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Published in:
International Journal of Injury Control and Safety Promotion

DOI:
[10.1080/17457300802240503](https://doi.org/10.1080/17457300802240503)

Publication date:
2008

Document version
Final published version

Citation for pulished version (APA):
Laursen, L. H., Hansen, H. L., & Jensen, O. (2008). Fatal occupational accidents in Danish fishing vessels 1989-2005. *International Journal of Injury Control and Safety Promotion*, 15(2), 109-117.
<https://doi.org/10.1080/17457300802240503>

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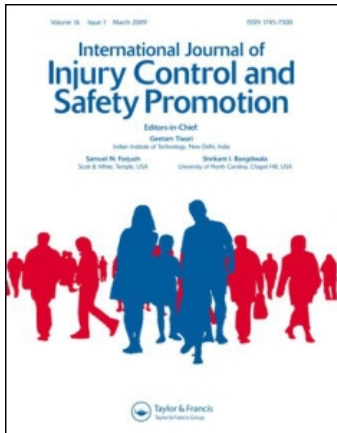
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International Journal of Injury Control and Safety Promotion

Publication details, including instructions for authors and subscription information:

<http://www.informaworld.com/smpp/title-content=t713734346>

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Online Publication Date: 01 June 2008

To cite this Article Laursen, Lise H., Hansen, Henrik L. and Jensen, Olaf C. (2008) 'Fatal occupational accidents in Danish fishing vessels 1989-2005', *International Journal of Injury Control and Safety Promotion*, 15:2, 109 — 117

To link to this Article: DOI: 10.1080/17457300802240503

URL: <http://dx.doi.org/10.1080/17457300802240503>

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Fatal occupational accidents in Danish fishing vessels 1989–2005

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(Received 5 February 2008; final version received 2 June 2008)

The purpose of the study was to study the circumstances and incidence rates of fatal accidents in inspection obligated and non-inspection obligated Danish fishing vessels to identify areas for prevention. Information about the fatalities came from maritime authority reports, including vessel disaster reports, post mortem reports, maritime inquiries and police reports. The person- and vessel years at risk came from the Danish Directorate of Fisheries. During the period 1989–2005, 114 fatalities occurred. Sixty-one of the fatalities occurred in 36 vessel disasters mainly caused by foundering/capsizing due to stability changes in rough weather and collisions; 39 fatal occupational accidents mainly occurred on the larger inspection obligated trawlers during fishing. In the remaining 14 other fatal accidents, the main causal factors were difficult embarking/disembarking conditions by darkness in foreign ports and alcohol intoxication. In the period 1995–2005, the overall incidence rate was 10 per 10,000 fishermen per year with no down-going trend during that period. The fatal accident rates are still too high, despite the efforts to reduce the risk. Increased focus on regular and repeated safety training for all fishermen and improved safety measures are needed, especially in the underscored areas of sea disasters concerning small vessels and occupational accidents on big vessels. Better registration of time at risk for fishermen is needed to validate the effect of the safety measures.

Keywords: occupational; accident; injury; fatality; fishing; fisherman

1. Introduction

Fishing is internationally known as a dangerous profession causing many occupational accidents and fatalities (Balanza & Mestre Molto, 1995; Kontosic & Vukelic, 1996; Jaremin, Kotulak & Starnawska, 1997a) with specific fatality rates ranging remarkably higher than the average for the general male population in different countries (Hasselback & Neutel, 1990; Jaremin, Kotulak, Starnawska, Mrozinski & Wojciechowski, 1997b; Lincoln, Husberg & Conway, 2001; Thomas, Lincoln, Husberg & Conway, 2001; Jaremin & Kotulak, 2004; Roberts, 2004; Chauvin & Le, 2006). However, there are big differences between different working processes and type of fishing.

The number of fatalities is influenced by many well-known risk factors (Driscoll, Ansari, Harrison, Frommer & Ruck, 1994; Törner, Karlsson, Saethre & Kadefors, 1995). Several studies have shown that the personal fatality rate due to vessel loss has decreased markedly by improved lifesaving equipment and safety attitudes (Conway & Lincoln, 1995; Lincoln et al. 2001; Thomas et al. 2001) while no decreased incidence of vessel loss has been observed. Alcohol may be a

contributing factor as recently reported in Polish fishery (Jaremin & Kotulak, 2004). Fatigue is a risk factor that has been shown to be in line with alcohol intoxication in the merchant fleet (Williamson, Feyer, Mattick, Friswell & Finlay-Brown, 2001) and recently also reported in fishery (Smith, Allen & Wadsworth, 2006). Of 81 fishermen, 60% stated that their personal safety had been at risk at work because of fatigue and 75% reported increasing fatigue effect with length of period at sea. Thus, fatigue seems to be an important factor in further preventive efforts.

To improve safety in Danish fishery, larger vessels are subjected to periodical obligatory inspection by the Danish Maritime Authorities (DMA). Until February 1999, the inspections included ships with a gross tonnage ≥ 20 and subsequently an overall length ≥ 15 m.

The purpose of this study was to describe the circumstances and causes of the fatal accidents in 1989–2005 and the incidence and time trend of fatal accidents in Danish professional fishing during the period 1995–2005. The overall aim was to give guidance for prevention.

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2. Methods

Occupational accidents aboard Danish vessels, including leisure time accidents among fishermen still signed on, should legally be reported to DMA. All fatal occupational accidents on Danish fishing vessels are investigated by the Division for Investigating Maritime Accidents (DIMA), which is an independent part of the DMA.

Information about the number and circumstances of fatal personal accidents and vessel disasters came from DIMA reports, i.e. vessel disaster reports, death certificates and post mortem reports, official marine inquiries, police reports and other specific information. Information about the vessels' size and type was further obtained from a DMA register available from 1989. The descriptive study covers the period 1989–2005.

The person- and vessel years at risk are derived from the electronically available dynamic vessel tables in the Danish Directorate of Fisheries (DDF, www.df.dk), including all full-time employed fishermen and vessels registered by 31 December. From 1995, the size of the vessels is available in DDF. Thus, separate calculation of incidence rates for non-inspected (NIO) and inspected (IO) vessels was possible from 1995. Annual cumulated incidence rates for fatalities and vessel disasters are based on the annual number of fatalities and vessel disasters from DIMA divided by the number of fishermen and number of vessels, respectively, by 31 December from DDF.

Registration as a full-time fisherman in the DDF register requires a previous 12 months period with minimum 60% of gross income earned by fishery. At a given time, presumably about 10% of active fishermen are not registered, as they have not yet been employed for 1 full year. On the other hand, fishermen are not obligated to inform about leaving fishery; only by death or by demanding special pension benefits, fishermen are 'automatically' signed off the register. Annual checks by DDF have shown that approximately 20% of the fishermen in the register do not count as full-time fishermen. All together, this means that the DDF denominator data may be as much as 10% too high. However, as it has not been possible to make a more precise estimation of the number of Danish fishermen, it was decided to present the incidence rates based on numbers from the DDF register.

The overall causes of personal fatalities were categorised in 'fatalities caused by vessel disasters', 'occupational fatalities' and 'other fatal accidents' (Hansen, 1996). The category of 'occupational fatalities' is sub-categorised by working process and

nearest causal mechanism at the time of the accident (Törner & Nordling, 1999; Jensen, Stage & Noer, 2005; Chauvin & Le, 2006). Only vessel disasters with at least one person lost were included. Vessels were categorised in two groups according to status concerning obligatory inspection: NIO and IO vessels as formerly described.

2.1. Statistics

Frequencies and incidence rates were calculated in SPSS 13.0 (SPSS Inc., Chicago, IL, USA), Excel and Access (Microsoft Office 2003; Microsoft Corporation, Redmond, WA, USA). Trend curves were calculated and linear regression R-square (SPSS), $p = 0.05$, was applied as basic for the trend curves in figures created in Excel. Rate-ratios were calculated for the incidences of the NIO and IO vessels.

3. Results

3.1. Overall results

During 1989–2005 a total of 114 fatal accidents were reported, primarily occurring on trawlers and gill-netters (94%) (Table 1). Vessel disasters caused 53.5% of the fatalities. During 1995–2005, the annual total number of fatalities decreased, range 0–9 fatalities per year (0–7 for the NIO vessels and 0–5 for the IO vessels). During 1995–2005, the number of full-time fishermen decreased from 6992 to 4073 per year (from 3786 to 2347 on NIO and 3206 to 1726 on IO vessels, respectively). Thus, the incidence rate of person fatalities per year during 1995–2005 was on average 10.0 per 10,000 Danish full-time fishermen with the trend curve almost status quo. Major fluctuating rates were also found during the latest 6 years (Figure 1).

3.2. Fatalities caused by vessel disasters

During 1989–2005, 61 fishermen died in 36 vessel disasters (Table 2).

3.2.1. Non inspection obligated vessels' disasters

Table 2 shows 34 fatalities in 22 NIO fishing vessel disasters. In all but one of the foundering disasters, stability changes of the vessels during the fishing process were found. Overload was reported in 50% of disasters on loaded vessels. A total of 13 disasters (59%) took place in minimum strong breeze. One fatal collision and one fire/explosion disaster took place in fine weather. Alcohol intoxication was suspected to be involved in the collision disaster. A total of 13 disasters (59%) took place on small one-man-operated vessels.

Table 1. Fatal accidents on Danish fishing vessels in 1989–2005 (n = 114) by type and obligatory and non-obligatory vessel inspection by the authorities.

Vessel type and size	Causes of deaths								Grand Total
	Vessel disasters		Occupational accidents		Other accidents		Total		
	NIO	IO	NIO	IO	NIO	IO	NIO	IO	
	n = 34	n = 27	n = 14	n = 24	n = 9	n = 5	n = 57	n = 57	
Trawler	17	14	8	21	5	3	30	38	68
Gill-netter	16	13	4	1	4	1	24	15	39
Danish seine			1	2			1	2	3
Liner			1				1	0	1
Pound net	1			1			1	1	2
Other						1	0	1	1
Total	34	27	14	25	9	5	57	57	114

IO = inspection obligated vessels; NIO = non-inspection obligated vessels.

Note: The causes are divided into three main groups: vessel disasters at sea (n = 61; 53.5%), occupational accidents on board (n = 39; 34.2%) and other accidents (n = 14; 12.3%), mainly in port while embarking/disembarking the vessel.

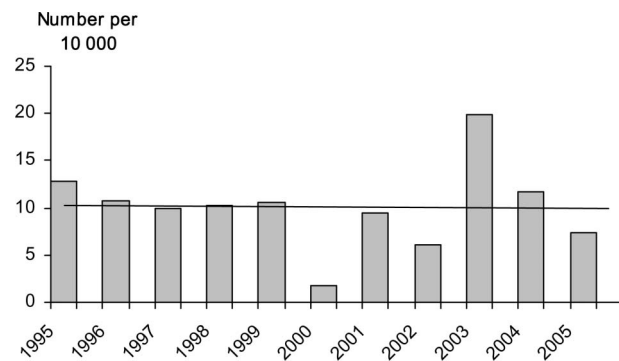


Figure 1. Incidence rates of persons lost in fatal accidents per 10,000 Danish full-time fishermen per year during 1995–2005 (trend curve analysis = non-significant).

3.2.2. Inspection obligated vessels' disasters

Table 2 shows 27 fatalities in 14 IO vessel disasters. During fishing, two of the three IO vessels foundered due to lack of stability and inappropriate handling of the lift. In addition, one of the foundering disasters during travelling while loaded was caused by stability changes. Bad weather conditions were reported in all but one foundering disasters during travelling. The remaining vessel disaster took place in fine weather during towing. Two men died – both alcoholic intoxicated. In three of four IO vessels' collision disasters, stormy or foggy weather was reported. Fire/explosion caused two IO vessels' disasters, one during fishing the other in port due to alcohol intoxication and smoking in bed.

3.2.3. Incidence rates and trends

During 1995–2005, the trend curve of the incidence rates of fatal accidents by vessel disasters increased

slightly for the NIO vessels and decreased for the IO vessel disasters, though both insignificantly (Figure 2). This subject is mirrored by the rate-ratio (IO/NIO) 1.0 for 1995–2005, reversing from 1.5 in 1995–2000 to 0.6 in 2001–2005.

3.3. Vessel disasters with at least one person lost

The trend curve of incidence rates of vessel disasters with at least one person lost per 10,000 Danish fishing vessels per year in 1995–2005 was almost status quo. The incidence rates were considerably higher for the large IO vessels than for the NIO vessels (Figure 3), mirrored by calculated rate-ratios (IO/NIO) 3.0 for 1995–2005.

3.4. Occupational fatalities

A total of 39 occupational fatalities occurred in the period 1989–2005 (Table 3), with a significant decreasing tendency in total numbers.

3.4.1. Circumstances of vessel and working process

The occupational fatalities mainly took place on IO trawlers (53.8%), NIO trawlers (20.5%) and NIO gill-netters (10.3%) (Table 1). Table 3 shows injury mechanisms vs. vessel and working process distributed on NIO and IO vessels. Four mechanisms were predominant: 'fall overboard'; 'jammed'; 'hit by object'; 'pulled out by gear'.

3.4.2. Occupational fatalities on non inspection obligated vessels

A total of 11 of the 14 fatal occupational accidents occurred on one-man-operated, NIO vessels. 'Fall

Table 2. Fatalities in vessel disasters 1989–2005, distributed on vessel activity and type of disaster (61 persons in all were lost).

Vessel activity	Type of vessel disaster								Grand Total
	Foundering/ Capsizing n = 28 (47 fatalities)		Collision n = 5 (10 fatalities)		Fire/explosion n = 3 (4 fatalities)		Total n = 6 (61 fatalities)		
	NIO	IO	NIO	IO	NIO	IO	NIO	IO	
In port						1 (1)		1 (1)	1 (1)
Fishing	7 (11)	3 (5)	1 (1)	1 (1)	1 (2)	1 (1)	9 (14)	5 (7)	14 (21)
Travelling loaded	8 (11)	3 (7)		1 (1)			8 (11)	4 (8)	12 (19)
Travelling empty	2 (3)	2 (4)					2 (3)	2 (4)	4 (7)
Unknown	3 (6)			2 (7)			3 (6)	2 (7)	5 (13)
Total	20 (31)	8 (16)	1 (1)	4 (9)	1 (2)	2 (2)	22 (34)	14 (27)	36 (61)

IO = inspection obligated vessels; NIO = non-inspection obligated vessels.

Note: n = number of vessel disasters with at least one person lost (number of persons lost – fatalities). Foundering and capsizing disasters are grouped together as foundering.

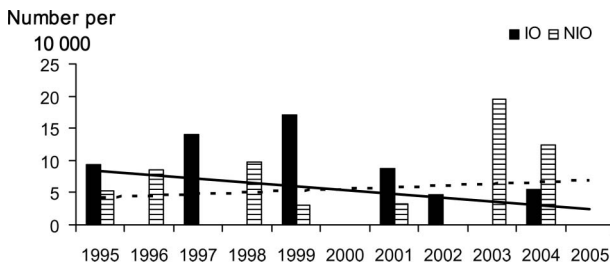


Figure 2. The incidence rates of persons lost in fatal vessel disasters per 10,000 Danish full-time fishermen per year during 1995–2005. IO = inspection obligated vessels; NIO = non-inspection obligated vessels. (Trend curve analysis = non-significant.)

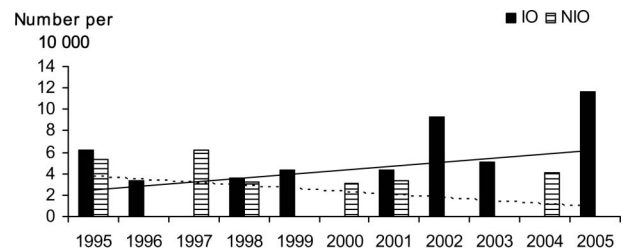


Figure 4. The incidence rates of fatal occupational accidents per 10,000 Danish full-time fishermen per year during 1995–2005. IO = inspection obligated vessels; NIO = non-inspection obligated vessels. (Trend curve analysis = non-significant.)

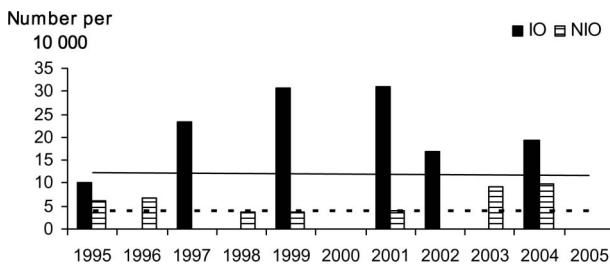


Figure 3. The incidence rates of vessel disasters with at least one person lost per 10,000 Danish fishing vessels per year in 1995–2005. IO = inspection obligated vessels; NIO = non-inspection obligated vessels. (Trend curve analysis = non-significant.)

overboard' had not occurred since 2000. 'Jammed' in trawl drum during fishing caused four fatalities, all on one-man-operated vessels. Two fishermen were 'pulled out' while standing on a loop and shooting of the net

during 'fishing'. One fisherman drowned as he went outboard removing a rope from the propeller and one got a fatal *vibrio* bacterial infection by a 'prick' from a hook. Bad weather – strong breeze – was reported in one of four cases reporting weather conditions.

3.4.3. Occupational fatalities in obligatory inspected vessels

In total, 25 fatal occupational accidents on inspected vessels mainly took place on trawlers (Tables 1 and 3). 'Fall overboard' fatalities had not occurred since 2000. All but one 'jammed' fatalities took place on trawlers during fishing. 'Hit by an object' fatalities were reported only on IO trawlers. 'Pulled out' in three instances took place by handling the trawl. One fatality was caused by a person 'hitting against object' (the mast), shipping a heavy sea; one by 'breathing poisoning gasses' during unloading; one as the fisherman went outboard removing rope from the propeller;

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Table 3. Number of fatal occupational accidents distributed by injury mechanism vs. vessel and working process.

Vessel process	Injury Mechanism														Main total n = 39				
	Pulled out by fishing gear						Injury Mechanism						Total						
	n = 6	Fall over board		Fall to lower level		Hit by object		Hitting against object		Jammed		Pricks/cuts		Unfavourable working posture		Breathing poisoning gases			
NIO IO	n = 11	NIO IO	n = 1	NIO IO	n = 7	NIO IO	n = 1	NIO IO	n = 9	NIO IO	n = 1	NIO IO	n = 1	NIO IO	n = 2	NIO IO	n = 39		
Working process/activity																			
In port																			
Mooring Loading/unloading				1					1									1	
Other																		2	
Fishing																			
Hauling of gear/trawl	2	3	1		2	2			1	2								1	
Shooting of gear/trawl	2	1	1		2	2			1	1								10	
Working with fishing tackle																		7	
Repairing fishing tackle																		10	
Loading/unloading																		2	
Other																		1	
Travelling from fishery																			
Working with fishing tackle	1																	1	
Moving on deck																		1	
Clearing deck																		1	
At sea																			
Unknown process		1																1	
Total	2	4	6	5	1	7	1	1	4	5	1	1	1	1	1	1	14	25	39

IO = inspection obligated vessels; NIO = non-inspection obligated vessels.

Note: Shaded columns represent IO vessels.

The major part of the accidents occurred in the vessel during the process of fishing 79.5% (31/39), mainly during the working processes hauling and shooting of gear and handling fishing tackle working with and repairing).

and one 'fall to lower level' during mooring by unsuccessfully jumping from the vessel to the wharf. Weather conditions were reported in 13 cases, six of these in minimum strong breeze.

3.4.4. Trends of incidence rates and rate ratios

During 1995–2005, the trend of the incidence rates of occupational fatalities was increasing for the IO vessels, and decreasing for the NIO vessels – although none of these was significant (Figure 3). This subject was mirrored by a fatal incidence rate ratio for IO/NIO vessels, 1.7 for the whole period 1995–2005, increasing from 1.0 in 1995–2000 to 3.9 in 2001–2005.

3.5. Other fatal accidents

During 1989–2005, 14 fatal drowning accidents (all single) occurred in port areas on both NIO and IO vessels. Of these, 10 took place in foreign ports – all but one in darkness. Alcohol consumption was presumed to be involved in three of the four fatalities taking place in Danish ports, all in darkness.

Six of the 14 fatalities took place while the fishermen were embarking/disembarking the vessels. The fishermen fell down and drowned between the vessel and the wharf, some unconscious after hitting the vessel or wharf during the fall and hit by cold shock. The alcohol blood level was tested only in two cases, both with considerable intoxication levels (3.54 and 2.82 ‰). In an additional four cases, alcoholic intoxication was suspected.

4. Discussion

4.1. Overall results

Former studies on Danish vessels found incidence rates of 24 deaths per 10,000 per year (1970–1972) and 18 per 10,000 (1980–1985) (Vanggaard & Nielsen, 1977; Søfarts-og Fiskerimedisin 1988). This study has shown a decreasing tendency compared to the older data mentioned above (10 per 10,000). However, no decreasing tendency was observed during the latest period 1995–2005. The incidence is higher than in Swedish fishery, with 6.7 deaths per 10,000 fishermen per year from 1983 to 1995 (Törner & Nordling, 1999). In Iceland and Norway, a remarkably decreasing tendency in incidence rate of fatalities during 1980–2006 has been found, coincident with increased safety training of fishermen (Research Unit of Maritime Medicine, 2007). In Danish shore industries, 0.38 fatal accidents per 10,000 full-time workers per year was found in 1995–2005 (Arbejdstilsynet, 2006); thus, 26 times lower than for fishing. In 1980–1985, the corresponding rate was 36 (Bang et al. 1987). The

comparison should be done with some caution as definitions are different in the two groups.

In conclusion, there has been a decreasing difference between the incidences of fatal accidents among on-shore workers and fishermen. The goal of reaching the same level still seems far away and initiatives need to be taken if the situation is to be changed.

4.2. Fatalities caused by vessel disasters

Vessel disasters were the main cause of fatalities (53%) in Danish fishery in the period 1989–2005. It has remained almost unchanged with 57% found in 1980–1985 (Bang et al. 1987) and in line with studies elsewhere: Norway 49% in 1961–1975 (Pedersen, 1978) and US 59% in 1994–1999 (Jin, Kite-Powell & Talley, 2001).

For the smaller NIO vessels, the most important factors causing foundering and capsizing during travelling fully loaded was poor stability of the vessel caused by inappropriate alterations in the vessel construction or rigging, often in combination with overloading or loading of catch on deck. Poor stability was also found to be the major cause of disasters during hauling of the fishing gear. Thus, ensuring stability of the small vessels – by regularly inspections and training of crews in awareness of vessel stability – is an important issue in further preventing efforts.

The incidence rates of vessel disasters with at least one person lost were almost status quo during 1995–2005 with an increasing tendency for the bigger IO vessels – in line with findings in a Swedish study (Törner & Nordling, 1999) – and about three times higher than the incidence of the NIO vessels. However, given that a disaster had taken place, the risk of a fatal outcome was lower for the IO vessel than for the NIO vessels. This means that lifesaving equipment and education of fishermen seems to have improved in Danish IO fishery vessels, in line with findings in other nations (Conway & Lincoln, 1995; Lincoln et al. 2001; Thomas et al. 2001). Thus, regular inspections may have contributed to improvement of equipment; however, it did not affect the incidence rate of sea disasters of IO vessels during 1995–2005. Fatigue and fishermen ignoring bad weather conditions seems to be human factors hindering improvement of the incidence rate of vessel disasters, and further studies should concentrate on these factors.

4.3. Fatal occupational accidents

Fatal accidents mainly occurred on trawlers during hauling and shooting of the gear and working with the fishing tackle, consistent with findings in other studies (Dorval, 1984; Jensen, 1996; Törner & Nordling, 1999). 'Fall overboard' fatalities seem to have been

successfully prevented in Danish fishery, decreasing from 23% in 1980–1985 (Bang et al. 1987) to 9.6% in 1995–2000 and none reported since then. During the latter part of the study period, it gradually became mandatory to fit rails aboard all fishing vessels. Fall to a lower level only caused one fatal accident.

For the smaller NIO vessels, single accidents dominated. Among these, ‘jammed by trawl drum’ typically occurred, as the fishermen were not able to stop the trawl drum when caught. The winches are built to stop automatically if the handles are not activated. This automatic function was either intentionally blocked or was not functioning properly.

‘Pulled out’ took place on NIO and IO vessels as well as by shooting and by hauling the gear. Efforts to improve safety attitudes concerning the fishermen’s awareness during these working processes are of utmost importance. In two instances, the accidents took place while the fishermen went outboard to remove rope from the propeller. One-man-operated vessels in this sense exert a major challenge in preventive efforts.

‘Hit by object’ all took place on IO trawlers, mainly during handling the trawl. Heavy objects such as trawl doors, blocks, booms, wires, steering bars and hooks jamming and hitting the fisherman were registered as causal factors. There was no systematically safety reporting in the DIMA reports in the entire period from 1989. However, in all the six accidents after 1995, important lack of safety awareness was reported by DIMA and only one minor equipment failure.

There was an unexpected slightly increasing incidence of fatal occupational accidents on the IO vessels and correspondingly decreasing on NIO vessels, which has not been found in other studies. This calls for focus on improvement of safety attitudes during equipment handling combined with improved inspection of equipment and handling on the big IO vessels.

4.4. Other fatal accidents

A total of 14 fatal drowning accidents took place, mainly by embarking/disembarking the vessel, which is known as one of the most risky tasks in fishing (Hansen & Jensen, 1997; Jensen, 2006; Jensen, Stage & Noer, 2006), usually performed by jumping from the wharf to the gunwale or vice versa without any exterior safety precaution. Furthermore, rescue manoeuvres may be difficult or impossible to carry out in the narrow space between the vessel and the wharf. More extensive use of proper gangways and safety nets would probably help to prevent this kind of accident.

Alcohol intoxication and performing unsafe acts in darkness seem to play a major role. Recently, it has been shown that alcohol was implicated in at least one-quarter of accidents among Polish fishermen (Jaremin

& Kotulak, 2004). Few data on alcohol intake were available in this study.

4.5. Data validity

No absolutely valid source for calculating the person-time at risk of Danish full-time fishermen was available. In addition, the sources of information about time at risk have been changed during the study period, diminishing the possibility to obtain identical data for the whole period. The few cases put some limits on the possibility to make more general conclusions about the causes. This calls for an international corporation for studies of fatal accidents in fishing to obtain larger study material.

The NIO fishing vessels were mainly small, with fewer days at sea per year than the large IO vessels. As the person-time at risk is calculated to be equal for small and larger vessels, the incidence rates for the NIO vessels erroneously tend to be underestimated compared with the incidences of the IO vessels, thus affecting the IO/NIO rates.

The problem of getting proper denominator data concerning number of employees, not to mention the total amount of working days or even working hours at sea, is well known to limit comparison with other occupations and findings in other countries. However, the international tendency to use cumulative rates by using the annual number of registered fishermen means that data are handled the same way, thus allowing future comparison between countries.

4.6. Implications for prevention

4.6.1. Vessel disasters

Preventing NIO vessel sea disasters should concentrate on securing inspections when the vessels have gone through major changes with possible impact on stability (Lincoln et al. 2001) and implementation of lifesaving precautions (Conway & Lincoln, 1995), including focus on weather forecasts. One-man-operated vessels exert a special problem in respect of this.

Changes in stability of the vessels caused by handling of big catches and bad weather conditions also played an important role for IO vessels foundering. Bad weather, including storm and low sight, was the main cause of collision disasters. However, collisions also took place in fine weather, putting the focus on fatigue as a risk factor.

4.6.2. Fatal occupational accidents

Despite regular inspections of the larger vessels during the latest years, prevention of fatal occupational

accidents has not been improved, indicating a need for renewal of initiatives focusing on human factors such as safety attitudes, including fatigue. This subject is so much more important as fishery is increasingly dominated by large vessels. For the smaller NIO vessels' accidents, 'jammed by trawl drum' could be prevented by secured function of a dead man's handle. In addition, drowning accidents caused by the mechanism 'pulled out' is a major challenge in preventive efforts. Lack of safety attitude is an important risk factor and should be improved in all sectors of fishing. The International Safety Management (ISM) Code – initiated to achieve unique safety and environmental standards – has not so far been implemented in fishing vessels. Obviously, this calls for the ISM Code to be implemented in fishery as well.

4.6.3. Other fatal accidents

Accidents caused by embarking and disembarking the vessels emphasise the importance of easier and safer admittance to the fishing vessels and safety nets should be available. The importance of an improved safety attitude to alcohol intake should also be emphasised.

5. Conclusions

The fatal accident rates are still too high, despite efforts to reduce the risk. Increased focus on regular and repeated safety training for all fishermen and improved safety measures is needed, especially in the underscored areas of sea disasters concerning small vessels and occupational accidents on big vessels. Better registration of time at risk for fishermen is needed to validate the effect of the safety measures.

Acknowledgements

The authors wish to thank DIMA for providing the case material at our disposition; ship surveyor Arne Mikkelsen, the DMA for assistance by determination of vessel size; Lone Jensen and Arne Lorentzen, Fishery Inspection, Esbjerg, for information about the validity of data on fishermen registered in the DDF; Troels Pade, Mette Wandall and Rasmus Nielsen of the statistical department of DDF for advice and assistance by use of the dynamic vessel register; Mogens Nielsen, Jesper Nielsen and Flemming Christensen, the Danish Fishermen's Occupational Health Services for assistance by searching for missing information about vessels. There was no conflict of interests in the writing of this paper.

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