there is an apparent gap in the literature in exploring the historical context and institutional processes which led to the development of the salmon aquaculture industry in Chile a short period. The literature focuses more on technological transference and economic success, and less on the role of institutions. In the case of Chile and the history of salmon aquaculture development in the country, Méndez and Munita wrote a great piece about the early history of salmon industry in Chile (1989). However, the most comprehensive work trying to track the historical attempts to introduce salmon is that of Sergio Basulto in his book *The Long Journey of Salmon: a Forgotten Chronicle* (In Spanish: *El Largo Viaje de los Salmones: una crónica olvidada*) (2003). Despite being a unique piece about the salmon timeline in Chile since the nineteenth century, Basulto does not explore the role that state institutions had in the country. The author is more interested in telling the history without analyzing, theorizing or conceptualizing it.

The importance of the state for the salmon farming development in Chile is often assumed (Rainbird and Ramirez, 2012) and under-explored. The book *Chile's Salmon Industry* is probably the most comprehensive academic attempt in providing a historical account since the beginning of this activity in the country as a commercial enterprise (Hosono et al., 2016). Few authors explore the active role of the Chilean state, first under the dictatorship and later under a democratic government, as an essential element for the industry to succeed. This thesis is interested in the historical formation and implementation process backed by state actors that resulted in a massive industry, which accounts for around one-third of salmon production in the world. Chile serves as a case study to examine the impact that state institutions can have to develop a new sector ground-up and their social-economic consequences in a developing country. This work will add to the literature on historical institutionalism by examining the key historical processes behind the transformation of a non-traditional industry, and what are the political and environmental implications of Chile's increasing reliance on salmon farming.

Analyzing the historical process behind how salmon aquaculture evolved in Chile is central to understand how state institutions continue to support and shape the industry. As aquaculture keeps growing in Chile, recognizing the actors involved in this industry and the role of the state is imperative to reduce negative environmental and social consequences, increase accountability and establish a sustainable – or less damaging – way of production.

2.5 Theoretical Framework

Institutions are an important part of the Political Science field, and it is essential to clarify how this thesis understands the concept. Some authors define institutions simply as rules that frame or condition action (Hall and Taylor, 1996; North, 1990; Ostrom, 1990). This work borrows the definition of the celebrated Argentinean political scientist, Guillermo O'Donnell. O'Donnell understands institutions as a “regularized pattern of interaction” that is accepted by the actors involved – even if they do not agree – who interact under formal or informal rules sanctioned and backed by that pattern (O'Donnell, 1996). Despite acknowledging their relevance, this work does not dive too deep in the importance of Chilean informal institutions for salmon aquaculture in Chile.

For Thelen and Steinmo, it is necessary to look at the institutional landscape to answer questions regarding policy outcomes across time and space (1992: 5). According to Sven Steinmo, there could be no organized form of politics without institutions (2001). In addition, institutions exist in a context; they influence and are influenced by it (Steinmo, 1989). A report from the Inter-American Development Bank (IADB) highlights the importance of institutions to explain “why reforms endure in some countries, why some countries can easily change policies that are not working well or why some can adjust better when circumstances demand it” (2005: v).

Institutions do not exist in a vacuum. They are created and shaped by actors seeking to gain strategic advantage and control the wealth distribution mechanisms that were until

not so long ago controlled by others – i.e., politics driven by the self-interest in furthering their career, or political parties trying to improve their presence (Schamis, 1999; Ames, 2001). The enforcing institutions of a society affect its economic performance and become the forum for interest-led politics and policymaking (Schamis, 1999: 267). Moreover, institutions define who can participate in a specific political arena, and not only are shaped by, but influence the actors by modifying their political strategies, and can even influence what these actors' preferences are (Steinmo, 2001). In other words, the institutional framework affects the behavior of actors "according to the dynamic effect that interactions among these actors produce in the final result" (IADB, 2005: 256). A historical approach must inquire into the institutional context. The central point is that institutions set the context in which actors make policy choices (Hall and Taylor, 1996). Nonetheless, focusing this study on Chilean state institutions does not imply denying the influence of other structural variables that can directly influence social policy and political outcomes. History, beliefs, and attitudes of citizens, economic outlook, and leadership also have influence (Ibid.: v).

This study uses Historical Institutionalism (HI) as its theoretical framework to analyze how state institutions shaped processes that directly influence the salmon industry in Chile. This work is interested in how processes and political behavior develop over time and how the institutional context affects these outcomes. According to HI, human beings are "norm abiding rule followers" that will behave depending on the individual, on the institutional context, and the rule (Steinmo, 2008: 163). For historical

institutionalists, institutions bestow power or authority upon some actors, and in the same way, they reduce the influence of others. HI focuses on empirical questions with a historical orientation and is mainly concerned with how institutions structure and shape political behavior and outcomes over a period of time (Ibid.: 150). This framework helps to analyze choices and outcomes: why were they made, which actors influenced them and what were the consequences? Institutions are not neutral battlegrounds; they are the center of political activity and structure this activity over time. As Steinmo argues, the institutional context is so important that interests and values do not have any substantive meaning if abstracted from it (1989: 502).

Historical institutionalism is a useful tool to develop a better understanding of how processes can affect political outcomes (Hall and Taylor, 1998: 960-962). According to Pierson and Skocpol, historical institutionalists ask "big, substantive questions" using macro contexts to analyze the combined effects of institutions in a period, rather than looking to one just institution or process each time (2002: 695-696). For Peter Hall, historical institutionalists place institutions in a causal chain that can leave room for other factors such as "socioeconomic development and the diffusion of ideas" (1996: 942). Albeit not common, other authors have used HI to investigate the transformation of the aquaculture industry (see Aarset and Jakobsen, 2009). The two main advantages of HI are the possibility to look at processes continuity over time and space, and see how policy outcomes develop in different institutional landscapes throughout time. Therefore, it is paramount to study the combined effects of distinct state institutions in

an extended period to analyze the development of commercial salmon aquaculture in Chile.

Institutional developments do not happen overnight; instead it is an ongoing evolution that takes time, the involvement of several actors, and a series of events in a context to exist. It is also important to underline that this does not imply historical determinism (see Thelen, 2003). For Chile's salmon industry, this means not a simple look to the past, but rather a careful analysis to understand the processes behind the development of this non-traditional industry. Which institutions were involved, what was the historical background, and what are the main factors and actors behind the creation and development of this industry, the second largest in the world? Next section explains and justifies the methodology used to answer those questions.

2.6 Methods and Data

This thesis uses three main methods of inquiry. First, an extensive investigation of primary sources – governmental regulations, investments, subsidies, laws and environmental policies since the formation of salmon farming in Chile. Second, it reviews the existing published literature on salmon aquaculture in Chile in English and Spanish; as previously seen in this chapter, to highlight the gaps and explain the issues it is trying to address. Third, this research includes a field work to Chile in March of 2019 that allowed archival work at the Chilean National Library and detailed interviews with scholars, industry professionals, and non-governmental organizations. All interviewees

were selected due to published works, presence in the press, or senior position at an institution with involvement in the aquaculture industry. In total, five interviews were conducted in Chile. Due to the time constraint of this process, it was not possible to have a larger and more diverse group of interviewees. It is a future interest of this researcher to include more social organizations, government officials and indigenous populations, and visit communities that are, at the same time, directly impacted and also benefit from aquaculture.

Interviews lasted around 45 minutes and were semi-structured in ten open ended questions that began as an exploration of the history of aquaculture in the world in the past 50 years to set a broader context in which Chilean salmon industry was inserted. Specifically, in this case, the global context is important as the aquaculture technology was developed in Norway, and other countries were also testing the feasibility of developing production on a commercial scale. Interview questions then changed to a narrower angle to focus on the early days of the industry in Chile and the influence the Chilean state had on its growth. Some of the questions focused on the role of institutional actors and the future of the industry in Chile. The last question addressed environmental issues and lessons learned after the ISA virus crisis. This field work and these interviews are the backbones of Chapter 4 and the discussion that follows right after it. The interviews were conducted in English or Spanish. Language was not a barrier; interviews in Spanish were transcribed and translated to English by the author.

The data used in this thesis to elaborate graphs regarding the production, exportation and historical growth of aquaculture comes, in its majority, from FishStatJ, a free software available online that gives access to FAO's Fisheries and Aquaculture data since the 1950s. The Chilean National Fisheries and Aquaculture Service also publishes an annual report that provides valuable data, which was used as reference for this research.

2.7 Conclusion

The literature on salmon aquaculture in Chile has expanded considerably in the past two decades. Nonetheless, with the salmon farms expanding southward to new areas, the increasing production, and the consolidation of the industry into large multinational conglomerates there is an urgent need to examine the topic using new or less explored lenses. This research considers the evolution of institutional processes that shaped the aquaculture industry since the introduction of salmonids in Chilean waters to address a gap in the literature. Focusing this study on Chilean state institutions does not imply denying the influence of other variables – such as informal institutions, social structure, or economic factors – that can influence social policies and political outcomes.

In the next chapter, we provide a historical background of the development of salmon aquaculture in Chile divided into five development phases (Table 1), beginning in the mid-1800s until the current phase that began in 2010.

Chapter 3 – History of Salmon Aquaculture in Chile

The history of salmon aquaculture in Chile is marked by state subsidies since the early days until the expansion and establishment of salmon farming and the decline of ocean ranching in Chile. This thesis asks the role of national institutions in fostering the salmon aquaculture industry in Chile from 1969 onwards. But to explain the rapid expansion of salmon farming in Chile, and the transformations that came as a result, using a historical institutionalism lens one must look to its origins. This historical approach shows that Chilean state institutions were involved since the first efforts to introduce and ultimately control non-native salmonid species in Chilean waters. The government signed agreements, hired experts, provided funding, acquired technological know-how and created regulations to develop a domestic salmon fish production.

As we will see in this chapter, commercial salmon aquaculture in Chile is relatively new. Its early days can be traced back to the 1980s, with a major growth from 1990s onwards. Scholars who study the history of salmon aquaculture in Chile often focus on the neoliberal context after dictator August Pinochet took power in the 1970s as the starting point of the industry (see Phyne and Mansilla, 2003; Rainbird and Ramirez, 2012). However, the first efforts to introduce salmon in Chile started in the second half of the nineteenth century, way before commercial salmon farming appeared in Chilean waters. The Chilean government had an interest in introducing salmon and trout due to (1) the low population of freshwater species in rivers and lakes; (2) the influence of Europeans

immigrants; (3) to increase fisheries production with a new species (4) and to reduce imports of U.S. canned salmon (Wurmann, 2007: 415-416). The plan was to use ranching technique for the introduction of salmonids in rivers and lakes to grow unassisted to be subsequently harvested. This technique requires low capital investment, but the return rate is uncertain and there is not much control during production. The idea of introducing salmon to Chile was also strengthened after the successful introduction of several species of trout in Chilean rivers during early twentieth century. Furthermore, it also got momentum after the success introduction of salmon in New Zealand.

When commercial salmon aquaculture took off almost 100 years after the first attempts to introduce this exotic fish species, Chilean Government justified the need to develop this industry with the increasing pressure on wild fish stocks (Claude et al, 2000: 8). Instead of helping wild fish stocks, one side effect of the uncontrolled growth of salmon aquaculture was an increase in the capture of native species to produce fish feed (Naylor et al., 2000). In more than a century, this activity changed from scattered attempts to introduce salmon in rivers using the ranching technique to a full-fledged massive salmon farming industry that controls all the life cycle of the fish, from the fertilization of the egg to the rearing of the smolt up to the processing of the fish. This long process can be historically divided into five phases (Table 1). First, an exploratory phase that goes from the first tests and experiments until the 1960s. Second, a preparatory phase that goes from 1960, passing through the first cooperation agreements between Chile and Japan, and Chile and the United States, to 1975.

Third, an establishment phase that goes from late 1970s until the end of the 1980s when Fundación Chile was created and the commercial viability of the industry was proved. Fourth, an expansionist phase that began in the early 1990s when the industry started to expand globally until the ISA crisis in the late 2000s. Fifth, a regulatory phase that came after the ISA crisis and saw the Chilean government bailing out the salmon aquaculture industry and introducing a new set of regulations. Since the dawn of the salmon industry to the current days, the Chilean state is involved with a direct or indirect involvement.

3.1 Exploratory phase (pre-1960s)²

The introduction of trout and salmon in rivers began in Chile in 1905 when shipments of fertilized eggs arrived from Germany and later from the United States (Thorpe, 1980). But the interest of in introducing new species dates back to the second part of the nineteenth century when private organizations, investors, and the Chilean government started to explore possibilities of introducing exotic species in Chilean waters. In 1848, the Chilean Government hired French geologist Pierre Joseph Aimé Pissis to prepare a geologic description of the Republic of Chile. On his report, he wrote that Chile did not have many freshwater species of fish on its rivers or lakes (quoted on Basulto, 2003). According to Basulto, his opinion might have influenced the government to do more research on the topic. The first recorded attempt to introduce a salmonid in Chile comes a few years later. In 1865, the newspapers “El Correo del Sur” printed a short

² Summary of the exploratory phase is mainly based on the book *El largo viaje de los salmones: Una crónica olvidada, or A Salmon Journey: A Forgotten Chronicle* (Basulto, 2003), the most complete historical account of these early efforts.

note about the efforts of a rich coal mine owner in southern rivers. There is no other record of this attempt besides that brief newspaper note (Basulto 2003: 37). In 1878, a rich landlord hired the German naturalist Rodolfo Phillipi to breed eggs brought from Scotland. The results of this attempt were also lost in time after a flood destroyed the hatchery (Wells, 2009).

Chilean state institutions were involved since the beginning. At the same time of those unsuccessful private attempts, the Chilean government started its own experiments. In 1874, the government hired Julio Besnard, a French veterinarian to head the Department of Animal Husbandry at the University of Chile. Bernard made several expeditions to Europe with the objective to bring eggs and introduce them in Chilean rivers. All those attempts failed due to a lack of technical expertise (Basulto, 2003: 47-63; Wells, 2009). In 1885, the National Society for Agriculture (NSA) started building an aquaculture station on the East side of Santiago, the first of its kind in South America, to experiment which species were most likely to succeed its introduction in Chilean waters. With institutional incentive and funding from the government, thousands of eggs were imported from Europe. In 1890, after reading Besnard's reports, the Chilean government tried to import salmon eggs from a hatchery in California. The eggs were never sent due to intense rains that affected the hatchery. Later the government hired William Anderson Smith, a fishing consultant from Scotland to write a report about the introduction of salmon in Chile, which was published in 1897. In 1889, several species from Europe had been experimented on NSA's aquaculture station (Wurmann, 2007:

416). All those successive attempts can be seen as unconnected, but they show a structural commitment from individuals and government officials to introduce an exotic species to Chile.

According to Basulto, the government was seriously interested in materializing the introduction of salmon in Chile (2003: 67). The Ministry of Industry hired experts, analyzed international experiences, and invested in technological expertise. Another factor that can help to explain the increasing interest was the appetite for canned salmon imports and its value in the commercial balance. From \$62,129 in 1898, to \$294,361 in 1902, to \$1,379,973 in 1907 (Ibid: 139-140).³ Those numbers indicate that behind the efforts to provide new sources of food to please European immigrants and incentivize recreational fishing, there were financial reasons behind the governmental determined attempt. Another related reason was the first reported returns of Chinook salmon in New Zealand in the beginning of the twentieth century after years of failed attempts to introduce the fish in the southern hemisphere (McDowall, 1994). The Chilean government saw this as an opportunity and increased its efforts to introduce salmon to the nation's waters.

The year that some scholars point as the moment where salmonids were introduced in Chilean rivers is 1905 (Reyes, 2005). Federico Albert Taupp, a German Natural Scientist hired by the Chilean president in 1889, built the first hatchery in Río Blanco, located 200kms north of Santiago. With four hundred thousand fish eggs imported from

³ Values not adjusted for inflation.

Gemany, Albert Taupp succeeded in introducing rainbow and brown trout, but he also tried, with no success, with several other non-native species (Wells, 2009). The success of this experiment encouraged the government to finance two new hatcheries in southern Chile to reduce the dependency of imported eggs. Until 1914 all introductions on rivers depended entirely on fertilized eggs imported from the United States and Germany (Thorpe, 1980). In 1910, the Maullín hatchery on Lake Llanquihue was inaugurated, and in 1916 the Lautaro hatchery was built (Basulto 2003). In 1912, the first report of trout captured by anglers occurred near the Rio Blanco hatchery.

The introduction of trout in Chilean rivers was a tremendous success from a recreational or sporting perspective. Chilean state's interest in salmon aquaculture only increased after that, as it wanted to replicate the success with trout. Besides the government, associations of sports fishermen invested in the dissemination of salmonids in southern Chile. By 1930, brown trout and rainbow trout were considered established in Chile. Both species started inhabiting streams from central Chile to the south, a range that stretched over 2,500 kilometers. Concurrently, Chilean hatcheries were producing enough eggs to export to South American countries including Peru, Argentina, Colombia, Ecuador and Bolivia (Wurmann, 2007: 416). But Atlantic salmon did not have the same success. After a brief period of high productivity from 1920s to early 1930s, they began a rapid decline before disappearing completely from hatchery records in 1939 (Soluri, 2011). In 1938, the Lautaro hatchery stopped the production of Atlantic salmon. According to Basulto, the low return of Atlantic salmon can be explained due to

competition from other salmonids that became predator of juvenile Atlantic salmon in rivers, exotic species were competing for the same resources. In addition, lower genetic diversity and ocean currents that carried the fish to distant waters from which they were not able to return (Basulto, 2003). The economic interest of establishing salmon runs from ranching in a commercial scale faded away for a couple of decades. Chile needed more institutional support for research, investments and technology in order to succeed.

3.2 Preparatory phase (1960 to 1975)

In 1965 and 1966, a Chilean government institution called Fisheries Development Institute (IFOP) launched extensive surveys of potential salmon habitats (Thorpe, 1980). In 1967, the Chilean Agricultural and Livestock Services, part of the Ministry of Agriculture, signed an agreement with the Peace Corps of the United States to repopulate southern rivers with Pacific Salmon and to exchange aquaculture technology (Wells, 2009: 127). Despite advances in salmon farming, the method used for this domestication attempt was ocean ranching. A year later, an airplane from Canadian Pacific arrived in Chile with 30,000 eggs; it was the first time fertilized eggs were brought by plane instead of ships. This cooperation agreement signed by a government institution is considered to be the first “modern initiative responsible for salmon propagation in Chile” (Wurmann, 2008: 416).

In the late 60s, Japanese fishing and fish processing companies began to seek alternatives to their increasingly limited access to North Pacific salmon (Swanson, 2015:

103-104). Due to several restrictions imposed on Japan after the Second World War, Japan lost its access to Russian-bound salmon. During that time, food shortages led General MacArthur, responsible to oversee the occupation of Japan after WWII, to allow Japanese fishermen to build large salmon vessels to harvest and process salmon across North Pacific (Ibid: 103). It did not last long. Several restrictions imposed by USA and the Soviet Union in the 1960s reduced the allowable catch. Moreover, Japan's salmon stocks were suffering from overfishing and degradation. The Japanese government started to invest in salmon aquaculture by building new hatcheries. But the goal was to have another source of salmon that could be transformed into a reliably supply chain and imported directly to Japan and provide the so desired fish. According to Swanson, Japanese fish companies first tried to contact the New Zealand government to supply fertilized eggs and equipment to implement a commercial salmon industry there, but the offer was rejected (2015: 104-105).

Seeking an alternative, the Japan Fisheries Association turned to Chile after some reports on the possibility of transplanting salmon to that country. In 1969, the Japanese International Cooperation Agency (JICA) signed a cooperation agreement with the Chilean government to explore the possibility of introducing Pacific salmon in Chile (Hosono et al., 2016: 28). Technicians, egg shipments and aquaculture techniques were all sent to Chile and new hatcheries for salmon ranching were constructed. Scholarships and funding were also provided to Chileans to receive education in Japan. In early 1970s, JICA in cooperation with Chilean officials selected a site near the town of Coyhaique in

the south-central zone of Aisén, one of Chile's administrative regions, to rear eggs brought from Hokaido, Japan. By 1976, the newly permanent Dr. Shiraishi Hatchery, built with Chilean funds, started to operate. More than 2,000,000 eggs were shipped each year from Japan to Chile (Thorpe, 1980: 266). Despite all the efforts and millions of smolt released on Chilean rivers, the project was a commercial failure (Swason: 2015: 104). Nonetheless, as a consequence of these two agreements and a renewed government interest to boost its fishery sector, Chile had several new companies undertaking research and experiments throughout the country to find the more suitable way of raising and farming salmon. Moreover, the country also had hatcheries, production facilities, human resources and a know-how, which became the backbone for a starting industry.

3.3 Establishment phase (1976 to 1989)

1976 is a turning point in the history of salmon aquaculture in Chile, it was the beginning of the establishment phase, or learning period. The same year that the Dr Shiraishi Hatchery was completed, a businessman from the state of Washington, USA decided to invest in sea ranching in Chile. Jon Lindbergh, son of the first man to complete a nonstop transatlantic flight, was director of Domsea Farms Inc., a subsidiary of Union Carbide, a United States company that was investing in salmon aquaculture research since early 1970s. After failed attempts to take salmon farming to the US on the same scale that Norway was doing Lindbergh decided to invest in Chile after reports indicating the

country was appropriate for salmon (Hosono et al., 2016: 32). After consulting with the Chilean government, Domsea Farms built a hatchery and started to import thousands of Coho and Chinook salmon eggs to release at Lake Popetan in Chiloé Island. Although the experiment was able to achieve return of adult salmon, return rates remained below 1%, which was far from a lucrative enterprise. Union Carbide decided to sell all the facilities of Domsea Farms (Ibid: 33). Campbell Soup Co. bought the hatchery in 1979 but was not interested in the salmon project. Ricardo Rodríguez, a Chilean responsible for the project, went to Norway to learn about a new farming technique, and later began to build marine floating cages in Chiloé Island (Basulto, 2003). As it became clear that Chile was suitable for salmon production, more private companies began to invest in the country, while the national government started to create its first institutions to oversee this rising industry.

In 1976, the Chilean government created the Undersecretariat of Fisheries (SUBPESCA) to regulate the fishing industry and the rising aquaculture sector, and the establishment of Fundación Chile (In Spanish: Fundación Chile), a quasi-autonomous non-governmental organization. The latter was created as a joint venture between the Government of Chile and the US-based transnational corporation International Telephone and Telegraph Corporation (ITT) with the goal to transfer technology to improve production of natural resources and stimulate new business (Huss, 1991: 98). According to Basulto, the practical aspect of Fundación Chile was to find new technologies and adapt to the Chilean reality (2003: 419). Fundación Chile used some of the US\$50 million initial

endowment received in its conception to explore the feasibility of commercial salmon production. After a couple of years, Fundación Chile started to study the possibility of using net pen cage technology to produce salmon. To speed up the process, in 1981, Fundación Chile bought the facilities built by Domsea Farms, including the hatchery in Curacao de Vélez and the fish cages developed by Ricardo Rodríguez, in southern Chile (Huss, 1991: 107). The company was renamed to Salmones Antártica (Spanish for Antarctic Salmon), built two new hatcheries and started to heavily invest in open sea farming using open-net pens technology. In addition, Fundación Chile bought several facilities on Chilóe Island and transferred their ownership to Salmones Antártica (Wurmann, 2007: 417).

Several salmonid projects were underway in Chile at the end of the decade with the larger focus on stocking salmon in the hope they would return to breed. The company Sociedad de Pesquería Lago Llanquihue Ltda, created in 1975 with funding from the Chilean Production Development Corporation, was to export salmonids in Chile. Using ranching, the company exported 40 tons of rainbow trout to France in 1978 and later to other European countries and the United States (Basulto, 2003: 240-241). This constitutes another example that demonstrates Chilean state institutions influence since the early days of the industry. In the same year, the Japanese company Nichiro started surveys to select sites for sea farming and decided on Puerto Montt, a port city in southern Chile's Lake District. The company imported 200,000 Coho salmon eggs from United States and after two years, in 1980, managed to be the first to successfully farm

Coho, a variety of Pacific salmon (Hosono et al., 2016: 35). Chilean Company Mares Australes was also experimenting with Coho salmon at the same time and can also be considered a pioneer in commercial salmon farming in Chile (Basulto, 2003: 241).

Salmon sea farming was no longer a dream and its expansion resulted in a decline in sea ranching. Between 1981 and 1988, Salmenes Antártica managed to achieve an installed production capacity of 2500 tons of salmon per year, production of 5 million alevins⁴ and 10.000 tons of fish feed (Basulto, 2003: 240). In 1985, 36 firms were involved with salmon farming. In the following year, the Association of Salmon and Trout Producers of Chile (APSTC) was created with support from Fundación Chile (Mendez and Munita, 1989). New companies entered the business and by 1987 the number had increased to 56 firms with 117 salmon farms (UNCTAD, 2006). The success of intensive ocean farming confinement systems and the lack of regulations regarding the ownership of salmon runs discouraged ranching (Basulto, 2003).

In 1987, Salmenes Antártica was the first Chilean company to surpass the production of 1,000 metric tons of salmon in net-pen cages (Wurmann, 2007: 417). After demonstrating the feasibility of commercial salmon farming, Fundación Chile sold Salmenes Antártica in 1988 to the Japanese company Nippon Suisan Kaisha Ltda for US\$21 million (Basulto, 2003: 240). More than 100 years after Pierre Joseph Aimé Pissis wrote his report about the lack of fish diversity on Chilean rivers and lakes, commercial

⁴ The second stage of a salmon life cycle, which happens after the egg is hatched.

salmon aquaculture was an established industry in Chile, and it was time for it to expand.

3.4 Expansion phase (1990 to 2009)

The early success in salmon farming, new breeding techniques and the increasing demand abroad stimulated a larger investment from the private sector. The lack of government regulations and willingness to accept foreign capital to seek new markets also played a role in the expansion or globalization phase of the industry from 1990s until the ISA crisis. By 1991 there were about 471 Atlantic salmon farms, up from the 117 a few years earlier, and 523 Pacific salmon farms (UNCTAD, 2006: 6). In that year, the production of salmon reached 42,000 tons, an impressive growth if compared to the 109 tons produced in 1984 (Wurtmann, 2007: 424). In 1992, Chile achieved what seemed almost impossible a decade earlier. It became the second largest salmon producer in the world after Norway surpassing Canada and the United Kingdom (Bjørndal and Aarland, 1999: 238). Overall world production of salmon doubled surpassing 1 million tons at the end of the 1990s, and the Chilean production grew 10 times in that same period (UNCTAD, 2006: 7-8; Iizuka, 2004). In 1998, Chile's share of world production reached 22% transforming the country in a global supplier of farmed salmon (Bjørndal, 2001).

As the private sector increased its presence with several investments in Chile and the production of salmon and trout reaching records in production, the government

established the General Law of Fishing and Aquaculture (LGPA) in 1991 to organize, coordinate and regulate the industry (Iizuka, 2004). This regulatory framework was in fact mostly to simplify procedures and avoid conflicts with the fishery sector. But as we will see in Chapter 4, the focus on fisheries and the lack of resources for state institutions in charge of regulating the newly created aquaculture industry meant that this law was not enforced.

Demand was on the rise especially in the United States, with an average growth rate of 21% from 1995 to 2000, compared to 11% in Europe (Montero, 2004). Chile had an advantage to meet that demand. It not only had the geographical conditions, cheap labor and cheap feed, but had developed the technology to produce eggs locally and was capable of producing Atlantic salmon all year long. Investing in Atlantic salmon allowed Chilean companies compete directly with North American and European salmon farmers. In addition, it had the capacity of delivering fresh salmon to United States only five days after an order was placed (Montero, 2004: 61). From 1,645 tons exported in 1986, Chile reached 264,000 tons of salmon exported in 2001 (Winn, 2004: 320). With all the state support and the comparative advantages that Chile had, production was booming, demand was on the rise and aquaculture was providing profit to this newly consolidate export industry.

Looking at the expansionist phase in aquaculture industry in Chile only through a market perspective allows the history to be told from a narrow lens. Despite all the enhancement of salmon farming techniques, including the development of eggs

reproduction in Chile that happened in the 1990s, there were setbacks and crises that indicate that there are consequences for such growth. In 1997, Atlantic and Pacific fishermen from the United States accused the Chilean government of subsidizing salmon products to be sold at a lower price on American market. The accusation was rejected by the US International Trade Commission after the Chilean government proved no such distorting subsidies existed (Peacock et al, 2004: 6). A similar accusation of dumping from United Kingdom and Ireland with the argument that their fish farms and workers were being damaged led to an investigation from the European Union in early 2000s (Peterkin, 2004).

The unparalleled expansion of the industry created tensions between a desire for economic growth, a necessity for sustainable development and a regulatory framework to oversee it. With all the new capital entering Chile and a booming export-industry, there was no real interest from the government to propose and enforce tougher regulations to create conditions for sustainable growth. And in 2007 the aggressive farm expansion hit a wall, with environmental, social and economic consequences. The highly infectious disease ISA devastated the salmon production and raised many questions regarding the environmental impact of the industry. The ISA crisis was considered the worst disease outbreak in all aquaculture “possibly ever” (Asche et al, 2009: 405). The industry focus on maximizing production by keeping salmon at a high density population in sea cages holding up to 500,000 fish within a small geographical area contributed to the fast spread of the virus (Buschmann et al., 2009). The first reports of the disease

came only in 2007, but because the production cycle of salmon can last two years, the hard consequences appeared later in 2009. The crisis cannot be understood only as an environmental or sanitary problem. Production of Atlantic salmon decreased sharply from 386,000 metric tons in 2006 to 123,000 metric tons in 2011, millions of salmon were killed, and the industry lost around US\$2 billion dollars, but even more critical was that approximately 20,000 direct and indirect workers lost their jobs (Gerhart, 2017). After the ISA crisis, the Chilean state through CORFO provided guarantees for up to 60% of bank loans to fund sanitary and environmental investments for part of the industry (Bustos, 2015). The industry advocates for self-regulation and low regulation, but whenever it needs help, the government comes to the rescue. This demonstrates how intertwined the government is with the salmon aquaculture in Chile.

3.5 Current phase (2010 to ongoing)

Numbers show only part of the story and the rapid expansion of salmon aquaculture has caused concerns about its negative environmental and social impact. Looking from an economic perspective, despite the social and environmental damage of the ISA crisis in 2007-2009, the industry rebounded with help from Chilean government and reached production levels of almost 650,000 metric tons of Atlantic salmon, and nearly 950,000 metric tons of all species of farmed salmon (FAO, 2016). Demand for seafood is still growing and Chilean aquaculture farmers are profiting from an ever larger production, but the after effects of the ISA crisis are still part of life in Chiloé, where thousands were left unemployed as the industry continues to automatize (Gerhart, 2017). As was

demonstrated by the collapse of the salmon industry in 2007-2009, actors in the Chilean salmon industry have economic incentives to improve environmental and sanitary practices. From less than US\$50 million in 1989, the value of exported salmon reached US\$4.65 billion in 2017 (Chandra, 2006; Ministry of Foreign Affairs, 2018). Despite the economic rationale to improve its environmental conditions, the industry's uncontrolled growth poses a risk to local ecosystems. Some authors recommend halting its expansion to increase sustainability and reduce risks of environmental damage (Niklitschek et al., 2013).

Although regulations were enacted and changes were made in the General Law on Fisheries and Aquaculture, the ISA crisis was not the only recent major crisis involving this intensive industry in Chile. In 2016, a toxic algae boom emerged in the coast of the Chiloé archipelago causing the death of mussels, penguins and whales, and killing up to 25 million salmon resulting in US\$800 million of economic loss (The Guardian, 2016). The Chilean government and the industry claimed it was caused by a strong El Niño, a natural phenomenon that can warm the waters and create microalgae, while fishermen accuse a Chilean Navy operation authorized by the government that dumped dead fish into the sea weeks earlier (Pfeiffer, 2016). Some authors say harmful algal blooms have affected salmon farms in Chile since the early 1970's (Montes et al, 2018).

In 2018, 900,000 salmon escaped from a Marine Harvest ASA farm during a storm (Guzman, 2018). According to Marine Harvest, the fish were "not fit for consumption" (quoted on Reuters, 2018). In another statement the company said it "has full trust in

our country's institutions" to investigate the incident (Reuters, 2018). The result of an investigation from the Chilean Superintendency of the Environment (SMA) found out that the sea cages "do not keep the appropriate safety conditions or elements of optimal quality", but no farm was closed, and the company was not fined by the government (The Santiago Times, 2018). Escaped salmon can have negative ecological impact that vary from the increase in consumption of native pelagic fish putting more pressure on local ecosystems (Niklitschek et al., 2013) to the spreading of pathogens and diseases (Sepulveda et al., 2013). The current phase of salmon aquaculture development in Chile requires that government institutions act proactively to regulate and specially to enforce authority to avoid similar crises or reduce the social and environmental aftermath. Chile must learn with its errors if the goal is to maintain sustainable levels of production, otherwise crises like the aforementioned ones will become more frequent.

3.6 Conclusion

As Gustavo Wells argues, the historical process that led to introduction of salmon in Chile cannot be explained as a clear-cut evolutionary rationale of causal factors that led one to the other, or cause and effect (2009). Rather, we must examine the historical introduction of salmon in Chile and the subsequent development of salmon farming in Chile as a series of network interactions. Where Wells is more focused on the social aspect of these interactions, this work focuses on the interactions between Chilean state institutions and actors that influenced one another and shaped the development of

salmon aquaculture in Chile. After the development and successful introduction of open-net pens technology in Norway, salmon farming started to spread around the world. In Chile, renewed public and private interest led to a new phase of research and efforts to strength commercial fisheries industry based on this exotic species. In chapter 4, we will discuss the active role of the Chilean state in shaping the aquaculture sector with an emphasis on the historical trajectory of actors, policies and regulatory frameworks that oversee the sector since its inception to the current stage.

Chapter 4 – State Institutions and the Chilean Blue Revolution

This chapter examines the role of Chilean state institutions in fostering a non-traditional export-led industry in a developing country. In less than three decades, Chile went from a country without a salmon farming industry to a major global actor producing almost a quarter of the total world supply of salmon with exports surpassing US\$5 billion (UNCTAD, 2006; Garcês, 2019). Despite a history that can be traced back to the nineteenth century with several failed attempts to introduce salmon in Chilean waters, the background for the emergence of this industry is more recent. It started to take shape after the military coup that resulted in the death of socialist President Salvador Allende on September 11, 1973, which led to a 17-year dictatorship in Chile. General Augusto Pinochet's dictatorship implemented a neoliberal economic model that opened the country to foreign direct investment, removed tariff protections, discouraged trade unions and privatized state-owned companies (Schurman, 2003).

State institutions created during the dictatorship of the 1970s and 1980s played a key role in the early stages of the salmon industry. New government institutions were created to structure and promote resource-extraction industries, including an incipient salmon aquaculture. The same government institutions that provided legitimacy and state support to salmon aquaculture are still present and continue to ultimately shape the actors and the rules of the game in Chile.

The Chilean state has been the propulsion engine behind the salmon aquaculture industry since its inception. With public policies, tax incentives, wage subsidies and regulations (or lack of), state institutions structured the sector since its exploratory period until today. Using the historical framework presented in Chapter 3 (Table 1), this chapter will examine the creation of state institutions and the main regulations throughout time and its impact on the development of salmon in Chile. In addition, semi-structured interviews conducted with scholars, non-profit organizations, and industry experts during field work in Chile provide a foundation that helps understand the close relationship between state institutions and the salmon farming sector in Chile. The industry's growing participation in the Chilean gross domestic product shows that the relationship between the state and the industry's main stakeholders will not be disentangled any time soon. Quite the contrary, as FAO estimates that Chile will continue increasing its aquaculture production (Latta and Aguayo, 2012: 174; Bustos-Gallardo and Irarrázaval, 2016; FAO, 2018).

This chapter depicts the institutional and policy changes in Chile with a particular focus from the late 1960s to early 2010s to answer this thesis's research question: what is the role of national institutions in fostering the salmon aquaculture industry in Chile from 1969 to 2016? On this timeframe, Chile experienced a neoliberal economic model imposed by Pinochet's dictatorship and maintained by subsequent democratic governments. The model of import substitution that had characterized some Latin American economies on the first half of the twentieth century was replaced by an export

model focused on exploiting natural resources for which there was demand abroad (Schurman, 2003). In 1982, the economist Milton Friedman affirmed that the neoliberal pro-market policies imposed by the military dictatorship were producing a “Chilean miracle” (Cypher, 2004: 528). What Friedman did not mention was that the same state institutions promoting a free-market open economy were heavily supporting salmon aquaculture and other non-traditional industries. This narrative suited Friedman, as he was one of the proponents of the neoliberal model and taught Chilean economists at the University of Chicago (Winn, 2004).

Despite a transition to democracy in 1990, it is argued in this work that the institutional framework set during the dictatorship shaped actors, rules and processes that are still influencing the outcomes of the Chilean aquaculture industry. The institutional changes of the past 50 years provide a window of opportunity to understand social and economic transformations in Chile through the lens of historical institutionalism. Salmon aquaculture serves as a case study for this transformation over time. Although not the focus of this work, other factors such as a shift in taste among consumers in the United States and Japan, new technologies and investors seeking short-term profit are also connected to the early stages of this industry’s development (Soluri, 2011: 57). As examined in Chapter 3, Chile went from several failed attempts to introduce salmon to become the second largest producer in the world behind Norway. Therefore, to answer our main research question, we turn now to the key institutional actors behind the

salmon industry's growth and the historical context in which this development took place.

4.1 Exploratory phase (pre-1960s)

During the second part of the nineteenth century, the Chilean government was interested in materializing the introduction of salmon to provide new sources of food, to incentivize recreational fishing, and reduce the dependence of canned salmon (Basulto, 2003). Theories of acclimatization were also in vogue after the successful introduction of brown trout (in 1867), rainbow trout (in 1883) and Chinook salmon (in 1905), in New Zealand after years of failed attempts (McDowall, 1994). At the time, the term acclimatization was used to describe a “rationally forced adaptation to new environments”, or the transfer of exotic species from one place to another with similar climate conditions (for a history of the concept, see Osborne, 2000). Some initiatives from the Chilean government started to appear to regulate the fishery activity, which later influenced the first aquaculture regulations.

The exploratory phase saw Jorge Montt, president of Chile from 1891 to 1896 and a former Navy vice admiral, to create the first state campaign to increase the consumption of fish among the general population (Basulto, 2014: 178). In 1907, Pedro Montt, cousin of the former president, promulgated the first Fishery Law (Law N° 1.949). The first law of fisheries had only six articles. It had the goal to protect fisheries by providing a financial subsidy for each boat involved in fishing. Another article stated that coastal

areas not exceeding 4 hectares could be used to install and create mollusks for a period of 20 years, demonstrating one of the first state direct interventions towards aquaculture (Soto and Paredes, 2018). However, most importantly, the law was intended to promote the consumption of fish in the country. Despite government efforts, the first Fishery Law, and some smaller alterations that came into effect later on, did not produce the desired effect. According to Soto and Paredes, this happened due to (1) a lack of technological and management capacity from national companies and (2) a larger focus on the speculation of coastal areas concessions rather than in the production of fish (Ibid.: 18). Those formal rules and norms provide an early context to demonstrate how the Chilean government was behind an attempt to transform not only the economic aspects of the country through formal incentives for fisheries, but to shape social norms, by ultimately influencing what people should eat.

In March of 1931, a decree (N° 34) recognized the necessity to institutionalize the fisheries industry (Stormansan, 2016: 349). The decree created a new state institution, the Fisheries Protection Division of the Agricultural and Livestock Service (SAG), under the Ministry of Agriculture. For 47 years, the Fisheries Protection Division regulated the fishery industry and promoted several attempts to introduce aquaculture in the country until it was closed in 1978. The 1930s also had the creation of a new government entity that years later became fundamental to the salmon aquaculture development. In the aftermath of the single deadliest earthquake in Chile in 1939 that claimed around 20,000 lives, the government of President Pedro Aguirre Cerda promulgated the law N°6334 to

create the Chilean Production Development Corporation (CORFO) (Soto and Paredes, 2018: 21). The initial objective of this national institution was to reconstruct the infrastructure of the country and promote economic growth. After the reconstruction, CORFO's mission changed to support new industries and increase the country's power supply. CORFO had an impact in the production of fisheries during the exploratory phase, and later it became involved in the development of salmon aquaculture industry in Chile during the second half of the twentieth century.

4.2 Preparatory phase (1960 to 1975)

In the preparatory phase, the Chilean government decided to evaluate the feasibility of salmon farming in Chile. In the 1960s, a year after another earthquake hit Chile, this time the most powerful ever recorded, CORFO was at the forefront of the fishing industry reconstruction and investment. In 1961, CORFO created the company Pesquera Tarapacá S.A., which focused on fishing tuna and pelagic fish to produce fishmeal (Basulto, 2014). The availability of cheap fish meal helped the salmon aquaculture later on, as feed represents almost 50 percent of the direct costs of salmon cultivation (Soluri, 2011). The Fisheries Development Institute (IFOP) was established in 1964 as a non-profit organization by CORFO to develop technology and data analysis for the fishing industry, such as fish stock assessment (UNCTAD, 2006). In 1964 Chile recorded for the first time the landmark of one million ton of fish caught in one year, been 86,2% of that total anchovy for feed (Basulto, 2014). Two years later, the main stocks of anchovies collapsed after a strong El Niño, a phenomenon that warms the waters in the Pacific

Ocean (Ibid.). It can be argued that the government's intense promotion of fishing since the early 1960s added more pressure to the pelagic fishing stock, the most important industrial fisheries in Chile (Soto and Paredes, 2018: 25).

The government sought solutions for the crisis and started to be more open for new ideas, including ocean ranching of exotic species to increase the production of fisheries. In 1965 and 1966, IFOP started surveys of potential salmon habitats (Thorpe, 1980). In 1967, CORFO was behind the merger of small fisheries to create larger conglomerates that could resist financial instability (Ibid.: 26). In the same year, the Chilean government established the first mollusk farming in the Lakes Region using French and Spanish technology. It was operated by IFOP and by the Division of Fishing and Hunting (Servicio Agrícola y Ganadero), which was part of the Department of Agriculture (Daughters and Pitchon, 2018). The mollusk farm was the first operated aquaculture venture in Chile. It serves as an early indication of how the salmon aquaculture was going to develop in Chile: heavy government financial and institutional support with foreign technology and know-how.

At the same time, Japan was seeking alternatives to their limited access to North Pacific salmon, and their salmon stocks were suffering from overfishing and degradation (Swanson, 2015). In 1969, Chile and Japan signed a cooperation agreement to introduce several species of Pacific salmon into Chilean waters (Fornahl et al., 2015). The agreement signed between the Japanese International Cooperation Agency (JICA) and the Chilean government focused on human resource development and feasibility studies

for farming salmon in Chile. It was responsible for identifying areas for salmon and trout cultivation and experiment with ocean ranching techniques. According to Hidemitsu Sakurai, head of JICA in Chile, “the purpose of the project was to bring Japanese salmon to Chile and establish this fish as a marine resource” (quoted on We are Tomodachi, 2016). This public-funded initiative became an important source of knowledge for private entrepreneurs who lacked the financial capabilities to invest large sums of money into an unproved industry (Fornahl et al., 2015). Moreover, Chile was passing through a meat supply crisis, and Allende’s government started to push for more local fish production to reduce imports of higher cost meat (Soto and Paredes, 2018: 26).

During the preparatory phase, Chile faced an intense transformation in the institutional background. After a military coup, Pinochet implemented a widespread neoliberal economic model known as *apertura* (“the opening” in English), that dropped interest rates, reduced import tariffs, and privatized state-owned companies and services, including assets from CORFO (Schurman, 2003). In 1974, the military dictatorship enacted the Foreign Investment Statute (Decree Law 600) to open the market and provide guarantees to foreign capital (Ministry of Economy, Development and Reconstruction, 1978). This legal instrument was used to expand and diversify the economy focusing on export-based products (Salcedo and Akoorie, 2013). Although aquaculture was not mentioned in that statute, it was a clear indication that the military dictatorship was opening the market and imposing few restrictions to foreign capital. At the same time, Pinochet’s government created or reformed public institutions to

structure and promote resource-extraction industries, including an incipient salmon aquaculture.

In 1975, CORFO provided a financial loan for the creation of the private company Sociedad de Pesquería Lago Llanquihue Ltda, one of the first companies to export salmonids in Chile using ranching. The company exported 40 tons of rainbow trout to France in 1978 and later to other European countries and the United States (Basulto, 2003: 240-241). Because the salmon price was high, other private companies decided to invest in salmon farming. This moment shows the institutional interdependence of the Chilean government, the fisheries and the appearance of the first aquaculture private companies.

4.3 Establishment phase (1976 to 1989)

State Institutions created during the dictatorship of 1970s and 1980s played a key role in the early stages of the industry. Considered by some authors the main institutional force behind the development of salmon in Chile, Fundación Chile (Chilean Foundation) was created in 1976 as a semi-public joint venture by the government of Pinochet and the US multinational International Telephone and Telegraph Corporation (ITT) (Soluri, 2011: 60; Iizuka, 2004: 11). But the steps that led to the creation of Fundación Chile began a few years earlier when ITT assets were nationalized by the government of Salvador Allende (Soluri, 2011: 61). ITT sent a plan to the US government suggesting that US officials should create economic pressure against Chilean socialist president Salvador Allende

proposing an “economic squeeze” through denial of international credit, a ban on imports of copper and other Chilean products (New York Times, 1972). The plan sent by ITT was not their first attempt to influence the government in Chile. ITT had also tried to prevent Allende's inauguration on November 1970, as Chile's first freely elected socialist president. This included an operation with the CIA in early 1970 to provide financial support to one of Allende's opponents, Jorge Alessandri (Ibid.). Salvador Allende declared that he would not compensate ITT for its expropriated Chilean assets by stating that “no one can dream that we are going to pay even half-cent to this multinational company which was on the verge of plunging Chile into civil war” (New York Times, 1973). The military dictatorship did exactly this and it defined the early stages of salmon aquaculture in Chile.

A decree (N° 1528) issued on August 3, 1976, determined that a new public-private institution was going to be formed with a US\$50 million endowment donated in equal parts between the Chilean government and the ITT, to compensate the latter for the nationalized assets. Fundación Chile had a stated goal to foster the Chilean economy and become self-financing by selling services, providing expertise and transferring technology and know-how to the private sector (Huss, 1991). Although advertised as a non-profit private organization, the Chilean government had 50% of participation in Fundación Chile and several seats on the board. One of the first projects of Fundación Chile, under the direction of ex-ITT engineer Wayne Sandvig, was to explore the feasibility of establishing commercial aquaculture in Chile. The same decree that created

Fundación Chile also provided several tax exemptions to the institute. Article 3° and 4° exempted all contracts firmed by Fundación Chile of federal and municipal taxes. The history of commercial salmon aquaculture begins with the state operating to promote economic diversification and regional development.

“Fundación Chile was created as a government institution to do research and development. Then was asked to generate more of external resources and became this quango, *quasi-public-quasi privado*, a status which it retains today. This odd thing where they get some sort of direct grant, but they do work for the private sector. Back in the 1970s, it was the leading institution for exploring new sectors to develop. [...] Without that, how would JICA (Japanese International Development Agency) have found a partner institution to develop this pilot project?” (Interviewee 1, Chilean scholar, 2019)

Few months after Fundación Chile was created, the military dictatorship published in December 21, 1976 the Decree Law Nº 1.626 to establish the Undersecretary of Fisheries (Subpesca), under the Ministry of Economy, Development and Reconstruction (in 2010 the name was changed to Ministry of Economy, Development and Tourism) (Stormansan, 2016). This very short decree only instituted the position of an undersecretary and an intention to organize the fishery sector. Aquaculture is only mentioned once, in its name.

It took two years until the Decree Law Nº 2.442, of December 1978 established the attributions of the Ministry of Economy, Development and Reconstruction regarding fishing. Until that time, regulations of fishing was under the Fisheries Protection Division of the SAG, under the Ministry of Agriculture, a division that was eliminated in these institutional reforms. Subpesca was formed with 37 employees to develop a national

policy regarding fisheries and centralize the statistical records of fishing activities. Furthermore, the same decree also created the National Fisheries and Aquaculture Service (Servicio Nacional de Pesca y Acuicultura, or Sernapesca), responsible for supervising and enforcing the national fisheries and aquaculture policies developed by Subpesca.

The role of Subpesca and Sernapesca changed over the years, and they became responsible for overseeing and regulating Chilean aquaculture and prosecute violations, sometimes with overlapping and conflicting roles (Peña-Torres, 1997: 258). But in the first decades of the salmon industry, their role was to support the development of the incipient salmon farming rather than to regulate its activities (Hosono et al., 2016: 155). Professionals that worked in Sernapesca and other public initiatives related to the salmon research program moved to the private sector, taking the training and know-how they acquired (Fornahl et al., 2015).

It was only in 1980 that the Chilean state recognized fisheries and aquaculture as two separate activities and established procedures for granting new concessions. In the same decree, the Ministry of Economy defined aquaculture as “that part of the fishing activity destined to the controlled cultivation of hydro biological resources” (My translation. Decree 175 from March 20, 1980). At the same time, the state was recognizing aquaculture as ‘something else’, it was still placing it as part of the fishing industry under the supervision of the Subpesca, the state institution in charge of

overseeing fisheries. This action reflects on the outcomes of policies created by an institution that is not specialized in dealing with this non-traditional industry. Salmon aquaculture was born with institutional support, but without specific state regulations to control its growth.

In 1980, Fundación Chile's started to define its areas of interest and it ended up focusing on five: Agro-industry, Marine Resources, Product Development, Laboratory and Pilot Plant. For each of them, Fundación Chile implemented 'demonstration projects' aimed at transferring foreign technologies (Andreoni and Chang, 2014: 14). In 1982, Fundación Chile acquired Domsea (later renamed to Salmenes Antártica S.A.), a US-owned hatchery specialized in aquaculture techniques, to demonstrate the technical capabilities and commercial possibilities of salmon farming (Huss, 1991: 110-111). Salmenes Antártica adopted cage cultivation and became the first fully integrated company in salmon farming industry. Once salmon farming was demonstrated as viable, it brought more international capital and new actors (Iizuka, 2004). According to Andreoni and Chang, the "Chilean salmon miracle would not have been possible without the original involvement of the government in salmon research from the 1960s onward" (2014: 16). The dissemination of salmon aquaculture was only possible due to the role the Chilean state played forming institutions to support and reduce the cost of the industry.

4.4 Expansion phase (1990 to 2009)

From 1990 until the infectious salmon anemia (ISA) crisis, in a transition from a dictatorship to democracy, the industry grew in volume of production, technical capabilities and number of government regulations – although it can be argued that a larger number of regulations do not mean accountability. In this period, the Chilean government promulgated the General Law of Fishing and Aquaculture (LGPA, or Ley General de Pesca y Acuicultura in Spanish) to structure and to clarify the responsibilities of different institutions involved with the operation of aquaculture. Yet, despite coming into effect in 1991, the foundation of the law was written a couple of years earlier during the dictatorship. In 1988, a national plebiscite was held to determine whether Pinochet should stay as president for eight more years. The population went to the streets and nearly 56% of Chileans voted against Pinochet (Angell and Pollac, 1990). In 1989, democratic elections took place and Patricio Aylwin won and took office in 1990, putting an end to a dictatorship that began 17 years earlier.

In this context, the new fisheries law (or Merino law) was enacted in December of 1989 (Peña-Torres, 1997). The reform of the fisheries regulation was intended to come into effect in 1990, but the newly elected government decided to postpone and review the framework designed by the then Commander-in-Chief of the Chilean Navy José Toribio Merino. After several changes in the original proposal with decrees N° 19079 and N° 19080, the LGPA was modified and promulgated in 1991 (Rivas, 2018). LGPA main goal

regarding aquaculture was to solve the confusion over the jurisdictions of different government institutions and to reduce the bureaucracy for new concessions (Iizuka, 2004). Furthermore, the new law created an institutional framework to support the expansion of the salmon industry by establishing a method of identifying the areas for aquaculture without interfering with extractive fisheries (Hosono et al., 2016). LGPA also provided salmon farm concessions for an indefinite amount of time, which means that the government role as the industry's champion remained in this period.

“Behind the growth of aquaculture, there is a mechanism to promote the industry in which there is a lack of regulations. The aquaculture and fisheries law that determined some basic rules for the salmon industry is from 1991, but the first regulations related to the environment and sanitary issues came only in 2001. The law was created but was not implemented during this time. And there was almost no inspection back then” (Interviewee #2, NGO representative, 2019)

Besides the LGPA, in the early 1990s, the newly elected Chilean government focused on increasing the productivity of the country through export growth. Several government funding mechanisms to the private sector were established including the Scientific and Technological Development Fund (FONDEF), the Fisheries Research Fund (FIP), the National Fund for Technological and Productive Development (FONTEC), and the Development and Innovation Fund (FID) (Iizuka, 2004). These funds were targeted to develop other industries in Chile, but aquaculture benefited directly from it. One of the main difficulties that firms in the salmon industry faced in the expansion phase was the

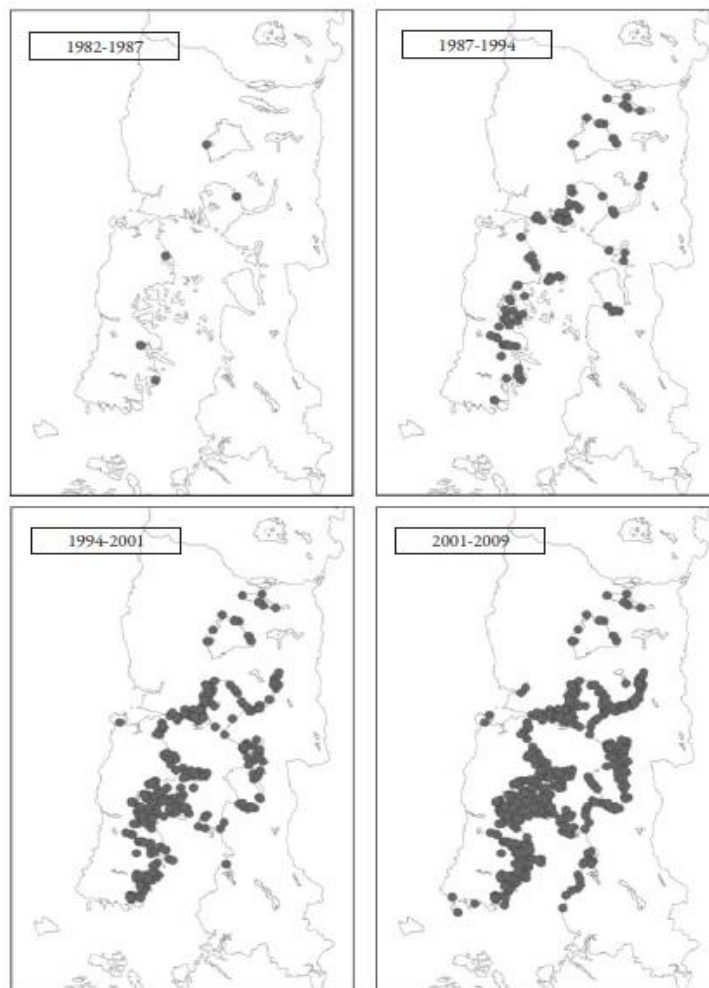
difficulty of entering international markets due to the lack of quality certification (Iizuka, 2004).

To fill that void, the Salmon Technology Institute (or Instituto Tecnológico del Salmón in Spanish) (Intesal) was established in 1995 by the Association of Salmon and Trout Producers with 45% financial assistance from the National Fund for Technological and Productive Development (Bjørndal and Aarland, 1999). Intesal was created with governmental support to develop and share quality control technologies, and sanitary, environmental and personnel training (Hosono et al., 2016). In addition to the initial funding, Intesal received tax exemption as part of the Chilean National Training and Employment Service, which facilitated the specialized training for the industry (Ibid.: 2016: 100). The financial aid demonstrates support from state institutions – or from a non-governmental institution that was created with funding from the government – to facilitate the development of the industry, thus shaping the early stages of the sector and providing the means for it to succeed.

At the same time, another research institute created in the 1960s changed its original focus from providing technological assistance to fisheries to a position of advising and providing information to SUBPESCA. IFOP became the major public aquaculture and fisheries research institute in Chile and receives financial contributions in the order of up to 96% of its total income from different government agencies. While only approximately 4% of their income comes from private sector, for the sale of advisory services (IFOP, 2014). IFOP's mission is to provide technical assessment needed by the

government to design policies for fisheries and aquaculture. The research produced by IFOP serves as foundation for the development of fisheries and aquaculture policies. IFOP was created by a national government institution as an independent non-profit institute and still functions as another state actor in assessing the technical viability and providing all the support the salmon farming needs to grow.

Figure 2 Number of farming concessions in Los Lagos region from 1982 to 2009



Source: (Bustos, 2012: 228)

With an economic model friendly to the market and a policy of minimum intervention, aquaculture kept expanding its number of concessions and production jumped from

1.119 tons recorded in 1985 to 259.000 tons in 1998, an average annual growth of 52% in total production (Bjørndal Aarland, 1999). As we can see in Figure 2, the number of concessions grew considerably in Los Lagos region from 1982 to 2009. During this time there was not regulatory constraints for the industry, quite the contrary, there was an institutional support from the government (Interviewee #2, NGO representative, 2019).

As the production and exportation grew, the state was committed to offer no barriers to commercial salmon farming in Chile. This included not imposing regulations that could limit the growth, even in matters concerning the environment. A top official from the state institution in charge of overseeing regulations did not believe that it was possible for Chile to have diseases like the ISA. As Sernapesca's Chief of Health, José Miguel Burgos, affirmed in 2001: "I am quite emphatic that the disease as such does not exist in Chile" (quoted on Gerhart, 2017: 727). From his sentence we can take at least two things: 1) an unwavering state support from an institution in charge of regulating the industry and 2) a shortsightedness that would be proved wrong less than a decade later.

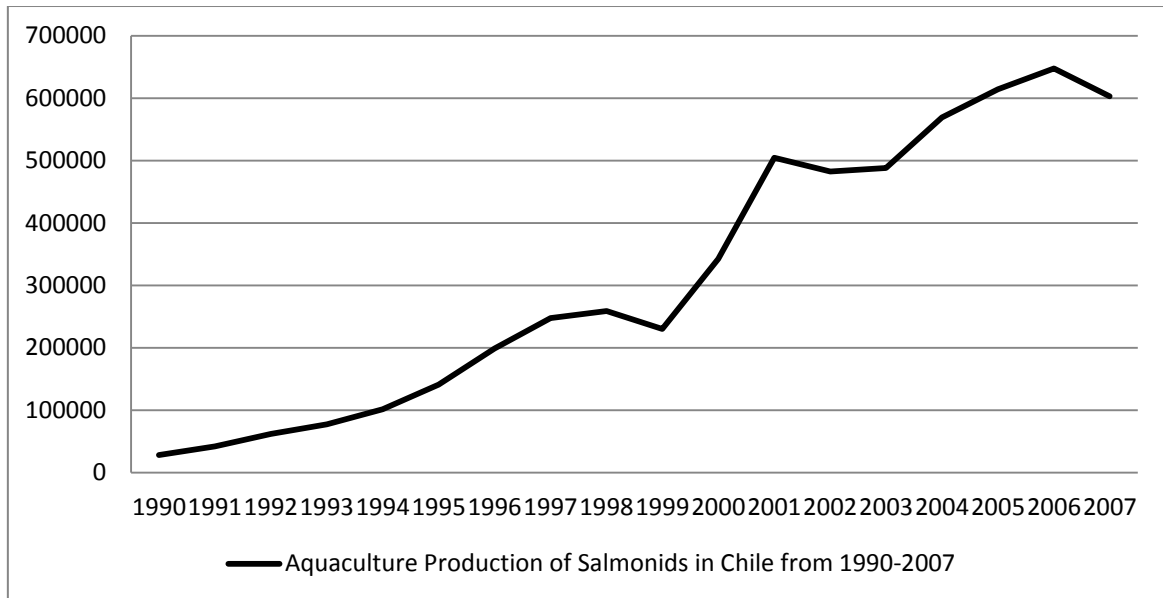
Despite the creation of the General Law of the Environment (Law N^o 19300), the Regulations of Concessions (DL N^o 290) and the Regulation of Aquaculture National Register, the government still acted with the main goal to support the industry, no matter the consequences. According to David Carruthers, environmental regulations are "constrained by the legacies of dictatorship and transition and by an economic orthodoxy often overtly hostile to sustainability" (2001: 344). The author argues that the lack of regulation provides profit for private companies but push the environmental cost

for future generations (Ibid.: 347). The act of non-regulating, or of creating regulations but not enforcing, also exemplifies the role the Chilean state institutions continued playing in the development of salmon aquaculture in the country.

After pressure from NGOs, the Ministry of Economics issued decree N° 320, the first environmental framework for aquaculture (RAMA in Spanish). It took ten years since the LGPA was put in place in 1991 for the government to establish measures for the protection of the environment in relation to aquaculture. With a stated goal of providing a tool for sustainable development of aquaculture projects, critics point that RAMA was another form of government support and only resulted in measures of oxygen conditions below the net cages once a year (Bustos-Gallardo and Irrázaval, 2016: 9). In that time, Daniel Albarrán became the Undersecretary of SUBPESCA, but his time in the position was short. Albarrán resigned in 2001 due to alleged conflicts of interest related to his connections to aquaculture firms in which he held participation (Irrázaval, 2015).

Following the implementation of RAMA, in 2002 the Chilean government promulgated Sanitary Rules and Regulations for Aquaculture (RESA), to supposedly control and eradicate diseases. As Figure 3 shows, the aquaculture production of salmonids in Chile grew from 28.602 tons in 1990 to a staggering 647.263 tons in 2006 just before the ISA crisis. The new set of legal and administrative procedures served to propel the development of the private industry without a clear motivation from the state in enforcing regulations that would ensure a sustainable development of the sector and protect the environment.

Figure 3 Aquaculture Production of Salmonids in Chile from 1990 to 2007



Source: Prepared by the author based on FAO Fishery and Aquaculture Statistics (2019)

The regulations created during the expansion phase period were not enough to avoid the ISA crisis that hit the industry from 2007 to 2010. The government oversight and flexible investment rules allowed the farmed salmon industry to grow exponentially (Phyne, 2010). And the industry did not acknowledge any responsibility during the crisis, quite the opposite, it wanted to grow more. When interviewed by a local newspaper if the industry was to blame for any environmental damage, Cesar Barros, the then president of SalmonChile, stated that the industry did not have any “mea culpa, none. The industry must keep growing at a near 10% growth rate and double its size in areas it is not as big, like regions XI and XII” (My translation, quoted on Pinto, 2008:13). The lack of accountability from a senior leadership in the middle of its largest environmental

crisis can only be explained by an institutional structure that was created 30 years earlier with the only goal of supporting the industry.

The main policies of the neoliberal economic regime put in place by Pinochet were kept after the period of transition to democracy, but despite a stated free-market approach and policies, the state still played a significant role in fostering the salmon industry during the 1990s. As Rivas highlights, “the role of the state is not always by action; it can be by inaction” (2018: 18). There were more than 30 instruments (i.e. decrees and simple regulations), but only loosely enforced or not implemented at all (Asche and Bjørndal, 2011: 38). It was only after the major sanitary crisis of the salmon industry in 2007 that the Chilean state institutions were forced to change their strategy of unwavering support and virtually no oversight.

4.5 Current phase (2010 to ongoing)

After a period of expansion in which Chile became the second largest producer of salmon in the world in 2006 reaching 38.2% of the global market share just behind Norway (39.7%), the first signs of overexploitation appeared in July 2007 when the ISA virus was spotted in salmon farms in southern Chile. ISA is the most impactful viral disease that affects farmed Atlantic salmon (*Salmo salar*), the main variety farmed in Chile (Alvial, 2012: 20). On November of 2007, the government was still downplaying the problem. In a statement to a local newspaper, the director of Sernapesca Inès Montalva affirmed that:

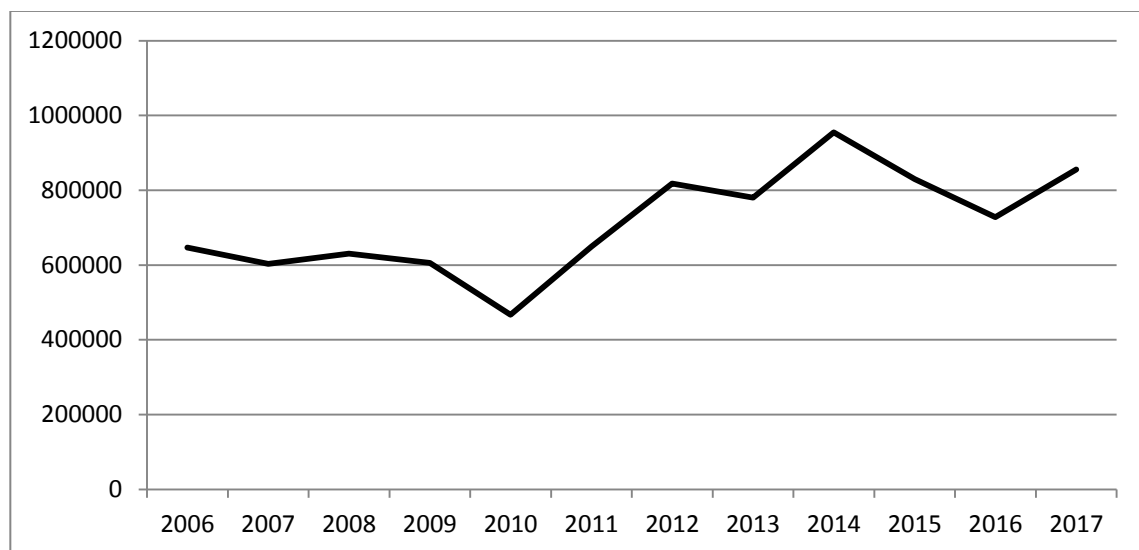
“there is a clear campaign that has always chased after the salmon producers. That they don’t meet standards, that they don’t look after the environment, that they are invasive. But it is an industry that has to look after the environment for its own benefit” (quoted on Barton and Floysand, 2010: 749).

By December 2008, the density of fish farms allowed the virus to spread, and 105 production sites reported the presence of the highly contagious virus (Soluri, 2011). Marine Harvest, one of the world’s largest aquaculture firms, reported losses of US\$560 million in 2008, down from a US\$290 million profit in 2006, and laid off 37% of its Chilean employees (Ibid.). By 2009, the industry lost around US\$2 billion dollars, and the social impact was such that approximately 20.000 people lost their jobs (Gerhart, 2017).

As figure 4 shows, due to a production cycle of salmon that can last two years, the consequences lasted until 2010 and the Chilean state, supporter of the industry since its inception, came to the rescue. In March 27, 2008, the New York Times published an article entitled “Virus Kills Chile’s Salmon and Indicts Its Fishing Methods” in which the salmon industry methods such high density in cages and overuse of antibiotics were presented as contributing factors for the crisis (Barrionuevo, 2008). On April 4th, the Ambassador of Chile in the United States sent a letter to the newspaper to defend the salmon industry in Chile stating that the report was damaging to the industry and that the country “shows remarkable record in prevention and management of food safety in this field” (quoted on Rivas, 2018: 100). This shows an institutional state actor behaving in a specific way to offer full support for the salmon industry in the middle of its largest crisis.

Chilean state institutions are so entangled with the aquaculture industry that the political reaction of an environmental and socioeconomic crisis was to find a way to make the industry succeed. Given the widespread impact the ISA outbreak produced, this is not to say that state institutions do not need to be concerned with the industry and the socioeconomic consequences of its collapse, that reached an estimated 10,000 jobs during the first quarter of 2009 alone (Wells, 2009: 10). But the immediate discourse defending the industry no matter what and the financial aid – US\$ 9 million for temporary labor programs compared to US\$ 120 million for the industry (ibid.: 10-11) – shows a political intervention aimed to shield the industry, despite a problem that was caused in parts by the industry and its uncontrolled growth.

Figure 4 Aquaculture Production of Salmonids in Chile from 2006 to 2017



Source: Prepared by the author based on FAO Fishery and Aquaculture Statistics (2019)

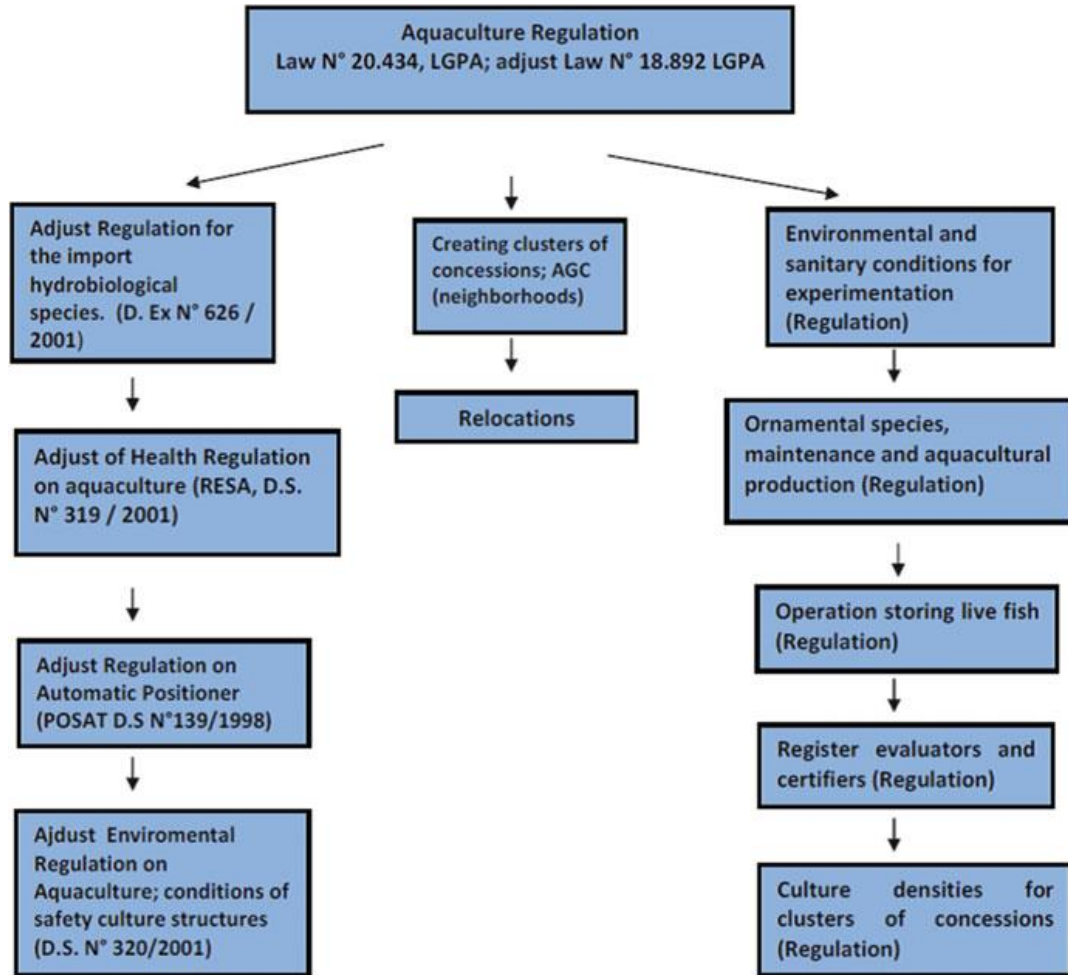
After the spread of ISA, the environmental, social and economic impacts forced the Chilean state to act. In addition to the short-term disease control, the institutional

response came nine months after the first reports of the virus. In April of 2008, President Michelle Bachelet appointed the former undersecretary of Subpesca, Felipe Sandoval, to lead “*la Mesa del Salmón*” (Henceforth, The Salmon Roundtable). The Salmon Roundtable consisted of representatives from public institutions such as the Ministry of Economy, Subpesca, Sernapesca, CORFO, and SAG. It was initially responsible for evaluating the industry practices and to propose a new regulatory framework. Due to the overwhelming social impact of the ISA crisis the Salmon Roundtable ended up also dealing with regional unemployment, financial debt of salmon firms, reform of concession rights system, restrictions on the use of antibiotics, and regional coastal planning (Hosono et al., 2016: 142). The main objective achieved by the Salmon Roundtable was the modification of the General Law of Fisheries and Aquaculture (LGPA), the modified law (N° 20.434) was promulgated in April of 2010. The changes in the LGPA included:

- a) Limit of 25 years for new farm concessions, with the possibility of renewal, instead of the “indefinite time” from the original LGPA;
- b) Establishment of more environmental parameters to restrict the transmission of pathogens;
- c) Establishment of micro and macro zones via a system called *barrios* (neighborhoods) in which concessions are grouped within a similar geographical area. The goal was to make private companies in those areas to work together and collectively manage the environment;
- d) Strength state institutions in charge of enforcing regulations by creating the aquaculture subdivision in Sernapesca and reinforcing Subpesca (See Figure 5; Alvial, 2012).

According to a Chilean scholar, the “regulations created after the ISA crisis were to ensure that the industry would continue. They weren’t long term policies. [...] The problem with these regulations is that they answered a moment, but there was a lack of political vision. They lacked a systemic vision” (Interviewee #3, Chilean scholar, 2019). Besides the new institutional framework, the government provided US\$120 million in loan guarantees to bail out the affected farming companies and provided subsidies for part of the industry (Latta and Aguayo, 2012: 174). In addition, the 25-year limit to new concessions also served as leverage for credit, meaning that an outcome of the crisis was more direct and indirect incentives to the same industry that was the center of the environmental crisis.

Figure 5 Institutional changes proposed after the modification of the LGPA in 2010

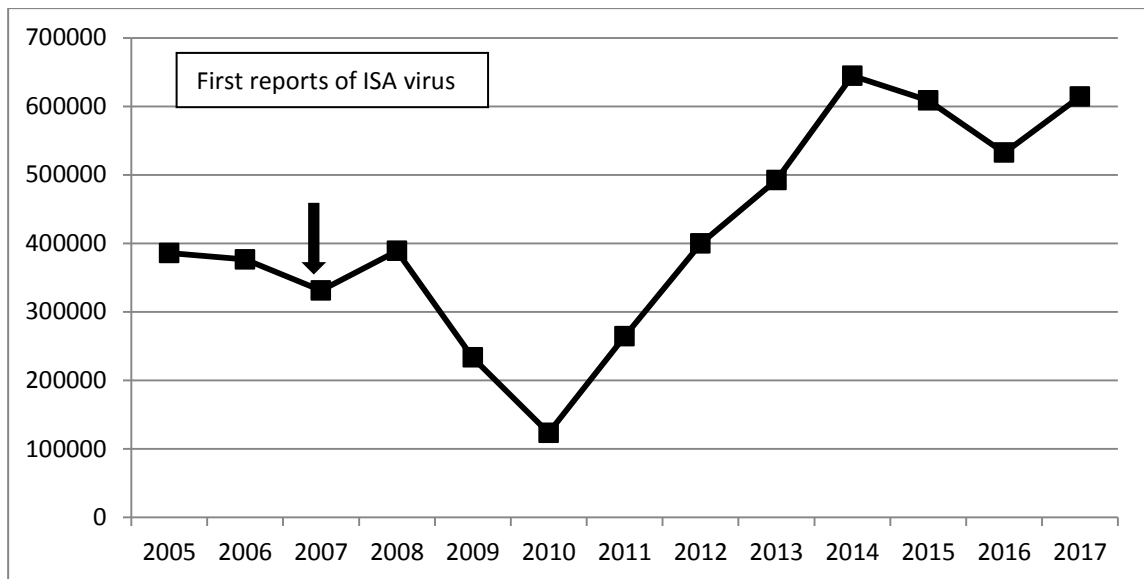


Source: Hosono et al., 2016: 146

The negative impacts on production were severe and Atlantic salmon faced a sharp decline from almost 376,000 tons in 2006 to 123,000 tons in 2010 (Figure 6). But it did not last long and with institutional support from the government the salmon aquaculture rebounded quickly in a few years to an impressive 644459 tons in 2014 (Ibid.). The social consequences did not follow the same pace of recovery and thousands of people remained unemployed (Gerhart, 2017). Some authors recommended halting its expansion to increase sustainability and reduce risks of environmental damage

(Niklitschek et al., 2013), but as Figure 6 shows, this did not happen. In addition to the government, the banks in Chile also played a role in solving the financial struggle of salmon companies, which had a combined debt of up to US\$ 4 billion (Alvial, 2012: 43).

Figure 6 Production of Atlantic salmon from 2005 to 2017



Source: Prepared by the author based on FAO Fishery and Aquaculture Statistics (2019)

The policies from the government, the close relationship to the private sector, and actions from the financial system cannot be understood separately. In 2012, a new institution was born. The National Aquaculture Commission was created to advise the President of Chile in matters regarding the national aquaculture policy. The commission involves members from the industry, union and producer associations. In 2013, Felipe Sandoval, responsible for leading the Salmon Roundtable that resulted in a new institutional framework, was appointed to head SalmonChile, the largest private consortium of salmon producers in Chile (Daughters et al., 2018). In his position as head

of SalmonChile, Sandoval is part of the National Aquaculture Commission. This means that when Sandoval left the government, he became part of an institution that advises the president, this time representing private interests. It goes towards our theoretical framework, where political interests shape state institutions and are at the same time being shaped by it. As Daughters et al put, the main challenge for regulation change in the salmon industry in Chile is a “revolving door between the private and public sectors” (2018: 17). There is a clear historical interdependence between the industry and state institutions that is accepted as normal by the actors involved.

Despite the changes made in the LGPA, the ISA crisis was not the only crisis in the sector. Another environmental crisis affected the salmon industry in early 2016 as a toxic algae boom known as *marea roja* (red tide) emerged in the coast of the Chiloé archipelago causing the death of mussels, penguins, and whales, and killing up to 25 million salmon resulting in US\$800 million of economic loss (The Guardian, 2016). The Chilean government and the industry claimed it was caused by a strong El Niño, a natural phenomenon that can warm the waters and create microalgae, while fisher workers accused a Chilean Navy operation authorized by the government that dumped dead fish into the sea weeks earlier (Pfeiffer, 2016). The local population, with a livelihood dependent of salmon farming, mobilized and protested against the industry and the government by building barricades and blocking roads and ferries for eighteen days (Le Monde, 2018).

“It [the red tide] was a natural phenomenon, but the salmon companies took 15 days to remove the dead fish from the sea. [...] In the collective imaginary in Southern Chile, the industry is a bad neighbor. It is an industry that contaminates and exploits. Some reason they have, but on the other hand, all industries in Chile are like that. [...] In the communities the salmon industry is perceived as bad. And we need to ask is: how to change this?” (Interviewee #4, Chilean scholar, 2019)

The regulatory framework implemented as a result of the ISA crisis did not reduce the social and environmental consequences and, most importantly, did not change the role of the government as supporter of the industry. In 2017, CORFO, the agency that helped finance the industry in its early days, announced the co-financing of a project to develop a 60 by 60 meter fish farming cage in contrast to the current 30 by 50 meters or 50 by 50 meters cages (Fish Information & Services, 2017). This project goes against an idea of sustainable production considering that the high fish density in the same geographical location is considered a factor that can influence the mortality rate of fish and is one of the possible causes of the ISA crisis (Hosono et al., 2016: 121). Besides increasing the possibility of escapes, the cultivation of a large number of salmon in confined net cages generates feed waste and fecal matter on the sea floor that can be toxic to wild fish and can lead to toxic algae blooms (Heen et al., 1993: 212).

After 900,000 salmon escaped from a Marine Harvest farm during a storm, the company said it had full trust in Chilean institutions (Guzman, 2018). After an investigation from the Chilean Superintendence of the Environment and some charges against Marine Harvest, no farm was closed and nothing changed (Fish Farming Expert, 2018). These situations highlighted above – financing of new technologies that can damage the

environment and lack of enforceability – add to the theoretical framework proposed in this work that institutions influence the actors but are also influenced by key actors in the industry. In the case of Chile, there is a clear interest from the Chilean state to avoid disrupting the industry operation, even in the face of major environmental disasters. The state institutions' hands-off approach regarding regulations, but supportive when it comes to financial and development aid, is a defining characteristic of the ever-growing salmon aquaculture in Chile.

4.6 Conclusion

An institutional transformation that moved Chile to a neoliberal economic model in the 1970s was the background for the creation of an industry. The economic, political, and social context of the time shaped the state institutions currently regulating the aquaculture sector. Most of these institutions were forged under a context of the military dictatorship, or right after its demise, with a stated goal to structure and support a rising industry. According to an NGO representative interviewed for this research, state institutions also helped with “support to organizations that wanted to invest in Chile” (Interviewee #5, NGO representative, 2019). The same government institutions that provided legitimacy and support to salmon aquaculture in its early stages are still present and continue to shape the actors and the rules of the game in Chile and are in return shaped by them.

The behavior of state actors since the first attempts to introduce salmon in Chilean waters goes toward my hypothesis that national institutions played a significant role in the development of the aquaculture industry in Chile. What I did not know was the extent of that role. To summarize and answer our research question, Chilean state institutions' policies, strategies and behaviors structured the salmon aquaculture by:

- 1) Providing financial grants that allowed access to technology and international know-how;
- 2) Facilitating the entrance of high levels of direct foreign investments;
- 3) Developing public institutions that work very connected to private interests;
- 4) Helping the industry to expand to international markets;
- 5) Issuing a regulatory framework that amplified the number of marine aquaculture concessions for a low price and for an indefinite amount of time;
- 6) Providing wage subsidies and tax exemptions;
- 7) Building public infrastructure to develop the production region, ultimately reducing the economic cost of firms;
- 8) Creating policies and frameworks that served the industry;
- 9) Offering monetary loans to bail companies from crises aggravated by overproduction;
- 10) Allowing a system of self-regulation that increased the likelihood of ecological and social crises in the country;
- 11) Not enforcing health, labor, environmental and sanitary laws to reduce the "ecological rubble" (Gerhart, 2017), and to increase the accountability from actors involved in the industry.

As the importance of salmon grows for the Chilean GDP, this public-private relationship tends to become even more interdependent. As Steinmo argues, history is not a chain of

independent events, and in the case of salmon aquaculture in Chile, there isn't a single event or variable that can explain the boom (2008: 128). Rather, the interactive effect of multiple causal variables shows a historical interdependence among the actors involved in the industry. State institutions had an active and direct role in nurturing an industry and providing the mechanisms for it to succeed. As we have seen in Chapter 4, the economic model in which the salmon aquaculture industry thrives is neoliberal – self-regulation, open and free-market, low-taxes, and lack of regulations – as long as the industry does not need state help to survive.

Chapter 5 - Conclusion

The history of salmon farming is connected to the globalization story. It is also a history of neo-capitalist practices that – through a massive flow of international capital, reduction of social welfare and repression of political rights – is always seeking new frontiers to expand in search of the highest financial gains. Despite advocating economic liberalism, Chilean state institutions also promoted a conservative nationalism. The ideology during the dictatorship supported the development of non-traditional industries focused on exports of commodities that had demand abroad, no matter the socio-environmental consequences.

This thesis main research question asked the role of state institutions in fostering the salmon aquaculture industry in Chile from 1969 to 2016. My hypothesis was that national institutions played a significant role in the development of the aquaculture industry in Chile by creating policies and frameworks, providing subsidies and tax exemptions, promoting the transfer of technology from other countries, and allowing foreign investment in the sector. After doing a literature review, archival work, fieldwork to Chile, which resulted in several interviews, and examining policies and regulations, I argued in this research that the rise of salmon aquaculture in Chile is not only connected to, but it was dependent on state institutions and their complete support. Also, I argue that the institutional framework set during the dictatorship shaped actors and processes and continue to structure the rules of the game in Chile.

This thesis is structured in five chapters. Chapter 1 is a general overview that provides a background to the industry and states the importance of the study and the puzzle that ignited this research: how did Chile become the second largest producer of farmed salmon in the world if salmon was not a native species in the country? In Chapter 2, I analyzed the salmon industry in Chile from a qualitative perspective using historical institutionalism as its theoretical framework. In order to assess the institutional impact in the Chilean aquaculture this work first examined the history of salmon aquaculture in Chile using a review of the existing literature to set a context of the historical processes behind the rise of the aquaculture industry and the blue revolution.

During this thesis, I was able to undertake a fieldwork in Chile to do archival work at the National Library and qualitative face-to-face semi-structured interviews with scholars and industry experts in March of 2019. These interviews serve as the base for Chapter 4 and contribute to the understanding of institutional development and social processes in Chile. All interviews conducted for this research stated the importance of the state for salmon aquaculture in Chile. In addition, policies, legislation, and regulatory frameworks examined in this thesis show that state institutions were involved since the beginning. In the early stages, state institutions funded researches that confirmed the potential for salmon production, and signed the first international agreements that brought foreign technology and know-how to Chile. Moreover, they financed companies, a decision that reduced the risks for business in a non-traditional industry, and provided the legal framework that helped – or at least did not constrain – the industry to succeed. The

history of salmon aquaculture development in Chile is marked by a paradox in which the Chilean state, the same that advocates for a neoliberal economy with a minimum-state presence, continues to support, promote, finance and define the salmon aquaculture industry direct and indirectly.

Chapter 3 presented a historical background of salmon aquaculture in Chile. I provided a framework that divided the development of salmon aquaculture into five phases (see Table 1). First, an exploratory phase that goes from the first and experiments in the nineteenth century until the 1960s. Second, a preparatory phase that goes from 1960 to 1975. Third, an establishment phase that goes from 1976 until the end of the 1980s. Fourth, an expansionist phase that began in 1990 until the ISA crisis in the late 2000s. Fifth, the current phase that began in 2010, after the ISA crisis. A commonality that trespasses all periods above is the constant state presence that is fundamental for salmon aquaculture to this day, as the response to recent crises show.

Chapter 4 utilized the framework presented in Chapter 3 to analyze the role of state institutions in light of the Chilean salmon farming boom. It examined their role by looking at policies and regulatory frameworks established to structure and oversee the industry. Some of these actors were created during the military dictatorship (Subpesca, Sernapesca) or promulgated just after it ended (LGPA). Interviews with scholars and non-government representatives complement the analysis and highlight the role of the state. In addition, I looked at production and exportation data from the Food and

Agriculture Organization that indicated a growth of the industry after institutional interventions, especially after the LGPA was promulgated in 1991.

5.1 Contributions to the Literature

Since the early days of salmon aquaculture in Chile, state institutions have been a key factor for the development of this non-traditional export industry. The rise of salmon aquaculture in Chile is not only an account of technical innovation or a tale of private entrepreneurs; it is a history with a deep connection to the state. The same state that was promoting a reduction of state intervention through neoliberal policies under the influence of the 'Chicago Boys' (Chilean economists trained at the University of Chicago) (Winn, 2004). Commercial salmon aquaculture was born in Chile in the middle of a forced transition from democracy to dictatorship.

As we saw in the literature review, salmon aquaculture in Chile has received lots of attention from scholars in the past two decades. What is lacking in these accounts is the definitive participation state institutions had in its creation, and continue to have. The revolving door between public institutions and private companies means that private entrepreneurs received incentives from the state, which can be understood as a transfer of public capital towards the market, with no guarantee of return to the society.

What the ISA crisis, and the more recent red tide, demonstrated is that the state is always ready to bail out the industry, whenever it is in need, but at the same that participation is not acknowledged by the same industry. As Beatriz Bustos explains, the

narrative of salmon entrepreneurs that saved an impoverished region in southern Chile is part of a foundational myth that only serves the accumulation of capital, with little or no regard for the local communities (Bustos, 2012: 222-223). This neoliberal narrative of new technologies and conquest of new frontiers leaves the state out of history. This research addressed this gap by demonstrating the pivotal role the Chilean state played in fostering this industry, which benefited, and still does, from strong state support while defending low or self-regulation.

5.2 Future Research

The theoretical framework used in this thesis can also be used to examine other non-traditional export-focused industries in developing countries to understand the role of state institutions in fostering those activities. As a future path for research, this framework can also be used to compare with other industries that were created or promoted during the dictatorship, like forestry. Also, it can be used to analyze other countries that experienced a forced transition towards a neoliberal economic model.

The environmental consequences of salmon aquaculture are mentioned in this research. Yet, more research is needed to examine the role the state played in relation to the environment. Some questions for future research can include: did the lack of specific policies, the minimal environmental and sanitary regulations, or the government lack of action contribute to the environmental degradation caused by the fast expansion of salmon aquaculture? Although the answer might seem positive at first sight, what is not

so obvious is the role of the Chilean state in regards to the socio-environmental consequences, especially in a scenario of expansion to the south.

The General Law of Fisheries and Aquaculture has been changed since it was first promulgated, and there are still discussions of what needs to change for it to become more effective. The close connections between a consolidated private salmon industry and the state need to be at the forefront of any future research into the topic. This close relationship affects local communities and, as we saw, can have a tremendous impact on the natural world.

5.3 Final Thoughts

Notwithstanding the fast growth and economic importance for Chile, the salmon industry has had its share of environmental crises and profound social transformations. If the Chilean government intends to reduce future negative social and environmental consequences, stronger institutions are needed to monitor, enforce regulations and hold companies accountable while maintaining economic growth and distributing benefits to workers and the affected population. Policy makers are faced with a dilemma of promoting more growth through the same policies that historically supported the industry or constraining the industry with a more rigid set of regulations. If the past 50 years serve as any indication, the state will keep supporting the salmon industry, even if the ecological costs are increasing.

The industry is expanding further south in Chile and has no plans to stop. The government plays a crucial role in ensuring this development is controlled, regulated, and sustainable. The neoliberal discourse connected with a close relationship between government and industry restrains measures that could promote a more sustainable growth. The same neoliberal practice that promotes self-regulation does not reduce the negative consequences of overexploitation caused by a desire for short-term gains whatever the future ecological cost.

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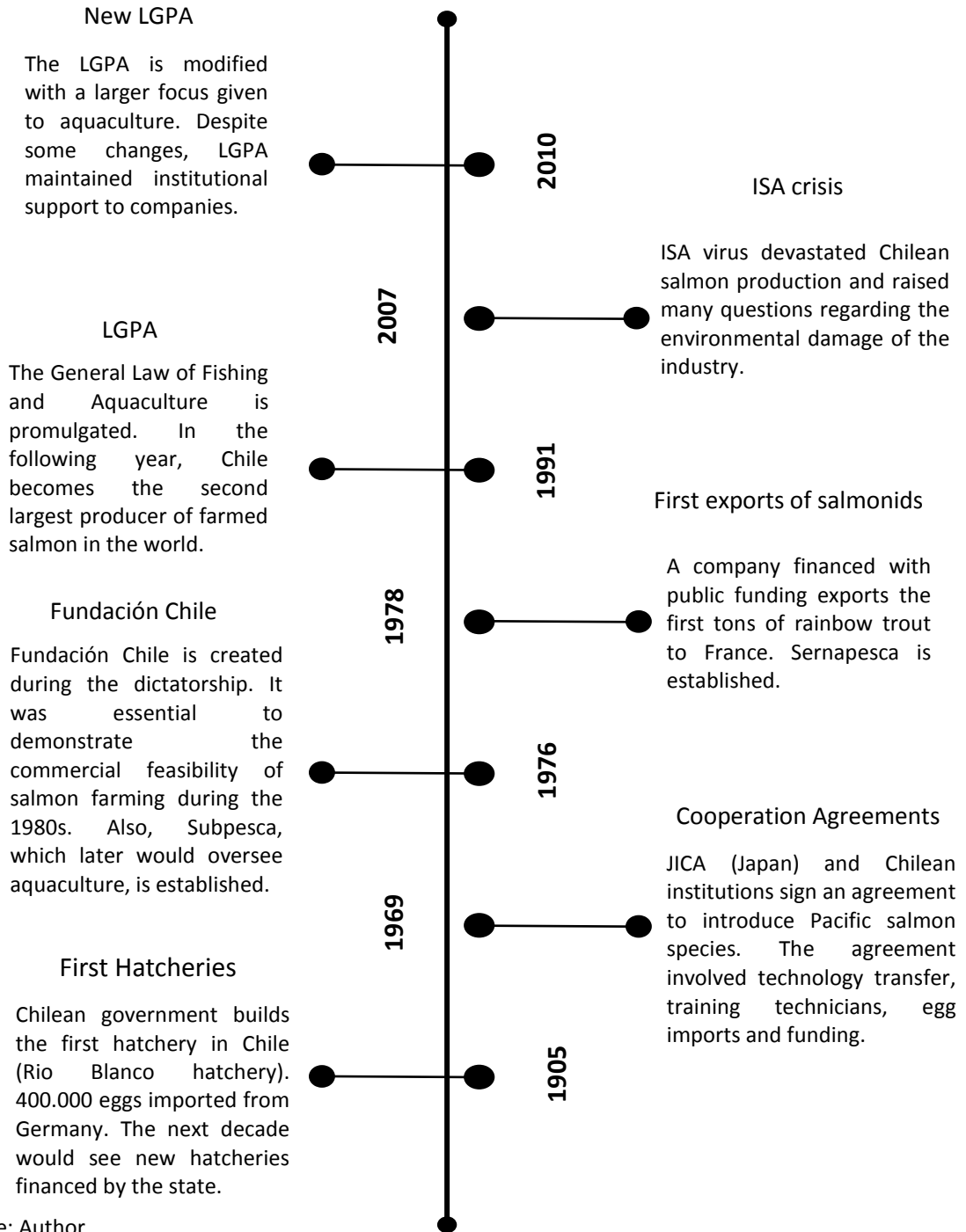
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Appendix

Appendix A: Timeline of Salmon Aquaculture Development in Chile



Source: Author.