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Interorganizational Operations in Norwegian Fish Farming: A Study of Personnel Safety for Subcontractor and Fish Farming Employees.

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This study explores risks affecting personnel safety in Norwegian salmon farming, one of the most hazard-prone industries in the country. Norwegian salmon farming companies rely heavily on subcontractors, including well boats, slaughter vessels and specialized service vessels. Some fish farm operations where subcontractors are key actors, such as delousing, are complex as there are many people and vessels involved, and high-energy equipment such as pumps and cranes are used. While challenges for personnel safety in Norwegian salmon farming are well documented, risk factors related to subcontracting in fish farming has not been sufficiently explored in previous research. Earlier research from other industries has shown that in operations where actors from different organizations are involved, several safety challenges can arise. In fish farming operations, considerations regarding fish welfare, environmental impact and safety for workers must be made, and collaboration and cooperation is crucial. Based on 20 interviews and a field observation conducted in 2025, challenges are identified related to safety in fish farm work operations involving subcontractors. The findings are structured according to themes related to safety and collaboration identified in earlier research on interorganizational safety: economic pressures, disorganization, dilution of competence, organizational differences and inadequate regulatory controls and the ability of workers to organize to protect themselves. The results show that key interorganizational safety challenges described in other industries are also relevant in Norwegian fish farming. However, results show that the fish farming industries have additional challenges related to operational requirements of ensuring fish-welfare and a fragmented regulatory framework that does not sufficiently counterweigh efficiency pressures in the operation. Suggested take-aways for improving occupational health and safety are presented related to the planning phase, the performance of operations, and coordination and regulations.

Keywords: Interorganizational operations, interorganizational safety, subcontractors, operations at sea, fish farming, aquaculture

1. Introduction

Atlantic salmon is the key species in Norwegian fish farming, an industry that employs thousands of workers dedicated to tending to both the fish and the technical aspects of the fish farms. Overall, fish farming companies rely heavily on specialized subcontractors, including well boats, slaughter vessels and specialized service vessels (Holen et al. 2026, Kongsvik et al. 2025).

Particular for the fish farming industry, compared to other industries, is that considerations both regarding fish welfare, environmental impact and occupational health and safety (OHS) for workers must be made (Yang et al., 2020). When subcontractors participate in operations well-functioning cooperation across companies at all phases: before, during and after operations are needed to

ensure the right priorities at the right time. For example, in an international study in five salmon producing countries Neis et al. (2023), found that work activities associated with fish mass mortality events, are associated with increased risk for the operators. These types of activities, such as diving, loading and fish transport are often outsourced to subcontractors. There are several regulatory requirements and authorities mandated to manage these different risks of fish farming, such as the Directory of fisheries, the Food Safety Authority and the Labour inspection Authority. These authorities are structured in a fragmented manner, tasked with safeguarding somewhat competing interests (Holmen, 2022). Neis et al., (2026) points to similar fragmentation of Canadian aquaculture regulation.

While new farm concepts are emerging, most sea-based fish farms still operate with open net pen technology. In the operations at these farms vessels are moored to the net pens, while high-energy equipment is used. For example, tubes that are used to pump fish from the net pens to treat onboard vessels are placed over walkways, and cranes installed on the vessels are used to lift and create tension in ropes. The operations are thus directly influenced by environmental forces, increasing the risk of personnel accidents. Types of accidents that have occurred in these types of operations include blows from objects, entanglement and crush and fall over board (Holen & Holmen, 2025).

Over the past decade, there has been a notable increase in the number of reported accidents from shipping companies that provide services to the fish farmers (Holen & Holmen, 2025). This rise may partly reflect increased regulatory attention to safety within this segment of the industry and increased reporting. However, it should also be understood in the context of an increase in the number of operations due to a growing demand for maritime services. This is driven by the intensification of aquaculture operations, for example in the increased need for delousing operations to keep the salmon lice within the regulatory limits.

Challenges for personnel safety in Norwegian fish farming are well documented and include a tension between production (ensuring fish welfare) and safety as well as organizational factors such as inadequate staffing, insufficient training, poor planning and lack of time for maintenance (Bjelland et al. 2025, Størkersen et al. 2021, Thorvaldsen et al. 2020, 2025). Qualitative studies targeting OHS in interorganizational work and cooperation between subcontractors and fish farming companies are few. However, a 2023-survey of HSE in the fish farming industry showed that many subcontractors find that their work is undervalued by fish farming companies and that lack of cooperation was considered a threat to safety (Kongsvik et al., 2025). This analysis also indicates that subcontractors experience higher efficiency demands than fixed employees

Studies in industries such as construction, mining and petroleum show that working conditions and safety for subcontractors may be worse than those of fixed employees (Milch & Laumann 2016, Nygren et al. 2017). To provide further knowledge about safety for subcontractors and fixed employees in Norwegian fish farming, the objective of this paper is to study personnel safety in the context of interorganizational work. Based on this some key takeaways for improving safety are discussed.

2. Methods

2.1. *Data collection*

This study presents results from formal interviews, observation and informal interviews conducted in 2025. A total of 20 informants participated in formal interviews, conducted as Teams video meetings lasting approximately 1,5 hours. Two researchers performed each interviews, alternating between a group of four researchers. Audio recordings, transcriptions in Teams and detailed notes from one researcher documented the interviews. Most interviews had one informant, while three interviews had two informants. Interviews were semi-structured, based on an interview guide that allowed participants to elaborate on topics that were particularly important to them. Key topics included: descriptions of key actors, contractual relationships, procedures and practices, regulations and their implications and challenges for personnel safety in collaborative operations.

Informants were recruited through the researchers' networks as well as publicly available information on company websites. Selection criteria included type of actor (ship owner, fish farming company, authorities and unions),

company size, geographic location and job categories. The sample consisted of nine informants from ship owners, five informants from salmon farming companies, three union representatives, and three representatives from the authorities.

In the spring of 2025, two researchers observed a delousing operation, where several vessels and crews from different companies participated. The observations included informal interviews with ten employees. The observation provided insight into the practices of a collaborative operation involving two companies, including different unities within the companies, which supplemented the data from the interviews in a valuable way.

Two researchers started the analysis process by manually categorizing interview transcripts and notes into main topics and sub-topics. The initial findings were discussed among the four researchers who conducted the different interviews. They were also discussed with a group of six industry representatives (one worked for a shipowner, three for salmon farming companies and two for unions). Through this inductive approach, the data was explored with the aim of identifying patterns and key themes that informants were particularly concerned with. Observational data underwent the same process. For this paper, the key themes and quotes were categorized according to themes found in previous literature, described in table 1. Relevant quotes were selected to illustrate findings and translated from Norwegian to English by the authors.

The study was revised by the Norwegian Agency for Shared Services in Education and Research (SIKT) and has been conducted according to legislation that safeguards participants privacy.

2.2. *Key themes of interorganizational safety*

Kongsvik et al. (2025) discuss how types of safety challenges found in other industries, as described by Milch and Laumann (2016), are relevant also in interorganizational work in the fish farming industry.

In this paper, these categories of safety challenges in interorganizational work described in other industries provide a framework to explore empirical data from the Norwegian fish farming sector. In addition, themes as identified in Mayhew et al. (1997) who explored the effects of subcontracting and outsourcing in four industries were found relevant to explore. The key themes addressed are economic pressures and reward factors, disorganization, dilution of competence, organizational differences, inadequate regulatory controls and the ability of workers to organize to protect themselves. A short description of the themes is presented in Table 1.

3. Results

The results section describes challenges for personnel safety for employees in interorganizational work related to economic pressures and reward factors, disorganization, dilution of competence, organizational differences, inadequate regulatory controls and the ability of workers to protect themselves.

3.1. *Economic pressures and reward factors*

Several aspects related to economic pressures and reward factors were found in the material, including undercutting prices, complying with client's production goals over own safety goals, and not reporting errors in fear of not getting new contracts.

Ship owners may lower their prices to win contracts, and managers, operators and crew share concerns that this affects resources and conditions on board the vessels.

The service companies have a particular focus on delivering a service to the fish farmer and keeping the customer happy. Interviews show concerns from subcontractors regarding renewal of contracts, that in turn affect the operational context. For instance, vessel crew are afraid that they may cause contracts not being renewed if they "give up" before other contractors who may compete for the same contracts, even though the cause for this may relate to the capacity of their equipment such as cranes.

Table 1. Challenges in interorganizational work, themes and descriptions.

Theme	Description	Reference
Economic pressures and reward factors	Lack of shared sense of responsibility for safety-related issues (e.g., less training for contract workers, smaller firms have less resources for training, not reporting errors in fear of not getting new contracts, avoiding direct costs related to accidents). Safety/production trade-offs (e.g., price reduction, complying to clients' production goals not own safety goals, not reporting (again).	Milch & Laumann (2016) and Mayhew et al. (1997)
Disorganization	Confusion in roles and responsibilities, breakdown in communication and information flow and complex safety management systems (e.g., extra written procedures). Fragmentation in the management of organizational processes (e.g., safety manuals having no real value for OHS).	Milch & Laumann (2016) and Mayhew et al. (1997)
Dilution of competence	Employees are unfamiliar with local work environment, lack of industry-specific knowledge and experience (e.g., related to outsourcing).	Milch & Laumann (2016)
Organizational differences	Distrust and conflicts (e.g., due to different ways of working).	Milch & Laumann (2016)
Inadequate regulatory controls	Regulations are mainly written for traditional employer/employee relationships, economic-driven labor intensification not accounted for (e.g., mismatch in regulations and the way work is organized)	Mayhew et al. (1997)
Ability of workers to organize to protect themselves.	Unions, workers geographically dispersed (e.g., few organized workers)	Mayhew et al. (1997)

In addition, the subcontractors worry about ripple effects of discontinuing operations. For instance, well boats operating for various companies must adhere to their contracts about scheduled farms and number of fish, and if slaughtered fish are not delivered at the scheduled time, it may result in pauses at the processing facilities, leading to lost income. The pressure that the fish owners feel can spill over to the contractor managers and vessel crew who express that they may choose to continue an operation to avoid negative reactions.

"It is easier to take that risk because you feel that the consequences of not doing it are so much greater." (OHS, Ship owner)

Examples of operations where the pressure is not as strong, due to the specialization of the services, were also given. One informant said that there was no pressure from the fish farmer when it comes to diving assignments. There, the fish farmers respect the time it takes to get the job done according to the procedures.

3.2. *Disorganization*

Interviews show that health and safety for workers is not prominent in contracts, and that safety management systems are not coordinated.

3.2.1. *OHS not included in contracts*

In general, the interviews describe a situation with little interaction regarding safety management across companies at a higher organizational level. OHS appears disconnected from considerations about the fish or technical equipment, which is also shown in contracts. The shipowners in this study are not familiar with OHS being used as a particular criterion for the contracts. One informant said:

"OHS criterion should definitely be included. Like, compared with offshore, and the processes we do there, they are very concerned with it" (OHS, Ship owner)

3.2.2. *Few common procedures*

Internal procedures are common, but procedures made for use across cooperating companies are not. As one employee explained:

"We have an expectation that external people who work at our location will follow our procedures and our OHS thinking." (OHS, Fish farming)

The subcontractors often get access to the fish farmers' guidelines, and it is agreed in advance which procedures should be used. However, as some subcontractors are specialized, they have their own specific procedures for operations such as net cleaning, towing or diving.

While most fish farmers use subcontractors, farming companies with their own vessels emphasize the benefit of having access to each other's procedures across both farms and vessels.

3.2.3. *Reporting incidents*

There are different practices when it comes to handling deviations in interorganizational work. Some subcontractors are linked directly to the fish farming company's incident reporting system, whereas others utilize their own systems and share reports manually. One informant said that sharing experiences across fish farms and vessels was very important to prevent unwanted events. Another said that not all deviations that happen on the vessels are shared with the fish farmers.

3.3. *Dilution of competence*

Challenges related to employees being unfamiliar with local work environment, and lacking industry-specific knowledge and experience, were pointed out in several interviews.

By some, the dilution of competence was discussed related to the wide-spread outsourcing of vessel services, rather than keeping the crew as part of the fish farming companies.

"My personal opinion after [several years in the industry] when it comes to service boats, is that it is wrong that they have taken it out of their own organization, because what they do is part of the actual craft of fish farming." (OHS, Fish farming)

Furthermore, lacking competence among subcontractors, as well as unclear division of roles related to lack of dedicated managers on board was described.

Inexperienced personnel have also led to discontinuation of operations. One informant said:

"There are people who come straight from the street and who are suddenly sailors on board a service vessel. Whom our people must teach how to tie a knot, to put it bluntly." (Organization representative)

3.4. *Organizational differences*

Due to the many companies operating in the industry, descriptions that point to fragmented decision-making were found in the study. One informant described the organizational differences this way:

"In every fjord there is a vessel, a small workplace here and a small workplace there. And they do things completely different." (Organization representative)

Differences are also evident in interorganizational operations. As an example, stop criteria related to weather conditions may vary. While it is the skipper who decides, interviews show that different ship owners and vessels may have different criteria while working at the same fish farm, as this quote exemplifies:

"When we have two subcontractors to the same customer, we may have two completely different approaches, or three, because we are three parties, with completely different stop criteria. Because we have our limitations, they have their limitations and the customer has their limitations, and everyone knows their own, but not their counterparts." (OHS, Ship owner)

Challenges related to employees being unfamiliar with local work environment, lacking industry-specific knowledge and experience were described in several interviews.

3.5. *Inadequate regulatory controls*

In fish farming, employees who work together adhere to different regulations (one set of regulations for seafarers, and another set of regulations for fish farm employees). In addition there is weak regulatory control regarding contractor/customer relationships.

3.5.1. *Two regulatory regimes*

Fish farming employees are subject to either regulations that apply to land-based workers (fish

farm employees) or to workers on ships (vessel crew), depending on the type of work they do.

In practice, the different regulations have different restrictions regarding work time and overtime. Some fish farming companies choose to create an internal company acting as ship owner, which means their employees work under regulations for seafarers. This has some practical consequences:

"I guess they want to use the workers for longer periods of time, on more straining work time arrangements than what is allowed in the Working Environment Act chapter 10 about work time. But if one looks at the physiology in it all, there is no differences between the people, we do not tolerate a greater load if we change the contract." (Authority)

The different work time regulations are challenging during large continuous operations that can last for days. One OHS manager at a ship owner belonging to a fish farming company says that working night during large operations may be particularly challenging for service vessels that are not staffed for this, and thus have to change their work schedule. This is less an issue for well boats.

"The well boats operate 24/7, they have the manning to do the same operation whether it is 2 am or 2 pm or whatever." (OHS, Ship owner at Fish farming company)

3.5.2. *Weak regulatory control for coordination responsibility*

According to the regulation, the responsibility of coordinating operations is put on the customer, which in the fish farming operations is the company owning the fish farm (Norwegian Ministry of Labour and Social Inclusion, 1996). For instance:

"when diving takes place on the companies' fish farm, there shall be coordination." (Authority)

Some say that the regulation is not clear with regards how it should be followed up by the fish farming companies, beyond what they already do today in terms of planning of interorganizational operations.

Others say that the Norwegian Labour Inspection Authority (fish farms) perform less inspections than the Norwegian Maritime Authority (vessels), and one informant compares fish farming with the oil and gas industry, where the operators (oil and gas companies) are subject to government inspections which includes to make sure that also their subcontractors have good OHS-processes.

3.6. *The ability of workers to organize to protect themselves*

In Norwegian fish farming, many employees are organized in unions that negotiate wage agreements with the employers' organizations and support the workers in disputes with the employer. Still, some challenges related to protection are found in the interviews.

3.6.1. *The employees do not complain*

A labor union representative said that fish farming vessel crewmembers *"don't complain a lot"* in the sense that the union receives few inquiries regarding working environment, health or safety from their members in the fish farming sector. This may be related to a job market where fish farming vessel crew members easily find new jobs, because there is a demand in the sector.

Still, the interviews show that both ship owners and fish farmers may pressure the crew to work too hard. Since subcontractors are keen to keep the customers happy, critique from the fish farming companies has led to layoffs of crew by the subcontractors and the fish farming companies are not always informed about poor conditions for employees in companies they hire.

4. Discussion

This paper shows that key interorganizational safety challenges in other industries are also relevant in Norwegian fish farming. Findings indicate an asymmetrical power relation between the subcontractors and the fish farming companies, as described in Tillement & Hayes (2022). The fish farming companies (the setting where the work is performed) dictate many of the terms and goals related to safety/production trade-offs, similar to what is found in earlier research on other industries (Milch & Laumann 2016, Mayhew et al. 1997, Nygren et al. 2017). Based on this, some takeaways for improving occupational health and safety are discussed in this section.

4.1. *Planning: Contracts, procedures and OHS*

Economic pressure described in other industries such as petroleum and construction (Milch & Laumann, 2016) is also found in fish farming. Subcontractors are concerned with keeping the customer happy and not losing their contracts, and some may undercut prices or keep reports of deviations internal. Results also show challenges related to competence among some subcontractors and that OHS is not thoroughly addressed in contracts today. This may indicate a lack of shared responsibility for safety (Milch & Laumann 2016, Mayhew et al. 1997).

A suggested measure is therefore to make considerations regarding the health and safety of workers explicit in contracts and the planning phase. Research in the nuclear industry finds that project contracts that reward information sharing and account for local needs increase safety (Gotcheva et al., 2022). Design of safety measures in contracts and procedures must thus be based on the actual work that is done (Thorvaldsen et al., 2020) and offer necessary guidance for performance such as capacities needed to perform the operations and defining roles and responsibilities. In addition, a measure to build trust across organizations is to establish long-term contracts (Tillement & Hayes, 2022). In the interviews, such contracts are preferred over hiring vessels from the spot market.

4.2. *Performing the operations: Organization of work*

Subcontractors may take and be exposed to risks during operations, because they experience pressure from both their own management and the customers. The same type of challenges for safety/production trade-offs are described in other industries (Milch & Laumann 2016, Mayhew et al. 1997, Nygren et al., 2017). Particular to fish farming, however, is the tending of live fish, which adds pressure in operations, as ensuring the welfare of fish is also considered a crucial part of "efficient" work.

Measures that target the learning across organizations (e.g. training and drills that include workers from different companies) and collaboration in the operations (e.g. pre-operation meetings discussing roles and responsibilities with all relevant workers) are valued in the interviews. In the construction industry, which is characterized by temporary and interorganizational projects, Griegel et al., (2025) have found that systematic approaches to sharing experiences and learning from deviations and unwanted events after operations are beneficial to strengthen preventative safety.

4.3. *Regulating the industry: Coordination and supervision*

Regulations are mainly designed for traditional employer/employee relations (Mayhew et al. 1997). Watterson et al. (2020) highlight the tripartite approach applied in Norway as an ideal for improving aquaculture OHS in other countries. Still, this study shows that coordination across companies needs improvement. Even though regulations requirements for coordination across companies exist, it remains unclear how responsibilities should be enforced when knowledge of operations lies mainly with the subcontractors. In addition, the fish farming industry must comply with two parallel regulatory frameworks for work environment, overseen by separate authorities (for vessels and fish farms). This dual regulation enforces different work hours and rest time regimes, leading to additional adjustments to be made between the actors.

As Pilbeam (2024) points out, regulatory failure can be reinforced by economic pressure. In fish farming, the work environment regulation has not been enforced in a way that sufficiently counterweigh the safety issues that arise when subcontractors experience pressure to "keep the customer happy". Efficient operations are prioritized and driven by a wish to reduce costs, but also to ensure fish welfare, while less attention is given to personnel safety. Additional complexity is added through other regulations that require the most hazard prone operations (delousing) to be performed due to requirements ensuring welfare for both wild and farmed salmon.

5. Conclusion

This study has explored personnel safety in Norwegian fish farming considering key themes based on previous research on interorganizational work in other industries. Based on the challenges identified, measures related to planning, performing the operations and regulating the industry are suggested. Examples include integrating OHS into

contracts to improve trust and share responsibility for safety and more joint training across organizations. Clarifying safety related responsibilities within the regulatory framework is also a step towards counteracting the pressures that currently result in work safety being prioritized after fish welfare and cost-reducing measures.

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