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Original Article

Safety Management in Norwegian Fish Farming: Current Status, Challenges, and Further Improvements

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ABSTRACT

Background: Safety management is required to ensure health and safety of personnel in Norwegian fish farming. However, few studies have addressed the status and practical relevance of this risk-reducing measure.

Methods: This article provides new knowledge through interviews with 35 employees at different company levels, addressing perceptions of various safety management activities according to managers and operational personnel.

Results: The interviews show that managers and operational personnel at fish farms agree that the quantity of measures aimed to improve safety has increased in recent years. However, some activities are perceived to have higher practical relevance than others. In general, measures that fit well with the practical reality are well received by the employees at the fish farms.

Conclusion: Suggested improvements include involving operational personnel in the design of procedures, considering all risk dimensions that may affect occupational health and safety, and challenging the value of specific safety activities based on a detailed knowledge of the distinctive characteristics of work practice in fish farming.

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1. Introduction

Employees in the aquaculture industry work under varying conditions, are exposed to harsh weather and a changing climate, and the work is practical and physically demanding. There is cause for concern about the frequency and seriousness of occupational accidents in the industry. [1].

This description of the aquaculture industry, by the Norwegian Labour and Inspection Authority (Labour Authority), reflects the high occupational injury rate in fish farming compared with other industries [2,3]. Globally, aquaculture workers are exposed to various occupational health and safety (OHS) risks [4], and researchers have called for commitment to improving this situation [5].

Norwegian fish farming has become a profitable producer that exports to a global market [6]. The main species are Atlantic salmon and trout [7]. In all, around 8,500 employees work in aquaculture

production in Norway. Studies of Norwegian fish farming show that employees are exposed to various risks that may cause physical harm and that musculoskeletal complaints are common [3,8].

The legislation and regulation of the industry are fragmented, with five regulatory authorities for separate governance fields [9]. This leaves companies and employees with several (sometimes conflicting) areas of responsibility [10]. Preventing the amount of salmon lice and escape of farmed fish is highly prioritized [11–13].

To ensure the health and safety of personnel, safety management is required for all fish farming companies [14]. The national regulations for addressing safety management are known as the internal control regulations and require companies to use systematic and responsible safety practices [15]. Companies' operations should be run as per established OHS goals, overviews, routines, and risk-reducing measures. Personnel must participate in these processes to be well informed about the OHS requirements in their organizations.

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Safety management systems should document compliance through risk assessments, work descriptions (procedures), and nonconformity reports. While companies have to implement and manage their own systems, the role of the Labour Authority is simply to ensure that a system is documented [15]. The regulatory approach is thus performance based, and trust between the regulator and companies is a basic foundation for the regulatory system [16–18].

Over a decade ago, a study found that safety management systems were not used extensively in fish farming companies and were rarely audited by the Labour Authority [19]. However, a new study argues that safety management systems have grown considerably in the industry [20]. Despite the prominent role of safety management as a risk-reducing measure, few studies have qualitatively addressed the status and practical relevance of safety management in fish farming. The purpose of this article is to provide new knowledge through interviews with employees in the fish farming industry, applicable for further improvement of safety management in the industry. Based on 35 in-depth interviews, safety management is explored from both the operative and managerial points of views. The article asks the following question: What are the current status, challenges, and possible improvements for safety management in Norwegian sea-based fish farming? Additional research questions addressed are as follows: Which hazards are perceived as prominent? How do employees in management and operations view the practical relevance of safety management? What is important for successful implementation of safety management?

2. Materials and methods

For data collection, seven companies of different sizes and geographical locations were selected. Semistructured interviews were conducted with 35 people in the period from April to September 2017. The interviews were based on an interview guide designed to gather information about health, safety, and safety management. Questions were open-ended ones, and informants and researchers talked freely to allow relevant topics to be explored. All interviews were conducted in person, in three counties with many fish farms: namely, Trøndelag, Nordland, and Troms and Finnmark.

The target group for interviews was operational personnel and managers. At each fish farm, a group of employees performs daily inspections and operations such as delousing (to remove salmon lice). Each fish farm has an operational manager responsible for both the production of fish and the safety of workers. Onshore management teams play an important part in safety management. Some companies may have employees who work full time with OHS, whereas others have employees who have this role as one of the several areas of responsibility.

Twenty-seven of the interviewees worked as operational personnel at the farm sites. They included fish farmers, operational managers, and one fish farmer apprentice. Eight of the interviewees worked onshore, with OHS as one of their main responsibilities. Job titles in this group included OHS coordinators and OHS leaders (4), quality leaders (2), regional manager (1), and production coordinator (1). When discussed as a group, these participants will be referred to as managers.

The interviews were audio recorded and transcribed, or detailed notes were taken by a researcher not conducting the interviews. Interview data were analyzed to identify patterns related to the research questions (prominent hazards, views on practical relevance of safety management and implementation). Perceptions of five main safety management activities were described: risk assessments, procedures, resources, involvement of personnel, and well-informed personnel. To identify similarities

and differences between managers and employees, the results were analyzed separately for each group. To present the findings in the informants' own words, illustrative quotes were used. The quotes used in the article were translated from Norwegian to English by the authors. When it comes to generalization of the findings, the number of informants must be taken into consideration.

3. Theory

Along with the requirements of safety management systems comes an expectation that "organizations must be seen to act as if the management of risk is possible" [21]. Risk assessments and procedures are tools used to ensure safe work, but they also serve as documentation for authorities to verify that safety is taken seriously.

For practical purposes, the ideal is that procedures and practices should reflect each other. However, "work as imagined" (WAI) in procedures and documents will diverge from how work is actually done (WAD) [22]. Constantly changing working conditions and unforeseen events make different forms of prescriptive documentation underspecified; as such, documentation is not able to cover all eventualities. Thus, the ability to adapt work to situational changes might be important to ensure that "things go right" [23]. Inflexible procedures written by someone not actually performing the work may be perceived as unsuitable or difficult to comply with. Furthermore, a strict focus on compliance with procedures may cause practitioners to think that their strategies for staying safe are not acknowledged. Indeed, for many practical occupations, experience and flexibility are important safety factors [24–28]. In these work environments, competence is often closely related to knowledge acquired through personal involvement. The work is often performed as per norms and common sense, rather than written procedures [29]. Know-how and experienced-based embodied knowledge is thus key in high-risk professions in which recognizing, adapting to, and handling the unanticipated events are vital to staying safe [30]. Researchers have urged authorities and companies to consider the relevance to safety of the practical knowledge of workers and to avoid limiting safety to rules or marginalizing the safety measures that practitioners actually rely on [26,31–33]. Thus, it is advised that the knowledge and judgment of practitioners guide the development and implementation of safety management systems [34–36]. Although this might be difficult to achieve, owing to managerial and audit practices, some companies have successfully implemented and maintained practical and relevant safety management systems [20].

When the performance of everyday activities is significantly burdened by safety rules, this can be detrimental to both work and safety [37]. To ensure that safety work actually contributes to safety, the concept of "safety clutter," which is defined as "the accumulation of safety procedures, documents, roles, and activities that are performed in the name of safety, but do not contribute to the safety of operational work," is useful [37]. In other words, the implementation of (redundant) safety procedures might increase safety risks, particularly when companies are simultaneously attempting to keep production efficiency at the required level. To judge whether a safety management activity contributes to safety, it can be evaluated based on three dimensions:

"1. Contribution: the extent to which the activity has safety value. 2. Confidence: the certainty (either through evidence or strength of belief) with which this judgement is made. 3. Consensus: the level of agreement about the safety value of the activity between those who mandate the activity, those who perform the activity, and those who are ostensibly kept safe by the activity" [37].

Based on the evidence of efficiency for an activity, there may be gray areas between what is considered clutter and nonclutter. And although some activities may be very effective in one context, they may be ineffective in other contexts. In this article, the three dimensions are used to discuss the practical relevance of safety management activities in Norwegian fish farming.

4. Results

In this section, qualitative empirical data from the interviews are presented.

4.1. Hazards in fish farming operations

The physical hazards related to different types of equipment and weather conditions were highlighted by many interviewees, working both in management and at the fish farms.

“Yes, we have many risks. It's boats, it's equipment, it's the sea, it's crush injuries, it's ropes, it's winches, cranes and everything.” (OHS coordinator, management)

“The big danger is that there are objects in movement here. Different things are lifted with cranes. And then we have some danger of crushing. And that people fall and hurt themselves. And strain: there are some heavy workloads.” (operational manager, fish farm)

A fish farmer pointed out the impact of weather conditions and poor training:

“It's really the weather that makes it risky. If you take the chance when the weather's bad, you risk falling in the sea or getting crushed. And then there are operations like removing dead fish from the net cage, where you may use a crane, and if you don't have training or you're not cautious, that's of course a risk as well. It may lead to injury.” (fish farmer)

Fatigue or tiredness due to the heavy workload or overtime was also emphasized:

“I think when people start getting tired, that's when it starts getting dangerous. People make the wrong decisions.” (regional leader, management)

“You are so tired, and it may happen that you hit someone with the crane when you are sleepy and tired.” (fish farmer)

4.2. Safety management based on management

In the interviews, the managers described an increased attention to safety management in recent years. Managers described this increased attention as having both upsides and downsides. The totality of demands from the different regulators in aquaculture was a challenge for some:

“We who work in the industry see that there are few other industries that are as regulated: by the Maritime Authority, Directorate of Fisheries, Food Safety Authority, Labour Inspection Authority, you know. Demands, demands, demands.” (OHS coordinator, management)

In addition to complying with governmental regulations, many companies also had voluntary certification, which some of their customers required. One example is certification provided by the Aquaculture Stewardship Council (ASC). Although certification

schemes focus on environmental sustainability, they also appear to be drivers for safety work in the companies:

“We have 4–5 fish farms that are ASC-certified. That involves demands for OHS work that goes far beyond what they had before. So now we have a separate quality department, with an OHS leader in both regions in the company.” (OHS leader, management)

Risk assessments that identifies operational risks are used to create work descriptions/procedures, emergency preparedness, and other safety management measures.

“They've done risk assessments to please the authorities. Just to have an alibi: ‘Yes, here are our risk assessments.’ But to use them actively and make employees see the connection, there's still a lot that can be done. So, we've started working on it but [it] must become better.” (OHS leader, management)

Procedures are central in safety management systems. However, some managers find that there are too many procedures and say that both workers and managers can be concerned with the amount and usefulness of procedures. The offshore industry's extensive red tape is often used as an example of unwanted excessive and impractical safety management:

“Yes, we're not going there. That's what the workers here who've come to fish farming from the oil industry say too. It was good, but they got lost; it just ended up with paperwork. We must try to steer it right, and we make the procedures with the workers: they participate and write [the procedures] themselves and try to get it as practical as possible.” (production coordinator, management)

Safety management includes ensuring adequate **resources** for the work being performed at the fish farms. Some managers even attempted to use overtime among employees as a safety measure:

“Planning is very important: that you make sure you have the right people and plan for things to take more time.” (regional leader, management)

Involvement of personnel is an important part of safety management, and the managers highlighted both the role of management and the participation of workers when it came to implementation. The managers discussed how they work to remove the distance between the management group and the workers. An OHS coordinator who worked in a company with around 75 workers at sea said that he wanted the distance between the management group and the workers to be as short as possible:

“A foundation in the management is crucial: the benefit now is that commitment to OHS is secured in the top management. And then it's easier to transfer it downwards. [...] And we use it consciously too, because when it comes to investment budgets, or when it comes to getting materials and equipment, I say, ‘Yes, but this is OHS. Of course, we must buy this lifting gear. We don't want people to get strain injuries.’” (OHS coordinator, management)

“Then there's the importance of getting out and getting to know people. I think they'll listen to us more if they know us and have a relationship with us.” (OHS leader, management)

One manager exemplified how the company regularly had OHS on the meeting agenda to influence the workers. Other managers said they visit workers at the fish farms, share experiences with them, and challenge them to reflect on systematic causes for accidents. Involving workers in the implementation of safety management systems was talked about as a success factor.

“There’s no point making a nice system and then an operational manager comes afterwards and says, ‘This is just nonsense; it isn’t doable.’” (OHS leader, management)

Well-informed personnel are one of the responsibilities of companies’ management. In interviews, managers talked about the significance of good safety attitudes among workers. Managers related this to complying with procedures and not taking chances. This point was reflected in the answer of a production coordinator who was asked what he would do to improve OHS if money was not an object:

“It isn’t certain that money would do a whole lot. I think there’d be more for the organisation to gain from training and attitudes. To get a good attitude among the people, I think would give us the greatest gain.” (production coordinator, management)

Managers saw work experience as valuable for safety. Nevertheless, experienced workers who were too set in their ways and unwilling to comply with formal requirements were described as a safety challenge. An OHS coordinator explained that he had some challenges with changing employees’ old ways of thinking when it came to the use of personal protective equipment. He gave an example of a fish farmer who said that he had worked for 20 years without any accidents and therefore did not see why he should wear a helmet. The OHS coordinator’s response was that it was just a matter of time before something would happen. The coordinator explained why and told the fish farmer that if he did not want to comply with the rules, he should work at a supermarket instead. Another OHS leader wanted to establish a “better safe than sorry” culture in the company “to make it natural to think OHS before doing anything.” He proceeded with some examples of what such a culture should entail: conducting a Safe Job Analysis (SJA) before starting work tasks that are not performed regularly, avoiding falls by not jumping down from the barges to the boats, and preventing strain injuries by upgrading the manual equipment.

4.3. Safety management according to operational personnel

The majority of the operational fish farmers emphasized that safety has improved in recent years because of new requirements and improved regulations, such as mandatory safety equipment. Examples of such equipment are personal floatation devices, knives, and very high frequency (VHF) for communication.

“Like, you think all the time about what can happen worst case and what can prevent it from happening and how it can be solved. We have a knife and VHF: that’s our basic equipment. Like, if your foot gets stuck in a rope, right—if you have the knife, you can just pull it up and cut it, for instance, and that can save you.” (operational manager, fish farm)

Risk assessments were highlighted as one of the reasons for changes in the work organization. Some work operations that were previously performed by the fish farmers once or twice a year (e.g., maintenance of moorings or delousing) had been outsourced to specialized service vessel crews because the risk assessments documented a high level of risk for the workers at the fish farm. Having experienced crews on board and specialized and well-equipped service vessels is a prerequisite for reducing risk (in regard to personnel, escape of fish, and material assets). Nevertheless, some participants said that risk assessments were carried out just for the sake of pleasing authorities. Others, however, said they valued the SJA, which requires safety considerations before operations:

“We look at procedures and the job to be done. What are the hazards, what can happen? And then afterwards an evaluation of the operation: how did it go?; what could be done better?; what went well?” (operational manager, fish farm)

Another fish farmer said he found the SJA useful for new tasks or operations, but for the routine work, he knew well he did not need the SJA because all of the knowledge contained within it “was in his head.”

Furthermore, written **procedures** were used mainly for newcomers and training purposes. Some participants saw procedures primarily as documentation for management and authorities, and one fish farmer talked about the value of procedures for practical work:

“In my mind, it’s just as much about having a culture and talking and showing the practical task. It’s very important to have it in writing too, but it’s worth very little to just ‘click’ if you don’t actually understand what it’s about. If you just know everything, and click through everything, and ‘understood’ and ‘okay’ and hundreds of pages and it’s all there, but you don’t quite know what to do, then it’s not worth much. It just has like visual value. It’s there, and we can check it, and see that it’s been done. So, there must be a combination, right: that it’s there, and that one has it, and it must be documented. But it also must be talked about and understood.” (fish farmer)

Another operational manager pointed to the fact that procedures are in writing and that this may not be the most suitable form for all workers:

“That’s why one must try to make the procedures in a way that the majority think is correct, right, and then reconsider. There are audits every year, we get people together. We did that now in February for instance.” (operational manager, fish farm)

Another topic that was mentioned often was the planning and resources for avoiding long working hours. Two operational fish farmers, interviewed together, recalled working a shift lasting over 30 hours, with no more than three hours of sleep, and said it happened because of poor planning from management. The fish farmers explained that they were entitled to 8 to 9 hours of resting time, but this was often ignored owing to time pressure. Poor planning led to increased work pressure for employees at the fish farms:

“For instance, there will not be enough staff because people have worked so much overtime that they must rest.” (fish farmer)

At the same location, several workers were concerned about working alone. At some fish farms, this was not allowed, and a fish farmer questioned the different practices:

“Working alone, it’s easier to think ‘I’ll just do this.’ When there are two workers, one corrects each other.”

Another fish farmer said about someone falling into the water:

“It’s not certain that he’ll be able to get back up on the floater by himself: he may fall and hit his head.” (fish farmer)

Employee involvement is important for the success of safety management implementation. One fish farmer said that employees did not hear much from the top management but felt that managers closer to them put personal safety first. A practical approach was appreciated:

“It’s also positive. In general, with the management ... that very many of them have worked at fish farms. That many of them also

have a more practical approach and know a bit about the challenges we have.” (fish farmer)

From the operational personnel's point of view, having experience from the fish farms increased managers' knowledge about actual working conditions.

Considering well-informed operational personnel, the workers talk about taking care of each other: having conversations with their coworkers, telling others if something is not done properly and listening when others do the same, and listening to others' experiences. Some companies have also formalized the practice of taking care of each other in a “buddy check,” whereby two colleagues will check if the other one has all of his or her safety equipment (i.e., personal flotation device, knives, and helmet) in order before starting work. Many workers have certificates of apprenticeship.

“The difference between 2009 and now is that there may be more thinking today; before, one had to use one's body. The best people you found were real practitioners. Today it's almost the opposite: that the practitioners are put to the side. Because you need so many courses and schooling.” (fish farmer)

Nevertheless, practical skills are of high importance for fish farmers, and on-the-job training is still the main way to learn tasks and operations. Workers at the fish farms often describe work experience as crucial for operational safety. For instance, experience may have implications on the safety outcome of decision-making, such as judging the weather conditions.

5. Discussion

5.1. Safety management: status, challenges, and relevance

Data from interviews with managers and operational personnel provide new knowledge with regard to the status and challenges for safety management in Norwegian fish farming. To inform the author's suggested improvements, the relevance of current safety activities is discussed through considering Rae et al. [37] who propose that activities performed with no expectations of real safety benefit drain time, resources, and attention from activities that could improve safety.

The aim of safety management in Norwegian sea-based aquaculture is to mitigate risks for operative personnel. At fish farms, using boats, handling gear, and being influenced by weather conditions are described as prominent hazards. Previous studies have documented that operations using cranes and capstans involve risk of accidents [3]. Furthermore, organizational factors such as staffing, work hours, and maintenance are documented challenges for safety in aquaculture [8,38].

Adapting the points of view of operational personnel and managers, the practical relevance of different safety management activities may be evaluated by looking at the “contribution” to safety, how “confident” personnel are in this contribution, and the “consensus” between personnel groups [37].

The findings show that some activities are perceived as more valuable than others (see Table 1). The contribution of stricter requirements for using personal safety equipment appears to be high. Both operational personnel and managers seem confident that this measure has had a positive effect on safety, thus indicating consensus from employees at different company levels.

Considering risk assessments, the contribution of this activity appears to be moderate. A clear consensus among the informants is not found. Although some perceive risk assessments as an alibi to please authorities, employees also acknowledge that risk assessments have led to positive changes for safety in the

Table 1 Safety management activities, views of management and operational personnel, and perceived practical relevance (contribution, confidence, consensus)

	Views of management	Views of operational personnel	Perceived practical relevance
Safety management activities			
Safety management regulations	<ul style="list-style-type: none"> - Increased attention has both upsides and downsides. 	<ul style="list-style-type: none"> - Safety has improved owing to new requirements and regulations (personal safety equipment). 	High
Risk assessments (RAs)	<ul style="list-style-type: none"> - RAs are used to document compliance to authorities. - A lot can still be done. 	<ul style="list-style-type: none"> - Has led to changes in the organization - Safe Job Analysis (SJA) is useful to collectively reflect on hazards. 	Moderate
Procedures	<ul style="list-style-type: none"> - Concerned with the amount and usefulness of procedures 	<ul style="list-style-type: none"> - Used for newcomers and training - Some see it primarily as documentation. - Not suitable for all workers 	Low
Resources	<ul style="list-style-type: none"> - Planning is key. 		High
Involvement of personnel	<ul style="list-style-type: none"> - Considered important - Measures to remove the distance between managers and workers 	<ul style="list-style-type: none"> - Important to avoid long working hours and not working alone - Managers with experience from fish farms are valued. 	High
Well-informed personnel	<ul style="list-style-type: none"> - Good safety attitudes and training considered important - Experience-based knowledge is an asset. 	<ul style="list-style-type: none"> - Workers take care of each other. - Practical skills and on-the-job training important 	High

organization. Still, the SJA conducted shortly before work start was perceived by operational personnel as a useful way to collectively reflect on hazards and how to handle them. This supports findings in the Norwegian maritime transport sector, in which safety management regulation requires safety routines and awareness among the vessel crews: such requirements are believed to prevent personal injuries. However, safety management also leads to more procedures and administrative work, which can disturb onboard managers' concentration and tasks [39].

Employees at different company levels said that there were too many procedures and primarily saw them as documentation used for audits. Although written procedures may be used for training purposes, employees seem confident that procedures in their current documented form are not the most important measure for increased safety. The fact that there are currently too many procedures is consistent with the argument that it is easier to add to than to reduce safety work [37]. This is further described in Norwegian shipping and aquaculture operations [20]. For operational personnel, perceiving procedures as safety clutter also connects to gaps between "work as imagined" in documentation and "work as done" or actual practices [22], meaning the procedures are not necessarily important for the way the work is performed. As previously described, fish farmers rely heavily on their own knowledge and competence, such as experience, informal coordination, and pragmatic problem solving [40,41]. To stay safe, operational personnel are concerned with planning, not working alone, taking care of each other, and relying on experience. Staying safe is thus not merely about following standard procedures but is also rooted in practical know-how and personal relations, as described from other occupations [24–27,42].

Considering well-informed personnel, the managers also value the operational perspective and experience-based knowledge as a safety asset, indicating confidence and consensus that workers' practical knowledge contributes to safety.

Planning and ensuring enough resources were described as important safety activities by both managers and operators. Operational personnel rely on resources (staffing) from management to avoid overtime and to not work alone. Despite the perceived practical relevance, these resources are not always in place. As documented in previous studies from the aquaculture industry, production in some operations may be prioritized over safety [19,38,41]. For example, the safety of personnel may be compromised when employees work up to 20 consecutive hours without sleep during large operations such as delousing of fish [8].

Overall, the relevance of safety management depends on the communication between the developers and users of the safety management systems. There is a consensus that involvement of personnel is important to achieve this. Managers were also concerned with the importance of operational employees' attitudes and safety culture to succeed with safety activities (such as wearing safety equipment). When operational personnel's attitudes are identified as the main challenge for improved safety, organizations may find that the reality and knowledge of practitioners is marginalized [31]. Furthermore, a previous study [9] that examined the status and implementation of risk assessments in the Norwegian aquaculture industry found that today's operator involvement is not sufficient to comply with the regulatory requirements of internal control.

However, many managers in the present study were concerned with involving and communicating directly with employees at the fish farms and making systems that work for them.

5.2. Suggested improvements

Involve operational personnel

Companies must provide documentation that managers and authorities can inspect and compare [31]. The contribution (safety value) of procedures for operational personnel of procedures is described as lower than other measures. The contribution may increase with increased participation and usefulness for operative personnel. A study found that participation and competence had a positive influence on compliance [38]. However, 24.4 % of operational fish farmers were not involved when new procedures were introduced.

Consider all risk dimensions

The practical relevance of risk assessments is moderate, according to the informants. Furthermore, operations may entail conflicting objectives (e.g., risk to personnel, risk of escape, and risk to fish health) related to management decisions with regard to, for example, resource allocation (including personnel, equipment, and time) [13]. Therefore, OHS cannot be handled separately but should be considered together with other risk dimensions. It may be beneficial for personnel at the fish farms to take part in assessing different risks based on detailed descriptions of each operation, rather than merely listing general hazards in the work environment [9].

Challenge the value of specific safety activities

In general, it seems that measures that fit well with the practical reality at fish farms are well received by workers. With this starting point, companies may benefit from basing their efforts less on external stakeholder demands, accountability, and auditability and more on creating the safety measures and activities that work, within the boundaries of regulatory requirements. Safety professionals in companies should not be afraid of challenging the value of specific safety activities: "Concern about the efficacy of, and evidence for, specific practices is a good thing for safety" [37]. This requires a detailed knowledge of the distinctive characteristics of work practice in fish farming, along with a systematic evaluation of what contributes safety value for the employees working at the fish farms and what is, in fact, mere safety clutter.

6. Conclusion

This study has provided new qualitative knowledge about status, challenges, and improvements for safety management in Norwegian sea-based fish farming. It shows that both managers and operational personnel at fish farms agree that the quality and quantity of measures aimed to improve safety have increased in recent years. Furthermore, some elements of safety management have been found to be more useful than others. A biased focus on procedural compliance with written documentation might miss out on identifying the safety measures fish farmers see as valuable. Managers at all company levels are concerned with involving workers and acknowledging their practical experience. This is a good starting point for tailoring a safety management approach to the specific needs of the fish farming industry.

Conflicts of interest

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authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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