Work related injuries in Danish fishermen

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A one-year retrospective study among Danish commercial fishermen revealed that the overall rate of injury was 20.4 per 100 persons per year. There were no significant differences in injury rates related to age. The overall rates of injury related to the different types of vessels — trawlers, gill-netters and Danish seiners — did differ statistically when the number of man-days at sea was taken into account. There was, however, a significant increase in the number of injuries on trawlers over 100 gross register tons. The overall number of days lost due to injury among all fishermen was 47 days per 1,000 days at sea. The highest number of days lost for work was on trawlers of 100–199 gross register tonnage. Preventive measures should be implemented in all age groups and in all the main types of fishing vessels.

Key words: Epidemiological; fishermen; injury; occupational.

INTRODUCTION

Fatal accidents constitute an inherent and unsolved problem in fisheries. Fatalities are often related to vessel casualties or falls overboard.1-3 While the problem of fatal accidents is well known, the scope of nonfatal injuries and specific causation has lacked attention. Previous studies have shown overall rates of nonfatal injuries to range from 50–280 per 1,000 persons in one year.4-6 However no consistent estimate of the problem can be obtained due to different case ascertainment and uncertainty regarding denominators. Also, the statistics from the Maritime Authorities do not supply reliable information about the significance of the problem, due to incomplete reporting.7 The absence of sufficient knowledge may explain the lack of interest in prevention of nonfatal fishing injuries hitherto.

A successful prevention programme must, among other things, rely on sound knowledge of the crude injury rates as well as of the specific injury pattern with respect to fishermen’s age, the fishing gear used, and the sizes of vessel. None of the previous studies, including the official statistics, has attempted to estimate the rates of nonfatal injury in different types of fishing vessels, and only a few have estimated the risk related to age.

The objectives of this study were to describe the significance of nonfatal fishing injuries with respect to the number and consequences of the injuries; to describe variation in injuries with the fishermen’s age and the type and size of vessel, and to estimate the completeness of reporting of injuries to the Maritime Authorities. The research hypotheses were: (1) that younger fishermen had a higher rate of injury than older fishermen; (2) that trawlers had a higher rate of injury than other types of vessel; and (3) that there were serious deficiencies in the reporting of injuries to the Maritime Authorities.

METHODS

The theoretical basis for this study was the epidemiological method, which presents a promising approach to further elucidation of the injury phenomenon,8-9 especially for study of the incidence in different substrata of the population at risk.10-11 The method of using man-days at sea as the denominator for estimating rates seemed the most convenient way of obtaining accurate and comparable results.6,12 The use of self-reported survey data has been shown to be useful for the study of occupational injuries.13

A retrospective one year follow-up study was conducted by means of postal questionnaires. The study population consisted of fishermen, all of whom were members of the Fishermen’s Unskilled Workers Union in Denmark (Specialarbejderforbundet), at the end of December, 1993. A total of 1,093 fishermen,
all male, from 17 union districts, were included and recorded by name, address and personal identification number. At the end of December 1993, the questionnaires were mailed together with a letter explaining the objectives of the study and guidelines for completing the questionnaire. Reminders, together with a new copy of the questionnaire, were sent to non-responders twice after a month's and a fortnight's interval.

A work-related injury in the fisheries was defined as any unintentional physical trauma that occurred at work and resulted in any kind of personal injury, whether the consequence was absence from work or not, and whether medically treated or not. The question was: ‘Were you injured while at work as a fisherman during 1993?’ In the event of an injury, there were further questions about the circumstances, including information on the type and size of the vessel and the number of days lost. Denominator data were obtained by asking how many days at sea on which specific types and sizes of fishing vessels worked had been completed during 1993. Skippers are legally required to notify the Maritime Authorities of all injuries resulting in at least one day of incapacity. The degree of compliance with this demand was assessed by comparing the number of such injuries in the study population with the number of notifications to the Maritime Authorities. This comparison was done by cross linking the register of the study population with the register of injury notifications.

Two pretests of the questionnaire gave response rates of 43% in the first pretest (n = 30) and 26% in the second (n = 20). To improve the response rate, the questionnaire was further simplified and retested by interviewing a small group of fishermen, who found it useful, before it was used for the full-scale study (Appendix).

Fishing vessels operating in the Baltic, the North Sea and the North Atlantic were included in the study. Near water vessels make trips of only one to a few days. Distant water fleets make trips of one to three weeks. Members of the union are wage-earners and work as crew, but some may have sailed as a substitute for the skipper. The study group consisted of a third of all wage earning fishermen in Denmark. At the end of 1992 the Danish commercial fishing fleet consisted of 3,488 registered vessels above 6 meters overall. The main categories of vessels were: side trawlers (n = 606), stern trawlers (n = 240), liners and gill-netters (n = 1549), Danish seiners (n = 211) and other types (n = 882). The total number of fishermen including skippers, was 7,277.14

Statistics
A log-linear Poisson-model with man-days as an offset-variable was applied for testing the hypotheses in Tables 1, 3 and 4.15 The chosen level of statistical significance was five per cent. Over-dispersion Poisson-models were used for testing rates of incapacity.

RESULTS
Of the 1,093 questionnaires mailed, 132 respondents were not eligible for the following reasons; 'letters were returned with address unknown' (n = 17), 'had stopped fishing before start of study' (n = 64), 'no days at sea in 1993' (n = 50), and 'subject deceased' (n = 1). Of the remaining 961 persons eligible, 17 answered that they did not wish to participate and 319 did not reply. The remaining 625 respondents represented a response rate of 65%.

In all, 128 persons reported an injury, 122 of these stating the specific date of injury, or month only in 1993. The overall rate of injury was 128/625 (20.4%) fishermen per year (95% confidence interval [CI] = 17.5–23.8). The overall rate of injury was 1.41 injuries per 1,000 man-days at sea (CI = 1.19–1.68).

Work incapacity following injury accounted for 4,277 lost days among 117 injured persons who stated the number of lost days; 74 of them (63.2%) had at least one day of lost time, corresponding to 118 injuries per 1,000 persons a year. The overall rate of lost days was 6.8 days per fisherman per year, and 47.1 days per 1,000 man-days at sea. Each injury caused an average of 36.6 days of lost time. Of the 74 injuries with one day or more of incapacity, only 18 (24.3%) had been reported to the Maritime Authorities.

Table 1 shows the rate of injury by age group. The differences are not statistically significant. The rates of incapacity for work showed a slight increase with age, and this increase was statistically significant. Also, incapacity for work per injury showed a significant increase with age.

<table>
<thead>
<tr>
<th>Age</th>
<th>Man-days at sea</th>
<th>Rate of injury*</th>
<th>Incapacity for work per 1,000 man-days at sea</th>
<th>Incapacity for work per injury</th>
</tr>
</thead>
<tbody>
<tr>
<td>15–24</td>
<td>7,234</td>
<td>193</td>
<td>40.9</td>
<td>21.1</td>
</tr>
<tr>
<td>25–34</td>
<td>22,150</td>
<td>122</td>
<td>38.5</td>
<td>32.8</td>
</tr>
<tr>
<td>35–44</td>
<td>26,884</td>
<td>156</td>
<td>50.5</td>
<td>37.8</td>
</tr>
<tr>
<td>45–54</td>
<td>29,330</td>
<td>130</td>
<td>54.0</td>
<td>44.0</td>
</tr>
<tr>
<td>&gt; 54</td>
<td>5,021</td>
<td>139</td>
<td>36.4</td>
<td>36.6</td>
</tr>
<tr>
<td>Total</td>
<td>90,619</td>
<td>141</td>
<td>47.2</td>
<td>36.6</td>
</tr>
</tbody>
</table>

* No. of persons injured per 100,000 man-days at sea
Table 2. Work activity at the time of injury

<table>
<thead>
<tr>
<th>Work activity</th>
<th>Number of Injuries</th>
<th>Percentages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hauling gear</td>
<td>41</td>
<td>36.9</td>
</tr>
<tr>
<td>Shooting gear</td>
<td>16</td>
<td>14.4</td>
</tr>
<tr>
<td>Icing fish</td>
<td>13</td>
<td>11.7</td>
</tr>
<tr>
<td>Repair</td>
<td>7</td>
<td>6.3</td>
</tr>
<tr>
<td>Handling fish</td>
<td>8</td>
<td>7.2</td>
</tr>
<tr>
<td>Gutting</td>
<td>6</td>
<td>5.4</td>
</tr>
<tr>
<td>Other activities</td>
<td>20</td>
<td>18.0</td>
</tr>
<tr>
<td>Total</td>
<td>111</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 3. Rate of injury and 95% confidence intervals (CI) by type of fishing vessel

<table>
<thead>
<tr>
<th>Type of vessel</th>
<th>Man-days at sea</th>
<th>Rate* (CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stern trawler</td>
<td>22,652</td>
<td>19 (14-26)</td>
</tr>
<tr>
<td>Side trawler</td>
<td>21,355</td>
<td>10 (6-15)</td>
</tr>
<tr>
<td>Gill-netter</td>
<td>24,421</td>
<td>12 (6-17)</td>
</tr>
<tr>
<td>Danish seiner</td>
<td>16,196</td>
<td>12 (7-18)</td>
</tr>
<tr>
<td>Other vessels**</td>
<td>5,725</td>
<td>17 (9-32)</td>
</tr>
<tr>
<td>Total</td>
<td>90,349</td>
<td>14 (11-18)</td>
</tr>
</tbody>
</table>

* Rates of injury per 10,000 man-days at sea
** Other types of fishing vessel included 15 different types. The most common were beamers, purse seiners, liners and other types of trawlers.

Table 4. Rate of injury and of incapacity for work by type and size of the fishing vessels

<table>
<thead>
<tr>
<th>Type and size of vessel*</th>
<th>Number of injuries</th>
<th>Rates of injury per 10,000 man-days at sea</th>
<th>Incapacity in days per 1,000 man-days at sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 100</td>
<td>3</td>
<td>9</td>
<td>18.7</td>
</tr>
<tr>
<td>100–199</td>
<td>18</td>
<td>22</td>
<td>146.7</td>
</tr>
<tr>
<td>&gt; 200</td>
<td>23</td>
<td>21</td>
<td>79.4</td>
</tr>
<tr>
<td>Side trawler</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 100</td>
<td>6</td>
<td>5</td>
<td>16.5</td>
</tr>
<tr>
<td>100–199</td>
<td>10</td>
<td>14</td>
<td>52.7</td>
</tr>
<tr>
<td>&gt; 200</td>
<td>5</td>
<td>23</td>
<td>19.3</td>
</tr>
<tr>
<td>Gill-netter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 20</td>
<td>7</td>
<td>11</td>
<td>31.8</td>
</tr>
<tr>
<td>20–49</td>
<td>15</td>
<td>10</td>
<td>18.2</td>
</tr>
<tr>
<td>&gt; 50</td>
<td>8</td>
<td>22</td>
<td>114.4</td>
</tr>
<tr>
<td>Danish seiner</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20–49</td>
<td>16</td>
<td>13</td>
<td>32.4</td>
</tr>
<tr>
<td>&gt; 50</td>
<td>2</td>
<td>6</td>
<td>1.5</td>
</tr>
</tbody>
</table>

* Sizes of vessels in Gross Register Tons

The main types of injury were: contusion, bruise and swelling (31%), laceration (25%), fracture (12%), sprain and strain (10%), eye or tooth injury (10%) and multiple types of injury (12%). The injured body parts were mainly the fingers 20%, hand/wrist 13%, other part of the upper extremity 15%, lower extremity 21% and the back 10%. Eight per cent of the injuries were only treated on the vessel and 16.8% were not treated at all. The remaining 74.8% were treated in general practice and/or at hospital.

Table 2 shows the activity performed at the time of injury. On trawlers, 11% of the injuries occurred while working at the trawl doors.

Table 3 shows rates of injury by type of vessel. Separate estimates of the injury rates of the different types of vessel showed no statistical difference.

In Table 4 the injury rates and the length of incapacity for work are further stratified with respect to size of vessel. A log-linear Poisson-model with man-days as an offset has been applied. Injury rates of side and stern trawlers were analyzed together, and the results showed a significant increase in rate of injury on trawlers over 100 GRT. The analysis of injury rates on gill-netters and Danish seiners showed no significant difference related to type or size of vessel, nor was there any difference from the rate of injury on trawlers under 100 GRT.

DISCUSSION

The overall rate of injury in this study was 1.41 injuries per 1,000 man-days at sea. In a British study in 1963 the rate was 0.93 injuries per 1,000 man-days at sea on trawlers. The number of injuries was based on trawler log-book entries and clinical medical records. The author assumed that minor injuries were not recorded, which may explain part of the difference from the present study.

Based on the number of fishermen, irrespective of the number of man-days at sea, the overall rate of injury in this study was 204/1,000 fishermen per year and 118/1,000 with at least one day's incapacity. Among Danish economically active men there were 40/1,000 per year who sustained some injury resulting in at least one day's incapacity. In two studies among farmers the corresponding self-reported number of injuries with at least one day's incapacity were 70 and 96 persons respectively per 1,000 persons in one year. In a Norwegian survey based on a representative sample of all fishermen, the rate of injury requiring medical treatment or causing incapacity was 58/1,000 fishermen per year. A different structure of the fishing fleet, as well as a long tradition for improving safety in the Norwegian fishing industry, may explain this difference.
The rate of incapacity for work in this study was an average of 47.2 days per 1,000 man-days at sea. In the Grimsby study the over-all rate of incapacity due to injury was 13.8 per 1,000 man-days at sea. The author stated that this may be an underestimate of the injury rate due to inadequate recording and the difficulty of keeping in touch with deep sea fishermen. In this study each injury was followed by an average of 36.6 days of lost time. Among Danish farmers there was an average of 17.3 days lost per injury and among a group of Polish workers ashore, the average was 23.2 days lost per injury. Consistent with a study from New Zealand, there was no significant difference in injury rates by age. The rate of incapacity in this study was highest in the 35–54 year old age group. Moore found that the highest rate of incapacity occurred in the 61–70 year old age group (36 days/1,000 man-days), and the lowest in the 21–30 year old age group (8.2 days/1,000 man-days). The differences are significant. Almost half (47.5%) of all injuries involved the upper limb, especially the fingers which is consistent with the results of other studies. Most of the injuries happened while working with deck machinery, and half happened while hauling or shooting the gear. This is also consistent with the findings of other studies. Stratification by types and sizes of vessel showed that the rate of injury was highest on large trawlers and gill-netters. Rates of incapacity of more than 100 days per 1,000 man-days at sea were only found on stern trawlers of 100–199 GRT and on gill-netters over 50 GRT; this may be of special interest in relation to prevention.

A one-year recall period may underestimate the overall incidence rate since recall of injuries that happened during the course of one year could be subject to memory loss, especially in cases which did not require medical care. It has been suggested that this type of recall-bias is a minor problem in estimation of injury rate differences. A tendency also to recall especially more serious injuries which occurred prior to the study period may overestimate the rate. However, this does not seem to be a serious problem as nearly all recalled the time of year in 1993 when their injury occurred. A response rate of 65% is acceptable, but it may bias the results to a certain extent. The magnitude of this bias could be assessed from a sample of nonresponders, but these were not obtainable. As the study population was limited to crew members, generalization of the results to all fishermen including skippers is uncertain.

CONCLUSION

This survey contributed to a more precise knowledge of the nonfatal injury problem in the fishing industry than has been presented before. Nonfatal injuries in fisheries are a serious problem, especially because of the rather high number of injuries and because of the remarkable number of days of work incapacity following such injuries. There was no significant difference in injury rates in relation to fishermen’s age, but there was a significant increase in incapacity following with age. The number of injuries was significantly highest on trawlers of over 100 GRT. The number of injuries reported to the Maritime Authorities was rather low and the reporting system should be improved. The results show that prevention measures should be taken not only among the youngest fishermen but in all age groups. Preventive measures should cover all types and sizes of fishing vessel, with special attention being paid to trawlers of over 100 GRT.

ACKNOWLEDGEMENTS

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REFERENCES

13. Zwerling C, Sprince NL, Wallace RB, Davis CS, Whitten PS, Heeringa SG. Effect of recall period on the reporting of oc-
APPENDIX

No. ________

Fishing Injury Survey 1993

1. Were you injured while at work as a fisherman in 1993? Yes ____  No ____

2. Questions about type and size of the vessel/s and the number of man-days at sea

<table>
<thead>
<tr>
<th>Mark with a cross the type of vessel you have worked on in 1993, (possible to mark more than one).</th>
<th>Give the approximate size (GRT) for each of them.</th>
<th>Write the total number of days at sea in 1993 — with each of them.</th>
</tr>
</thead>
<tbody>
<tr>
<td>____ Stern trawler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>____ Side trawler</td>
<td></td>
<td></td>
</tr>
<tr>
<td>____ Gill-netter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>____ Danish seiner</td>
<td></td>
<td></td>
</tr>
<tr>
<td>____ Other types</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If you were injured at work in 1993, please answer the questions on page 2.
To be filled out, if you have been injured at work as a fisherman during 1993 (including small injuries).

Date of injury: ______________ 1993

Where did it happen?
- [ ] on ship at sea  
- [ ] on ship at quay  
- [ ] on the quay

What type of ship was it?
- [ ] sidetrawler  
- [ ] sterntrawler  
- [ ] gill-netter  
- [ ] Danish seiner  
- [ ] other, what?

Size of the ship (GRT)? ___________  
How many on board? ___________

What kind of work were you doing when it happened?
- [ ] shooting gear  
- [ ] hauling of gear  
- [ ] handling the fish  
- [ ] gutting
- [ ] icing  
- [ ] repair  
- [ ] other, what?

Where on the ship did it happen?
- [ ] at winches  
- [ ] at wires  
- [ ] at trawl-board  
- [ ] other places on deck
- [ ] in the hold  
- [ ] galley  
- [ ] other, where?

Injured body part?
- [ ] finger  
- [ ] neck/head  
- [ ] thigh  
- [ ] hand  
- [ ] eyes  
- [ ] leg  
- [ ] wrist  
- [ ] toes  
- [ ] knee  
- [ ] forearm  
- [ ] foot  
- [ ] upper arm/shoulder  
- [ ] ankle  
- [ ] other?

Type of injury?
- [ ] contusion  
- [ ] amputation  
- [ ] bruise  
- [ ] laceration  
- [ ] fracture
- [ ] other?

Treatment?
- [ ] on board  
- [ ] at general practice  
- [ ] hospital  
- [ ] no treatment

How many days have you been incapacitated after the injury? ___________ days

This was the last question, thank you for your participation.