

# Occupational mortality in British commercial fishing, 1976–95

S E Roberts

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**Aims:** To establish the causes and circumstances of all deaths occurring at work or related to work among fishermen in British commercial fishing between 1976 and 1995.

**Methods:** A retrospective study, based on official mortality files, with a population of 440 355 fishermen-years at risk.

**Results:** Of 616 deaths in British fishing, 454 (74%) were due to accidents at work, and 394 (87%) of these fishermen drowned. A total of 270 accidents were caused by casualties to vessels and 184 by personal accidents. There was no significant decline in the fatal accident rate, 103.1 per 100 000 fishermen-years, between 1976 and 1995. The fatal accident rate was 52.4 times higher (95% CI 42.9 to 63.8) than for all workers in Great Britain during the same period, and this relative risk increased through the 1980s up to 76.6 during 1991–95. Relative risks with the construction (12.3) and manufacturing (46.0) industries were higher than 5 and 20 respectively, during 1959–68. Trawlers foundering in adverse weather was the most frequent cause of mortality from casualties to vessels (115 deaths), and 82 of 145 personal accidents at sea arose during operations involving trawling nets.

**Conclusions:** When compared with shore based industries, fishing remains at least as hazardous as before. Prevention should be aimed, most importantly, at the unnecessary operation of small vessels and trawling net manoeuvres in hazardous weather and sea conditions. Other measures should focus on preventing falls overboard, reducing fatigue, a more widespread use of personal flotation devices, and improvements in weather forecast evaluation.

Correspondence to:  
Dr S E Roberts, Unit of  
Health-Care  
Epidemiology, Department  
of Public Health, University  
of Oxford, Old Road,  
Oxford OX3 7LF, UK;  
stephen.roberts@  
uhce.ox.ac.uk

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Historically, merchant seafaring has been cited as the most hazardous occupation in Britain.<sup>1–3</sup> By the early 1960s, however, the fatal accident rate in fishing was suspected as being the highest of all occupations.<sup>4</sup> A few years later, after the hazards witnessed by the author, trawler fishing was termed an “extreme occupation” by Schilling,<sup>5</sup> and a Committee of Inquiry into Trawler Safety was subsequently commissioned to investigate the levels and causes of mortality in British commercial fishing.

The excessive fatal accident rate was eventually confirmed by the publication of the final report of the committee in 1969.<sup>6</sup> The findings and recommendations of the report were acknowledged in additional legislation the following year,<sup>7</sup> and in the later publication of a safety recommendation code in 1978.<sup>8</sup> However, a subsequent study concluded that the fatal accident rate in British fishing had not significantly declined during the decade after the legislation (1971–80) when compared with the previous decade.<sup>9</sup>

The primary aims of the present study were to establish, in detail, the rates and causes of mortality occurring at work or related to work in British commercial fishing, during the recent period 1976 to 1995. In an earlier short paper, it was reported briefly that fishing has remained the most hazardous occupation in Great Britain.<sup>10</sup> In this paper, a detailed analysis of the causes of mortality in British fishing is provided, while further aims were to investigate whether the fatal accident rate in British fishing has declined over time, to compare fatal accident rates with those in other British industries and in international fishing fleets, and to discuss recommendations for the reduction of mortality.

## METHODS

Deaths at sea are not usually registered with the local registrars of deaths and are not included in routine national occupational mortality statistics, as published by the Office of

Population Censuses and Surveys (OPCS) and the Office for National Statistics (ONS). Thus standardised mortality ratios for fishermen and seafarers, as reported by these sources, are often grossly underestimated.<sup>5–11</sup> This is because deaths at sea are registered separately at the Registrar General for Shipping and Seamen (RGSS). In this study, details of all deaths in British fishing were identified from official mortality files held at the RGSS, and at the principal British marine investigative authority, the Marine Accident Investigation Branch (MAIB). The causes and circumstances of deaths were determined from postmortem examination reports, death certificates and registers, reports of coroners’ inquisitions, procurator fiscals’ fatal accident inquiries, official marine inquiries, log books, and other official documents.

## Inclusion criteria

Included in this study were all deaths among commercial fishermen in British registered fishing vessels between 1976 and 1995, occurring at work or after being landed ashore as a result of accident or illness at work, provided that the death occurred within 30 days of discharge ashore. Deaths among leisure fishermen and non-fishermen such as passengers and stowaways were excluded, as were deaths in merchant ships, pleasure craft, and other non-fishing vessels. It is expected that almost all deaths that satisfied the inclusion criteria were identified from the study data sources. The study period was the 20 years from 1 January 1976 to 31 December 1995 for deaths in British commercial fishing and for the comparison of fatal accident rates with other British industries.

## Certification of deaths

Of 616 fatalities in British fishing between 1976 and 1995, 77 (13%) were due to natural causes. At least 46 of the diagnoses (60%) were based on postmortem examination; 11 other

### Main messages

- Between 1976 and 1995, the risk of a fatal accident at work was 52.4 times higher in British commercial fishing than in the general workforce of Great Britain.
- There was no significant reduction in the fatal accident rate, 103.1 per 100 000 fishermen-years, between 1976 and 1995.
- As the fatal accident rate for all workers in Great Britain fell between 1976 and 1995, in relative terms, trawler fishing has remained at least as hazardous as before.
- Casualties to vessels accounted for almost 60% of 454 fatal accidents, and were most frequently caused by vessels foundering in adverse conditions, followed by grounding on rocks, collisions with other vessels, and capsizing after snagging trawling nets on underwater obstructions.
- Most fatal personal accidents at sea arose during operations to "haul-in" or "shoot-out" trawling nets; these were often conducted during hazardous weather conditions.

diagnoses (14%) were obtained from Scottish deaths registers which, for legal reasons, usually denoted the underlying cause of death only and did not indicate whether a postmortem examination had been performed. Fifteen diagnoses (19%) were obtained from other medical sources, and five through official marine inquiries or trawling skippers (unknown source of certification, 6%). Of the 539 deaths due to non-natural or unknown causes, 246 fishermen were lost at sea. The results of a postmortem examination were available for at least 175 of the other 293 deaths (60%), and diagnoses were provided by other medical sources in at least a further 58 cases (20%). Of the 246 fishermen who were lost at sea, 221 (90%) were subject to MAIB investigation or other official marine inquiries. Information on the other 25 deaths was obtained from procurator fiscals' fatal accident inquiries in 13 cases, coroners' inquisitions (nine), and other sources (three).

### Population at risk

The numbers of commercial fishermen employed annually in UK fishing were obtained from official government statistics, published by the former Ministry of Agriculture, Fisheries and Food (MAFF) from 1976 to 1995.<sup>12</sup> The fishermen were conventionally counted as if they had been employed for the whole of each year, yielding a total population of 440 355 fishermen-years at risk. The annual numbers of fishermen remained fairly stable throughout the study period, reaching a peak of 23 990 in 1981, before declining to 19 928 in 1995. Over the entire study period, 74.6% of the fishermen were full time employed and 25.4% part time; annual percentages of full time fishermen were also fairly stable between 1976 (76.4% full time) and 1995 (80.7%).

Official published statistics show that there were a total of 112 558 fishing vessel-years in the active British fishing fleet from 1976 to 1990; 79 888 of these were for vessels under 12 metres in length, 28 992 for vessels measuring 12–23.9 metres, and 3778 for vessels of 24 metres and above.<sup>13–15</sup> From 1991 the official figures were no longer collected in this format by MAFF but included all registered British fishing vessels rather than just the active fleet; a total of 52 657 vessel-years from 1991 to 1995 referred to, respectively, 42 306, 7970, and 2381 vessel-years for

### Policy implications

- Prevention should be aimed most importantly at reducing hazardous working practices and, in particular, at the unnecessary operation of small trawlers and trawling net manoeuvres in hazardous weather conditions.
- Since a majority (52%) of all personal accidents at sea were caused by fishermen drowning after falling or being washed overboard by heavy seas, appropriate measures would include the maintenance of hazard free decks, improved evaluation of weather related risks when deploying crew on deck, and a more widespread use of personal flotation devices.
- Prevention progress may benefit from international cooperation and the identification of risk factors that are specific to particular subsectors of international fishing fleets.

vessels of under 12, 12–23.9, and 24 metres or more in length.

### Comparison of fatal accident rates with other workers

Comparison was made with all workers in Great Britain, and with those working in five main industrial sectors, using fatal accident statistics published annually by the Health and Safety Executive (HSE) for the period 1976 to 1995.<sup>16</sup> Numerators were all fatal accidents occurring at the workplace, excluding non-work related traffic accidents and self inflicted poisoning by alcohol or drugs, and denominators were the populations of workers at risk.

### Statistical methods

The statistical methods used include cause specific mortality rates, relative risks, and Spearman's rank correlation coefficients. Ninety five per cent confidence intervals for mortality rates and relative risks were adjusted for multiple fatalities arising through the same accident; for example, when a fishing vessel founders with the loss of several lives.

### RESULTS

Of 616 fatalities in British fishing between 1976 and 1995, 77 deaths (13%) were caused by illness, 454 (74%) by accidents, and 82 (13%) by other non-natural causes (table 1). In the remaining three cases the medical diagnosis was not specific enough to determine the cause of death.

### Demographics

All but one of the 616 deceased were men, 577 (94%) were British nationals, followed by Spanish (18), Danish (8), and Dutch (6). The mean age of the deceased was 37.5 years (SD 13.1); 20% were aged 16–24 years, 49% were 25–44, 30% were 45–64, and 1% were aged 65 and over. Forty five per cent of the deceased British nationals had been resident in Scotland, 18% in Humberside, 8% in Cornwall, and 29% in other locations.

### Deaths due to illness

Of 77 deaths from natural causes, 62 (81%) were caused by cardiovascular disease. Fifty five of the 62 (89%) were taken ill at sea, and seven in port. Only four of the deceased (6%) were evacuated from their trawlers before death and all four were dead on arrival at hospital. Most of the 62 were found dead or died within minutes of acute heart attack. The mean age at death from cardiovascular disease was 53.9 years (SD 7.3).

**Table 1** Cause of death among fishermen in British commercial fishing, 1976–95

Cause of death	Number (%)
<b>Natural causes</b>	
Cardiovascular disease	62 (10.1%)
Infectious disease	2 (0.3%)
Gastrointestinal disease	4 (0.6%)
Cerebrovascular disease	4 (0.6%)
Respiratory disease	2 (0.3%)
Malignant neoplasms	1 (0.2%)
Not known	2 (0.3%)
Total	77 (12.5%)
<b>Non-natural causes</b>	
Accidents	
Casualties to vessels	270 (43.8%)
Personal accidents	184 (29.9%)
Homicide	2 (0.3%)
Suicide	4 (0.6%)
Drug or alcohol intoxication	2 (0.3%)
Unknown circumstances	
Drowning	44 (7.1%)
Missing at sea	29 (4.7%)
Other	1 (0.2%)
Total	536 (87.0%)
<b>Inconclusive causes</b>	
Undetermined	3 (0.5%)
<b>Total</b>	<b>616 (100.0%)</b>

### Deaths due to accidents

Deaths from accidents have been split into two categories. These are firstly, casualties to vessels resulting from an accident or incident involving the fishing vessel such as a collision, capsize, grounding, or fire; and secondly, personal accidents directly affecting individual fishermen at work. Casualties to vessels accounted for 270 (44%) and personal accidents 184 (30%) of all deaths.

Thirty seven of the 102 vessel casualties, and 115 deaths, were caused by fishing vessels foundering or capsizing as a result of hazardous weather and sea state conditions (table 2). All but two of the 37 vessels were less than 24 metres in length, and 21 of these were under 12 metres. The median gross tonnage of the trawlers was 11.2 (interquartile range 4.3–41.2), the mean age was 13.3 years (SD 10.2), and most were constructed from wood or fibreglass rather than steel.

Fourteen vessels foundered after grounding on rocks and harbour entrances (38 deaths), usually when returning to port in darkness or poor visibility as watchmen were fatigued or had fallen asleep, or because of faulty radar or engine failure. Ten trawlers were involved in collisions (29 deaths) and 12 capsized after snagging trawling nets on shipwrecks and other underwater obstructions (26 deaths).

Table 3 shows the causes of the 184 personal accidents, and the work duties or activities of the deceased at the time. The most common causes were falls overboard (57 deaths, 31%), struck by trawling equipment (38, 21%) and entanglement in equipment (24, 13%). Most accidents (145, 79%) arose at sea; 82 of these (57%) occurred during operations to “shoot-out” or “haul-in” trawling nets, and weather conditions during these manoeuvres were gale force 8 or worse in 14 of 50 reported cases.

The fatal accident rates for casualties to vessels were respectively 6.8, 44.3, and 52.9 per 10 000 vessel-years at risk for vessels of lengths under 12, 12–23.9, and 24 metres or over in the active British fishing fleet from 1976 to 1990. The corresponding fatal accident rates for personal accidents were 2.6, 25.3, and 151 per 10 000 vessel-years.

The 454 fatal accidents in fishing refer to drowning, disappearance at sea, or hypothermia (394, 87%), injury (43, 9%), asphyxiation or poisoning by fumes (16, 4%) and other causes (one). Only nine (2%) were evacuated and admitted to hospital before death, although a further seven (2%) were dead on arrival. The mean age at death from accidents was 34.3 years (SD 11.8).

### Deaths due to other causes

Of four suicides, three jumped overboard and one was found hanged in a cabin, two were homicide victims when beaten to death ashore, and two died from alcohol intoxication. Official investigation was unable to establish the circumstances of 74 deaths from non-natural causes; 29 disappeared at sea and, apart from seven who had shown symptoms of psychiatric disturbance, most likely fell overboard. Another 44 also went missing, 10 at sea and 34 in port, but were subsequently found drowned. Twenty nine of the 34 were known to have been ashore, and most had been drinking, before failing to return to their vessels. Although it is likely that they accidentally fell into docks when returning to trawlers alone, the lack of evidence led coroners' inquisitions to record open verdicts. Finally, the circumstances of death were not known for one fishermen who died from non-natural causes, and the cause of death was not specific enough to determine whether three deaths were due to natural or non-natural causes.

### Comparison of fatal accident rates with international fishing mortality studies

Table 4 shows a summary comparison with fatal accident rates calculated from previous studies. For improved comparability with the other studies, unexplained drowning and disappearances at sea have been classified as accidents, even though British coroners' inquisitions normally record open verdicts for unexplained drowning and are not usually held, in the absence of a body for forensic examination, for disappearances at sea.

The fatal accident rate from this study, 120 per 100 000 fishermen-years (95% CI 104 to 136), was lower than those calculated from earlier studies of British fishing, in 1958–67 and 1961–80. The highest fatal accident rates were calculated from studies of Alaskan and New Zealand fishermen, although the extremely high Alaskan rate of 415 per 100 000 (1980–88) subsequently declined to 116 (1990–98). The British rate was broadly comparable to those for Danish, Australian, and Icelandic fishermen, and higher than in Canadian (Atlantic provinces), American, and Polish fishing.

### Comparison of fatal accident rates with other industries in Great Britain

Between 1976 and 1995, the mortality rate for fatal accidents occurring at work for all workers in Great Britain was 2.0 per 100 000 worker-years (table 5). The fatal accident rate in British fishing (103.1 per 100 000; 95% CI 87.5 to 118.7) was 52.4 times higher (95% CI 42.9 to 63.8) than for all workers in Great Britain.

The fatal accident rate in British fishing was 10 times higher than for workers in the energy and water supply industries, 12 times that for the construction industry, and 46 times greater than in manufacturing. If unexplained drowning and disappearances at sea are included as accidents, mortality in fishing (120 per 100 000) would be 60.8 times higher (95% CI 50.5 to 73.2) than for all workers.

### Trends in fatal accident rates

The annual fatal accident rate in British fishing fluctuated considerably with no overall upward or downward trend between 1976 and 1995 (Spearman's rank correlation coefficient (SR) –0.16). During the same period, the fatal

**Table 2** Causes of vessel casualties involving loss of life to fishermen in British commercial fishing, 1976–95

Cause of vessel casualty	No. of vessel casualties by length of fishing vessel (metres)				Total vessel casualties	Total deaths
	<12	12–23.9	24–35.9	≥36		
<b>Collisions</b>						
With merchant vessels	1	2	2	1	6	20
With fishing vessels			2		2	3
With unidentified vessels		2			2	6
<b>Grounding</b>						
Due to navigational error	3	6	2		11	27
Due to anchors dragging during storms	1			1	2	6
Due to unknown causes		1			1	5
<b>Capsized after snagged trawling nets</b>						
On submarines		1			1	4
On other underwater obstructions	5	4	2		11	22
<b>Foundered or capsized</b>						
Due to adverse weather or sea conditions	21	14	2		37	115
Due to instability during hauling-in operations	4	2			6	10
Due to unseaworthy trawlers	4	1			5	18
Due to anchor caught in trawling gear	1				1	1
Missing vessels and unknown causes	8	2			10	21
<b>Fires and explosions</b>						
In engine rooms			1	1	2	4
In galleys and in accommodation areas		4			4	7
Location not known		1			1	1
<b>Total</b>	<b>48</b>	<b>40</b>	<b>11</b>	<b>3</b>	<b>102</b>	<b>270</b>

accident rate for all workers in Great Britain declined sharply (SR  $-0.93$ ) as did those in the construction ( $-0.87$ ) and manufacturing industries ( $-0.95$ ).

Table 6 shows the fatal accident rate in British fishing in five year time periods from 1976–80 to 1991–95. Although the fatal accident rate fluctuated from 135 per 100 000 fisherman-years to 77, 105, and 96 during the four 5-year periods, there were no significant changes in the rate. The relative risk of a fatal accident in fishing, compared with all workers, decreased from 53 (in 1976–80) to 36 (1981–85), but increased to 55 (in 1986–90) and to 77 (1991–95).

## DISCUSSION

This study, with a population of over 440 000 fisherman-years at risk between 1976 and 1995, represents one of the largest studies of work related mortality in commercial fishing. Fishing was established as an extremely hazardous occupation in Britain during the 1960s and, after the introduction of additional safety legislation in 1970, the fatal accident rate did not decline during the subsequent decade.<sup>9</sup> Although the fatal accident rate was highest in the late 1970s, and increased again during the late 1980s, the present study found no significant change between 1976 and 1995.

The fatal accident rate was lower than in earlier studies of British fishing, and was much lower than in smaller studies of Alaskan and New Zealand fishing in the 1970s and 1980s. However, after legislation aimed largely at the heavy loss of life through casualties to vessels,<sup>27</sup> the Alaskan fatal accident rate in the 1990s declined to a level comparable with British fishing. The British rate was broadly similar or higher than those in the other fishing fleets. Although many fatal accidents occurred from small fishing vessels of under 12 metres in length, in terms of vessel-years at risk, the corresponding fatal accident rates were much lower in these vessels. However, an increase in the proportion of small vessels over time, from 63% of all active British fishing vessels in 1976 to 76% in 1990, did not reduce the fatal accident rate.

Commercial fishing is an extremely hazardous occupation when compared with general workforces that include both men and women. The relative risk of 52 in this study is similar to that of 53 for Danish fishing between 1988 and 1992.<sup>20</sup> Relative risks of about 50 and 12 were identified for Alaskan fishing during 1980 to 1988, in comparison to all workers in the USA and Alaska respectively,<sup>17</sup> although by 1991–98 the relative risk for the USA had declined to 26.<sup>22</sup> A lower relative risk of 18 was found for Australian fishing.<sup>21</sup> However, the fatal accident rates for the general workforces in these countries were higher than in Britain.

The fatal accident rate in British fishing, between 1959 and 1968, was five times that for the construction industry and 20 times greater than in manufacturing.<sup>11</sup> The corresponding relative risks from this study, 12 and 46, are substantially higher. Fatal accident rates in fishing are also typically higher than those from recent studies of merchant shipping,<sup>10 28</sup> the occupation historically regarded as the most dangerous. In Britain, fishing has been the most hazardous of all occupations in recent decades.<sup>10</sup>

Although previous studies of British fishing did not calculate a relative risk comparison with all shore based workers, the fatal accident rate for all employees in Great Britain was 5.6 per 100 000 worker-years in 1961.<sup>29</sup> Fatal accident rates for all workers are typically similar or slightly higher than for all employees and would indicate a relative risk of 35 to 40, for British fishing during 1959 to 1968, which compares with 52.4 in this study. The present study also identified relative risks that increased from the early 1980s up to 77 in 1991–95 and show that, in relative terms, fishing has remained at least as hazardous as before.

During the study period, there were structural labour market changes in the British workforce; in particular, reductions in the numbers employed in the energy and water supply and construction industries which predominantly employ men and which had high fatal accident rates among the shore based industries, and a large increase in the service industry that increasingly employed women and which had by far the lowest fatal accident rate. Especially since the fatal

**Table 3** Causes of fatal personal accidents in British commercial fishing, 1976–95

Cause of accident/work operations or activity	Fatal personal accidents by length of fishing vessel (metres)				Total deaths
	<12	12–23.9	24–35.9	≥36	
<b>Struck by heavy seas</b>					
Washed overboard: shooting-out operations		2	1		3
Washed overboard: hauling-in operations				3	3
Washed overboard: stowing nets	1	1	2	1	5
Washed overboard: other operations		2	2		4
Washed overboard: operations not known		1	2		3
Injured on deck: hauling-in operations		1			1
<b>Struck by trawling equipment</b>					
Injured: shooting-out operations		3	3		6
Injured: hauling-in operations		4	5	5	14
Injured: other operations		3		1	4
Injured: operations not known		1	1	1	3
Knocked overboard: shooting-out operations				1	1
Knocked overboard: hauling-in operations		7		1	8
Knocked overboard: other operations			1	1	2
<b>Entangled in trawling equipment</b>					
Dragged overboard: shooting-out operations	5	5	4		14
Dragged overboard: hauling-in operations	1		1		2
Dragged overboard: other operations		1			1
Injured, dragged into winch: hauling-in operations		3	1	3	7
<b>Falls overboard</b>					
During shooting-out operations	1	11	2		14
During hauling-in operations		4	2	2	8
Other falls overboard	8	19	7	1	35
<b>Falls into docks</b>					
When working on the quayside		1	1		2
When returning to berthed trawlers from ashore		6	5	5	16
When returning to moored trawlers by boat	2	1			3
<b>Other accidents</b>					
Boating disasters: laying out seine nets	2				2
Drowned: diving accidents	1	2			3
Knocked overboard: anchor laying operations		2			2
Asphyxiated by cabin heater fumes: sleeping	1	3			4
Other accidents	3	4	1	1	9
Not known	3	1	1		5
<b>Total</b>	<b>28</b>	<b>88</b>	<b>42</b>	<b>26</b>	<b>184</b>

**Table 4** Comparison of fatal accident rates in international commercial fishing

Study rank	Country*	Study period	Deaths from accidents at work	Population at risk	Fatal accident rate (per 100000 fishermen-years) <sup>§</sup>
1	Alaska	1980–88	278	67052	415
2	New Zealand	1975–84	79	30385†	260
3	UK – Grimsby	1963	6	2460	244
4	UK	1958–67	197	98100	201
5	UK	1961–80	711	420710†	169
6	Denmark	1988–92	44	30555	144
7	Australia	1982–84	47	32867†	143
8	UK	1976–95	527‡	440355	120
9	Alaska	1991–98	162	139200	116
10	Iceland	1966–86	132	147649	89
11	Poland – Baltic sea	1975–84	33	48113	69
12	USA	1982–87	648	1378723†	47
13	Canada – Atlantic coast	1975–83	84	183378	46
14	Poland – deep sea	1975–84	11	64044	17

\*References are 17–19 for studies ranked 1–3; 6 for study 4; 9 for study 5; 20, 21 for studies 6 and 7; 8 is the present study; 22–26 for studies 9–13; and 24 for study 14.

†Populations at risk are estimated from the number of fatal accidents and mortality rates cited.

‡Fatal accidents include drowning of uncertain circumstances and disappearances at sea.

§Comparison of fatal accident rates across the different studies can be affected by variation in the study inclusion criteria; for example, according to factors such as whether accidents in port are included, whether disappearances at sea and unexplained drowning are included as accidents, and whether part time fishermen are included in the population at risk.

**Table 5** A comparison of fatal accident rates in British commercial fishing with those for all workers, and workers in other industries, in Great Britain, 1976–95

Industry	Deaths from accidents at work*	Fatal accident rate per 100000 worker-years (95% CI)*	Relative risk fishermen: other workers
Fishermen in UK commercial fishing‡	454	103.1 (87.5 to 119)	
<b>Other industries in Great Britain†</b>			
Energy and water supply industries	700	10.0 (6.7 to 13.9)	10.3
Agriculture, forestry, and fishing	737	8.8 (8.2 to 9.5)	11.7
Construction	2404	8.4 (7.6 to 10.3)	12.3
Manufacturing	2264	2.2 (1.9 to 2.5)	46.0
Service industries	1619	0.7 (0.6 to 0.7)	157.3
<b>All workers in Great Britain</b>	<b>9543</b>	<b>2.0 (1.7 to 2.2)</b>	<b>52.4</b>

\*The data in these columns have appeared elsewhere.<sup>10</sup>

†Official HSE statistics for the period 1976–95. The figures for energy and water supply, agriculture, forestry, and fishing, and the service industries are for the period 1981–95 only. The figures for energy and water supply include employees only and exclude the small number of self employed. The figures for agriculture, forestry, and fishing exclude sea fishing. The figures for all workers in Great Britain exclude sea fishing, merchant seafaring, and civil aviation which are not covered under HSE legislation.

‡Original study data, based on official mortality files at the RGSS and the MAIB, for the period 1976–95.

accident rate in fishing did not alter greatly between 1976 and 1995, these changes would contribute to the increased risk in fishing compared to the general workforce.

Cardiovascular disease was the main cause of fatal illness. Few of these deceased were evacuated from their vessels before death, and most were found dead or died within minutes of onset. Fishermen aged 18 and over, unlike merchant seafarers, are not presently subject to medical examination in order to work at sea. However, as high levels of smoking and obesity have been found in European fishermen,<sup>30, 31</sup> primary prevention and health promotion may offer some benefits. The introduction of health screening may save some lives, but unemployment would most likely have a detrimental effect on fishermen's health ashore.

As found in previous studies,<sup>9, 17, 21, 22</sup> casualties involving fishing vessels were the cause of most fatal accidents, and foundering or capsizing of trawlers in hazardous weather conditions was the most common type of casualty. Most of these vessels were relatively small in size, made of wood or fibreglass, and were often not suited to operating in the prevailing weather conditions. Although some vessels were returning to port, or sailing for shelter amid deteriorating weather conditions, improvements in weather forecasting and evaluation would be beneficial.

There were often contributory factors affecting the foundering of fishing vessels in adverse conditions. Economic pressures had led some fishermen to overload the vessels with equipment, creating stability difficulties during hauling-in operations; some vessels were found to be unseaworthy, and others were unsuited to the prevailing conditions—the exhaustion of previously lucrative fishing grounds has brought increased pressures for fishermen to go

further to sea in small and unsuited vessels.<sup>32, 33</sup> Classification of fishing vessels according to the weather conditions they are suited for, and closer attention to stability limits, would be important preventative measures.

The capsizing of trawlers after nets became snagged on underwater obstructions was another major cause of death in British fishing. Since several of these obstructions were considered to be shipwrecks, the maintenance of maps or guides with the accurate locations of shipwrecks around the British Isles would be of benefit. Most fatal collisions involved trawlers being “run down” by flag of convenience or other foreign flagged merchant ships, whose crews were often outside the legal jurisdiction of British marine investigation, and raises the important matter of loss of life through watch keeping negligence and criminal prosecution in international merchant shipping.

The fatal grounding of fishing vessels largely arose when returning to port and were mostly due to navigational error. Although faulty radar, fog, and alcohol consumption were cited in some official inquiry reports, many of the watch keepers were known to have fallen asleep or were considered fatigued after long trips at sea. Fishermen typically work long hours at sea, with short rest periods often disrupted by trawlers rolling in heavy seas, engine noise and vibration, and confined sleeping conditions. Fatigue was also cited, or a likely causal factor, for many of the fatal personal accidents, and has previously been identified as a major factor affecting accident rates.<sup>6, 11, 34</sup> Prevention should be aimed at the implementation of adequate rest periods both at sea and, in between fishing trips, ashore.

A majority of fatal personal accidents at sea (57%) arose during operations to “haul-in” or “shoot-out” trawling

**Table 6** Trends in the fatal accident rate in British commercial fishing, 1976–95

Time period	Deaths from accidents at work	Population at risk	Fatal accident rate per 100000 fishermen-years (95% CI)	Relative risk fishermen: all workers
1976–80	150	111255	135 (101 to 169)	52.5
1981–85	87	113681	77 (49 to 104)	35.7
1986–90	117	111191	105 (73 to 127)	55.0
1991–95	100	104228	96 (65 to 127)	76.6
<b>1976–95</b>	<b>454</b>	<b>440355</b>	<b>103 (88 to 119)</b>	<b>52.4</b>

nets. These were often conducted in hazardous conditions. These operations have previously been identified as potentially high risk manoeuvres leading to a large proportion of accidents in fishing.<sup>33 35 36</sup> Improved evaluation is required as to weather related risks when deciding to conduct these operations.

Over 40% of fatal personal accidents at sea arose when fishermen were struck by or entangled in trawling lines and other equipment. The deceased were knocked or dragged overboard and drowned, or were dragged into the winch and fatally injured, or died from other injuries. Prevention should focus on the deck layout and the adequate guarding of trawling cables and the winch. Several of the deceased were engaged in manual operations to adjust the lines, and several others died after their clothing became entangled. Emphasis should be placed on methods to minimise the need to handle lines, alertness as to the position of the lines, and the use of close fitting clothing.<sup>37</sup>

A further 75 fishermen drowned (52% of personal accidents at sea) after they fell or were washed overboard by heavy seas. Prevention should be aimed at maintaining hazard free decks to minimise the risks of slips and falls, and at a more widespread use of personal flotation devices (PFDs). The former should include improved lighting on deck at night, and the regular removal of oil, ice, nets, ropes, wires, and other potential obstacles from trawling decks. The use of boots with adequate grip that are suited to operations on fishing vessels' decks, the use of anti-skid surfacing on decks, and increased height of railings on small vessels are further important preventative measures. The fishermen who were washed overboard by heavy seas further illustrate the need for better evaluation of weather related risks when deploying crew on deck.

Previous studies have shown that the use of PFDs is effective in improving the survival prospects of fishermen after falls overboard or after abandonment of stricken vessels.<sup>22 25</sup> However, many of the fishermen who drowned in this study were in fishing vessels that capsized or foundered rapidly after a collision, trawling nets snagging an underwater obstruction, or heavy seas swamping the vessel, and may have had insufficient time to retrieve a PFD, launch a life raft, or send distress signals. Others had insufficient time to board life rafts, which had been launched by colleagues who were subsequently rescued. A more widespread use of PFDs among fishermen, particularly those in hazardous situations such as those engaged in trawling net operations on deck, and the maintenance of life rafts and PFDs in easily retrievable locations should be effective in reducing drowning of fishermen. The rapid capsize or foundering of fishing vessels should also be addressed by improved awareness of the vessel's stability limits and the need to close hatch covers and watertight doors after use.

The British commercial fishing industry has been under increased financial pressures in recent years, particularly with the implementation of catching restrictions. These can lead fishermen to take greater risks by taking under-manned and badly maintained trawlers to sea and to continue fishing in rougher weather.<sup>34</sup> Particularly in this climate, the industry is unresponsive to the introduction of additional safety regulations, especially when developed and enforced by those outside the industry. It is therefore important that safety measures should be developed through dialogue with fishermen and the fishing industry. This should be achieved by the use of multidisciplinary teams of experts, including fishermen, who are most able to develop safety solutions that are both practicable and economically affordable to the fishing industry. Further research should also focus on the identification of risk factors that are specific to the different subsectors of international fishing fleets.

Although the fatal accident rate in British fishing has fallen since the 1950s and 1960s, there has been an even greater reduction in the general British workforce. In relative terms, the occupation of commercial fishing remains at least as hazardous as before. Prevention should be directed, most importantly, towards improved safety awareness and reductions in hazardous working practices. In particular, this should be aimed at the unnecessary operation of small vessels and trawling net manoeuvres in hazardous weather and sea state conditions.

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## ECHO

### Sexually transmitted infections in Indian female sex workers



Please visit the *Occupational and Environmental Medicine* website [[www.occenvmed.com](http://www.occenvmed.com)] for a link to the full text of this article.

Sexually transmitted infections (STIs) are prevalent in developing countries where diagnostic and treatment facilities are often poor. The World Health Organisation has advised an approach to prevalence assessment and management based on clinical features in areas where prevalence is high and facilities are poor. Researchers in India have shown the inaccuracies of such an approach.

Female sex workers in a red light area of the city of Surat were encouraged to attend a nearby health camp where a behavioural questionnaire was administered, clinical examination performed, and diagnostic samples collected. Testing for HIV was anonymous and unlinkable to the individual. Of an estimated 500 female sex workers in the area, 118 were studied. They reported a mean of five clients a day and 95% reported using condoms consistently. Almost 60% had no symptoms of STI when seen. The most frequently reported symptoms relevant to STI were lower abdominal pain (23 of 118), abnormal vaginal discharge (15), pain on intercourse (15), pain on micturition (13), genital itching (12), genital ulceration (7), and inguinal swelling (3). Four syndromic diagnoses were made; genital discharge syndrome (confirmed by speculum examination) 61 patients, genital ulcer syndrome (7), lower abdominal pain (23), and enlarged inguinal lymph nodes (14). Fifty one women (43%) were HIV positive. Laboratory tests were positive for syphilis (rapid papain resin (RPR) and *Treponema pallidum* haemagglutination assay (TPHA) test) in 27 women, gonorrhoea (gonococcal culture) in 20, genital chlamydia (Pace 2 CT assay on endocervical specimens) in 10, trichomonal infection (wet mount microscopy and culture in Whittington media) in 17. Vaginal discharge (by speculum) had a sensitivity of 88% for trichomonas infection, 70% for genital chlamydia, and 60% for gonorrhoea. The specificity of vaginal discharge for each of these infections was about 50%. Genital ulcer syndrome was 15% sensitive and 97% specific for syphilis.

STIs and HIV infection are highly prevalent among female sex workers in Surat. Diagnosis based on STI clinical syndromes misses asymptomatic cases and leads to treatment of non-infected women. STI services need to be improved for these women.

▲ *Sexually Transmitted Infections* 2003;**79**:111–115.