

Re-framing salmon aquaculture in the aftermath of the ISAV crisis in Chile

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ABSTRACT

Globally, aquaculture is expanding rapidly, with salmon becoming one of the most dynamic and fast-growing production systems in the world. Despite its commercial success, Chilean salmon production has navigated through severe economic and sanitary crises; followed by consecutive policy changes. Between 2007 and 2009, the rapid spread and the multiple effects of the Infectious Salmon Anemia virus (ISAV) marked a tipping point in the trajectory of the salmon aquaculture in southern Chile. This paper examines the discursive mechanisms through which the Chilean salmon aquaculture industry is currently being re-framed in the aftermath of the ISAV crisis, with a focus on searching for the emergence of ecosystem-related elements post crisis. The analysis shows that Chilean salmon aquaculture is being re-framed by the reproduction of three main discourses: *biosecurity*, *sustainable protein* and *The Promise of Patagonia*. The paper concludes that despite the staggering effects of the ISAV crisis on the national salmon production and on coastal communities more than a decade ago, new discourses are focused on the legitimization to growth, in the absence of integrated marine ecosystem-related elements, indicating a crucial gap toward environmental sustainability in salmon aquaculture.

1. Introduction

In the last two decades, the global aquaculture sector has rapidly expanded, and salmon aquaculture has become one of the most dynamic and fast-growing production systems in the world [1]. Influenced by the so-called blue discourses, aquaculture expansion is aimed to contribute to food security, coastal community livelihoods as well as to compensate for dwindling wild fisheries harvests worldwide [2]. Internationally, there has been a lot of attention though with limited application, for the introduction of ecosystem-based approaches in the global aquaculture sector to make sure that production processes and impacts do not exceed ecological and social limits [3,4].

Global salmon production, led by Norway and Chile, has transformed remote coastal areas into industrial and productive nodes in global supply chain networks. Although this economic activity has been a successful enterprise, Chilean production has navigated through severe economic and sanitary crises; followed by consecutive policy changes. The ongoing expansion of the salmon farming activity keeps on raising concerns about the environmental and social impacts [5,6], and calls for the introduction of an ecosystem-based approach to salmon aquaculture [6].

Currently, salmon aquaculture represents the second largest economic sector, and the most important animal production system in Chile

[7]. Chilean salmon aquaculture is composed of industrial salmonid production, i.e. Atlantic salmon, Pacific salmon and Rainbow trout; with Atlantic salmon (*Salmo salar* L.) being the most profitable salmonid species [8]. By July 2020, domestic fish harvests reached 540.8 thousand tonnes of which 80.1% consists of Atlantic salmon. Total aquaculture exports, for the same period, reached 471.3 thousand tonnes accounting for 2657.8 million USD, of which 62.5% corresponds to the total exported value of Atlantic salmon [9]. To date, Chile remains as second larger producer of Atlantic salmon, after Norway, and followed by Scotland and Canada (British Columbia). Nevertheless, Chilean production is increasing the market share of farmed Pacific salmon, accounting for 95% of the global production [10].

Salmon production is concentrated in southern Chile. The sea phase, based on the net-pen technology, is primarily carried out in the Los Lagos and Aysén regions, and to a lesser extent in Magallanes (Fig. 1).

Between 2007 and 2009, Los Lagos region became the epicenter of an unprecedented sanitary crisis with multiple socioeconomic and environmental effects, caused by the outbreak and the rapid spread of the Infectious Salmon Anemia virus (ISAV) [11]. With previous occurrences in Norway, Canada, Scotland, Faroe Islands and United States [12], the ISAV was already known to the salmon industry. The consequences of the ISAV outbreak propagated throughout the national value chain and global market [13]. High mortality rates of salmon, revenue losses and

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massive layoffs marked the trajectory of the fastest-growing salmon producer in the world [14]. According to Dresdner and Estay [15], the production of Atlantic salmon decreased by 60%, accompanied by the loss of approximately 8400 direct jobs. Thus, after 30 years of successful growth and integration with global markets [16], the Chilean salmon industry faced for the first time the consequences of its neoliberal production model characterized by self-regulation [17,18], or a sort of 'Far West austral', as it has been termed by environmental organizations [19]. Early evidence of fish health deterioration was also indicating a systemic collapse [20]. Unlike its competitors, Chilean production thrived at the expense of nature and labor, underpinned by the neoliberal nature of environmental policies [21,22].

In the aftermath, a series of institutional, financial and production-related measures were taken to mitigate the effects of the crisis [16]. The creation of the *group of salmonid concessions* informally called *barrios* (i.e. neighborhoods) and the sanitary macro zones (Fig. 1) represent the most important policy innovations that restructured production practices in relation to their geographic locations [18,23]. In addition, new sanitary and environmental regulations have been implemented ever since [24]. To date, after more than a decade of the first reported case of the ISAV in Chile, the staggering effects of the crisis continue to influence changes in the salmon aquaculture sector.

1.1. Making sense of the ISAV crisis

According to Roux-Dufort [25], crises should be understood as processes of accumulation of deficiencies and weaknesses rather than as extraordinary events, which start long before the triggering event. Additionally, crises serve as transformational processes that may catalyze institutional changes, and organizational renewal [26,27]. In this regard, Roa [28] points out that the ISAV crisis triggered policy learning and a policy change in the aquaculture sector in Chile.

The ISAV outbreak unveiled the weaknesses of the production model and the passive role of the state, accumulated over a period of three decades of rapid expansion. More concretely, high production densities, short distances among cultivation sites, a lax regulatory framework and a strong market demand created a highly vulnerable social-ecological system for any disruptive event to occur [23].

Bustos and Irarrázaval [8], conceptualize the ISAV crisis as a *capitalist crisis of realization*, that exposed the contradictions between capitalism and nature, and the conditions that challenge the salmon production at sea. From another stance, Iizuka and Katz [20] relate the ISAV crisis to the overexploitation of the *commons*, due to a lack of knowledge of local carrying capacity and neglect of the long-term environmental sustainability that the salmon industry should be based on. However, what environmental sustainability means for the salmon farming activity, continues to be open to interpretation [29].

Studies exploring what views have emerged as a consequence of the ISAV crisis are lacking. In analyzing current narratives on Chilean salmon aquaculture, this study contributes to filling this gap. Drawing upon the ideas of *discourse of renewal* induced by a crisis [27], this research examines the discursive mechanisms through which the Chilean salmon aquaculture sector is currently being re-framed, with a focus on searching for the emergence of ecosystem-related elements post ISAV crisis, and also by looking at the intersection with the local discourse. Two research questions guide the investigation, a) what are the main discourses that are re-framing the salmon industry? and b) how do these discourses conceptualize the environment? Conceptualizations of the environment may range from reductionist to more holistic or systemic approaches. Understanding how the environment is being conceptualized by the post ISAV crisis discourses, represents a key aspect to analyze how the environmental sustainability is being acted upon.

This study is based on empirical research, focusing on the Aysén region due its increasing importance for the southward expansion of the salmon activity into this region, especially after the ISAV crisis [30]. In line with Christiansen [29], this research aims to contribute to a better

understanding of how discourses on a global industry are reshaping well-established aquaculture practices and their effects on the local environment.

1.2. Renovated meanings

From a discursive perspective, this research argues that the ISAV crisis served as a tipping point in the discursive construction of the salmon industry. Consistent with a discourse of renewal that portrays optimistic, prospective and future-oriented goals [31], traditional views on industrial growth are being replaced with renovated meanings of more sustainable production practices, along with technological innovations. Meanwhile, on a local scale, what used to be seen as a booming business, nowadays is being taken with caution.

Within such renewal, this research looks at the emergence of new discourses. This work follows a constructivist approach to discourse analysis, rather than a critical discourse analysis in the tradition of Fairclough or Foucault. While critical discourse analysis focuses on power dynamics as their main analytical device, the constructivist approach used in this research draws upon the description and interpretation of the social context wherein discourses are realized, in which knowledgeable actors provide their accounts [32]. In line with this constructivist approach, Chong and Druckman [33] define framing as "the process by which people develop a particular conceptualization of an issue or reorient their thinking about an issue". Thus, the term 're-framing' is used to describe the repositioning of the salmon industry through renovated discursive reproductions, after the ISAV crisis.

Discourses respond to a specific time and space, reflecting past experiences, the present and future concerns [34]. In this regard, a discourse can be defined as "an ensemble of ideas, concepts and categories through which meaning is given to social and physical phenomena, which is produced and reproduced through an identifiable set of practices" [35]. Discourses create shared meanings and delineate what is socially acceptable and what is not. According to Olsen and Osmundsen [36], discourses can be seen as frameworks for interpretation, wherein dominant frames of reference can be traced. Discourses reveal how different actors construct their own reality, defining problems and solutions in a specific way [35]. On a local scale, discourses represent an input for policy making and policy change. Discourse analysis reveals how policy processes and practices are being influenced [37].

2. Salmon aquaculture in the Aysén region

The Aysén region is the third largest and the least populated of Chile's 16 administrative regions (Fig. 1). It holds a population of 103,158 inhabitants, with a density of 0.9 inhabitants per km² [38]. With a meandering coastline and sparsely populated coastal areas, the Aysén region offers a vast maritime territory and optimal physico-chemical conditions for salmon farming development. In July 2007, the first case of the ISAV was confirmed in the Los Lagos region [39], and six months later it was reported in the region of Aysén [40]. The poor sanitary conditions that boosted the ISAV crisis in the Los Lagos region, and the need to relocate salmon farms rapidly increased the number of maritime concessions operating in the region of Aysén [18]. While a large number of maritime concessions had been granted prior to the ISAV crisis, it is after the crisis, between 2012 and 2013, when the recovery and the expansion of the industry can be explained by the growing production of salmon in the region of Aysén, in comparison with the Los Lagos region [41].

In 2006, 543 maritime salmonid concessions had been granted within the limits of the Aysén region [41], while in January 2020, 724 concessions were registered [42]. Policy reforms introduced in 2010 placed a moratorium on the allocation of new maritime concessions for a period of five years [41]. In March 2020, the suspension was still in place [43].

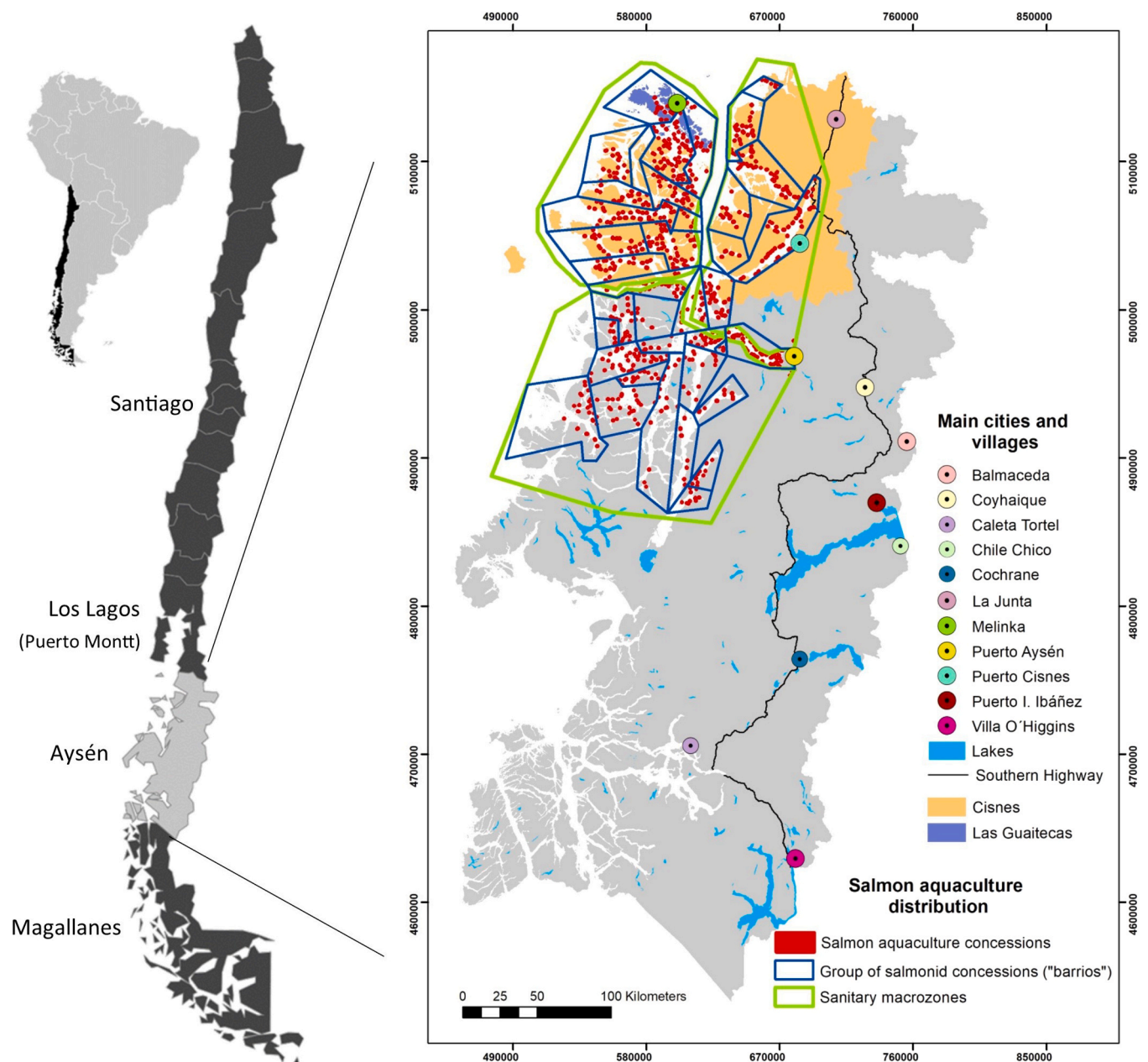


Fig. 1. Geographic location of the administrative regions where salmon production takes place, with special focus on the Aysén region. The map of the Aysén region shows Las Guaitecas and Cisnes municipalities located in the northern part of Aysén, and the location of the main cities and villages throughout the region. The map also indicates the salmon aquaculture concessions, the groups of salmonid concessions (barrios) and sanitary macro zones (Own elaboration, based on publicly available data at the National Catalogue of Geospatial Information-IDE Chile, WGS 84/UTM zone 18 S. For better definition of the territorial features, consider the color version of this figure available online).

Coastal municipalities, such as Las Guaitecas and Cisnes (Fig. 1), have witnessed the benefits and the consequences of the salmon industry. On one side, Las Guaitecas municipality with a permanent population of approximately 1800 inhabitants, holds a strategic geographic location for salmon operations by providing airport facilities that serve salmon firms, industry suppliers and local residents. On the other side, Cisnes municipality, with a larger territory (17,450 km²) and a population of 6000 residents accounts for the highest annual revenue from salmon activities (ca. 4 million EUR) among Chilean coastal municipalities where salmon farming takes place [44].

To date, salmon farming in the Aysén region accounts for 49% of the national production [45], and it is seen as a potential future growth region of the salmon industry [46]. North of Aysén, the Los Lagos region

possesses a high production density with higher associated sanitary risks. In the Magallanes region to the south, the salmon industry has encountered strong opposition from indigenous groups and environmental NGOs against further expansion. There, salmon aquaculture is seen as a threat to the bio-cultural values of austral territories that must be protected [47].

Up to now, regional production is mostly shipped to the Los Lagos region, where the main processing facilities are located. A weak value chain and a lack of infrastructure have characterized the Aysén's salmon industry. Recently, the public and private sector signed a cooperation agreement that aims to achieve better regional performance, to strengthen the regional value chain and to change the way regional development is being perceived [48]. Yet, results remain to be seen.

3. Research methods

Discourses were re-constructed based on semi-structured interviews with key informants and complemented with secondary sources, including specialized media reports, scientific publications, technical reports, online sources, and official documents. Between December 2017 and October and November 2018, 23 semi-structured interviews were conducted in four cities/localities located in the Aysén and the Los Lagos region, namely: Melinka (Guaitecas), Puerto Cisnes, Puerto Aysén and Puerto Montt. In investigating local communities, the main focus was on the Las Guaitecas and Cisnes municipalities (Fig. 1). Puerto Montt and Puerto Aysén cities were considered due to the geographic location of the salmon producers' headquarters and the aquaculture regulatory agencies, respectively. Key informants were selected according to their role and position within a variety of organizations related to the salmon farming activity. Interviewees consisted of six public sector representatives, including municipalities and aquaculture regulatory agencies; three members of research and academic institutions; three representatives of salmon firms (including a managing director, an environmental manager and a social/community coordinator); one member of the technical branch of the salmon trade group; three representatives of consultancy companies and private veterinary laboratories; three representatives of local and international NGOs; two teachers from local schools; one local service provider; and one representative of the local Chamber of Tourism. Local NGOs represent indigenous people as well as the 'red tide' committee led by artisanal fishers. The workers' position was incorporated through secondary information.

The main objective of the interviews was to inquire how respondents interpreted salmon aquaculture before and after the ISAV crisis and to get insights into the current situation. Most of the interviews were conducted face to face, audio recorded and subsequently transcribed. The opinions expressed by the interviewees do not necessarily represent their organization's stance.

In addition, the first author attended five stakeholder events held in southern Chile as an observer, including *Leadership for Sustainability* (Sustainable Salmon Program, CORFO - Chilean Economic Development Agency); *Challenges and Strategies in the Sanitary Sector, Chile-Norway* (Sernapesca - National Service for Fisheries and Aquaculture); *AquaSur 2018 International Fair*; *ASC in Chile* (Aquaculture Stewardship Council) and *Building The Future of Chilean Aquaculture - Our Turn to Lead* (Global Salmon Initiative - GSI). Observations made at these events enabled a better understanding of the national and regional context, as well as a deeper comprehension of actors, dialogues, and conflicts around salmon production systems.

Interview transcripts were indexed anonymously, by adding an identification code and a consecutive number (i.e. 'Int_1'). Primary information and field notes were analyzed following an inductive approach [49], whereby the main themes and narratives emerging from the raw data were identified, with the aid of Atlas.ti software [50]. Thus, discourses were selected among the most recurrent and conspicuous topics that interviewees referred to. Subsequently, secondary information was used to complement the argumentation of each discourse.

4. Results

There seems to be a common understanding about the causes that led to the ISAV crisis. Reflections about the errors of the past and the future challenges of the salmon industry are now publicly discussed. Salmon production is back to 'normal', but the risk of a new crisis still concern both public and private sector actors. Meanwhile, episodes of harmful algal blooms and salmon escapees, as well as contested management practices (e.g. use of antibiotics, misreporting mortalities, and labor conditions), continue to question the future (sustainable) development of the salmon industry in Chile. In addition, as one of the interviewees expressed: "there is still a lack of knowledge on how the industry deals

with sustainability issues" (Int_13).

Based on an inductive analysis of interviews and documents, four discourses were identified. Three discourses signal a re-framing of national policy and aquaculture practices which coexist with a local discourse of (un)willing acceptance toward salmon aquaculture and its effects, especially after the ISAV crisis. Accordingly, four key environmental elements are portrayed in these discourses. Table 1 summarizes the findings.

4.1. The biosecurity discourse

The *biosecurity* discourse combines the ideas and practices that emerged right after the ISAV outbreak, to contain the spread of the virus throughout the salmon production chain. Producers as well as suppliers had to adapt to new sanitary protocols, incurring in higher productions costs, but wagering that better sanitary control would lead to greater productive benefits [51]. In this respect, interviewees point out that "before (the ISAV crisis), there was no awareness of reporting, or being more careful with the sanitary heritage" (Int_15). Nevertheless, "regulations were created because of the crisis, but not based on a long-term vision" (Int_10).

The creation of the *group of salmonid concessions* (i.e. barrios) introduced significant changes in salmon farming practices. Synchronization of productive cycles and following periods among firms sharing the same *barrio* reorganized the industrial production. According to one of the respondents: "the ISAV crisis forced the industry to create the *barrios* system, which were not created based on ecosystem carrying capacity, they are based on biosecurity, which is far from perfect" (Int_9). Biosecurity, defined as the "actions, techniques or methods that must be applied to reduce or avoid the risk of introduction or spread of the causative agent of a disease" [52], became the new norm for salmon farming. In practical terms, biosecurity measures are primarily enforced through the definition of farming densities of each salmonid species within each *group of salmonid concession*. The definition of fish farming densities are subject to sanitary results from the previous productive cycle, farming projection and environmental records indicating aerobic conditions in the sediments [53]. To date, the biosecurity discourse is well established, and it also concerns surveillance practices of diseases, such as Caligidosis, in addition to a permanent monitoring of ISAV cases.

4.2. The sustainable protein discourse

The *sustainable protein* discourse entails the narratives that position the salmon production as an efficient source of animal protein with high nutritional value. Feed conversion ratio and carbon footprint are the

Table 1

Discourses, practices, environmental elements and the discursive relation in the re-framing of the salmon farming in Chile (Promise of Patagonia ©, Chilean Salmon Marketing Council 2019).

Discourses	Practices prompted by the ISAV crisis	Key environmental elements	Discursive relation
Biosecurity	Coordination of production cycles in the same group of salmonid concession, reporting of mortalities, disease surveillance	Oxygen concentration in the sediments	Different but compatible ways of re-framing salmon culture
Sustainable protein	ASC certification	Carbon footprint on a global scale	
The Promise of Patagonia ©	Fostering US market, reduction of antibiotics	Image of pristine landscapes	
The local (un)willing acceptance	Small-scale nature-based tourism development	Intertwined social and ecological dimensions	(tense) Coexistence

main indicators whereby the salmon production is deemed more efficient, in comparison with cattle and chicken production [54]. In addition, high contents of Omega-3 enrich the narrative around nutritional value, and its benefits for human health [55].

Driven by the Global Salmon Initiative (GSI), a joint venture by leading CEOs of salmon production companies from around the world, launched in 2013, and with almost half of its members operating in Chile, salmon producers aim to fulfil the increasing global demand of food and protein, while at the same time contribute to maintaining both wild fish stocks and marine biodiversity [56]. For example, one of the GSI representative argue that by farming salmon “we take part of the solution and we take our rightful place in food security” (Field notes, GSI 2018).

The *sustainable protein* discourse finds support in global discourses. Food security, protein nutrition and blue discourses are conveyed as a hegemonic set of meanings, through which the growth of salmon aquaculture is being legitimized [2].

On the ground, the *sustainable protein* discourse can be related to the increasing number of Aquaculture Stewardship Council's (ASC) certifications that members of the GSI are committed to achieve [57]. According to one of the interviewees, the ISAV crisis urged firms to undergo certification processes (Int_12). For example, ASC certifications are supported by WWF Chile (Int_10). Currently, there are 70 certified farms of Atlantic salmon in Chile [58].

4.3. “The Promise of Patagonia” discourse

The economic effects of the ISAV crisis and the need for harvesting smaller sized salmon during the virus outbreak, forced the industry to seek new markets [13]. Thus, Brazil became a new destination for salmon from Chile. Further, by 2013, the Chilean exports to the US market were re-established [59]. In 2019, the Chilean Salmon Marketing Council launched a marketing campaign called *The Promise of Patagonia*, to strengthen the reputation of Chilean salmon in the United States. By making use of metaphors referring to the landscape aesthetics, environmental quality and wilderness of Patagonia, this discourse relates the pure and pristine waters to the salmon reared in Patagonia, which is brought to the American consumers. The salmon from Patagonia promises “a conscious and sustainable collaboration between nature and nurture” [60].

Through this discourse, salmon producers associated with Salmon-Chile, a trade group representing Chile's salmon industry, have committed to produce high quality and healthy salmon, to preserve pristine territory and support local communities, to ensure fish welfare, to use the highest processing standards and to assure the availability of salmon year-round [60].

On a practical level, this discourse has been linked to the efforts of reducing the use of antibiotics in the Chilean salmon industry. In a strategic alliance, SalmonChile, the Salmon Marketing Council and the Monterey Bay Aquarium elaborated the *Chilean Salmon Antibiotic Reduction Program* (CSARP). By 2025, this program aims to reduce the use of antibiotics by 50% [61]. The ultimate goal is to become a ‘good alternative’ within the classification of the Monterey Bay Aquarium's Seafood Watch program. Currently, the Seafood Watch ranking recommends to ‘avoid’ Atlantic salmon from Chile [62].

4.4. The local (un)willing acceptance

On a local level, acceptance and resignation sentiments enmesh with local indigenous opposition toward the increasing use of maritime space by the salmon farming activity, along with the insufficient enforcement of environmental regulations. In the case of Las Guaitecas municipality, interviewees acknowledge the benefits they have received since the industry began. The increase of air and maritime connectivity, and the emergence of direct and indirect jobs, have boosted the local economy. One of the interviewees recalls: “at that time (prior the ISAV crisis),

working in a *salmonera* meant a permanent salary. It was a booming business” (Int_18). In parallel, the environmental effects are acknowledged as well. Images of an unnatural fatty, pinkish and rotten salmon are depicted by the respondents when answering the questions about the ISAV crisis and its local effects. Further, indigenous communities amid litigation over the maritime space, have argued that the ‘Lafkenche law’ (i.e. Marine Coastal Spaces of the Ethnic Populations), is the only legal instrument that can limit the southward expansion of salmon aquaculture (Int_19). Nevertheless, the indigenous community Pu Wapi, located in Las Guaitecas municipality, has brought to court their claims over maritime space, with no success yet [63].

Further south, interviewees in Puerto Cisnes draw attention to the fact that after the ISAV crisis “there is no certainty that this industry is sustainable” (Int_21). “The ISAV crisis was a disaster, in economic terms. There were no jobs, and hostels were empty. Part of the population had a very bad time” (Int_23). Currently, the local community is more focused on developing tourism activities, while a few remain employed by salmon firms. Meanwhile, the local perception about the environmental impacts of salmon farming still persists, expressed in the following quote: “the environmental damage is tremendous, only when the farms are under fallowing, it seems that the *huairo* (Giant kelp) recovers a bit, that it can breathe again, but after that, everything is almost gone again” (Int_23).

From another stance, by 2014, labor union leaders claimed that “the industry did not learn anything about the ISAV crisis” [64]. Labor conditions, such as low wage, safety at work and low standard sub-contracts, did not improve alongside the industry recovery. To date, the same issues remain in the industry's agenda [65].

5. Discussion

According to Ibieta et al. [66], the Chilean salmon industry emerged as a mature cluster, emphasizing the regional economy (primarily in the Los Lagos region) and the integration with global markets. Later on, the industry renewal (post ISAV crisis) was built on a stronger public-private coordination, with the support of the financial sector and the creation of new laws and regulations [67]. However, the question whether the salmon aquaculture is still developing as a cluster, or as an enclave economy remains debatable [11]. Either way, the salmon farming activity represents nowadays one of the main development discourses of the Aysén region and one of the most prominent drivers of socio-spatial transformations in the coastal areas of southern Chile. The discursive reproduction finds synergies in the assumptions of economic growth and development, employment creation, quality product from Patagonia and world salmon producer; which are underpinned by national development guidelines [68]. In this context, this research has attempted to capture the main discourses through which Chilean salmon aquaculture is currently being re-framed in the aftermath of the ISAV crisis.

5.1. Re-framing and coexisting

While the discourses have been reconstructed with a focus on the Aysén region, general considerations may be applicable to the other Chilean administrative regions where the salmon farming activity takes place.

The ISAV crisis prompted a series of discursive and practical changes, from a phase of economic imperative preceded by a social-ecological silence [17], to a new phase, where biosecurity measures are shaping the way the salmon aquaculture is being developed. The *biosecurity* discourse is the most prominent one. Driven by a series of consecutive policy changes, the *biosecurity* discourse disrupted the so-called ‘Far West austral’, which until the ISAV crisis dominated the industry culture. The *biosecurity* discourse, which has not been exempted from debate between salmon firms and regulatory agencies, continuous to legitimize new regulations, thus assuring the sanitary conditions required by the global market and making the salmon farming a highly

competitive industrial sector, in constant adaptation. To date, the *barrios* system and the estimation of salmon farming densities remain the key innovations that reorganized production practices. Thus, biosecurity became a new bargaining chip in salmon aquaculture risk politics [cf. 69]. It is to be expected that further technological innovations, such as closed net-pens or off-shore aquaculture may trigger a discursive shift toward more sustainable production practices, meaning a reduction of the environmental impacts at sea. However, as Fløysand and Jakobsen [70] indicate, the industry does not only need a technological change, a 'cognitive renewal' is also required.

From another stance, and complementary with what Fløysand and Jakobsen [70] labeled as the global demand narrative, the *sustainable protein* discourse portrays a carbon efficient animal protein that should fulfill the global demand of food and nutritional value. The *sustainable protein* discourse positions the national salmon production as an accountable sector within global food nutrition, hence justifying the local expansion for a greater benefit, which takes place far away in the remote fjords of Patagonia. Though this discourse might not have been directly emerged as a consequence of the ISAV crisis, it is after the crisis when the reproduction of ideas of sustainable protein found fertile ground, along with the implementation of ASC certifications.

On a national level, ideas about sustainable protein from farmed salmon have gained relevance on a discursive dimension, rather than on a practical one. According to Nahuelhual et al. [2], Chilean salmon aquaculture has neither contributed to improve the diet of national consumers, nor has it reduced the overexploitation of wild fisheries. On one side, the domestic salmon consumption is very low, 1.5 kg per person per year, and on the other side 70% of wild fisheries are over-exploited [2]. High retail prices of farmed salmon have hindered the access of domestic consumers. In addition, policy incentives have primarily focused on seafood exports [2].

The Promise of Patagonia discourse, brought forward as a marketing campaign that capitalizes on the image of iconic landscapes of Patagonia, applies similar rhetorical elements to those used as an argument for the green profile of New Zealand salmon production [71]. Accordingly, *The Promise of Patagonia* discourse is rebranding the local nature, as an iconic image, and as an integral resource for the development of the salmon aquaculture. *The Promise of Patagonia* discourse attempts to convince the consumers, that salmon reared in Patagonia is synonymous with environmental quality, but it is still debatable how the industry aims to commit to "preserving the pristine territory... of our homeland, the Chilean Patagonia" [60]. In recent years, several mismanagement practices have tarnished the efforts of the salmon industry in Patagonian waters. To name a few, a sinking well-boat, an industrial painting spill, massive salmon escapes and work accidents, have questioned the Social License to Operate [cf. 72]. In this respect, one of the respondents referred to: "there is still a lot to do, and one of the main topics is the social licence, the acceptance of the industry by the communities. This topic is one of the fundamental reasons why the industry has neither been able to grow, nor has it been able to be successful" (Int_10).

While on the ground *The Promise of Patagonia* discourse may be unknown, Patagonian residents express mixed feelings and an (un)willing acceptance toward the fluctuations of the industry, or as Saavedra et al. [73] state "an ambivalent, discursive division". The authors indicate, that such 'ambivalence' is expressed through local concerns that have to weigh their opportunities for employment vs. the environmental impacts of the salmon farming activity, while labor conditions remain a key public discussion.

The ISAV crisis left an indelible mark on coastal communities. The local development argument that underpinned the rapid expansion prior the ISAV crisis does no longer have the same impact. An increasing opposition has confronted the southward expansion of the salmon farming activities, foregrounding the discussion over marine spatial planning, and the conflicts between salmon farming areas, indigenous communities' maritime space and nature protected areas. In addition, artisanal fishers located in Melinka for example, remain occupied with

other urgent matters, such as the sea urchin extraction quota [74].

Findings based on the Aysén region, indicate a (tense) coexistence between the local discourse toward the salmon farming activity and the discourses that are re-framing the salmon aquaculture. Despite the local effects of the ISAV crisis, the local discourse seems to have very little influence on how the salmon farming activity is being re-framed in the Aysén region.

5.2. Legitimizing expansion

Resembling the cowboy economy model [75], salmon farming in Chile has enjoyed until now the seemingly infinite maritime space of Patagonian fjords and channels. The southward expansion of the salmon activity, induced by the poor sanitary conditions that triggered the ISAV crisis in the Los Lagos region, affected the maritime spaces of the Aysén and the Magallanes regions [41]. In this context, discourses described in this research mirror the legitimization of the salmon aquaculture expansion. The legitimization to growth is being materialized through the improvement of sanitary conditions, the justification of the sustainable protein production on a global scale and the promotion of the American market by compromising to reduce the use of antibiotics. Consistent with the rhetoric of *blue growth*, these three particular discourses may work in synergy, but in disconnection with what the local discourse conveys toward the marine ecosystems wherein the salmon farming activity is embedded [cf. 76].

In a recent turn, in March 2020, the Under-Secretariat for Fisheries and Aquaculture issued a decree indicating that the areas formerly designated as areas for aquaculture in the Aysén region, are no longer available for new maritime concessions. Only relocations will be processed [77]. In this scenario, spatial restrictions may become the main limiting factor for salmon aquaculture [78]. Hence, the need for more efficient management strategies in the future.

5.3. The absence of integrated ecosystem-related elements

Prior the ISAV crisis, salmon farmers were looking at the main fjords in the Aysén region as sites of production for the market, rather than as complex marine ecosystems [79]. To date, despite the multiple social-ecological effects of the ISAV crisis and the fact that salmon farming depends on certain environmental conditions, the discourses that are re-framing salmon aquaculture do not incorporate integrated marine ecosystem-related elements. One reason might be that biosecurity measures and the creation of the group of salmonid concessions (*barrios*), were not created based on ecosystem criteria, and according to Iizuka and Katz [20], *barrios* are being implemented on a trial and error basis. By contrast, the local discourse manifests an intertwined social-ecological relationship. The key environmental elements in the discourses, i.e. the oxygen concentration in the sediments, the carbon footprint of salmon production and the image of idyllic Patagonian landscapes are not part of an integrated perspective. The discourses thereby reduce the environmental condition of marine ecosystems to a few indicators, representing a part of the production function and overlooking the social-ecological complexity that challenges the salmon production at sea.

In this respect, the national aquaculture authority has recently acknowledged the relationship that ecosystem-based management and One Health principles should bring into salmon aquaculture [80]. In addition, the scientific community has proposed a series of ecosystem indicators for salmon production [81], yet their implementation remains a pending task.

To date, Chilean salmon farming policies are still removed from meeting the ASC environmental standards, while Norwegian regulations are the closest match to the ASC requirements in environmental sustainability [82]. This contrast indicates how differences in socioeconomic development standards shape global salmon aquaculture production, and therefore their potential to influence the emergence of

environmental discourses within the salmon industry.

5.4. Times of crises and uncertainties

At the time of writing, the COVID-19 crisis has brought back the memories of the ISAV effects both in the aquaculture industry and in the coastal communities. As an unexpected outcome, lab capacities installed back in 2007 to deal with the ISAV outbreak, are nowadays providing PCR tests for COVID-19 [83]. Both crises, have exposed the social inequalities and the uncertainties that shocking events cause in vulnerable socio-political systems. Even more, both crises are related to ecosystem components, and remind us once again of the importance of science-based policy making.

In Chile, recent crises have triggered the emergence of social uprisings, as means of protest against the state's failure in handling social inequalities and the detrimental environmental effects of some industrial activities. To date, social uprisings caused by ecosystem-related phenomena, such as the ISAV crisis, and later on by the massive harmful algal bloom that affected salmon aquaculture as well as artisanal fisheries in 2016 [84], had little impact on how the salmon aquaculture sector is conceptualizing its relation with marine social-ecological systems. Instead, biosecurity became the main discourse informing policies on animal disease risks. In light of complex and uncertain events, risk management, based on multi-level and multi-actor perspectives [85], should complement the biosecurity efforts that are currently shaping the way forward for salmon aquaculture in Chile. Further research on the discursive effects of consecutive crises around salmon farming production and marine social-ecological systems would certainly provide valuable insights on how the industry, the policy sector as well as local communities continue to re-frame the future of the salmon production in southern Chile.

6. Conclusion

This research has identified three discourses that signal a re-framing in salmon aquaculture in the aftermath of the ISAV crisis in Chile, namely: *biosecurity*, *sustainable protein*, and *The Promise of Patagonia*. These discourses, and the practices they refer to, coexist with the local (*un*)willing acceptance discourse. While the *biosecurity* discourse entails significant policy changes, the *sustainable protein* and *The Promise of Patagonia* discourses focus on changes within the business sector. The latter two are influenced by global blue discourses and the US market respectively. The local discourse has contested views toward the salmon aquaculture expansion, with little discursive power in the Aysén region.

The paper concludes that despite the staggering effects of the ISAV crisis on the national salmon production and on coastal communities more than a decade ago, new discourses are focused on the legitimization of growth, while integrated marine ecosystem-related elements remain absent. This absence denotes a crucial gap toward environmental sustainability in salmon aquaculture.

This research suggests that if the public and private sectors aim to anticipate new critical episodes and advance toward sustainable salmon aquaculture, technology development as well as elements of common public good and ecosystem-based management should become central discourses in the discussion of the future of the salmon industry in Chile.

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CRedit authorship contribution statement

Pamela Bachmann-Vargas: Conceptualization, Investigation,

Methodology, Writing - original draft, Writing - review & editing. **C.S.A (Kris) van Koppen:** Conceptualization, Writing - review & editing. **Machiel Lamers:** Conceptualization, Writing - review & editing.

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Declarations of interest

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