

Article

Shaping Aquaculture Management—An Interest Tug O' War

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Abstract: (1) Background: Although Norwegian aquaculture has experienced tremendous development, environmental challenges limit opportunities for growth. To promote environmentally sustainable industry growth, a new spatial management regime was introduced: the Traffic Light System (TLS). However, with a focus on environmental sustainability and economic growth, the new regime largely ignores important factors for industry development: legitimacy and acceptance. (2) Methods: This study used qualitative methods such as interviews and document analysis. (3) Results: The results showed how aquaculture stakeholders perceive and weigh the dimensions of sustainability. Low social sustainability, owing to low content legitimacy and acceptance, places stakeholders in an interest tug o' war. (4) Conclusions: Legitimacy and acceptance are prerequisites for industry growth, which may ultimately affect the objective of sustainable growth. In particular, a lack of legitimacy and acceptance may affect procedural legitimacy and thus the long-standing institutional setup in Norway.

Keywords: aquaculture management; social sustainability; legitimacy; acceptance



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1. Introduction

Having reached their production limits [1], capture fisheries alone are unlikely to meet future demand for fish protein. Aquaculture is therefore promoted as a way to provide high-quality protein to a growing world population and to enable continued sustainable development [2]. At the global level, aquaculture is the fastest-growing food sector. FAO [3] estimates that by 2025, aquaculture will provide 57 percent of all fish consumed by humans globally.

Despite being a relatively young industry, the farming of Atlantic salmon (*Salmo salar*) has experienced remarkable development since its commencement in the 1960s [4]. Norway is a major producer of farmed Atlantic salmon, accounting for 55.3 percent of the global salmon production [5]. Nationally, the industry contributes to income, employment, and settlement along the coast. In 2019, Norway produced 1.1 million tonnes of Atlantic salmon, and almost 9000 people were employed in aquaculture [6,7]. The export value in the same year was about NOK 72.5 billion (about USD 8.5 billion) [7]. At the global level, the Norwegian aquaculture industry claims to produce 17.5 billion meals annually and provides 133,000 jobs in coastal communities all over the world [8]. The industry therefore contributes to several of the UN sustainable development goals (SDGs): eradicating hunger (SDG 2), facilitating employment and economic growth (SDG 8), and conserving life under water (SDG 14) [9].

The Norwegian government and the aquaculture industry have high future ambitions, as the government foresees a five-fold increase in salmon and trout farming between 2010 and 2050 [10]. However, despite these ambitions, aquaculture production in Norway, as well as Europe, is stagnating [11–14]. According to Guillen et al. [15], this stagnation is due to the inability to integrate environmental policy with economic ambitions, particularly in marine finfish aquaculture [16]. However, stagnation has also been linked to socio-environmental conflicts due to the failure of the institutional or political framework to

accommodate stakeholder interests [2,16,17]. More specifically, environmental challenges, limited access to space, and policies and bureaucratic regulations have hindered growth in aquaculture production [16,18,19].

As a result of environmental challenges, over time, the Norwegian aquaculture industry has become subject to a comprehensive and detailed management regime [20,21]. However, although Norwegian aquaculture regulation “... is viewed as the Gold Standard” [22], the aquaculture industry continues to struggle with escapes, pollution, and lice [18,23,24]. Consequently, the sustainability of the aquaculture industry is being increasingly scrutinized [2,16].

Environmental challenges, coupled with the desire for growth, have led the Norwegian government to introduce an indicator-based spatial management regime known as the “Traffic Light System” (TLS). The TLS manages aquaculture production based on spatially delimited sea areas that act as natural barriers to the spread of disease. The TLS aims to ensure sustainable growth by reducing the risk of disease and opening new areas for production. The focus of the TLS is mainly on environmental and economic sustainability, as it uses lice as an indicator of production and industry growth.

According to some authors, social sustainability has largely been ignored and is the main barrier to the expansion of the industry [25–27]. Solås et al. [21] studied how scientific knowledge and political objectives shaped aquaculture policy and management, and their results indicated that Norwegian aquaculture policy was too narrowly focused on environmental sustainability. Hersoug [28] showed that policy reforms seek to make aquaculture “green” and more acceptable to the public. He pointed out that the success of a management regime depends on the authorities’ ability to stabilize it, giving it legitimacy and acceptance. This requires political support and acceptance by and cooperation with major stakeholders (aquaculture industry and ENGOs), as well as a solid scientific foundation. In general, however, relatively little research effort has been invested in the social dimensions of seafood sustainability [29].

This article contributes to the body of literature by exploring social sustainability in aquaculture, focusing on legitimacy and acceptance. In particular, it shows that these dimensions place stakeholders in an “interest tug o’ war”, which ultimately shapes the management system.

2. Theoretical Framework

2.1. Social Sustainability in Aquaculture

The concept of sustainable development was popularized in the 1980s with the publication of “Our Common Future” (Brundtland 1987:43). In general terms, sustainability is the “capacity to persist in the long term ...” [11,30]. This was further refined by Barbier [31], who defined sustainability as “... an interaction among three systems: the biological and resource system, the economic system and the social system”. As the three pillars depend on each other, a number of studies have highlighted the need to balance the three dimensions [21,32,33].

Although Barbier characterized sustainability, it is a complex and fuzzy term, and what sustainable aquaculture entails is not straightforward. Environmental sustainability requires sound relations between aquaculture development and the environment upon which it relies [30]. This includes protecting fish and their habitats, managing organic waste and preventing escapes, as well as maintaining fish health and welfare by reducing stress, disease, and pest risk [34].

All economic activity is associated with ecological footprints. On the one hand, aquaculture contributes to value creation and income for enterprises, municipalities and the state. On the other hand, aquaculture tends to be associated with negative environmental impacts, adversely affecting the image of the industry and its possibilities for further growth. Hence, the level of environmental risk and impacts that are acceptable need to be defined [30].

Some scholars have argued that sustainability is fundamentally a social issue [35]. “Environmental problems are first and foremost social problems. You manage the people who impact on the natural environment, you do not *per se* manage nature itself” [25:366]. As the dimensions of sustainability do not function in isolation, sustainability is a relational term. Moreover, social sustainability itself is relational. Welfare, wellbeing, stakeholder–industry relations, governance, and civil society [34] are all examples of social factors that depend on social relations and interactions.

Although social sustainability is a rather vague concept, a number of studies in aquaculture have attempted to operationalize it [36,37]. Some studies have focused on Corporate Social Responsibility, the Triple Bottom-Line approach, or Social License to Operate (SLO) in aquaculture [26,38,39]. Others have focused on structural indicators, such as employment conditions, wages, and occupational safety [37,40]. In these examples, social sustainability is represented by legitimacy and acceptance, in which legitimacy is necessary for acceptance of industry activity [41]. However, legitimacy and acceptance also concerns what the industry finds acceptable and legitimate. Those affected by the system are less likely to break rules if they accept the system [42]. Hence, for the stability of the management system, the system must be deemed legitimate and acceptable by those whom it intends to manage (the industry). As a result, although environmental and economic sustainability are the main challenges in Norwegian aquaculture [28,43], the future development of the industry depends on “whether the demands of the industry are seen as legitimate and valid” [28:17], but also that the industry sees the management system as legitimate and acceptable.

2.2. Legitimacy and Acceptance by Aquaculture

In light of the present criticism of aquaculture practices, there is a need for a system that legitimizes and creates acceptance for industry growth. Thus, within a resource management system that is increasingly focusing on ecosystem-based management [44], sustainable growth is the only pathway to legitimize growth. Legitimacy is both a premise for and a result of the management system.

There are two main types of legitimacy: content legitimacy and procedural legitimacy. According to Jentoft and Mikalsen [42], the content “is in the thing itself”, or the content of the regulatory system. Content legitimacy will “exist if the citizen accepts the policy due to support for its substantive content” [45]. It is thus a property of judicial acts, the management system, and “the public’s belief that a particular judicial decision is substantively correct” [46]. Content legitimacy depends on whether the management system satisfies established standards and requirements, but there may not be an agreement on what these are [42]. Hence, despite the substantive nature of content legitimacy, perceptions of legitimacy also vary between stakeholder groups [46]. In the long term, though, a regulatory system that actually realizes sustainable development will more easily gain acceptance, but, again, how sustainable development is understood will always be open to negotiation [47,48]. However, even if actors disagree with the content of a regulation, legitimacy can be achieved if the processes of developing the management system and its implementation are perceived as legitimate. This is procedural legitimacy [42]. Procedural legitimacy deals with how decisions are made and how stakeholders are involved in the process. As such, stakeholder inclusion and participation are more likely to lead to acceptance and compliance [49].

Closely tied to procedural legitimacy in the Norwegian setting is institutional sustainability. Whether viewed as part of social sustainability or as a dimension of sustainability in its own right, institutional sustainability is central to Norwegian aquaculture management. Institutional sustainability encompasses the management, the regulatory framework, and the institutions (organizations) that implement the management and long-term maintenance of these elements. According to some scholars, institutional sustainability is a precondition for ecological, economic, and social sustainability [50,51].

Marine management in Norway is largely based on a corporative model with a close partnership and coordination between authorities, industry, and non-governmental organizations [52,53]. This entails a sharing of responsibilities between the state and industry in terms of management and industry development [54]. Furthermore, the Norwegian planning tradition emphasizes stakeholder participation in planning processes. This is also the foundation of aquaculture management [55]. As such, the procedural legitimacy is intertwined with the corporative model for decision-making and planning processes.

In addition, knowledge-based management is a central principle in aquaculture management and is increasingly a contributor to policy formulation. Political decisions should be based on scientific knowledge, or “facts”. However, as this paper shows, research is complex and encumbered by uncertainty and even controversy. Uncertainty leads to different interpretations of knowledge, which may benefit one interest group over another. Thus, scientific knowledge can easily become politicized [56]. We recognize that compliance with regulations will be greatest if both content and procedural legitimacy are in place [42]. However, the main focus in this article was on content legitimacy, as this is where the greatest controversy has arisen in terms of the TLS. We reflected on how content legitimacy may affect procedural legitimacy.

3. Materials and Methods

The data and analysis in this article were based on the work carried out by Vik [57] and were obtained using a qualitative approach. The work drew on two sources of data: documents (secondary data) and interviews (primary data) [58]. The secondary data sources used were public documents such as White and Green Papers, consultation process documents, reports, laws and regulations, scientific articles, and media articles. The majority of the documents were retrieved from the internet, particularly from government webpages (i.e. www.regjeringen.no), (accessed on 20 July 2021).

Primary data were collected through semi-structured interviews. A total of five in-depth interviews were carried out with key informants in the aquaculture sector. Three interviews were performed with leading representatives from aquaculture companies, and two were conducted with representatives of authorities. These interviewees were chosen because they have been central actors in the implementation of new regulations (authorities) or directly affected by the new regulations (industry). All interviews were performed over the telephone and lasted about 1–1.5 h each. Interview guides were designed and provided to all interviewees before the interview. Detailed notes of the interviews were recorded, and interviewees were offered the opportunity to comment and correct them. Data were collected and stored in accordance with the regulations of the Norwegian Centre for Research Data (www.nsd.no), (accessed on 20 July 2021).

The methodology of this study included Document Analysis (DA), which is the study of documents assembled by others [59] and is particularly suitable for case studies that provide rich descriptions of a phenomenon [58]. It is a systematic procedure for reviewing and evaluating documents to interpret and understand their contents [60,61]. Moreover, DA is a time-efficient and cost-effective method for collecting data, as the data are already available. A major drawback with DA is that the documents are not produced for a particular research purpose; hence, there is a possibility of selection bias. This weakness is minimized, as all relevant documents related to the research question are available online and have been assessed. Missing details in documents were supplemented with information from interviews with key stakeholders in the industry and management [60].

The DA procedure used in this work was inspired by Bowen [60]. First, documents were selected based on their relevance to the research question. These were skimmed to obtain an overview of the topic and organized and systematized according to their relevance. This process revealed missing documents but also narrowed down the scope of the documents. The document with the highest relevance to the research questions was selected for further analysis.

Notes from interviews supplemented the secondary literature and were thus treated as documents and included in the DA [62]. A combination of content analysis (CA) and thematic analysis (TA) was applied. CA was used to organize data into categories related to the research question. This was an iterative process, starting with a large number of categories, which further narrowed the scope. TA was then used to identify patterns and themes within the categorized data. The data were re-analyzed in detail and coded according to the research questions. Initially, there were a large number of codes, but they were reduced through categorization and coding to form patterns [60,63].

4. Results

4.1. Aquaculture Governance: Marine Spatial Governance

The intention of the new spatial planning management regime, the Traffic Light System (TLS), was to promote sustainable and predictable industry growth by providing authorities with an objective decision-support tool [64]. In this system, the coast was divided into thirteen production areas (PAs) separated by “firegates”. The firegates are natural barriers, such as deep fjords acting as barriers to the spread of disease. Production capacity within a PA was regulated based on an indicator measuring the mortality risk due to salmon lice on out-migrating wild salmon smolt [65]. Mortality risk was classified into three categories: low, moderate and high. Low risk is defined as a probability of less than 10 percent that out-migrating smolt will die due to lice infestation (green light). Moderate risk is a 10 to 30 percent probability that smolt will die (yellow light), whereas high risk is over 30 percent probability that the out-migrating smolt will die as a result of salmon lice (red light) [66]. These estimates were based on (1) a surveillance program that registers the number of lice on out-migrating smolt, (2) models that simulate the infection pressure on smolt based on lice counts and currents, and (3) the effects of lice on smolt survival. The TLS works according to the precautionary approach, as the production capacity of an entire PA is based on the river with the highest lice-induced mortality risk for out-migrating smolt within the PA [56,67].

In general, an aquaculture license is linked to a PA, and within a PA are a number of licenses and a number of different enterprises. Figure 1 shows the PAs along the coast in 2021. Nine PAs were defined as posing a low risk of lice-induced mortality to smolt (green) and were offered an increase of 6 percent in production capacity. Two PAs were defined as moderate risk (yellow), in which case the capacity was frozen, and two PAs were defined as high risk (red), resulting in a reduction in capacity. This has become known as “the rule of action”. The environmental status of the PAs and production capacity adjustments are re-evaluated every two years [64]. Although the system was implemented in 2017, to allow the industry to adjust, red PAs were not required to reduce capacity until 2020. In addition to controlling production capacity, another intention of the TLS is to offer direct incentives for environmentally sustainable operations through investments in environmentally friendly production technology and operational modes [65]. In sum, the TLS aims to contribute to environmental sustainability by reducing lice and to economic sustainability by increasing production through expanded areas available for aquaculture.

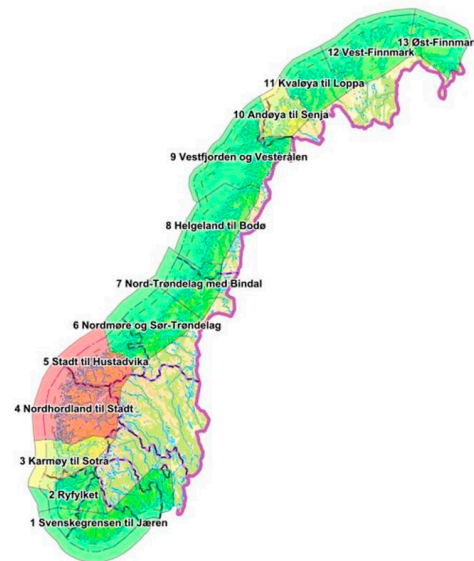


Figure 1. Production areas (PAs) in the Norwegian spatial management model [68].

4.2. Reception of the New Spatial Management Regime

4.2.1. Questioning the Science

Despite the promises of the new regime, the TLS has been controversial. From the point of view of advisory bodies, such as the Institute of Marine Research (IMR), the Norwegian Institute of Nature Research (NINA), and the Norwegian Food Safety Authority (NFSA), lice and escapees pose significant threats to wild salmon populations in areas with intensive aquaculture. These institutions have argued for expanding the TLS by including other environmental indicators in addition to lice [69–72]. According to these actors, the new management system is scientifically sound and perceived as more knowledge-based and precise than the previous one. In particular, it is viewed as more sustainable, as the TLS accounts for the collective environmental impact on wild salmon stocks. Knowledge gaps in relation to the TLS have been recognized, especially regarding the total release of lice and how the location of farms and water currents affect lice release. These gaps, however, were not regarded as sufficiently good reasons not to implement a new system [70,71].

Other stakeholders, however, have been rather critical of the TLS. The NGO Norwegian Salmon Rivers (Norske lakseelver) supported the introduction of PAs but questioned the assumptions on which it was based [73]. Others questioned the certainty of the IMR's smolt mortality models and also addressed a number of knowledge gaps [56,65,74]. For instance, Norwegian Seafood Producers (NSL) questioned the link between the number of lice and mortality [75] and referred to a group of scientists that, in the spring of 2016, concluded that there was a lack of crucial knowledge about the link between the number of lice in pens and the risk of unacceptable levels for wild fish. In their opinion, these gaps need to be closed before the environmental consequences can be modeled with enough accuracy to determine the color of an area [76].

Similarly, the Norwegian Seafood Federation (NSF) also questioned the link between lice and the mortality of wild fish and claimed that the TLS was not suitable for handling either lice or the future development of the industry. The Norwegian Seafood Federation argued that there are too many shortcomings in the new system: "... The uncertainty is great, and is an addition to uncertainties that comes with biological production. We cannot accept that a billion-dollar industry that produces 14 million meals of salmon every day is the subject of a large-scale experiment" [77].

As the NSL pointed to, scientific reports did highlight the uncertainty related to smolt mortality, as mortality has been shown to have a range of sources, such as hydropower developments, migration barriers, habitat change, and climate change. Hence, it

was not possible to document the negative effects of salmon lice on wild salmon populations in isolation [78–80].

Despite these arguments, the Standing Committee on Business and Industry supported the assessment of a correlation between lice and smolt mortality and stated that there was a “... clear correspondence between the occurrence of lice in pens and lice on wild fish, affecting mortality of migrating smolt”. Moreover, the committee called for management based on the precautionary principle [65], indicating the necessity to ensure the sustainable development of the industry.

4.2.2. Questioning the Legality

The other criticism of the TLS was the effect of collective punishment, as the TLS would regulate the production capacity of all companies within a PA [81,82]. In a red PA, a company operating with lice counts well below threshold values would have to reduce its production capacity on par with all other companies in the PA. Industry actors expressed a sense of injustice that localities/companies operating without negative environmental effects would also have to endure a reduction [83]. The principle of collective responsibility for a situation pertaining to individual actors was perceived as genuinely unfair. Moreover, industry actors questioned whether the Aquaculture Act (§9) actually had a legal basis to reduce production capacity [84].

After the implementation of the TLS in 2017, to provide a period of adjustment, farms in red PAs did not have to reduce their production. In 2020, when the production capacity was adjusted, 9 of the 13 PAs were found to be green, 2 areas were yellow, and 2 were red. For the first time, a red light had consequences. “We do this out of consideration for the environment”, the Minister of Fisheries argued. The Minister of Climate and Environment further elaborated on the Norwegian responsibility to ensure the sustainability of wild salmon. The two areas that received a red light did so because of the unacceptable impact of salmon lice on wild salmon [85].

However, according to Seafood Norway, this would be devastating for the industry in the area. A six percent reduction in red areas would amount to 17,000 tonnes and affect about 140 farms, with a reduced turnover of NOK 850 million (about USD 100 million) [86]. Farmers in red areas were critical of the result; as one aquaculture entrepreneur put it:

We operate legally and responsibly and abide by all regulations, including the lice regulations. That a prudent operation, is not considered prudent and must be reduced, we believe is very wrong and a threat to the rule of law. I definitely believe that this should be regulated at the individual locality that does not comply with the rules. Instead, we get a collective punishment [87]

The Minister of Fisheries responded that the principles of the management system were defined by White Paper 16 [13] and adopted by the Parliament. For the system to be legitimate, a reduction must be implemented when it is overwhelmingly probable that over 30 percent of the wild salmon smolt will die due to lice. According to him, “it shows that the government is serious about sustainable aquaculture” [87].

To avoid lawsuits, the Ministry of Trade, Industry, and Fisheries proposed an amendment to the Aquaculture Act, which would clarify the authorities’ right to reduce production capacity in red areas. The amendment aimed to resolve questions of legal interpretation, increase the legitimacy of the TLS, and reduce incentives to take legal action.

This did not calm industry actors. The Bar Association, one of the consultative bodies, was critical and disagreed with the Ministry’s view that individual circumstances are not relevant when assessing production reduction [86]. Subsequently, in the fall of 2020, a lawsuit was filed against the state. The plaintiff, a network of aquaculture actors on the west coast situated in red areas (also known as “PO3/4 Knowledge Incubator”), disagreed with the legality of the system. As the spokesperson said:

We disagree with the legal basis for the traffic light system, including lack of assessments, lack of legal basis, and lack of consultation... At the same time, rules have been changed

along the way. This applies to various regulations as well as parts of the Aquaculture Act. Predictability is gone . . . The foundation for the system must be certainty and predictability. [88]

The trial started in February 2021, in which the argument revolved around the content legitimacy of the system, namely, the scientific uncertainty of the TLS. It was argued that when the state imposes a large-scale reduction in production and value creation, it should be based on solid and verifiable facts [89]. The plaintiff asked, “How can we calculate that lice causes x percent mortality in wild salmon?...And how can we estimate the share of salmon that dies due to salmon lice?” [90]. Furthermore, as the plaintiff’s legal counsel said: “There is not a single salmon that can be presented here in court that has died of salmon lice. It is calculated and estimated in models” [91].

The 25 fish farmers sued the state for NOK 250 million (about USD 31 million) for lost production capacity, but they lost in the district court. The state won on all accounts, and the fish farmers had to pay legal expenses. After the loss, the fish farmers’ legal counsel said that the case is of principal importance and that they would appeal the verdict [92–94]. The discussions among aquaculture actors show that social sustainability is closely linked to environmental and economic sustainability. Moreover, the trial shows that the content, legality, acceptance and, in the end, social sustainability of the management system are thoroughly challenged by industry actors.

4.3. The Exemption Rule: Addressing Legitimacy

The question of the legality and acceptance of the system has been the subject of continuous discussion alongside the development of the TLS. The standing committee on business and industry claimed that production reduction would be a strict but necessary measure to ensure environmental sustainability in aquaculture. As the Aquaculture Act grants authorities the right to actually withdraw permits, a reduction in production capacity would be a relatively minor intervention. However, to address some of the criticism, the standing committee allowed for an exemption to the rule of action if the operation could demonstrate little or no negative environmental impact. This allowed for an individually targeted procedure, as opposed to the collective procedure of the TLS, to reduce the risk of collective punishment [65]. As such, “the exemption rule” (§12) to the rule of action was introduced [95,96]. The exemption rule was introduced as §12 in both the Production Area Regulation and the Production Capacity Regulation.

Fulfillment of the exemption rule would allow farmers at a locality to increase their production capacity, irrespective of the color of the PA [70]. The intention was to maintain the foundation of the TLS while simultaneously stimulating the development of environmentally friendly technologies and operations. As with the TSL, and as recommended by the standing committee on business and industry, the execution of the exemption rule had to be objective and non-discretionary, and the companies had to demonstrate that operations did not negatively affect the environmental status in the PA [65]. Consequently, a farmer with no or minimal influence on the environment would be able to increase production, regardless of the color of the PA. The conditions required for exemption were:

1. No salmon lice larvae were released into the marine environment in the last production cycle (minimum 12 months), *or*
2. (i) There were fewer than 0.1 adult female lice on average per fish at all lice counts from 1st April to 30th September, or the discharge of eggs and salmon lice larvae was less than or equal to what the discharge would have been from a corresponding number of fish with 0.1 adult female lice on average per fish, *and*
 (ii) A maximum of one medical lice treatment was applied during the last production cycle.

Even if the observed lice level at a locality exceeded the lice limit specified above, a farm may still increase production as long as the observed values:

3. Exceeded 0.17 at only one count per production cycle, *and*

4. A lice level higher than 0.1 was not detected in more than three consecutive counts during the production cycle [96].

Farmers that satisfied these conditions would be allowed an increase of six percent production capacity every second year [97].

4.3.1. The Reception of the Exemption Rule

As with the TLS, the reception of the exemption rule varied. Some actors responded positively to the rule, as it was regarded as a safety valve in relation to the strict TLS and was perceived to contribute to the legitimacy of the system. As one fish farmer said:

“...if one is in a production area with many ‘bad neighbors’, but is operating well, then the exemption arrangement is a safety valve that contributes to legitimizing the TLS. The exemption arrangement contributes to mend some of the weaknesses of the TLS, as one can nuance the situation inside a production area”. [98]

Other industry actors, however, were not as positive due to the strict interpretation of the rule. The Norwegian Seafood Federation (NSF) felt that the required conditions were too strict. In particular, they argued that the requirements of a low level of lice and few lice treatments would not necessarily serve the purpose, as the location and size of the farm also had to be taken into consideration when assessing the contribution of a farm to the lice infection pressure [84].

Other actors, particularly ENGOs, worried that the exemption rules would liberalize the TLS and undermine its purpose. According to the WWF and Sabima, the exemption rule should not be based solely on the number of lice, as this does not reflect the total environmental load within a PA. They referred to the Food Safety Authority (NFSA), which, in 2016, stated that even lice levels below threshold values could have unacceptable effects on wild fish. Furthermore, they claimed that the criteria for exemption had to be so narrow that exemptions did not become the rule, which would undermine the TLS [99]. Nature and Youth maintained that a production increase in yellow and red zones would increase the total production of sea lice in an area and increase the stress on wild salmon [100].

Similarly, the Norwegian Salmon Rivers felt that this stance was based on a poor understanding of the dynamics of the TLS and that the work to reduce lice would take place first and foremost at the locality level. Hence, “... production reduction in a PA would come as a collective measure, when measures on locality level do not have the wanted effect in the PA”. For the organization, it was essential that the exemption rule did not undermine the principles and legitimacy of the TLS [73]. Similarly, according to Friends of the Earth, “it is unfortunate that exemption rule allows fish farmers in yellow and red areas to grow. This will significantly weaken the credibility of the system” [101]. Thus, the exemption rule simultaneously strengthened and weakened the legitimacy of the TLS, depending on the point of view.

4.3.2. The Exemption Rule in Practice

Although the TLS and the exemption rule are relatively new, their implementation has led to some outcomes. In the first round with the exemption rule in 2018, 43 localities applied for exemptions, of which 12 satisfied the criteria. However, only three were in red or yellow zones (Note: localities in green zones can apply for an additional 2 percent increase in capacity) [102]. In the second round in 2019, 50 localities applied for exemptions, of which 23 fulfilled the requirements. Of these, 11 were in red or yellow zones [103].

Both authorities handling the applications and farmers applying for exemptions felt that the requirements had been interpreted strictly in a non-discretionary manner [83,98,102,104]. It was not enough to almost fulfill the criteria: all criteria had to be completely fulfilled. For instance, applications for increased capacity in a yellow or red PA would be rejected if there were two medical lice treatments rather than just one. Similarly, more than one count exceeding 0.17 adult female lice per fish at a locality would also lead to a rejection [105]. According to the authorities, this was in line with the regulations, which required objectivity

and allowed for very little discretion [106]. Moreover, despite 17 grievances in the first round and 15 in the second, no changes were made to these decisions [103,107].

The exemption rule enabled authorities to reward those operating well and thereby provide incentives to improve operations. Some industry actors perceived the rule to be working according to its intentions [98]. The predictable and non-discretionary nature of the rule was appreciated. As one farmer said when asked about the experiences with exemption applications:

As predicted, predictable. We are not disappointed. [. . .] We got an increased respect for the authorities. The NFSA treated this mathematically and there was no discretion. And we agree that it must be like this, when the criteria are made this way . . . The arrangements and the exemption rule, demand and encourage the use of new technology, for both de-licing and semi-closed facilities . . . One needs to be good at lice to be eligible for the exemption rule. One gets technology development. [104]

Other industry actors, however, accused the authorities of being too rigid and myopic. “The trust in the authorities is reduced, when the NSFA interpreted the rules so rigidly . . . the NFSA does not see the totality” [83]. Moreover, the scientific foundation of the exemption rule is the same as that of the TLS and was thus also being questioned. The criticism involved the methods for counting lice on wild fish and the fact that lice are not the only source of increased mortality of wild fish [83,98,104]. As a couple of farmers stated, “We are building the management of a whole industry on a contested foundation with large sources of error” [98] and “[l]ice is one of the minor reasons affecting mortality of migrating smolt” [104].

Other experiences with the TLS have illustrated unforeseen effects. The substitution of mechanical lice treatment for medical lice treatment negatively affected fish welfare [83,98,104,107]. The authorities were perceived to focus too much on environmental issues and not enough on fish welfare [104]. This unforeseen effect was also a concern of the NFSA, but they pointed out that the Animal Welfare Act [108] supersedes the lice regulations. Thus, the operator has to ensure a balance between lice treatments and animal welfare [107].

Despite the criticism of the new aquaculture management regime, industry actors recognize that it is a new system that needs to operate for a longer period before the effects are evident, but they demand transparency in the process and openness around its effects.

The TLS and the statutes for the exemption rule are the beginning of a new management system, and we do not want to criticize. But if it is to work in the future, we need to get more information about the final result and final effects in the different areas”. [104]

Overall, industry actors felt that the exemption rule provides legitimacy, as it is seen as being “more specific, and gives a better accuracy than the TLS” [104] and necessary in “ . . . a system that treats everyone the same. Without [the exemption rule], the TLS would have less support” [98]. Again, the practice of the exemption rule both strengthen and weaken the legitimacy to the TLS, depending on the point of view.

5. Discussion and Conclusions

In order to simplify the discussion, we examined two main groups of stakeholders: industry interests and environmental interests. Initially, the TLS was welcomed by both groups, either as a more objective and predictable system for growth or as a more environmentally sustainable system.

For years, the industry had complained about the license allocation system, which resembled “beauty contests” based on political and administrative discretion [23]. This resulted in irregular growth, with few possibilities of making long-term plans. Hence, from an industry perspective, the six percent growth every second year offered by the indicator-based TLS was, in principle, an improvement. However, when push came to shove and capacity reduction became a reality, the industry disputed the scientific foundation of the TLS. Tying the future of a nationally important industry to an uncertain scientific foundation

was seen as a gamble with potentially large negative economic effects. Moreover, forcing well-run enterprises to reduce production was widely regarded as unfair and likely to inhibit the possibility of reaching industry growth objectives. The exemption rule was therefore perceived as a welcomed safety valve to limit collective punishment, promote growth, and provide incentives for more environmentally sound production. However, the exemption rule was clearly insufficient to ensure the system's content legitimacy, as demonstrated by the court case.

From the perspective of environmental interests, the initial TLS was seen as an improvement over the previous aquaculture management system. This improvement was viewed in terms of reduced environmental impacts of the industry as a whole. From this perspective, however, the concern was that the exemption rule would liberalize the TLS too much and thereby undermine its ability to promote environmental sustainability. As producers of knowledge of the TLS, these actors did not explicitly question the procedural legitimacy but addressed the content legitimacy of the TLS as the exemption rule was introduced.

Table 1 summarizes the changing content legitimacy as negotiations proceeded throughout the implementation of the new spatial management regime. Initially, the TLS had low content legitimacy in the industry, but the exemption rule improved it, as it reduced the risk of collective punishment. Moreover, a strict, non-discretionary practice, combined with clear indicators and procedures, offered predictability. From the environmental side, the initial TLS was seen as a major improvement, but the exemption rule weakened the content legitimacy of the system. In both stakeholder groups, sustainability involved environmental and/or economic issues, and social issues were rarely addressed. However, as we previously discussed, legitimacy and acceptance are central to the stability of the system. Again, this is evident from the court case.

Table 1. Development of content legitimacy of the Norwegian spatial management regime.

	TLS	§12
Industry Interests	Low content legitimacy	High content legitimacy
Environmental interests	High content legitimacy	Low content legitimacy

To ensure a stable system, scientific knowledge must be reliable, credible, legitimate, and relevant [109]. However, as stakeholders continue challenging scientific knowledge (the content) and the processes that produce it (the procedure), they also challenge traditional planning processes and thus the procedural legitimacy and institutional stability. Hence, a lack of legitimacy and acceptance may, in the long run, affect the traditional institutional setup in aquaculture management.

Other upcoming issues affecting social sustainability are the Aquaculture Fund and potential resource taxes. The Aquaculture Fund was established in 2016 to provide municipalities and counties that host aquaculture operations a return on their investments. Initially, 80 percent of the revenue from capacity increases was allocated to host municipalities and counties. The revenue is based on a combination of a fixed price and auction. In 2019, this amounted to about NOK 450 million (about USD 49 million) [110]. For a number of municipalities, this was welcomed income but was also perceived as buying industry goodwill in municipalities [111] or buying the industry a Social License to Operate [39]. Starting in 2022, the revenue basis for the Aquaculture Fund will be based on a production fee of NOK 0.40 per kilo. Moreover, the allocation key will change, as only 40 percent of the revenue will be allocated to host municipalities and counties. According to one of the counties, even if the production fee increases the total revenue, revenue allocated to municipalities and counties will be reduced or only marginally increased due to reduced shares [112]. A number of municipalities were disappointed [113,114], which, at least temporarily, could affect their willingness to further accommodate the aquaculture indus-

try. Another pressing issue in terms of long-term legitimacy is whether the aquaculture industry will pay resource tax (40 percent of net income) [5]. This issue is yet to be solved.

In an ideal situation, we strive for a balance between the dimensions of sustainability. This article showed that the balance is continuously open to negotiation. It also showed how a system founded on two dimensions falls short as the third dimension inevitably surfaces. Whether the TLS will deliver as promised depends on this interest tug o' war. Over time, the challenge will be to prevent the incremental nature of political processes from complicating the management and returning the system to square one with an unpredictable and unsustainable management system. It is, however, too early to judge the outcome of the TLS. The law dictates that all management interventions should be "proportional", meaning the positive effects of improving the environmental situation must be viewed in relation to the negative effects of reduced income and the potential economic repercussions in the industry. The proof of the pudding is in the eating, as the system unfolds and, in particular, as it is further tried in court. In the end, the future of the industry will largely be decided by its legitimacy and, in the long term, the success of the TLS will depend on its ability to reduce the industry's footprint while also promoting growth. Thus, despite the Norwegian management systems being a "gold standard" for aquaculture management, it may not be so on all accounts, which may prove to be an effective barrier to sustainable growth and development of the aquaculture industry.

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