A Study of Factors Relating to Work Accidents among Seamen

Shuji HISAMUNE1*, Kiyoshi AMAGAI2, Nobuo KIMURA2 and Koya KISHIDA3

1 Hachinohe University, 13-98 Mihono, Hachinohe, Aomori 031-8533, Japan
2 Hokkaido University Graduate school of Fishery Sciences, 3–1–1 Minatochou, Hakodate, Hokkaido 041-8611, Japan
3 Takasaki City University of Economic, 1300 Kaminamie, Takasaki, Gunma 370-0801, Japan

Received August 31, 2005 and accepted November 22, 2005

Abstract: In Japan, the accident rate for seamen is 5 times higher than that for all other industries. Many maritime work accidents are related to the poor ergonomic conditions of the working environment. It is particularly important to examine seamen safety in terms of vessel type and seamen age, as these factors are related to various sorts of accidents. In this paper, maritime work accidents were analyzed according to fundamental factors including vessel type, seamen age, and seaman rank. It is suggested that safety education should be provided according specifically to seamen age and vessel type, as they are revealed to be strong factors relating to maritime work accidents. Such education and further research may also lead to improvements in maritime equipment in relation to worker safety.

Key words: Aging, Maritime work, Work accidents

Introduction

In Japan, the occurrence rate of work accidents among seamen is 5 times higher than that for all other industries1). Thus it is necessary to examine the factors that play roles in work-related work accidents. The number of work accidents experienced by Japanese seamen from 1986 to 2001 was 43,047, with the number of those work accidents taking place on merchant vessel being 11,018, accounting for 25.6% of 43,047 total accidents. The number of work accidents taking place on fishing vessels was 27,605, accounting for 64.1% of the total number of accidents. It is particularly important that the type of vessel and the seamen’s age are distinguished, as these factors play a role in accident occurrence. In attempting to prevent accidents among seamen, several factors are examined, including the age of seamen, the type of vessel, and the seaman’s rank.

Methods

We analyzed the data of 43,047 work accidents which had been reported to the Ministry of Land, Infrastructure and Transport of Japan from 1986 to 2001. The work accidents were divided into subgroups according to fundamental factors (vessel type, type of work, and the seaman’s rank).

Results

Figure 1 shows the number of work accidents over a period of 15 yr.

The number of work accidents decreased to 1,522 in 2000 compared with 4,571 in 1986. The primary factor relating to this decrease was the decrease in the number of crew members per vessel. However, the rate of decrease rate has slowed since 1997.

Work accidents in relation to type of vessel

Figure 2 also shows the number of work accidents over a period of 15 yr. The number of work accidents in fishing boats is 27,605, constituting two-third of the total number. Figure 3 shows the number of work accidents according to type of vessel and the various types of work performed on them.

Maintenance showed the highest occurrence of work accidents among fishing vessels. The number of maintenance work accidents was 15,633, accounting for 56.6% of the total number of work accidents in fishing vessels. On the other hand, the number of construction work accidents was 11,662, accounting for 42.1% of the total number of work accidents in construction.
accidents in foreign-trade vessels. Cargo handling showed the highest occurrence of work accidents in domestic-trade vessels, while fishing operations showed the highest in occurrence of work accidents in fishing vessels. The χ²-test showed a significant difference of 1% between the danger rates.

Figure 4 shows work accidents according to type of vessel and place in which the accident took place.

The deck showed the highest occurrence of work accidents in foreign-trade vessels. The χ²-test showed a significant difference of 1% between the danger rates.

Figure 5 shows the causes of accidents according to type of vessel and object causing injury (deck equipment, fishing equipment, deck, tools, fishing devices, and waves).

Deck, deck equipment, and tools caused the same rate of work accidents in domestic trade vessels, while fishing equipment caused the highest occurrence of work accidents in fishing vessels. The χ²-test showed a significant difference of 1% between the danger rates.

Figure 6 shows work accidents according to type of vessel and cause (capsizing, fly, iteration, catch and other).

The capsizing the highest cause of work accidents in foreign-trade vessels. The capsizing and iteration were the highest cause of work accidents in domestic-trade vessels. The capsizing and catch were the highest cause of work accidents in fishing vessels. The χ²-test showed a significant difference of 1% between the danger rates.

Work accidents according to seaman age

Figure 7 shows the number of work accidents over a 15
year period according to seaman age group.

One-third of the total numbers of accidents were experienced by those in the 45-54-yr-old age group. The decrease in the number of accidents experienced by those over 55 is due to the retirement of seamen over this age. Because of the increase in the number of seniors faced by Japan in the future, an increase in the size of this age group in the workforce will be seen. Thus, the maintenance of a safe work environment is essential for relatively older seamen.

Figure 8 shows work accidents according to seaman age and place in which the accident took place.

The main area in which work accidents took place among those who were 40–44 yr old was the warehouse. Among those who were 60 years old and older, the main accident area was the deck. The $\chi^2$-test showed a significant difference of 1% between the danger rates.

Figure 9 shows work accidents according to seaman age and object causing injury. The main source of work...
accidents among those who were 19 yr old and younger was the deck. Among those who were 55–59 yr old, it was deck and deck equipment. The $\chi^2$-test showed a significant difference of 1% between the danger rates.

Figure 10 shows work accidents according to seamen age and type of work. The main type of work in which accidents occurred among those who were 19 yr old and younger was catch handling. Among those who were 60 years old and older, accident happened the most frequently in port. The $\chi^2$-test showed a significant difference of 1% between the danger rates.

Figure 11 shows work accidents according to seaman age and cause.

The main cause of work accidents among those who were 34 yr old and younger and among those who were 55 yr old and older was capsizing. The $\chi^2$-test showed a significant difference of 1% between the danger rates.

**Work accidents according to rank**

Figure 12 shows work accidents according to rank. Of the total number of accidents surveyed, 29,177 were experienced by sailors, constituting 2/3 of the total.

Figure 13 shows work accidents according to rank and work.

Most accidents among sailors took place during fishing operations, while officers experienced the most accidents during maintenance operations. The $\chi^2$-test showed a significant difference of 1% between the danger rates.

Figure 14 shows work accidents according to rank and place in which the accident took place.

The main area in which accidents took place among sailors was the deck, while officers experienced the greatest number of accidents on the deck, in the warehouse, and in the engine room. The $\chi^2$-test showed a significant difference of 1% between the danger rates.

Figure 15 shows work accidents according to rank and object causing injury. The main object causing work accidents among sailors was the fishing net, while among officers it was the deck. The $\chi^2$-test showed a significant difference of 1% between the danger rates.

Figure 16 shows work accidents according to rank and cause.
The main cause of work accidents among sailors was the catch and capsizing. Among officers the main cause was the capsizing and catches. The $\chi^2$-test showed a significant difference of 1% between the danger rates.

**Discussion**

A guidebook for work accident prevention and work procedures in Shimane Prefecture published by the Japanese Fishery Agency points out dangers in the area’s net fishery\(^3\). A study of human energy expended in the fishery industry done by the Maritime Labor Research Institute also evaluated strenuous types of maritime work\(^4\), showing the importance of motion study focusing on the purse seine fishery. Kawasaki investigated the influence of the mental load of seamen during hull movement over long voyages\(^5\). During fishing operations, hull movement in relation to the human body is an important factor contributing to work fatigue, and its analysis is difficult with few studies being devoted to it\(^6\). K. Mikami analyzed fishing position, that is, the operating posture, of fishermen in the surf clam fishery, including safe operation of the winch\(^7\). M. Torner used a subjective questionnaire to examine the work habits of Swedish fishermen according to fish species, type of job, and age. This study proposed that ergonomical improvements could lower costs and reduce workload\(^8, 9\). The present study examined the operations of the offing purse seine fishery using conventional research methods.

The modernization of off shore fishing prompted by the Japanese Fishery Agency took account of -wave stability and work safety, reducing labor by the mechanization of the fishery without study of the fishermen’s movement on this ship. As a result, the increase in the amount of equipment on deck impeded hull stability\(^10–14\).

In the present study, work accidents experienced by seamen were analyzed in terms of fundamental factors such as type of vessel, seamen age, and rank.

As the seamen on foreign-trade vessel have been injured most commonly during maintenance, while on the deck, and while handling the catch, the safety concerning maintenance is necessary. As the seamen on domestic-trade vessel have been injured most commonly on the deck and during cargo handling and due to capsizing, further safety is necessary regarding basic cargo handling. As well, further improvements in the machines intended for cargo handling are also necessary. As fisherman have been injured on the deck, during fishing operations, and while handling the catch, the development of a safety training and support system is necessary. As relatively young seamen (19 years old) are injured handling the catch, and relatively aged seamen (60 years old and older) are injured by capsizing, it is necessary to improve working methods and adapt equipment in regard to age. Officers are most commonly injured on deck while performing maintenance, while sailor have most commonly been injured during fishing operations and while handling fishing nets. Injuries and their relation to rank are greatly influenced by type of vessel. In order to further enhance the safety of seamen, this relationship should be further studied.

The age of the seamen and vessel type are also factors in worker safety and should be further examined as a way to improve maritime equipment in relation to these factors.

**Acknowledgments**

This research part of the 8th Seamen’s Accidents Prevention Plan in the Ministry of Land, Infrastructure and Transport of Sea fares Department of Japan. We appreciate the Ministry of Land, Infrastructure and Transport and the Association for Promoting Safety and Sanitation for Seafarers for providing us with valuable data.

**Reference**


