

What works? Results of a Nordic survey on fishers' perceptions of safety measures



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ABSTRACT

Commercial fishing has a high accident rate compared to other industries. In the Nordic countries, analyses show a decline or stagnation in personal accidents in fisheries during the past few years. However, our knowledge of "what works" in preventing accidents in this branch is limited. This article explores fishers' perceptions of preventive measures. A survey where fishers graded the importance of different safety measures was carried out in Norway, Finland, the Faroe Islands, Denmark and Iceland. The responses of 47 fishers from different types of fleet groups have been analysed and compared. Most of the respondents were skippers, and all had at least 10 years' experience in commercial fishing. The comparison revealed many similarities between the countries. Three measures were considered particularly important for safety; safety culture on board, safety equipment and design and layout of vessels. Fishers in all countries found advice from trade unions or other organizations and guidelines and information from the authorities less important. The efficiency of safety measures depends on implementation, and thus on how workers perceive them. Knowledge of what fishers find useful is therefore valuable for future efforts to reduce risk in occupational fishing. This study indicates that guidance as well as involving fishers in the development and implementation of safety measures is an approach worth recommending.

1. Introduction

Due to the high risk of work-related injuries and fatalities, fishing is often described as a hazardous occupation [17]. Our knowledge of the causes of accidents depends on the available sources and quality of occupational accident data. Registration procedures differ significantly between the Nordic countries, making international comparisons difficult. A review of fatal accidents in Norway, Iceland, and Denmark and a few other countries found that fatal incident rates had fallen by about 50% from 1980 to 2010 [8]. A recent study from five of the Nordic countries; Norway, Finland, Denmark, the Faroe Islands and Iceland, indicate a positive development with accident numbers either

stabilising or decreasing during recent decades [3].

The regulatory safety requirements on board fishing vessels, aimed to reduce the number of accidents for occupational fishers in the Nordic countries, have become both stricter and more comprehensive since the late 1980s. International regulations, such as the International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel, 1995 (STCW-F 1995), that came into force in 2012, have influenced national regulations. In addition to safety training requirements and control of compliance, targeted information and attitude-shaping campaigns have frequently been employed. Suppliers to the fishing industry, such as vessel designers, producers of safety equipment, consultants, accident investigation boards, insurance

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companies and trade unions, have also provided measures and guidance to reduce the number of accidents in the fishing industry.

Given the wide range of preventive measures, and the fall in occupational accident numbers in the Nordic fishing fleet, it is interesting to ask ourselves: What works? The point of departure in this article is that fishers' opinions and perceptions are important when it comes to evaluating the effect of regulations and other safety measures. The following research questions are asked: What are the most important measures for improved safety seen from the fishers' point of view? Do national perceptions of safety measures differ, or do fishers share similar views? Based on the findings, we discuss what may contribute to fishers' perceptions of what works.

1.1. The Nordic fishing fleet

The Nordic fishing fleet ranges from large deep-sea trawlers to small one-man operated vessels fishing with nets or lines in coastal and inland territorial waters. The following brief description of the fleet in Norway, Finland and Denmark is based on publicly available information. The description of the fleet in Faroe Islands and Iceland is based on personal communication with the Faroe Islands Fisheries Inspection, Faroese unions and the Icelandic Transport Authority.

The Norwegian Directorate of Fisheries maintains official registers of vessels and active fishers [5]. Most of the 5100 vessels in the Norwegian fishing fleet are coastal vessels, less than 10.99 m in length. In 2016, the deep-sea fleet consisted of about 245 vessels more than 28 m long. In 2016 there were about 11,000 active fishers. About 9200 had fishing as their main occupation, while almost 1900 as their secondary occupation.

In Finland, the Centre for Economic Development, Transport and the Environment keeps a record of commercial fishers and fishing vessels operating in coastal water and the open sea. According to Statistics Finland, 3092 fishing vessels were operating in Finland's coastal waters, and 98% of the coastal fishing fleet are less than 12 m in length [19]. In 2016, there were about 2800 commercial fishers in Finland [19,20].

In Denmark, the Danish Maritime Authority manages fisheries, and the Fisheries Office in the Danish AgriFish Agency is responsible for activities related to commercial fishing. In 2016, three-quarters of all Danish fishing vessels were less than 10 m in length and trawlers make up 75% of the fishing vessel tonnages. In 2016, some 4900 fishermen had fishery as their main or secondary occupation [4].

The Faroese fishing fleet is categorised by tonnage, and most vessels are below 15 t. In 2016 there were 117 Faroese ships over 15 t fishing full-time. Of ships under 15 t, there were 26 ships fishing full time and 254 part-time. In 2016, there were about 2000 active fishermen in the Faroe Islands, of whom 1750 fished full-time and about 254 as a secondary occupation.

The Icelandic Transport Authority is responsible for ensuring that all Icelandic vessels over 6 m in length are registered and undergo surveys. Ships are divided into two main classes, open boats and decked vessels. Around 1200 open boats and 1100 decked vessels are registered in Iceland. In 2014, 5964 registered fishermen were working on 1384 boats.

1.2. Accidents and accident prevention in the Nordic countries

There has been a general decline or stagnation in registered accidents in the countries included in this study during the last couple of decades. The number of fishermen has also fallen during the same period. This section provides an overview of the accident rate and some key safety measures implemented by each country.

A total of 315 occupational fishers in Norway lost their lives between 1990 and 2017 [23]. Many of them worked alone, and the majority on coastal vessels. Capsizing, man overboard accidents, drowning in port as well as entanglement with machinery are common causes of

fatalities. Non-fatal accidents are mostly reported from the trawler fleet. Approximately 70% of non-fatal injuries occur on deck, but also during fish processing and work in the hold [17,18]. A survey showed that the prevalence of absence was highest among coastal fishers, often lasting for more than eight weeks [24]. Safety training for fishers became mandatory in 1989. In 2005, regulations regarding systematic safety efforts was introduced, followed in 2010 by requirements for safety management systems. The Norwegian Maritime Authority has increased their safety efforts, including inspections, information campaigns and web-based risk assessment tools [26].

In Finland, the injury rate among commercial fishers is 7.9 injuries per 100 person-work-years [11]. A slight but not statistically significant falling trend can be identified. There were 11 fatal injuries from 1996 to 2015 (0–3 per year); the fatality rate is 1.06 casualties per 1000 person-work-years. All the fatalities were due to drowning. Although the largest proportion of injuries (40%) occur on board vessels or when entering or leaving a vessel, a remarkably high proportion occurs ashore (37%) and quite a few when fishing on ice (11%). Fishers in Finland are being offered an occupational healthcare service (OHS), that is compulsory for salaried workers and voluntary for entrepreneurs. The voluntary OHS service has not been widely adopted, as only 13.8% of fishers have joined the voluntary system [12]. Occupational safety regulations only apply to employers with salaried staff. Vessel inspections, safety training and certification of crew are obligatory, depending on vessel size and catching location for boats greater 10 or 12 m in length. Social insurance providers also offer guidance regarding occupational health and safety matters, and some small-scale campaigns and projects have been carried out.

In Denmark, there has been a marked reduction in reported occupational accidents from 2000 to 2016 [3]. While 52 accidents were reported per 1000 fishermen in 2000, the number fell to 11.6 per 1000 fishermen in 2016. Fatalities were usually due falling overboard and handling fishing gear. Trawlers are clearly overrepresented in the accident statistics. A very large proportion of the accidents affected fishermen who had not worked for more than a year on the vessel at the time of the accident. In the late 1980s attention to the work environment and safety increased [9]. Safety organizations were established on board the vessels, and the Fisheries Working Environment Service provided services and advice. A three-week safety course was set up in the early 1990s. In 1992, it was decided that a Workplace Assessment (APV) should be drawn up for all Danish fishing vessels. Web-based risk assessment tools are also available. Studies have related the positive evolution of occupational accident figures to the safety culture in the fisheries [2,6].

Between 1994 and 2014, 1268 accidents were reported to the Faroese Accident Insurance Council by Faroese occupational fishers. Of these, 34 were fatal and occurred mainly on larger vessels. There has been a steady decline in accidents since the 1990s, with no single year since 2010 having more than 30 accidents. However, when calculated per 100,000 person-days at sea, the numbers reveal that from 1994 until 2002 there was a significant reduction in accident rate, which stabilised after 2003 at 125 accidents during each of the last two five-year periods. Being “hit by an object” and “falls and slips” are the most frequent causes of injury. A review of serious accidents by the Danish Maritime Accident Investigation Board, DMAIB, in fishing from 1997 to 2014 indicates that although serious accidents had reduced, (with no accidents from 2000 to 2007), they are back at the same rate as in 1997. The reason for this requires further investigation. Most of the serious accidents that have been investigated by the DMAIB, have taken place on ships older than 20 years. All legislation that applies to Danish fishermen also applies to Faroese fishermen.

In Iceland the annual number of occupational accidents in the fisheries has fallen from about 5300 per 100,000 workers in the early 1990s to about 3000 per 100,000 workers in 2015. From 1984 to 1997 the annual number of fatalities dropped from an average of 21 to nine, while in the past five years the number of fatalities has ranged

between zero and four. Since 1984, a sharper focus on safety has followed recommendations made by a parliamentary committee. Safety training for fishers started in 1985 and became mandatory in 1991. The National Life-Saving Association (NLAI), in particular the women's league, has played an important role in increasing the awareness of Icelandic fishers of the importance of safety measures, drills and equipment.

Summing up, many occupational accidents have occurred on small fishing vessels during the recent years, and the number of reported injuries on board seagoing vessels is also high. Authorities in most countries have focused their attention on regulation, control, information and safety training for fishers.

2. Materials and methods

To gain knowledge of fishers' perceptions of different safety measures, a collaborative survey was designed by a group of researchers from different Nordic countries. The survey was based on personal face-to-face or phone interviews in 2016. A total of 47 fishers participated.

Recruitment of participants was random, and included approaching participants at a fair for fishermen, contacting participants who had previously participated at a safety course, using the official registry for fishermen as well as researchers' networks in the industry.

Recruitment did not target particular sectors, vessel types or positions on board. However, the experience of the participants was a criterion. As the topic of the survey targeted experienced fishers who needed to be capable of evaluating the effect of measures over time, only participants who had worked as occupational fishers for more than ten years were included. They were first asked some background questions about education, vessels, crew and prevalence of on-board accidents. They were then asked to consider the importance/effect on safety of 13 different measures after the following introduction:

"What do you consider has had a positive influence on the prevention of occupational accidents in fishing? I will ask you some questions, and you may answer on a scale from 1 to 10 where 1 means little/no importance and 10 means great importance in reducing accidents".

Table 1 lists the safety measures assessed in the interviews. The participants then rated each measure on a scale from 1 to 10. If the question was not relevant to the participant, the score was set to 0. For statistical analysis, missing scores as well as measures scored with '0' were coded as missing data.

The mean values and standard deviations of the responses were calculated, and variance analysis performed with SAS Enterprise Guide

Table 1
Safety measures rated by survey participants.

Safety measure	What do you consider has had a positive influence on the prevention of occupational accidents in fishing? (Scale: 1 = little/no importance – 10 = great importance; 0 = not relevant)
#1	Safety training in fisheries
#2	Other education in relation to fisheries and safety
#3	Rules, auditing and controls by the authorities on safety and accident prevention in fisheries
#4	Guidelines and information from the authorities on safety and accident prevention in fisheries
#5	Investigation and recommendations from the authorities e.g. Maritime Investigation Board
#6	Use of on-board workplace assessments
#7	The design and physical layout of the vessel
#8	Technical aids on board to reduce workload; e.g. lifting gear
#9	Organisation of work on board e.g. delegation of tasks, knowledge of what to do and who does what
#10	Safety equipment for fishers and vessel
#11	Safety culture on board
#12	Advice, help and support from consultants
#13	Advice and help from others; e.g. trade unions and organizations

v. 7.13 software (SAS [22]). Variance analysis was used to assess existence of significant differences between least square (LS) mean scores of the 13 measures. The significance of differences in pairwise comparisons was determined using Tukey's HSD (honest significant difference) test ($p < 0.05$).

3. Results

Most of the 47 participants were skippers, including a few Norwegian skippers who fish alone on small coastal vessels. The Danish participants were all skippers on vessels with a crew of three or more. Crew size ranged from three to 40 members. Several participants had some formal education in fishing. All the participants apart from the Finnish fishers had completed safety training. All had at least ten years' experience in commercial fishing, but they were also asked about experience on the vessel on which they were currently working. Answers ranged from under one year to 28 years or more. They worked on fishing vessels of different lengths and types of operation such as line fishing, net fishing and trawl. Table 2 shows the background information of the respondents.

3.1. Ranking of safety measures across countries

The combined assessments of all 47 respondents, across all participated countries, are shown in Fig. 1. The ranking is tentative, because differences between mean estimates of scores are for most pairwise comparisons not significant. This is certainly true for scores that are close to each other.

Results suggest that there are differences between rankings of safety measures. Safety culture on board (#11), safety equipment for fishers and vessels (#10) and the design and physical layout of the vessels (#7) were scored highest. Differences with the next three (organisation of work on board #9, technical aids to reduce work load #8 and safety training in fisheries #1) were not statistically significant, but compared to all the rest, significant differences were found.

Scoring of the safety measures by country and significant differences between countries are presented in Table 3.

So, do perceptions of safety measures differ among fishers in different countries?

Opinions were very convergent when assessing influence of safety culture (#11), safety equipment (#10) or the design and physical layout of vessels (#7) on accident prevention – statistically significant differences between countries were minor (Table 3). Instead, organisation of work on board (#9) scored lower in Denmark (differences were significant when compared to Faroe Island and Norway). Preventative influence of safety training in fisheries was scored lower in Finland (significant difference when compared to Denmark, Iceland or Norway).

Advice and help from trade unions and other organizations (#13) got the lowest score. Fishers didn't consider these actors to have positive influence on prevention of occupational accidents. However, there were some differences between countries (Table 3): Fishers in Norway and Finland gave higher scores for this measure, whereas Denmark and Iceland gave lowest. Differences were found to be statistically significant when comparing Norway or Finland to Denmark and between Norway and Iceland.

Investigation and recommendations from the authorities (#5) scored low i.e. fishers saw that this action has had a rather weak influence on safety prevention (Table 3). Iceland was the only exception (mean score 8,6) on this. However, significant difference was found only when comparing Iceland to The Faroe Islands.

Advice, help and support from consultants (#12) scored high in Denmark (8,6) and in Finland (8,1). Fishers from other countries, Faroe Island and Iceland in particular, did not find this action to have important role in preventing occupational accidents.

In Norway, the safety measures with the highest mean scores were

Table 2
Background information of the survey participants.

	Norway	Finland	Denmark	The Faroe Islands	Iceland
Number of informants	10	10	11	10	6
Position on board	8: skippers (4 of them work alone) 2: fishers	9: skippers 1: other	11: skippers	2: captains 4: deckhands 3: chefs, factory foreman 1: other	1: captain 4: deckhands 1: other
Education	8: fishing skipper or sea captain 2: no formal education	9: comprehensive school 1: vocational school	11: Fishing skipper	3: fishing skipper 1: baker 2: fisherman chef 4: no formal education	1: fishing skipper or sea captain 3: vocational education 2: elementary
Safety training	All have completed safety training for fishermen	1: occupational safety 1: first Aid 1: navigation	All have completed safety training for fishermen	All have completed safety training for sailors, some got fire extinguisher and first aid certificate etc.	All have completed safety training for fishermen
Fishing crew size	4: 1 (fish alone) 1: 3 crew members	1: 3 crew members 2: 6 3: 1	Crew ranged from 3 to 8 fishermen; 4–5 most frequent size	1: 4 – 5 crew members 1: 6 – 8 1: 9 – 10 4: 11 – 15 1: 20 – 30 2: 30 – 40	2: 2–3 crew members 4: 10 – 15
Experience on current vessel	2: 1 year 6: 6–8 years 2: more than 28 years	Ranging from 10 to 30 years	Ranging from 3 to 19 years	2: 0 – 1 year 1: 6 – 8 4: 9 – 10 1: 19 – 20	2: 8 years 4: 25 years +
Length of vessel	4: < 11 m 1: 12.8 m 1: 19,3 m 1: 43 m 3: 55–59 m	7: < 10 m 2: > 10 m 1: fishing on ice	1: 14.9 m 8: 24–35 m 2: > 40 m	1: 15–24 m 4: 24–45 m 2: 45–60 m 3: 60 m+	
Vessel type	5: line fishing 3: net fishing 2: trawl/purse seiner	7: open motorboat 1: boat w/ cabin 1: trawler	10: trawl 1: fly-shooting (10 consumers fishery and 1 fish for industrial use)	4: trawl 1: netting vessel 2: longliner 2: purse seiner /trawler	2: line fishing 4: trawl

technical aids on board to reduce workload (#8), organisation of work on board (#9), safety equipment for fishers and vessel (#10), and safety culture on board (#11). At the other end of the scale, the lowest mean

scores are investigations and recommendations from the authorities (#5), use of workplace assessments on board (#6) and guidelines and information from the authorities (#4). There were no significant

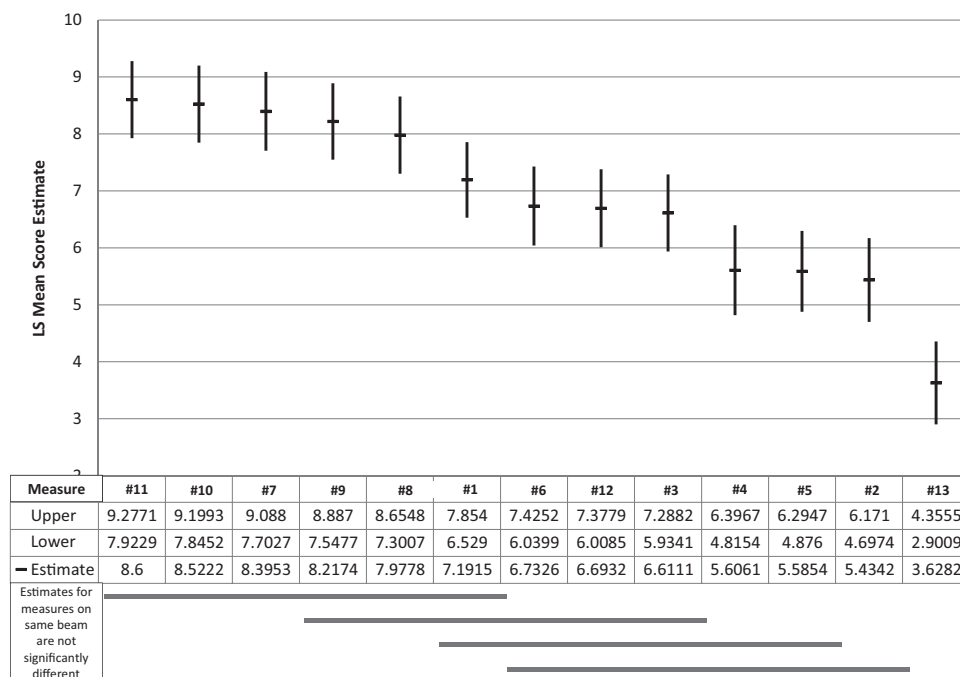


Fig. 1. Ranking of safety measures by score least square mean (LS mean) estimate across the participated countries. 95% confidence level limits are indicated. Differences of mean scores between measures that share the same beam (lower part of the figure) are not significant.

Table 3

Mean scores of safety measures on a scale from 1 to 10 by country (standard deviations in parentheses). Significant ($p < 0.05$) pairwise adjusted LS mean score differences between countries are denoted with country acronyms. Corresponding differences between safety measure scores inside each country are denoted with safety measure number pairs on the last row of the table.

#	Safety Measure (Total number of responses)	NO Norway (n = 10) Mean (SD)	FI Finland (n = 10)	DK Denmark (n = 11)	FO The Faroe Islands (n = 10)	IS Iceland (n = 6)	Significant difference between country means
1	Safety training in fisheries (n=47)	8.6 (1.8)	4.9 (2.0)	7.8 (1.8)	6.8 (2.4)	8.2 (2.8)	DK- FI FI - IS FI - NO
2	Other education in relation to fisheries and safety (n=38)	6.7 (2.8)	4.4 (2.5)	6.8 (1.3)	5.1 (2.1)	5.2 (2.4)	-
3	Rules, auditing and controls by the authorities on safety and prevention in fisheries (n=45)	6.6 (1.8)	4.0 (3.4)	7.7 (1.6)	7.1 (2.0)	7.8 (2.8)	DK - FI FI - IS
4	Guidelines and information from the authorities on safety and prevention in fisheries (n=33)	6.1 (2.2)	NA *)	5.1 (2.4)	6.5 (2.5)	3.6 (2.9)	-
5	Investigation and recommendations from the authorities; e.g. Maritime Investigation Board (n=41)	5.8 (2.9)	5.3 (3.1)	5.6 (2.2)	3.8 (2.4)	8.6 (1.3)	FO - IS
6	Use of on-board workplace assessments (n=43)	6.0 (3.0)	6.1 (3.5)	7.0 (1.9)	7.4 (2.3)	7.4 (3.7)	-
7	The design and physical layout of the vessel (n=43)	8.5 (1.2)	6.7 (4.1)	8.6 (0.7)	8.5 (1.3)	9.3 (1.0)	-
8	Technical aids on board to reduce workload e.g. lifting gear (n=45)	9.0 (1.1)	6.9 (3.3)	7.7 (1.1)	8.9 (1.4)	7.2 (1.9)	-
9	Organization of work on board e.g. delegation of tasks, knowledge of what to do and who does what (n=46)	8.9 (1.1)	8.4 (1.4)	6.8 (2.1)	8.8 (1.1)	8.3 (0.8)	DK -FO DK - NO
10	Safety equipment for fishers and vessel (n=45)	8.8 (1.9)	8.3 (1.5)	7.3 (1.4)	9.2 (1.6)	9.7 (0.8)	DK - IS
11	Safety culture on board (n=45)	8.8 (1.3)	8.9 (1.1)	8.1 (1.2)	9.0 (1.3)	8.2 (1.0)	-
12	Advice, help and support from consultants (n=44)	6.9 (2.4)	8.1 (0.9)	8.6 (1.2)	3.9 (2.0)	5.2 (2.7)	DK-FO DK - IS FI - FO FO - NO DK - FI DK - NO IS - NO
13	Advice and help from others; e.g. trade unions and organizations (n=39)	6.9 (2.0)	4.7 (3.3)	1.4 (1.0)	3.5 (2.9)	1.4 (0.6)	
	Significant differences between scores of safety means	-	#11 - #2 #11 - #3 #9 - #3	#7 - #5 #7 - #4 #7 - #13 #1 - #4 #1 - #13 #10 - #13	#10 - #2 #10 - #12 #10 - #5 #10 - #13 #6 - #12 #6 - #5 #6 - #13 #1 - #13	#10 - #12 #10 - #2 #10 - #4 #10 - #13 #7 - #4 #7 - #13 #3 - #13	

*) In Finland there is no authority that focuses on fishery-specific safety guidance and recommendations.

differences between the mean scores of safety measures.

The ten Finnish fishers ranked on board safety culture (#11) and work organisation (#9), as well as safety equipment (#10), as being the most effective measures to promote safety. Help and support from consultants (#12), e.g. extension service and occupational health professionals, were also acknowledged to help reduce safety risks. The ranking of these four measures were relatively consistent between the respondents. Rules and authority control (#3) were ranked lowest on the same scale. Other vocational training (#2) was ranked second lowest. Significant differences between means scores only exist between the two highest and two lowest scored safety measures.

In Denmark, the measures with the highest mean scores were the design and physical layout of the vessel (#7), advice, help and support from consultants (#12) and safety culture (#11). Advice and help from others (#13) were given the lowest score along with guidelines and information from the authorities on safety and prevention in fisheries (#4).

For the Faroese fishers, safety equipment for fishers and vessel (#10), safety culture (#11), as well as technical aids on board to reduce workload e.g. lifting gear (#8) and organisation of work on board (#9) were ranked highest. Advice and help from others; e.g. trade unions and organizations (#13), investigation and recommendations from the authorities (#5) and advice, help and support from consultants (#12), and were ranked lowest.

The Icelandic fishers ranked safety equipment for fishers and vessel (#10), the design and physical layout of the vessel (#7) and investigation and recommendations from the authorities (#5) highest.

The lowest score was given to advice and help from others; e.g. trade unions and organizations (#13) and guidelines and information from the authorities on safety and prevention in fisheries (#4).

4. Discussion

Findings show that the answers from fishers in different countries have many similarities. Three of the measures obtained an average score of more than 8 in four of the countries; namely "safety equipment for fishers and vessel", "the design and physical layout of the vessel" and "organisation of work on board". "Safety culture on board" scored over 8 in all five countries.

Considering these results, it is interesting to discuss what may contribute to fishers' perceptions and why these measures are given the highest grades?

One aspect shared by the most highly graded measures is that they are a major part of the fishers' everyday life and work at sea. Safety equipment for fishers and vessels, such as personal flotation devices, helmets, emergency shutdown, life/rafts and so forth, ensure protection and may help prevent accidents as well as reduce consequences of accidents. Similarly, the influence of organisation of work and the fishers' knowledge of how to perform their work is highly visible in everyday life on board, and the high mean grades for this measure relates well to previous findings that fishers' value knowledge and experience as important for safety [25]. The fishers' own experiences thus contribute to their perceptions of what works. The influence and practical utility value of these measures may be more obvious to fishers than some of

the other measures. The point that fishers evaluate and apply the measures and practices they need to stay safe has also been emphasised in previous studies in American and Norwegian contexts [16,25]. Furthermore, the design and physical layout of vessels is also an aspect that makes a difference for fishers in their daily work, as it is very important for vessels' sea-keeping capabilities, such as stability and working conditions.

"Safety culture" is a term used by both researchers and authorities and may mean different things in different contexts. A Danish fisher who participated in this survey explained that safety culture is related with a change in attitude regarding safety. A fisher from the Faroe Islands said that safety culture is a matter of helping each other. The high rating of safety culture also has similarities to a previous study in which fishers highlighted everyday work practices, experience and common sense as important for safety and feeling safe [25].

The mean scores for the measure advice, help and support from consultants, show that the occupational health services in Denmark and Finland are highly appreciated. Similar services do not exist in the other countries that took part in the study, and this point was also given a conspicuously lower score in the Faroe Islands and Iceland.

In Denmark, the Danish Fishermen' Occupational Health Service was one of the top three measures aimed at reducing accidents. The Danish Fishermen's Occupational Health Service, which was established in 1993, has worked to raise awareness about safety through advice and guidance, and the Danish Maritime Authority has cooperated closely with this Service for many years. A similar, voluntary service exists for self-employed commercial fishers in Finland as a derivative of a general and mandatory OHS for salaried workers. It comprises regular health checks and workplace assessments as well as guidance and rehabilitation at a low, subsidised cost for the fisher. The fact that Finnish fishers ranked advice, help and support from consultants high (including occupational health professionals) may indicate a tendency to listen and react to suggestions coming from expert consultants. The low rate of participation in the voluntary occupational health services, as well as statistical evidence on their relative slight effect (on fisher population level) on the risks of occupational injuries and diseases [12] may suggest that the ranking reflects a wish for more expert consultancy rather than for the status quo.

In Finland, mandatory regulations that govern vetting of fishing vessels and certification of the ship's skipper and crew, only apply to vessels longer than 10 or 12 m in length, depending their area of operation and engine power. Thus, they do not affect most fishers, since 93% of registered fishing vessels in Finland are less than 10 m in length. This could be one reason for the low rating of measure #3 (Rules, auditing and controls by the authorities on safety and accident prevention in fisheries).

At the other end of the scale, the measures given the lowest scores were; advice and help from others; e.g. trade unions and organizations, other education in relation to fisheries and safety, investigations and recommendations from the authorities and guidelines and information from the authorities on safety and accident prevention in fisheries.

Where other education in relation to fisheries and safety is concerned, the reason why it was rated so low may be that the respondents had worked as fishers for more than ten years, and few of them had any safety-specific education besides the safety training specifically aimed at fishers. Some respondents asked for an explanation of what the question implied, but one Danish fisher mentioned medical courses on board and a Faroese fisher mentioned a certificate in fire training he had obtained in addition to the mandatory safety training.

The lowest score over all was given to advice and help from others, e.g. trade unions and organizations. This suggests that fishers who participated in the survey do not perceive the trade unions as prominent actors or initiative-takers regarding safety-related issues. This point has previously been noted in the Norwegian context, as unions have organised both ship-owners and crew [15]. One Danish skipper and one Faroese fisherman stated that the trade unions relevance was

mainly related to the payroll, not safety. Besides the trade unions, other specific organizations were not defined in the survey. However, there were separate questions targeting consultants, authorities and investigation boards.

Guidelines and information from the authorities were not highly rated. This suggests either that little information is available, that fishers are not aware of relevant guidelines and information or that they do not find them as useful as other safety measures. It is important to note that this measure was separated from other governmental measures such as regulation, control and safety training. Rules, auditing and control is given a higher mean average score, and as we have seen, safety training was graded separately, and given a higher score in some of the countries (Norway, Iceland and Denmark). A previous review article concluded that the overall fatality rates in European and North American fisheries had decreased by about 50%. As for the Nordic countries, the review included Norway, Denmark and Iceland, but not Finland and the Faroe Islands. The probable explanation for the reduced fatality rates were seen to be the implementation of safety programmes, including safety training, inspections by the authorities and workplace risk assessments [8].

In this study "rules, auditing and control" and "workplace assessments" obtained a lower overall score than safety training. Fishers' dislike of safety regulations has previously been related to their perception of risk, arguing that they tend to minimise or even deny the real dangers of their work [21]. Similarly, the non-application of safety measures has been related to core values such as freedom and independence [1,14]. Another study found that fishers who had experienced accidents or near-accidents within the previous year displayed a significantly more positive attitude to rules and regulations [7]. The survey presented here supports the argument that fishers do not dismiss all safety measures, but in fact express their appreciation for several of them.

It is important to note that the aim of this study was to elucidate fishers' perceptions of the most important measures for preventing accidents. We have thus answered the question: What works? from the fishers' point of view. On the other hand, we have not tried to extract a correlation between the measures with the highest scores and the accident statistics. An earlier study that compared regulatory regimes and safety in six different countries [27], including Iceland as the only Nordic country, argued that it is difficult to identify any correlation between governmental strategies and accident trends. The types and levels of occupational risks vary and are influenced by a number of factors, including fisheries management. A recent FAO report that cited case-studies from several countries, including Iceland and Sweden, concluded that fisheries management may indirectly affect safety, and that safety assessments ought to be integrated in fisheries management as a direct objective [13]. The relationship between fisheries management and safety has also been related to the importance of legitimising power through co-management and involvement in regulatory processes [10].

4.1. Strengths and limitations

The results presented are based on personal interviews with fishers. Caution must be taken due to the rather small sample size from each country. A rather conservative statistical method was chosen to minimise type I errors in significance testing. Findings may be affected by differences in sample or interview techniques across the countries. There are also some differences in the selection of participants when it comes to position on board, i.e. most the fishers from Norway, Finland and Denmark were skippers, compared to the participants from the Faroe Islands and Iceland. Here, it must be noted that the crew size of the vessels these skippers work on varies greatly, and on smaller vessels, a skipper's duties may still include predominantly fishing tasks.

Furthermore, the analysis show that the range of scores differs between countries. Despite the range of scores (1–10), it seems that some

countries used the whole range, while others used a more "narrow" scale. This may be due to different perceptions or conventions of use of a 1–10 scale. These differences affect assessment of both inter country and inside country comparisons. For example, in Norway, all measures were found to have had at least a moderate to a good effect. In Iceland, the range is widest, and significant differences in means between the measures suggest that some of them were found to have had significantly higher influence than others.

5. Conclusions

This article has explored a variety of safety measures for fishermen, through their perspectives. Several similarities were found among the countries involved, as fishers do appear to appreciate measures that are practical and obvious in their everyday work.

Neither regulations nor other safety measures will have their intended effects if they are not implemented or used in everyday life. With accident prevention, it is essential to ensure that a common understanding of both challenges and solutions exists. It is essential to establish a dialogue between fishers who are exposed to occupational hazards, the regulatory authorities and other actors who are attempting to improve safety in the fishing fleet. As this article has demonstrated, measures that match fishers' own perceptions of what works are more likely to be followed up – and thus more likely to have an actual effect on safety. Consequently, involving fishers in the development and implementation of safety measures may be crucial to finding out what works.

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References

- [1] R. Bye, G.M. Lamvik, Professional culture and risk perception: coping with danger on board small fishing boats and offshore service vessels, *Reliab. Eng. Syst. Saf.* 92 (12) (2007) 1756–1763.
- [2] J.M. Christiansen, A.B. Carlsbæk, *Omvæltninger og Det Psykiske Arbejdsmiljø i Fiskeriet - i Ord Og Tal. Rapportserie 1*, Center for Maritim Sundhed og Samfund, 2015.
- [3] J.M. Christiansen, S.R. Hovmand, Prevention of accidents at work in Nordic fisheries – what has worked? TemaNord. Nordic Council of Ministers. Denmark. TemaNord, 2017, p. 509.
- [4] Danmarks Fiskeriforening, *Fiskeri i tal. Statistik fra Dansk erhvervsfiskeri*, 2017.
- [5] Fiskeridirektoratet, *Fartøi i merkeregisteret*. Retrieved 4th May 2016, from <<https://www.fiskeridir.no/Yrkesfiske/Registre-og-skjema/Fartoeystregisteret>>, 2016.
- [6] S. Grøn, H.B. Rasmussen, T.R. Poulsen, F.N. Christensen, *Sikkerhed i Fiskerierhvervet*, Senter for Maritim Sundhed og Samfund, 2014.
- [7] J.I. Håvold, Safety culture aboard fishing vessels, *Saf. Sci.* 48 (8) (2010) 1054–1061.
- [8] O.C. Jensen, G. Petursdóttir, I.M. Holmen, A. Abrahamson, J. Lincoln, A review of fatal accident incidence rate trends in fishing, *Int. Marit. Health* 65 (2) (2014) 47–52.
- [9] Jepsen, J.R, Christiansen, J.M (eds.), 1988. *Søfarts- og fiskerimedisin*. Sydjysk Universitetsforlag.
- [10] I.M. Kaplan, H.L. Kite-Powell, Safety at sea and fisheries management: fishermen's attitudes and the need for co-management, *Mar. Policy* 24 (6) (2000) 493–497.
- [11] K.O. Kaustell, T.E.A. Mattila, R.H. Rautiainen, occupational injuries and diseases among commercial fishers in Finland 1996–2015, *Int. Marit. Health* 67 (3) (2016) 163–170 (2016).
- [12] K.O. Kaustell, T.E.A. Mattila, T. Hurme, P.S. Salmi, R.H. Rautiainen, Predictors for occupational injuries and diseases among commercial fishers in Finland 1996–2015, *Int. Marit. Health* 68 (4) (2017) 196–202.
- [13] G. Knapp, *International Commercial Fishing Management Regime Safety Study: Synthesis of Case Reports*, Food and Agriculture Organization of the United Nations, Rome, 2016.
- [14] F. Knudsen, S. Grøn, Making sense of fishermen's risk perception, *Policy Pract. Health Saf.* 8 (2) (2010) 77–94.
- [15] P.H. Lindøe, Safe offshore workers and unsafe fishermen - a system failure? *Policy Pract. Health Saf.* 5 (2) (2007) 26–39.
- [16] M.A. McDonald, K.L. Kucera, Understanding non-industrialized workers' approaches to safety: how do commercial fishermen "stay safe"? *J. Saf. Res.* 38 (3) (2007) 289–297.
- [17] E. McGuinness, H.L. Aasjord, I.B. Utne, I.M. Holmen, Fatalities in the Norwegian fishing fleet 1990–2011, *Saf. Sci.* 57 (0) (2013) 335–351.
- [18] E. McGuinness, H.L. Aasjord, I.B. Utne, I.M. Holmen, Injuries in the commercial fishing fleet of Norway 2000–2011, *Saf. Sci.* 57 (0) (2013) 82–99.
- [19] OSF. Official Statistics of Finland: Natural Resources Institute Finland, Commercial marine fishery. Available at <<http://stat.luke.fi/en/commercial-marine-fishery>> (Accessed 6 February 2018), 2017a.
- [20] OSF. Official Statistics of Finland: Natural Resources Institute Finland, Commercial inland fishery. Available at <<http://stat.luke.fi/en/commercial-inland-fishery>> (Accessed 6 February 2018), 2017b.
- [21] J. Poggie, R. Pollnac, S. Jones, Perceptions of vessel safety regulations: a southern New England fishery, *Mar. Policy* 19 (5) (1995) 411–418.
- [22] SAS Enterprise Guide, v. 7.13 Software, SAS Institute Inc, Cary, NC, USA, 2016.
- [23] SINTEF Ocean, Database for fatal occupational accidents in the fisheries and aquaculture industry, Trondheim, 2017.
- [24] S.A. Sønvisen, T. Thorvaldsen, I.M. Holmen, A. Øren, Work environment and health in the fishing fleet: results from a survey amongst Norwegian fishers, *Int. Marit. Health* 68 (4) (2017) 203–210.
- [25] T. Thorvaldsen, The importance of common sense: how Norwegian coastal fishermen deal with occupational risk, *Mar. Policy* 42 (2013) 85–90.
- [26] T. Thorvaldsen, Managing risk in the Norwegian fishing fleet, *Policy Pract. Health Saf.* 13 (2015) 1.
- [27] M.J.S. Windle, B. Neis, S. Bornstein, M. Binkley, P. Navarro, Fishing occupational health and safety: a comparison of regulatory regimes and safety outcomes in six countries, *Mar. Policy* 32 (4) (2008) 701–710.