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ORIGINAL PAPER

Human and fishing vessel losses in sea accidents in the UK fishing industry from 1948 to 2008

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ABSTRACT

Objective. *To investigate long-term trends in mortality rates for accidents to fishing vessels in the UK fishing industry from 1948 to 2008; to investigate the circumstances and causes of these fishing vessel accidents and trends in fishing vessel losses.*

Material and methods. *Examination of paper death inquiry files, death registers, marine accident investigative files, annual casualty and death returns.*

Results. *Of 1039 fatalities from accidents to UK fishing vessels from 1948 to 2008, most (65%) resulted from vessels that foundered (or capsized or disappeared), followed by vessels grounding (21%), collisions (7%), and fires and explosions (5%). There was a significant increase over time of 1.04% per year in the overall fishing vessel loss rate and for vessels that foundered (5.19%), a reduction for vessels grounding (1.13%), but no trends for collisions or fires and explosions. Regarding mortality, there was a significant reduction over time for grounding (1.44%) and a non-significant reduction for vessel accidents overall, but no trends for other types of vessel accident. Mortality was highest during the winter months (for foundering and grounding), during night time (for grounding, fires and explosions), and afternoons (foundering and collisions). Since 1976, most fatalities from collisions (83%) occurred in the English Channel and North Sea, while 49% from grounding occurred off the west coast of Scotland.*

Conclusion. *The mortality rate from fishing vessel casualties in UK fishing is still very high. Fatalities in recent years have often been linked to fishing vessels that are unstable, overloaded, and unseaworthy.*

INTRODUCTION

Globally, the number of commercial fishermen in the world has increased sharply over the last 40 years from about 13 million in 1970 to 43.5 million in 2008, most of whom are in Asia and Africa [1]. Over the same time period, the fishing fleets of many European and western countries have contracted, which reflects diminished fish stocks in some areas and increases in regulations and fishing restrictions for conservation purposes. Globally, the health and safety of fishermen has been linked to principles and rights at work, employment security, social protection, and social dialogue [2].

Accidents involving fishing vessels have been shown to cause between 40% and 70% of all fatal accidents across fishing fleets internationally, including those of Alaska, Australia, Denmark, Norway, Poland, the UK, and the USA [3–13]. Adverse weather conditions and badly maintained or unseaworthy fishing vessels have often been identified as major

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causes of fishing vessel accidents that lead to heavy loss of life [6, 10, 11, 14, 15].

In the UK fishing industry there has been little improvement in the overall fatal accident rate during the last 60 years. However, it is less clear whether there has been any improvement in mortality from accidents to fishing vessels, and from different types and different causes of fishing vessel accident. Additionally, little has been reported about how loss of life from fishing vessel accidents is related to factors such as the overall vessel accident rate, the month of the year, the time of day, and the geographical location.

Since the late 1980s, there have been substantial reductions over time in the mortality rate from fishing vessel accidents in the Alaskan and US fishing industries, although the trend over time in losses of fishing vessels has been more stable [9, 16]. Across Europe, reductions in mortality rates from vessel accidents have been less apparent and trends in vessel losses are less clear [11, 14, 17, 18].

The main objectives of this study were, firstly, to investigate long-term trends in mortality rates for accidents to UK fishing vessels from 1948 to 2005, secondly to investigate the circumstances and causes of these fishing vessel accidents, and thirdly to investigate trends in fishing vessel loss rates. The overall aim was to inform prevention of mortality.

MATERIAL AND METHODS

Deaths at sea among fishermen in the UK fishing industry have not normally been registered with local registrars of deaths, but instead with the Registrar General for Shipping and Seamen (RGSS), later renamed the Registry of Shipping and Seamen (RSS). This study included all deaths resulting from fishing vessel accidents that occurred among full-time or part-time fishermen who were employed on board UK registered fishing vessels of any size — and with crews of any size including lone fishermen — from 1 January 1948 to 31 December 2008. Deaths among passengers and hobby fishermen who do not fish commercially were excluded, as were fatalities that arose from personal accidents to fishermen that were not connected to an accident to the fishing vessel.

Details of all deaths from accidents to UK fishing vessels, of the causes and circumstances surrounding the vessel accidents, and of the fishing vessels themselves were obtained from extensive reviews of several information sources. Firstly, paper death inquiry files which included marine inquiry reports (covering the period from 1976 to 2008) and death registers (from 1965 to 2008) held at the RSS. Secondly, paper marine accident investigation files held at the Marine Accident Investigation Branch (MAIB), narrative and electronic accident data provided by the MAIB and investigation, annual and safety reports published by the MAIB. These covered the period from 1989 to 2008, following the formation of the MAIB in 1989. Thirdly, annual death returns, which were based on the RSS death inquiry files and death registers (covering the period from 1948 to 1975). These returns were published by the Ministry of Transport and successive government departments [19–23]. Fourthly, through information provided through Board of Trade 'wreck reports' [24], hulltrawler.net [25], Medline, OSH-ROM and other literature searches, and from information provided by members of the Ships Nostalgia website. The main classification of the causes of the fishing vessel casualties was based on that used in the official death returns and by the MAIB. Additonally, ascertainment of major contributory causes of casualties was also based on the classification used by the MAIB.

Information on the populations of fishermen and fishing vessels in the UK fishing industry were obtained from publications produced annually by the former Ministry of Agriculture and Fisheries for the period from 1948 to 1954 [26] and its successors, the Ministry of Agriculture, Fisheries, and Food (MAFF) from 1955 to 1998, [27] and the Department for Environment, Food, and Rural Affairs (DEFRA) from 1999 to 2008 [28]. The number of fishermen fell from 47,647 in 1948 to a low of 12,729 in 2007, before increasing slightly to 12,761 in 2008.

Mortality rates were calculated using deaths from fishing vessel accidents as the numerators and the populations of fishermen-years at risk as the denominators, and were expressed per 100,000 fishermen-years at risk. Fishing vessel loss rates were calculated using fishing vessels that were lost as the numerators and the populations of fishing vessels in the UK fleet as the denominators, and were expressed per 1000 fishing vessel-years at risk. Statistical methods include linear regression and Spearman's rank correlation.

RESULTS

Of 1,039 fatalities from fishing vessel accidents in the UK fishing industry from 1948 to 2008 (Table 1), the majority (65%) arose through vessels that foundered, capsized, or disappeared, including 3% from vessels that capsized after snagging gear on under-

Table 1. Numbers of deaths from accidents to fishing vessels, fatal accident rates, and percentage annual changes in fatal accident rates, according to the type of vessel accident in the UK fishing industry, 1948–2008

Cause of death	No. of deaths from accidents to fishing vessels	Mortality rate (per 100,000 fishermen-years)	Percentage annual change in the mortality rate (p-value)
Fishing vessel accidents:			
— Foundered/capsized/missing	649	43.4	–0.69% (0.31)
— Capsized — snagged fishing gear	33	2.2	–0.35% (0.91)
— Collisions	70	4.7	0.29% (0.87)
— Grounded	222	14.9	–1.44% (0.019)
— Fires & explosions	55	3.7	–0.09% (0.95)
— Other	10	0.7	
Total deaths from vessel accidents	**1039**	**69.6**	**–0.84% (0.074)**

Notes

Vessels that capsized as a result of fishing gear that snagged are classified during the years from 1976 to 2008 rather than from 1948 to 2008. Corresponding percentage annual changes in the mortality rates during the recent 20-year period from 1989 to 2008 were as follows: all casualties (1.03% reduction; p = 0.40) foundered/capsized/disappeared (1.28% reduction; p = 0.115), capsized — snagged gear (1.74% reduction; p = 0.001), collisions (1.68% reduction; p = 0.17), grounded (2.68% increase; p = 0.47), fires and explosions (2.14% increase; p = 0.034)

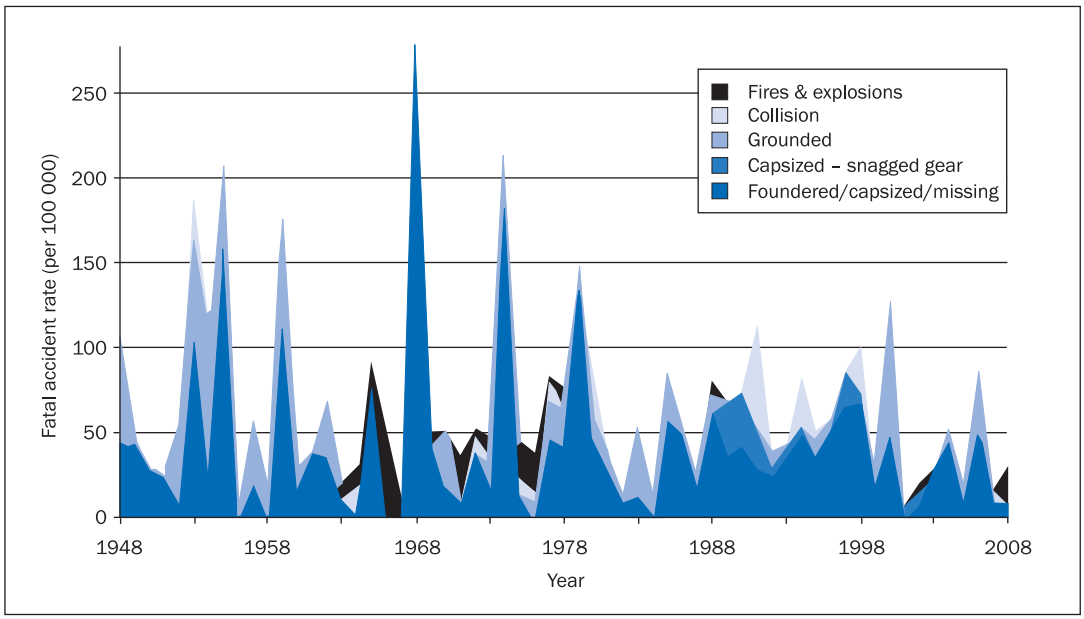


Figure 1. Trends in mortality rates for accidents to fishing vessels in the UK fishing industry, 1948–2008, according to the type of vessel accident

Notes

Vessels that capsized as a result of fishing gear that snagged are classified during the years from 1976 to 2008 rather than from 1948 to 2008. Mortality rates for all fishing vessel accidents over time were as follows: 1948–1959 (85 per 100,000 fishermen-years; based on 397 fatalities), 1960–1969 (65 per 100,000; 166 fatalities), 1970–1979 (79; 176), 1980–1989 (49; 111), 1990–1999 (67; 133), 2000–2008 (44; 54)

water obstructions. 21% resulted from vessels that were wrecked after grounding or stranding, 7% were from collisions with merchant ships or other fishing vessels, 5% were from fires and explosions, and 1% were from various other causes (Table 1).

TRENDS IN MORTALITY RATES FROM FISHING VESSEL ACCIDENTS

Over the 61-year study period from 1948 to 2008, the mortality rate for fishing vessel accidents was 70 per 100,000 fishermen, years. The rate

Table 2. Numbers of fishing vessels losses, loss rates, percentage annual changes in loss rates, and ratios of fatalities to vessel losses, according to the type of vessel loss in the UK fishing industry, 1948–2008

Type of fishing vessel loss	No. of fishing vessels lost	Vessel loss rate (per 1000 Vessel–years)	Percentage annual change in the vessel loss rate (p-value)	Ratio of fatalities to vessel losses
Fishing vessel losses:				
– Foundered/capsized/missing	893	1.82	5.19% (< 0.001)	0.76
– Collisions	152	0.31	0.28% (0.42)	0.46
– Grounded	394	0.80	–1.13% (< 0.001)	0.57
– Fires & explosions	180	0.37	–0.60% (0.50)	0.31
– Other	42	0.09		
Total fishing vessel losses	**1661**	**3.39**	**1.04% (0.007)**	**0.63**

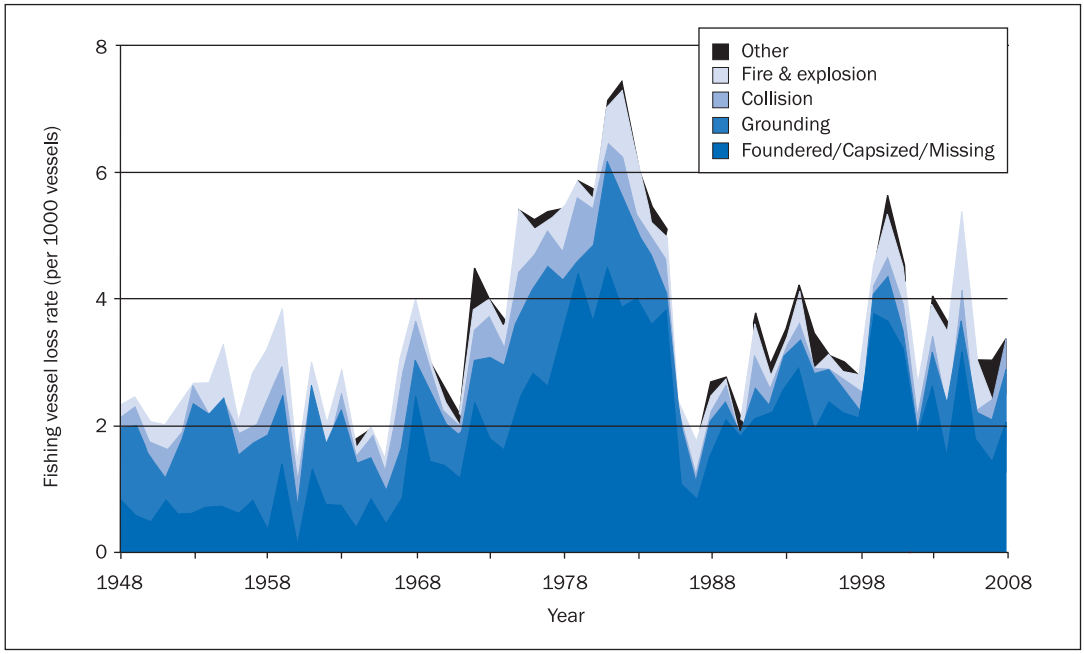


Figure 2. Trends in fishing vessel loss rates in the UK fishing industry, 1948–2008, according to the type of vessel accident

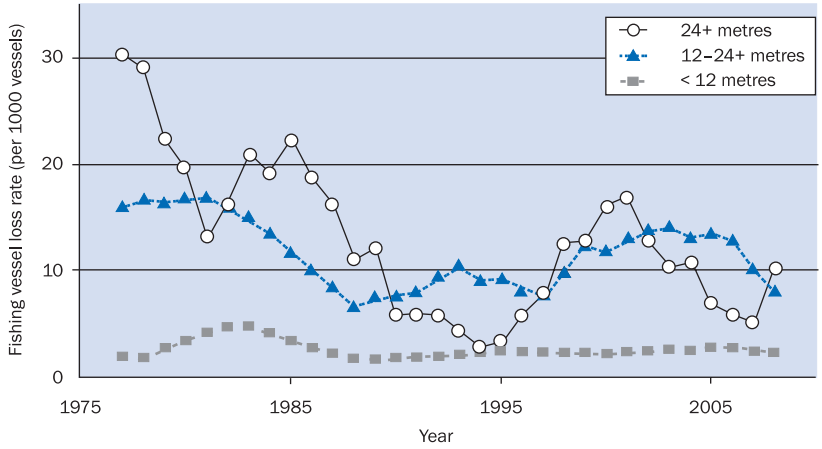
during the recent period from 2000–2008 (44 per 100,000) is lower than during the previous years ($p < 0.05$). Over the the 61 years, there was no significant trend in the mortality rate, nor during the more recent 20 years from 1989 to 2008 (Table 1 notes). Similarly, there were no significant trends in mortality from vessels that foundered, capsized or disappeared, capsized after snagging fishing gear, were involved in collisions, or had fires or explosions on board. There was, however, a significant reduction from 1948 to 2005 in mortality from fishing vessels that grounded ($p = 0.019$).

There were major peaks in the mortality rate in 1953, 1955, 1968, 1974, 1979, and 2000 (Figure 1), which co-incided with major fishing vessel losses with heavy loss of life. These include *Michael Griffith* and *Guava* (1953), *Lorella* and *Roderigo* (1955), *Kingston Peridot, Ross Cleveland* and *St Romanus* (1968), *Gaul* (1974), *Ocean Monarch* and *Tarradale II* (1979), and *Arosa* and the *Solway Harvester* (2000).

FISHING VESSEL LOSS RATES

Over the 61-year study period, there were 1,661 reported losses of fishing vessels (casualty rate = 3.4 per 1,000 fishing vessel-years; Table 2). Most vessel losses (54%) were attributed to foundering, capsize, and disappearances, followed by grounding/stranding (24%), fires and explosions (11%),

A. Fishing vessel losses



B. Mortality from accidents to fishing vessels

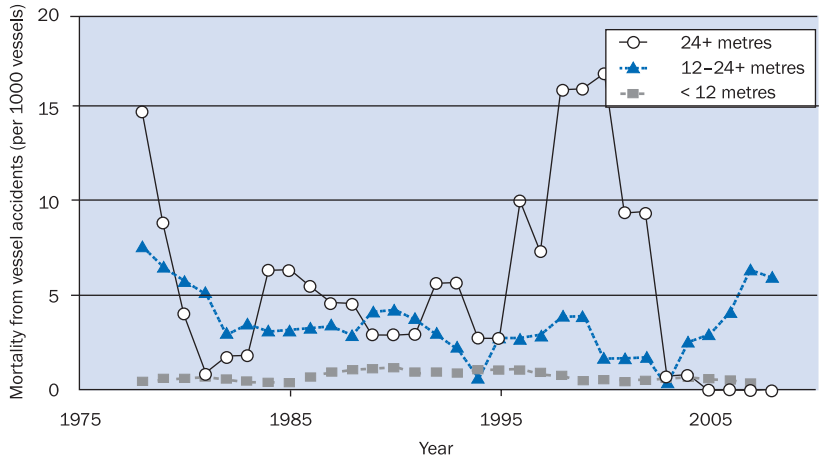


Figure 3. Trends in A. fishing vessel loss rates and B. mortality rates from accidents to fishing vessels in the UK fishing industry, 1977–2008, according to the length of the fishing vessel

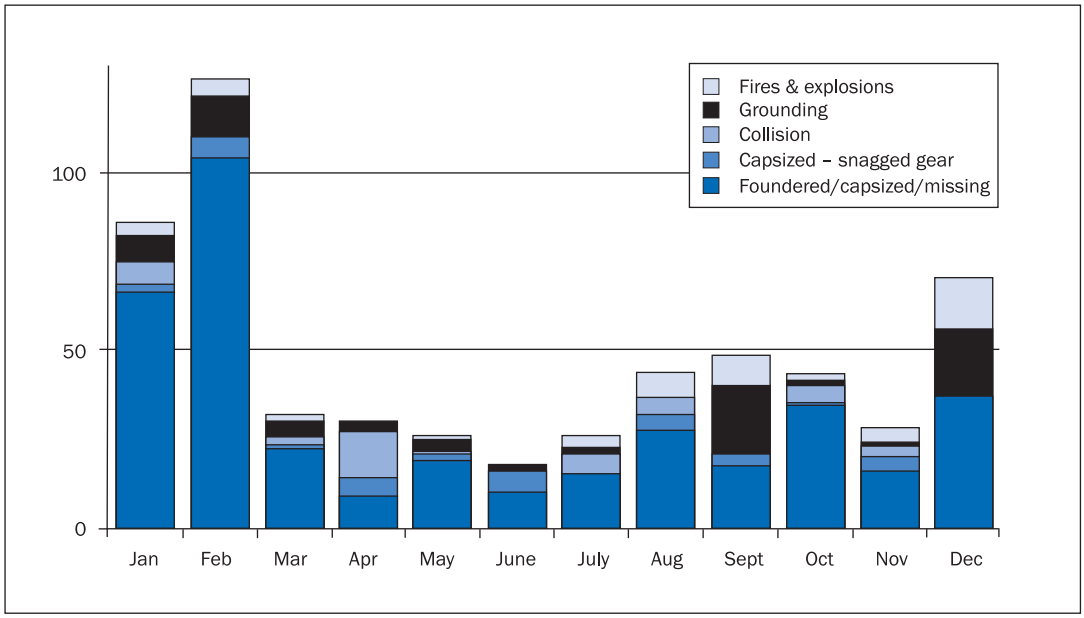
Notes
The fishing vessel loss and mortality rates are smoothed using five-year moving averages

collisions (9%), and other causes (3%). Overall, mortality risks were highest for vessels that foundered, capsized or disappeared (ratio of 0.76 fatalities per vessel loss) followed by vessels that grounded (0.57), collisions (0.46), and fires and explosions (0.31; Table 2).

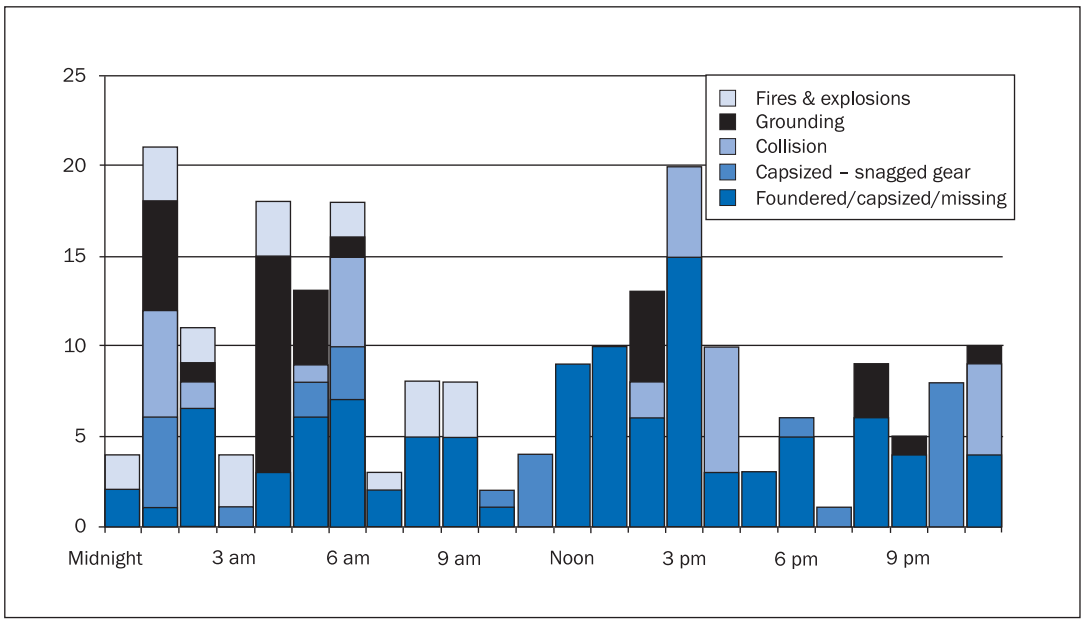
The overall vessel loss rate increased from approximately 2 per 1,000 vessels in the late 1940s to about 6 per 1,000 by the early 1980s (Figure 2). It then fell sharply during the 1980s but it increased during the 1990s to about 4 per 1000. Overall, there was a significant increase in the vessel loss rate from 1948 to 2008 of 1.04% per year ($p = 0.007$; Table 2). However, this increase was much larger during the earlier years from 1948 to 1984 than more recently (Figure 2).

Over the 61-year study period, there was a large significant increase in the vessel loss rate for vessels that foundered, capsized, or disappeared (5.19% per annum; $p < 0.001$) and a significant reduction in the vessel loss rate for vessels that grounded (1.13%, $p < 0.001$) but no significant trends for collisions or fires and explosions (Table 2).

Figures 3A and 3B show trends in, respectively, overall vessel loss rates and mortality rates according to the length of the fishing vessel from 1977 to 2008 (information on lengths was available in consistent categories from 1977 onwards). Both vessel loss rates and mortality rates from vessel accidents were lower for small vessels — reflecting lower exposure levels — with less fluctuation over time (Figures 3A and 3B).



A. Month of year (from 1965–2008)



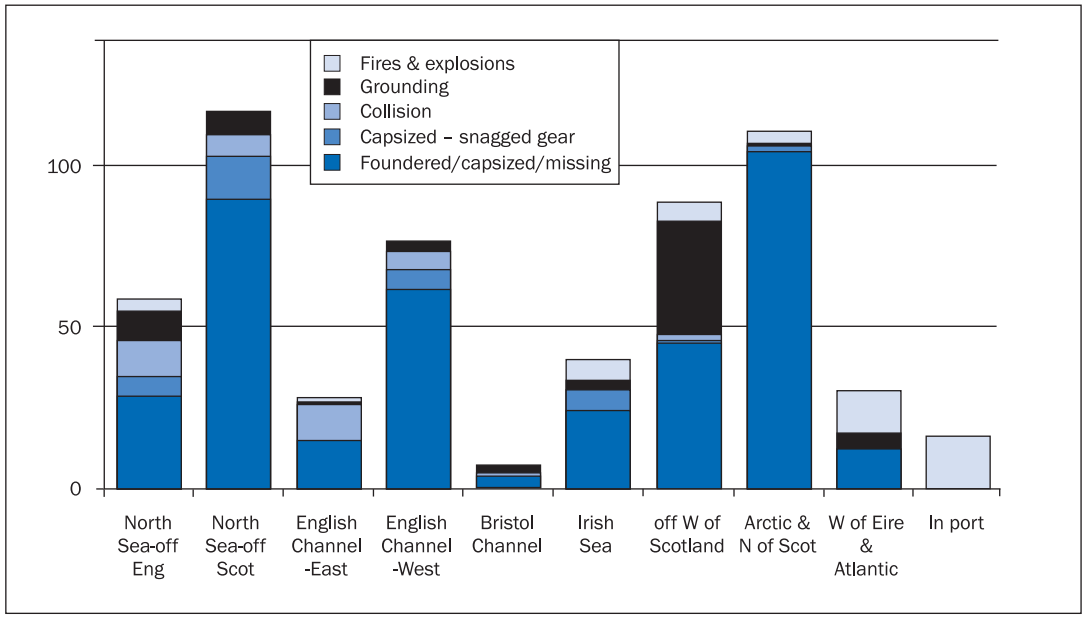
B. Time of day (from 1976–2008)

Figure 4. Incidence of fatalities from accidents to fishing vessels in the UK fishing industry according to: **A.** Month of year, **B.** Time of day, **C.** Location of death, **D.** Length of fishing vessel

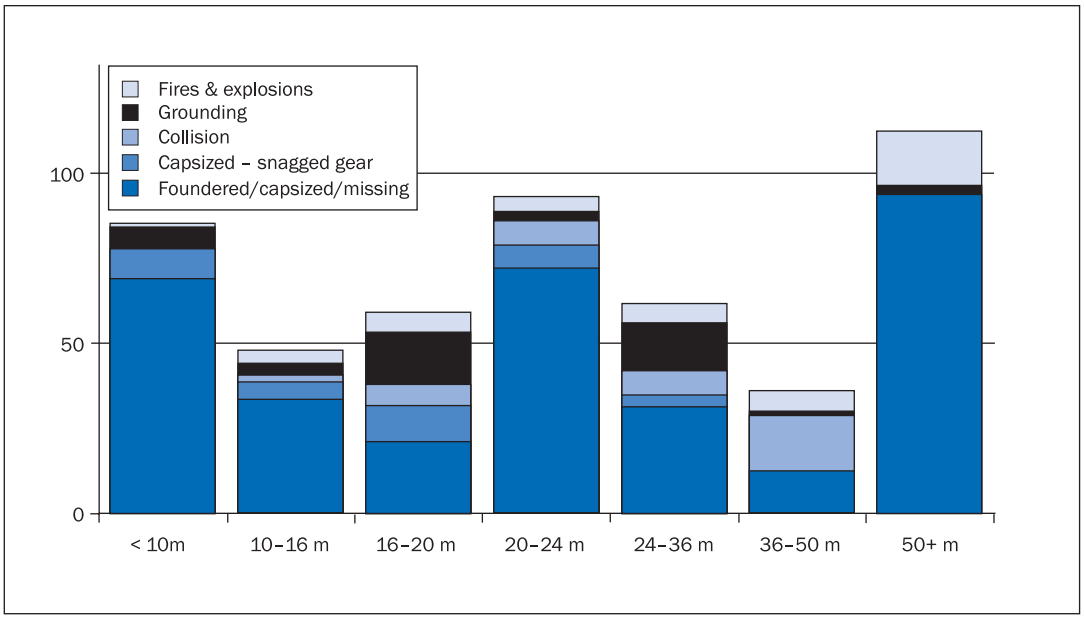
CIRCUMSTANCES AND CAUSES OF VESSEL ACCIDENTS WITH FATALITIES

Details of the circumstances and causes of fishing vessel accidents that led to fatalities among fishermen were available mainly for the years from 1965 to 2008 (for a total of 588 fatalities that resulted from 180 vessel accidents out of a total of 1,271 vessel accidents during this period), which is the basis of the analysis in this section.

Of the 588 fatalities between 1965 and 2008, most (387; 66%) were caused by fishing vessels that foundered, capsized, or disappeared. Weather and sea state conditions were cited as the major contributory factor for 288 (74%) of these fatalities, and



C. Location of death (from 1965–2008)



D. Length of fishing vessel (from 1976–2008)

Figure 4. Continuation

unstable, overloaded, and unseaworthy vessels for 57 (15%) with other and unknown causes in 11% of cases. During the more recent period from 1996 to 2008, unstable, overloaded, and unseaworthy vessels appear to have supereded weather and sea state conditions as the major cause of fatalities through fishing vessels that foundered, capsized, or disappeared, with 33 fatalities compared to 26 for weather conditions and 5 for other and unknown causes. Since 1996, nine fishermen have been lost with five fishing vessels which had undergone recent modifications that were considered detrimental to the vessel stability, while several other vessels were overloaded.

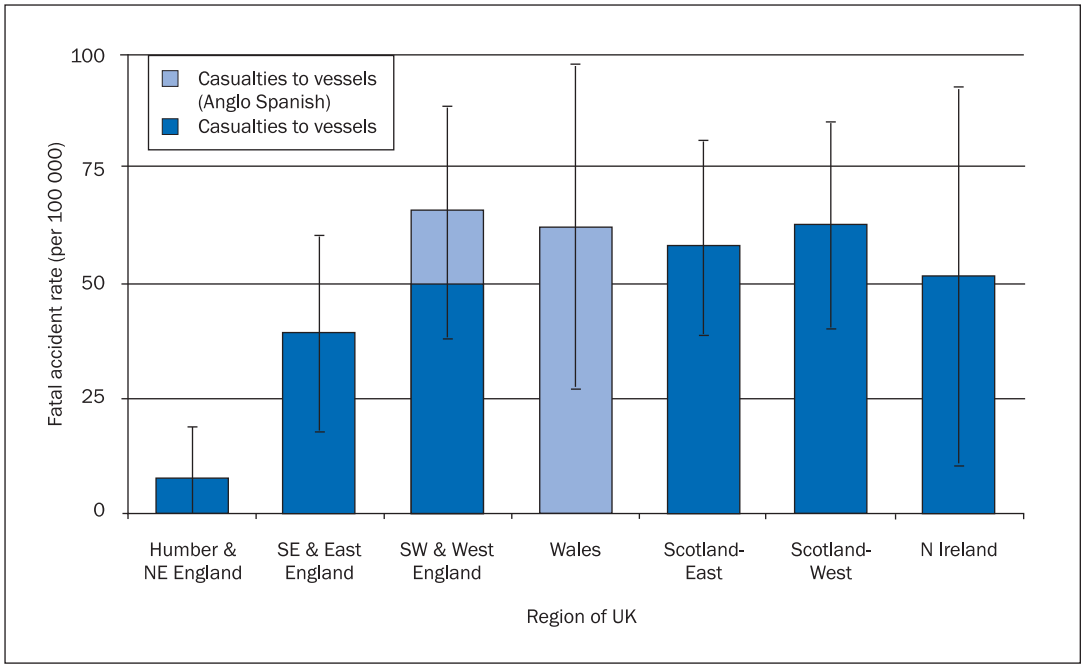


Figure 5. Mortality rates from accidents to fishing vessels in the UK fishing industry according to UK region, based on the port of registry of the fishing vessel, 1994–2008

Notes

The fatal accident rate for fishermen was highest in the northwest of England (215 per 100,000), but it has been excluded from this graph as it was based on only five fatalities and has a very wide 95% confidence interval (82–348)

Of the 72 lives lost through grounding of fishing vessels, fog, poor visibility, or severe weather were cited as the major causes for 38 deaths. Watchkeeping negligence, fatigue, or alcohol was cited for 19 fatalities. Of 41 lives lost through collisions, 31 resulted from collisions with cargo ships, six with other trawlers, and five with unidentified vessels.

Figure 4A shows a peak in the incidence of fatalities from fishing vessel accidents during the winter months of December, January, and February (49% of fatalities). Of fatalities that arose through vessels foundering, capsizing, or disappearing and grounding, most (55% and 51%, respectively) occurred during the winter, but relatively few fatalities from collisions occurred during these months (15%; Figure 4A).

Figure 4B shows two peaks in the incidence of fatalities: during the afternoon and at night from 1 am to 7 am. During the afternoon from noon to 4 pm, there was a high incidence of deaths from vessels that foundered, capsized, or disappeared (44%), whereas most fatalities from fires and explosions and from vessels that grounded (both 69%) occurred at night (from midnight to dawn). Fatalities from collisions occurred largely during the afternoon, at night, and soon after dawn.

Almost half (49%) of fatalities from fishing vessels that grounded occurred off the west coast of Scotland, while most fatalities from collisions occurred in the North Sea (43%) or the English Channel (40%; Figure 4C). Deaths from fires and explosions occurred largely in ports (31%) or in the Atlantic off the west coast of Ireland (25%), although most of the latter refer to the 12 fatalities that occurred on the *St Finbarr* off the Labrador coast of Canada in 1965. The fires and explosions occurred in cabins (six fatalities), engine rooms (four fatalities), galleys (three fatalities), and unspecified locations (three fatalities). Fatalities that arose from collisions and from fires and explosions often occurred on larger fishing vessels while fatalities from vessels that capsized after snagging fishing gear occurred largely on smaller vessels (Figure 4D).

MORTALITY RATES ACCORDING TO GEOGRAPHICAL REGION

Figure 5 shows mortality rates from fishing vessel accidents during the recent 15-year period from 1994 to 2008 according to the UK region where the fishing vessel was registered. Fishing vessels from the north west of England had the highest mortality (215 per 100,000 fishermen-years), although this was

based on just five fatalities. The south west of England, Wales, and Scotland (east and west coasts) had the next highest mortality rates (58 to 66 per 100,000) although mortalities for the south west of England and Wales were inflated by two major incidents involving Anglo Spanish fishing vessels (UK registered fishing vessels owned by Spanish companies and crewed typically by Spanish men): the *Arosa* (12 fatalities) and the *Pescalanza* (six). There was no correlation between the average distance from port ($p = 0.20$) or the shore ($p = 0.47$) and the fatal accident rate in each geographical region.

DISCUSSION

This study is one of the largest investigations of loss of life resulting from accidents to fishing vessels, covering more than 1,000 fatalities, over 1,500 vessel losses, and 1.49 million fishermen-years at risk. The case ascertainment sources used in this study are well established and reliable [3, 10, 29, 30], so almost all of the deaths from fishing vessel casualties — and the losses of fishing vessels — in the UK fishing industry would have been identified through this study.

Study limitations are, firstly, that the populations of fishing vessels and fishermen employed in the UK fishing industry throughout the 61-year study period were usually surveyed or estimated by successive governmental departments and agencies, with some degree of error which may have fluctuated over time. Secondly, the government departments and agencies changed nominally over time, although this should not substantially affect the long-term trends in mortality and vessel loss rates. Thirdly, when investigating the effects on mortality of factors such as time of day and month of year, we did not have denominator information on voyages or fishing activity, and were therefore able only to assess the incidence of fatalities rather than the mortality rates for these factors. Fourthly, population information over the 61-year study period was also unavailable for the ages of the fishermen employed, the sector of the UK fishing industry, and for some years for the lengths of the fishing vessels, although there was a reduction over time in larger fishing vessels of 24+ metres in length, from 9.8% in 1970 to 4.8% in 2008. In addition, the causes and cirumstances of some fishing vessel casualties could not always be established precisely, especially as some wrecks were not found.

The mortality rate from UK fishing vessel casualties in recent years is broadly comparable with the corresponding mortality rates of 76 in Alaskan fishing from 1992–1998 [16], 47 in Polish small-scale fishing from 1960 to 1999 [8], and ~50 in Danish fishing from 1989 to 2005 [11]. It is lower than 176 per 100,000 in US west coast fishing from 2000–2006 [31], but higher than 21 per 100,000 in Norwegian fishing from 1998–2006 [32], ~30 in Australian fishing from 1992–1998 [13], and 0 in Polish deep sea fishing from 1975–1984 [15].

Although we found indications of a slight reduction over time in mortality from fishing vessel accidents, it was not significant. There was similarly a lack of reduction in mortality in Danish fishing from 1989 to 2005 [11] and in Polish small-scale fishing from 1960 to 1999 [8]. There were, however, significant reductions in mortality in Icelandic fishing from 1980 to 2005 [18], and in US fishing from 1992 to 2007 [33], as well as in Alaskan [5, 16], Australian [6, 13], and Norwegian fishing,[4, 32].

Fishing vessels foundering, capsizing, or disappearing was by far the most significant cause of mortality from fishing vessel accidents. Although maritime and environmental factors such as severe and unpredictable weather and sea conditions have been recognised traditionally as the main occupational hazards in deep sea fishing [15, 30, 34, 35], human error and human factors have become recognised increasingly as major factors [8, 10, 11, 14]. In recent years, vessels that were unstable, overloaded, or unseaworthy appear to have supereded weather and sea state conditions as the major cause of mortality from vessel casualties in UK fishing, with several recent casualties involving fishing vessels which had undergone recent modifications that were of detriment to the stability of the vessels. As recommended previously [11], inspection of fishing vessels that have undergone major modification — especially for conversion to a different mode of fishing operation — should be a priority for marine surveys. There is evidence from case series of marine investigations that the problem of badly maintained and unseaworthy fishing vessels has increased, reflecting increased economic pressures, although it may also reflect improvements over time in the investigation and documentation of marine accidents. Poor maintenance of fishing vessels has been identified as a major causal factor for fatalities in UK and non-UK fishing fleets [6, 10, 36, 37].

Mortality from collisions occurred largely in the English Channel and off the northeast coast of Scotland. Several occurred along the Straits of Dover, which is one of the busiest sea traffic areas, where cargo traffic lanes cross passenger vessel routes. This area has been the subject of previous studies of col-

lisions [38–40]. Vessels that capsized after snagging gear often occurred off the Cornish coast and off Humberside. Most of the fatalities from vessels that grounded occurred off the northwest coast of Scotland, which presumably reflects the particularly hazardous nature of much of this coastline, as well as human and navigational error.

The incidence of fatalities was highest during the winter months, particularly for vessels that foundered, capsized, or disappeared and grounded. Most fatalities from grounding occurred at night when poor visibility and sometimes fatigue and alcohol were major causes of the casualties. There was a second peak in mortality during the afternoon — particularly for vessels that foundered, capsized, and disappeared and for collisions — although this probably reflects a peak in fishing activity during afternoons for smaller fishing vessels.

We found an increase over time in the fishing vessel loss rate in the UK fishing industry from 1948 to the early 1980s — although little increase since — but no significant trend in the mortality rate from accidents to fishing vessels. This suggests an improvement over time in the personal fatality rate or prognosis following a fishing vessel loss from the 1940s to the early 1980s, which would reflect widespread improvements over time in sea rescue services, navigational and safety equipment, sectoral shifts from Arctic and distant water to near water fishing, and increases in safety awareness among fishermen. Nonetheless the mortality rate in UK fishing is still very high, while the economic consequences of fatalities and fishing vessel losses are often large [41]. Fatalities in recent years have often been linked to fishing vessels that are unstable, overloaded, or unseaworthy.

KEY MESSAGES

1. Of 1,039 fatalities from accidents to UK fishing vessels from 1948 to 2008, most (65%) were caused by vessels that foundered, capsized, or disappeared, followed by vessels grounding (22%), collisions (7%), and fires and explosions (5%).
2. From 1948 to the early 1980s, there was a significant increase in the overall fishing vessel loss rate — but no trend since the 1990s. There has been no significant trend in mortality from fishing vessel accidents.
3. Mortality was highest during the winter months (for foundering and grounding), during night time (for grounding, fires and explosions), and afternoons (foundering and collisions). Most fatalities from collisions occurred in the English Channel and the North Sea, while almost half of fatalities from grounding occurred off the west coast of Scotland.
4. The mortality rate in British fishing is still very high. Fatalities in recent years have often been linked to fishing vessels that are unstable, overloaded, or unseaworthy.

ACKNOWLEDGEMENTS

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