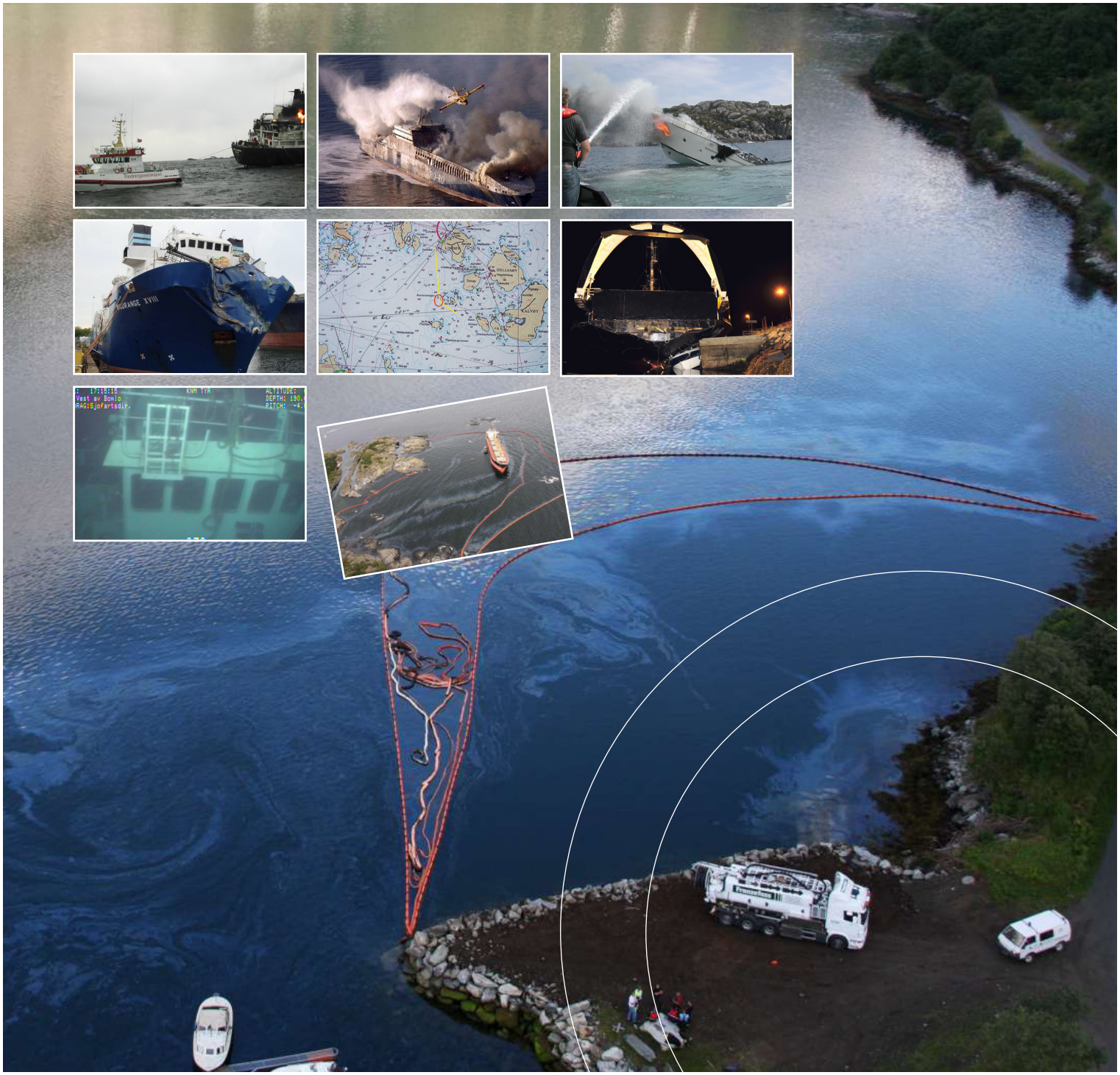
SJØFARTSDIREKTORATET
Norwegian Maritime Directorate

Marine casualties 2000 - 2010

Strategic Safety Department 2011



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1 Introduction

The Norwegian Maritime Directorate (NMD)'s overarching goal is to work for the highest safety standards to protect life, health, the environment and property. This can only be achieved by focusing on safety in cooperation with the maritime industry. NMD therefore emphasizes good and open dialogue, with particular focus on how safety can be ensured.

This report contains statistics on accidents at sea in the period 2000-2010. It also provides a summary and assessment of information from inspections and follow-up of accidents in the industry. Learning from accidents is an expensive way of making improvements. It is then all the more important that precisely the knowledge that accidents provide is used to the greatest extent to prevent accidents.

The aim of the report is to disseminate information related to accidents recorded and analyzed by NMD. In our work on safety, information from accidents can be used to improve ship-owners and vessel safety systems through the introduction of more and better barriers against failure. Barriers in this context mean measures of both a technical and organizational nature.

Causes of accidents are as a rule complicated and very resource-intensive to identify. A clear and true causal picture will also depend on an open flow of information from the industry to the authorities. Even with good dialogue, there will still be accidents where the individual element's effect on the accident is not explained, either for resource-related reasons or because the information is not available. However, the information that is available about the accidents will be important and useful in safety work.

While it is gratifying to note that the total number of accidents on Norwegian vessels is steadily improving, each year we see that seamen and fishermen perish in accidents on board. This is unacceptable and requires a greater focus on safety in the industry. The fact that we are also seeing a general increase in ship accidents underlines the urgency.

The maritime industry

Norway has a shipping industry where many companies and ship-owners have a high level of competence and high safety standards with innovative solutions. It is this part of the industry that is lifting our safety standards up and helping Norway achieve international recognition as a maritime nation.

Unfortunately, there are also elements that are contributing to the opposite effect. In too many cases it turns out that certain actors operate at a safety level that is in contravention of the regulations. This is evident in both the accident statistics and inspections conducted by the Directorate. There may be several reasons why some operators choose to bend the rules, such as finances or lack of knowledge about safety. Nevertheless, these factors lead to an increased risk of accident. Such behaviour harms the entire industry and damages Norway's reputation abroad. This is something ship-owners must take on board. The Ship Safety and Security Act clearly points out that it is the ship-owners who are responsible for ensuring the safety and protection of crews, vessels and the environment.

This report gives a small indication of whether the entire maritime industry is able to meet the safety challenges in a professional manner and reflect Norway's reputation as one of the world's best

maritime nations. Although many in the industry do a very good job, some obviously have a large potential for improvement.

NMD has a clear expectation that the maritime industry, which is responsible for ensuring safety, will intensify its work on accident prevention.

1.1 The report's structure

The report is based on accident information received from ship-owners and vessels, as well as information from the Directorate's own inspections and audits in connection with accidents. In addition, information from research institutions and other authorities has been used. See also the references in the report.

The report initially provides a summary of accidents in NMD's regulatory area in 2010. Developments in the period 2000-2010 are then discussed. Statistics on both work and ship accidents are presented in graphs with some explanatory information. Leisure boat-related statistics are not included in this report.

The next section of the report assesses the three vessel groups that represent the majority of accidents: passenger ships, fishing vessels and cargo ships. The accidents in each of these vessel groups are examined through assessment of the statistics and information from NMD inspections. Causes and consequences of accidents are specifically commented on, and an emphasis has been placed on accident areas with the most incidents, the greatest impact or the highest accident potential.

The final part of the report includes a list of reports prepared and published by the Accident Investigation Board Norway (AIBN) in 2010.

2 Accidents in 2010

A total of 495 accidents were recorded in 2010. Figure 2.1 shows that this is a slight decrease (2%) compared to 2009. About half of the reported accidents are occupational accidents.

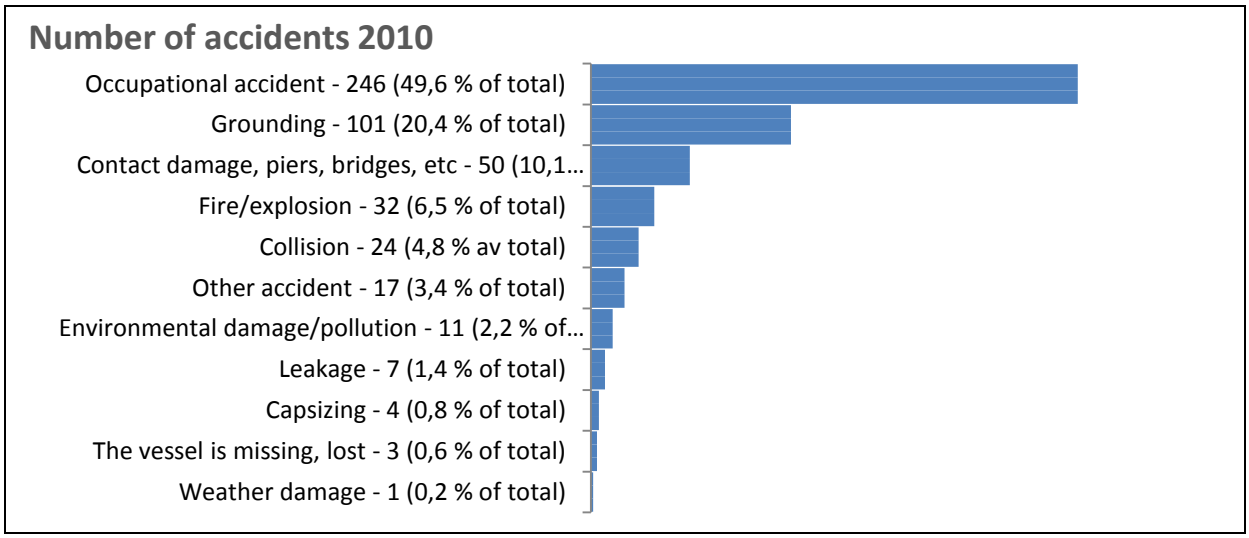

Figure 2.1 Accidents in 2010 by type of accident

Other accidents in this chart represent incidents such as those related to towing, mooring operations and lifting equipment.

Figure 2.2 shows accidents in 2010 by main groups of vessels.

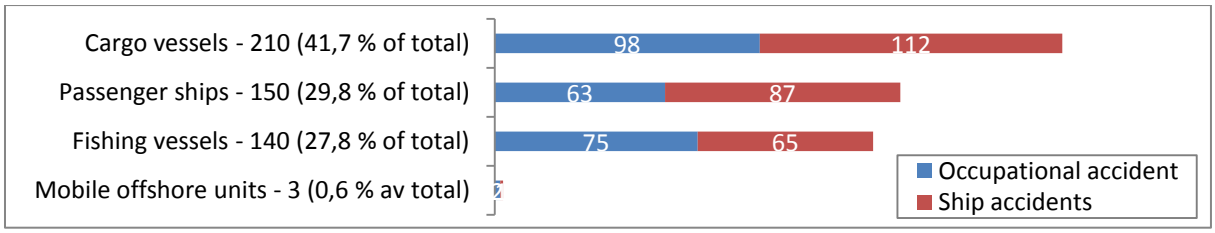

Figure 2.2 Accidents per vessel and accident group in 2010 (number of incidents per vessel involved)

2.1 Near accidents

We see a decrease in the number of near accidents reported in 2010 compared to previous years. Introduced by a 2008 amendment of the Norwegian Maritime Code, requirements for reporting near accidents are still relatively new. Most near accidents that are reported are related to engine failure or other technical problems with the vessel.

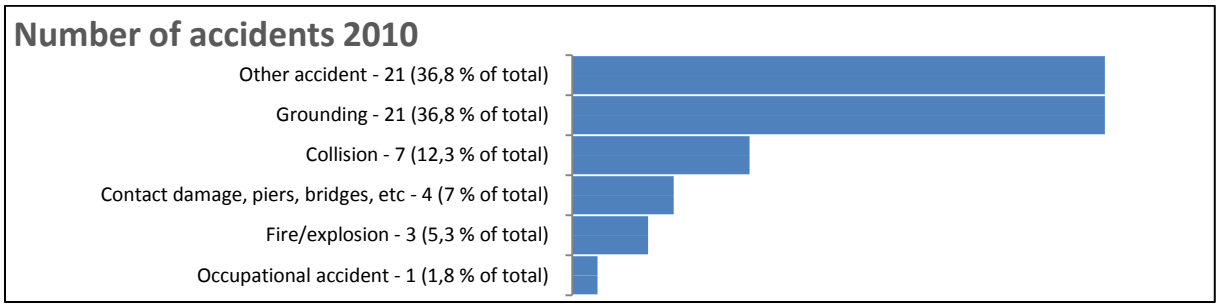

Figure 2.3 Near accidents in 2010 by type of accident

Other accidents in this list include incidents such as ropes in propellers, engine failure, technical problems with critical equipment and the like. Such incidents are recorded when they are considered to have a potential for disaster if they had occurred under slightly different circumstances.

2.2 Consequences of accidents

The vast majority of ship accidents reported to NMD result in limited material damage. This suggests that the many barriers that the regulations require to prevent or limit the extent of damage to life, the environment and property once an accident happen, have a good effect.

2.2.1 Fatalities

NMD recorded 15 fatalities in 2010, of which 12 people perished in connection with occupational accidents. In the last 10 years, 6 of 10 deaths occurred in connection with occupational accidents.

Three people were perished in 2010 as a result of ship accidents. Fatalities related to ship accidents has a historically strong connection with loss of the vessel. In 7 of 10 ship accidents involving fatalities, the vessel is lost.

This means that there were no reports of major accidents[1] in 2010. Major accident means an incident with 5 or more fatalities.

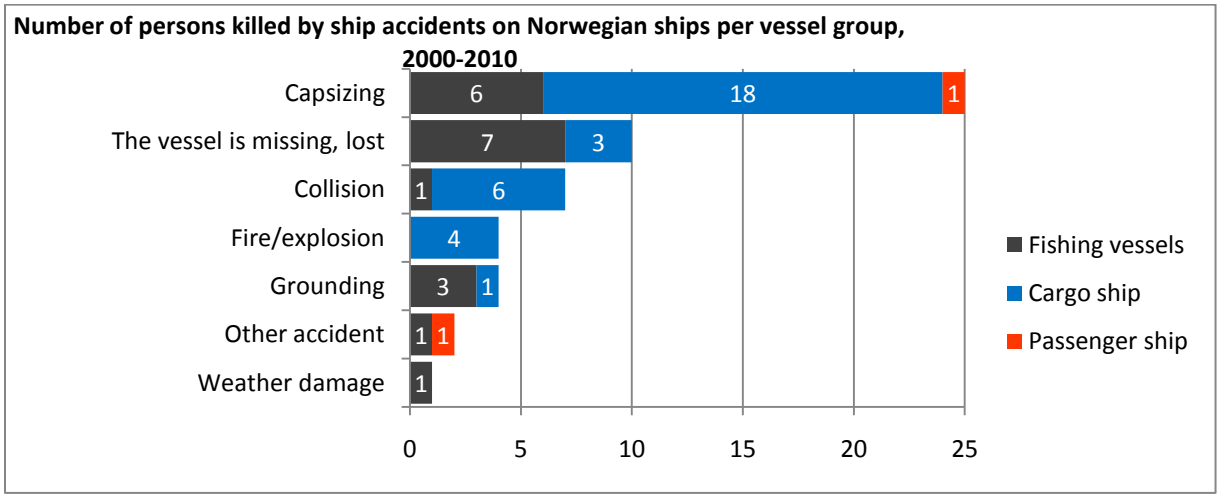

Figure 2.4 Number of fatalities in ship accidents on Norwegian ships per vessel group, 2000-2010

2.2.2 Pollution

Pollution is recorded both as a separate type of accident and as a consequence of other accidents, such as a grounding. Recording is based mainly on the ship-owners own estimates concerning quantity and scope. Today, only substances that are actually discharged are recorded. This means that pollutants on board a vessel that sinks are not recorded as environmental damage.

Eleven cases of contamination were recorded in 2010. In one case, 30 to 40 tonnes of diesel were discharged into the port of Tananger. In the other incidents, 100-400 litres of diesel fuel or hydraulic oil were discharged.

[1] See also E. Jersin, Storulykker i Norge (Major accidents in Norway) 1970 – 2001 (STF38 A0240)

2.2.3 Property damage

As Table 2.1 shows, most accidents result in minor or no damage to the vessel. Smaller vessels are over-represented with respect to severe damage and loss.

Of the 15 vessels that lost[2] in 2010, one was over 24 metres. The engine room of the fishing vessel "Hundvåkøy" took in large amounts of water after it collided with the cargo ship "Hordafor IV" in the Finnsnes Trench in March 2010. Although a total of 16 persons were on board the two vessels when they collided, no one was injured.

Extent of damage	Norwegian vessels	Foreign vessels	Total
No or unknown damage to the vessel	60	25	85
Vessel less seriously damaged	121	17	138
Vessel seriously damaged[3]	25	5	30
Ship lost[2]	16	0	16
Total	**223**	**48**	**271**

Table 2.1 Extent and nationality of the vessels involved in ship accidents in 2010

In 2000-2010, 3 out of 4 lost ships was a fishing vessel. However, it is worth noting that there were approximately 5,400 active fishing vessels in 2009, and that this is about twice the total number of cargo and passenger ships.

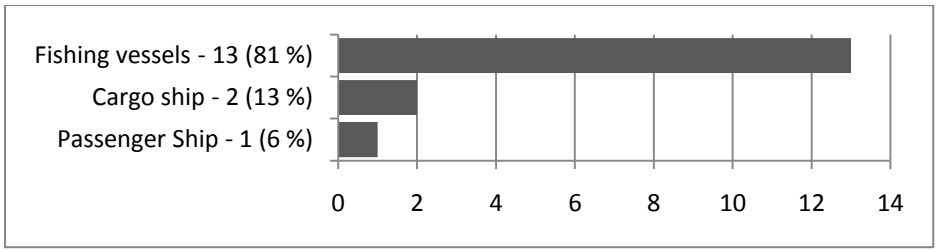

Figure 2.5 Number of lost ships in 2010 by vessel group

[2] Ship lost mean actual or technical loss of the vessel.

[3] Severe damage means damage to the vessel resulting in a shutdown of operations that must be rectified before the vessel can continue.

3 Accidents - 2000-2010

The very positive and long-term decline in the number of occupational accidents continued in 2010. NMD sees this as a result of long and targeted efforts in the industry. The reduction is occurring in all vessel groups.

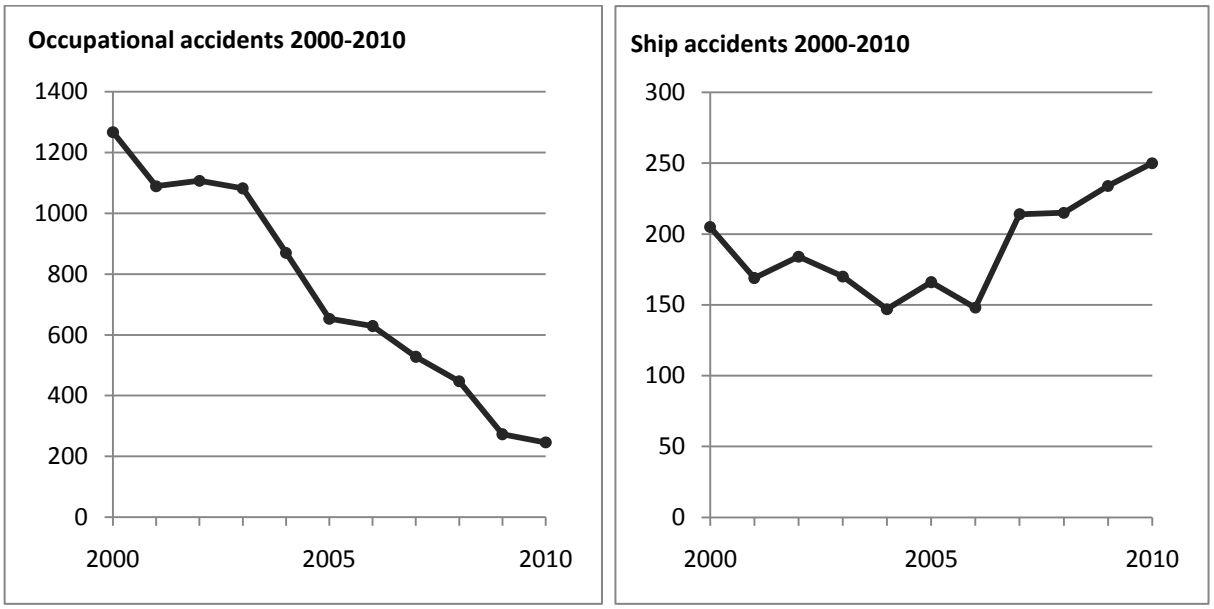

Figure 3.1 Number of occupational accidents and ship accidents for all ships (Norwegian and foreign flag)

Occupational accident means accidents affecting persons who work on board. Occupational accidents involving others on board, such as passengers and pilots, are also reported and included in the same statistics. Injuries to crews that happen as a result of a ship accident are not included in the figures in Figure 3.1. Very few accidents on foreign vessels in Norwegian waters are reported and recorded.

Figure 3.1 on ship accidents shows both Norwegian and foreign vessels[4]. The contribution from foreign vessels is mainly tankers. See Chapter 6 for further information.

The number of ship accidents has been increasing in recent years. The reason for the increase is not clear. The same period has seen a reduction in the number of vessels in NOR/NIS registers. Given that the utilization of each vessel is equal and there is no change in the percentage of the accidents reported, there is reason to believe that the increased number of accidents indicates an increased risk of an accident happening.

3.1 Occupational accidents

Figure 3.2 shows that there has been a positive development for all categories of occupational accidents in 2000-2010. Throughout the period, impact and crush injuries and falls on board were the most frequent types of accidents.

[4] Accidents on foreign vessels are recorded when the accident occurs within Norwegian territorial waters

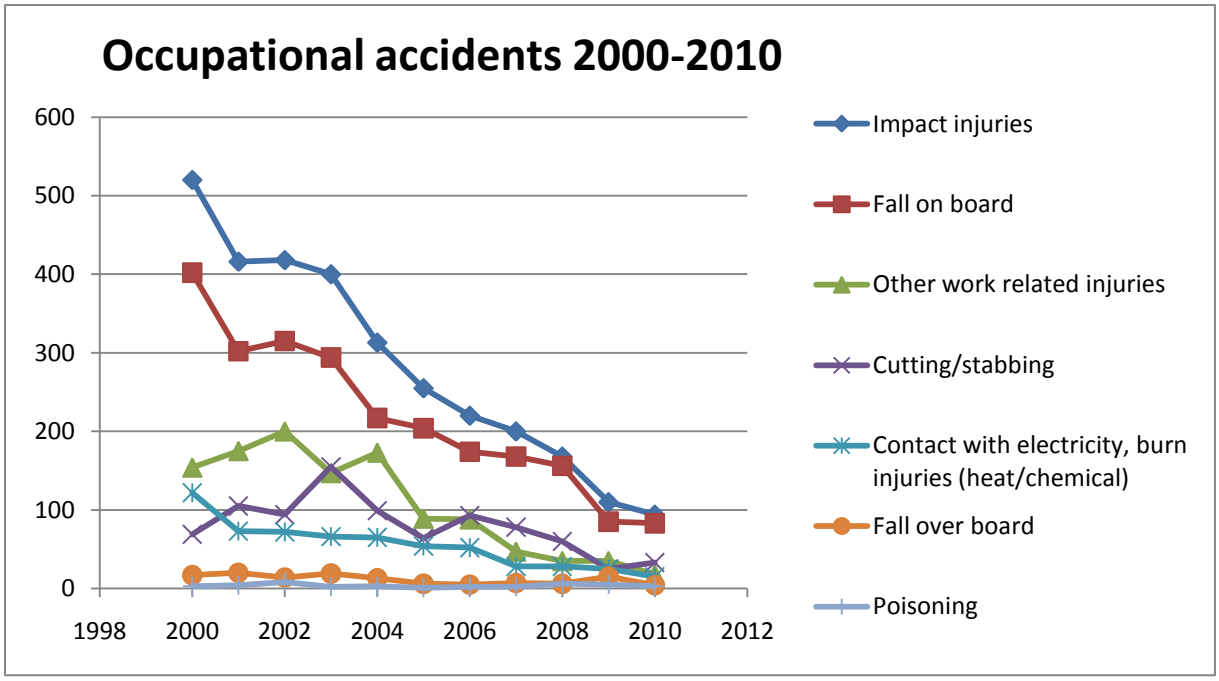

Figure 3.2 Number of occupational accidents 2000-2010 by category/cause

3.2 Ship accidents by accident type

The increase in ship accidents occurred mainly due to an increase in the number of groundings and contact damage. We see from Figure 3.3 that the number of groundings in 2010 was 101 and that there have been more than 100 groundings each year since 2007. Contact damage has increased sharply from 18 in 2006 to 50 incidents in 2010. But other types of accidents have also shown a negative trend. As at 2010, fire and/or explosion is the third most frequent type of accident which often leads to the loss of the vessel. This is especially true of fires on smaller fishing vessels.

Figure 3.3 shows the trend in the number of accidents per accident type during the period 2000-2010. Grounding means any contact between the vessel and the seabed. No distinction is made between grounding or ground contact. Grounding is recorded as an accident even when damage to the vessel is very limited.

Contact damage is defined as incidents in which the vessel collides with a pier or other fixed installations. A collision is defined as an incident in which the vessel collides with another vessel or floating object.

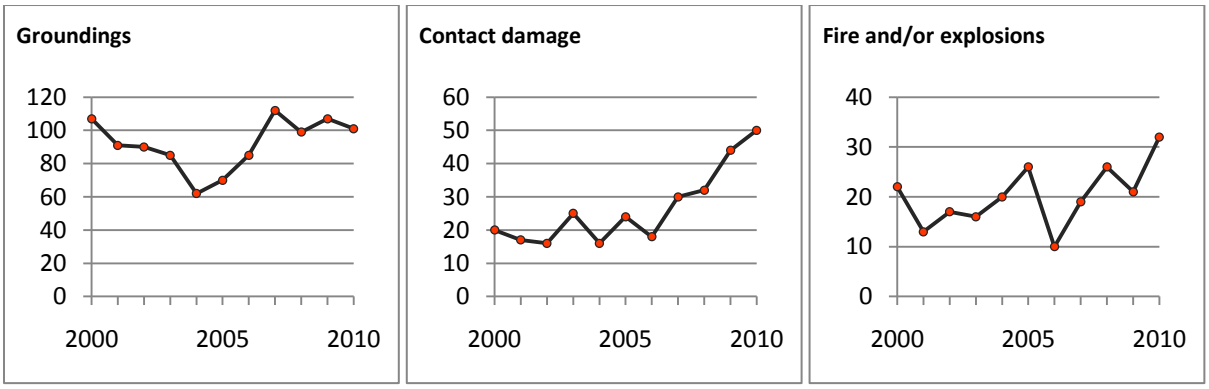

Figure 3.3 Groundings, contact damage and fires and/or explosions in the period 2000-2010

Figure 3.4 shows the number of collisions between vessels. In 2010, 24 collisions involving 44 vessels were recorded. A collision is defined as a single accident event even if it involves multiple vessels. All the involved vessels are recorded with the causes and consequences for each vessel's situation.

The accident type pollution is used when the primary incident is a discharge, for example, when a tank is overfilled. Pollution arising from an accident, such as grounding, is not included in Figure 3.4.

A leak means an intrusion of water that could cause a vessel to sink. Although leakage is an infrequent type of accident, nearly half of the 49 recorded cases in 2000-2010 led to the loss of the vessel.

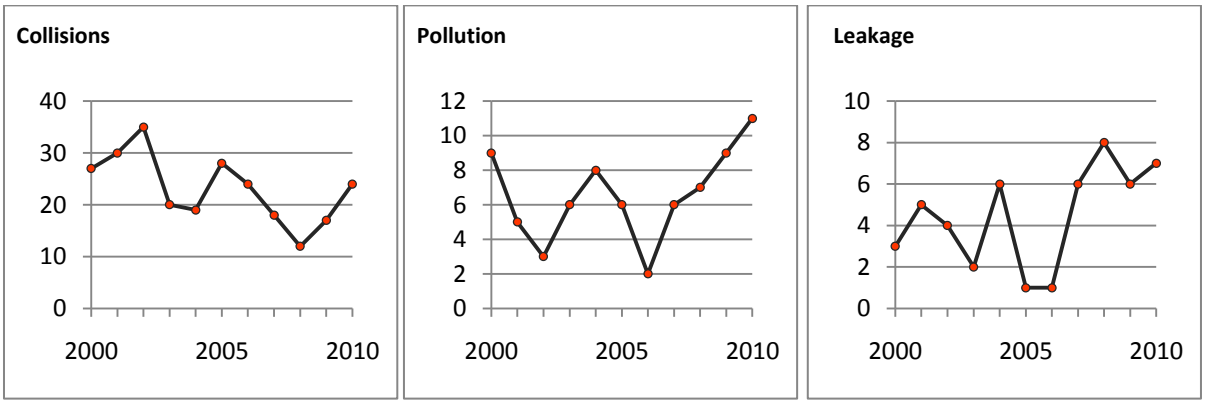

Figure 3.4 Collisions, pollution and leakage, 2000-2010. The number of collisions reflects the number of collisions and not the number of vessels involved.

Many of the most serious accidents in the last 10 years have been capsizing accidents (see Figure 3.5). In 2000-2010 capsizing accidents accounted for 1/3 of fatalities connected with ship accidents. Most capsizing accidents happen on fishing and cargo ships of less than 3,000 BT.

Examples of incidents that have been recorded as other accidents in Figure 3.5 are ropes in propellers, collisions between cars on car ferries, lifting accidents and suspension deck malfunctions.

The accident categories stability failure, heavy weather damage and vessel missing occur rarely and are combined in Figure 3.5 .

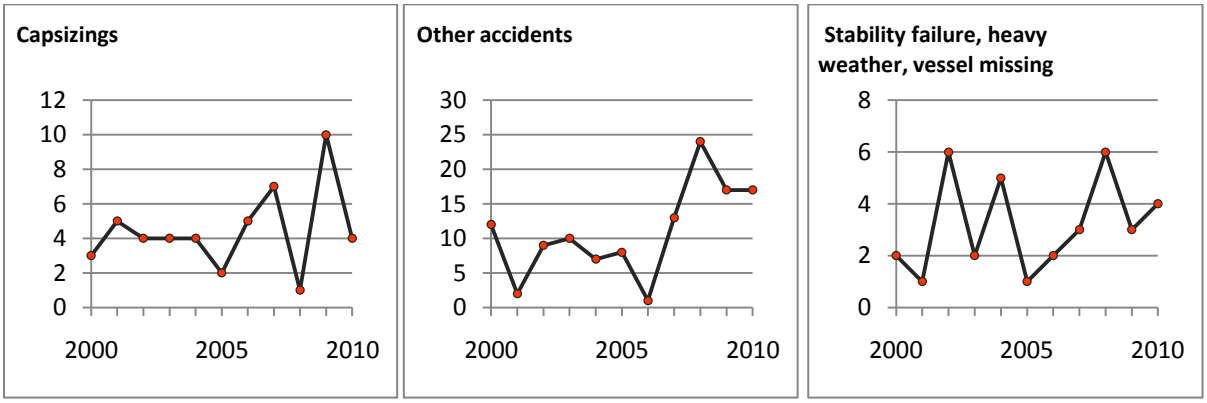

Figure 3.5 Capsizing, other accidents and stability failure/heavy weather/vessel missing

3.3 Why do accidents happen?

Causal explanations were originally based on simple theories where the relationship between the actual damage caused by the accident and triggering factors was direct and easily identifiable. It was

usually believed that the cause was human or technical failure, and the person directly involved, for example, the master of the ship, was assigned the criminal responsibility.

In recent years other explanatory models have been developed that emphasize an understanding of systems, taking into account various factors that affect the actor in the technical or organizational system of which he or she is a part. When one chooses to explain the causes of an accident from a systems approach, the person directly involved represents the triggering factor, while the explanation for the accident lies in the underlying causes. Such a focus shifts the causal understanding over to working conditions and labour management, to appropriate equipment and training, while also trying to identify governance- and management-related safety issues. (Røed-Larsen, 2004)

Today's accident investigation boards use a variety of methods for causal analysis. This provides a broader perspective that also includes the regulatory role of the authorities in the causal relationship. This is reflected in the safety recommendations arising from the AIBN's safety investigations.

Although the conclusions of human error or technical failure are in fact insufficient in a modern approach to safety, they are used a lot. This is probably due to several factors, but it is probably still the easiest to make conclusions according to what is most visible. The terms are also known and used by many. Furthermore, it is highly resource-intensive to find the underlying causes of an accident. NMD records about 500 accidents per year, and it would be too resource-intensive to uncover the underlying causes of each accident. Some of the accidents are therefore only recorded and followed up by the supervisory and regulatory system. The consequence of this is that the causes of these accidents will largely be defined by the person who reports it. It is then often the most conspicuous cause, namely the triggering cause, which is recorded.

NMD, however, follows up certain accidents more thoroughly to uncover the underlying conditions that may have played a role in the event. We do this by means of inspections after an accident, and by gathering information from both ships and ship-owners. These are in practice accidents that AIBN does not investigate, and that NMD would like to learn more about. The selection of accidents that are followed up with regard to further clarification of the causes is based on an assessment of various aspects of risk, accident potential and frequency of accident type. It can also be based on a desire for more knowledge about the sector in which the vessel operates, and documentation of operating conditions on board and in the ship-owners company.

How complex an accident is will vary significantly from event to event, but in most cases there are many causes that can trigger an accident, and it will be virtually impossible to specify only a single cause. However, recurring factors in accident situations include failure to use the lookout, the distribution of tasks on board, administrative burden, inattention, too little sleep or shift schedules that stretch over many weeks, inadequate communication, lack of maintenance, ergonomic solutions, etc.

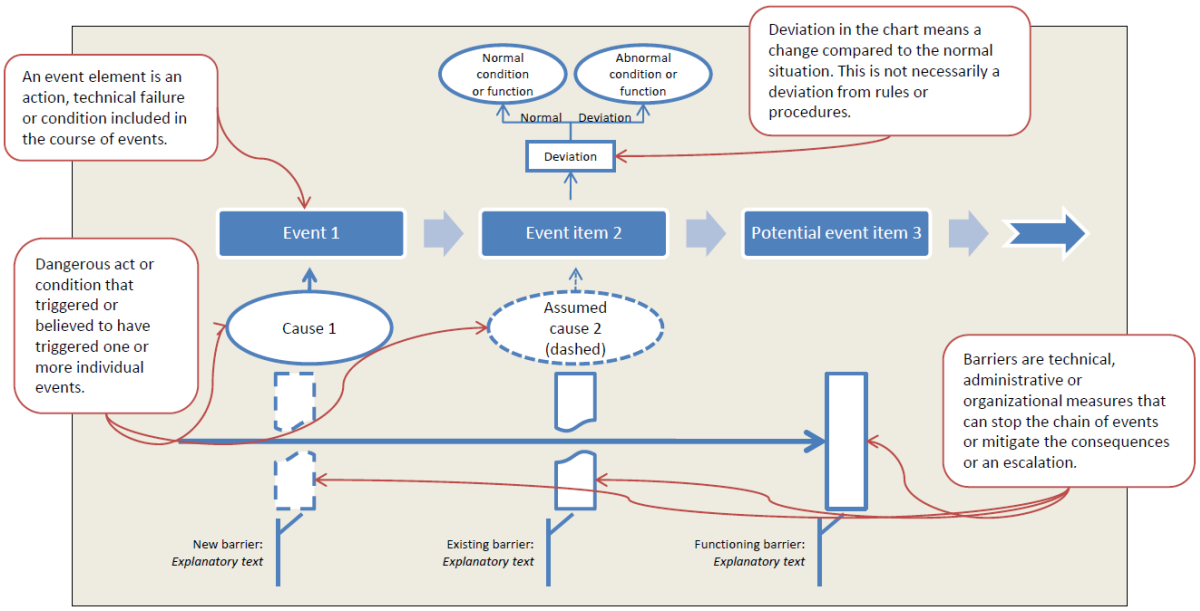

Figure 3.6 Incident and causal analysis. NMD analyzes accidents, among other things, on the basis of *Guidelines for the implementation of MTO analyses*. (Bento, 2001).

To conclude that the cause was human error is not wrong per se since almost all accidents are related to human actions. The cause of the accident is often found in the interface between man, technology and organization. It is people who make the decisions about how machines should be designed, what materials are to be used and how the work is to be carried out. Safety theory is subdivided into what is called active faults committed by those in the first line, for example, the operator of the vessel, and latent faults that arose already in the design and production stage. Latent faults also lie in the organization in terms of attitudes, safety culture and the decisions taken at different levels of the organization and with external stakeholders. There are a number of examples of latent defects that have played a key role in major and well-known accidents at sea. Two clear examples of this are the sinking of the "Estonia" in 1994 and the "Herald of Free Enterprise" in 1987.

4 Passenger ship - accidents 2000-2010

There was a decline in the number of passenger ships subject to control in the period 2002-2010. At the beginning of 2011 the Norwegian passenger ship fleet consisted of 711 ships. All passenger ships that carry 12 or more passengers are subject to control.

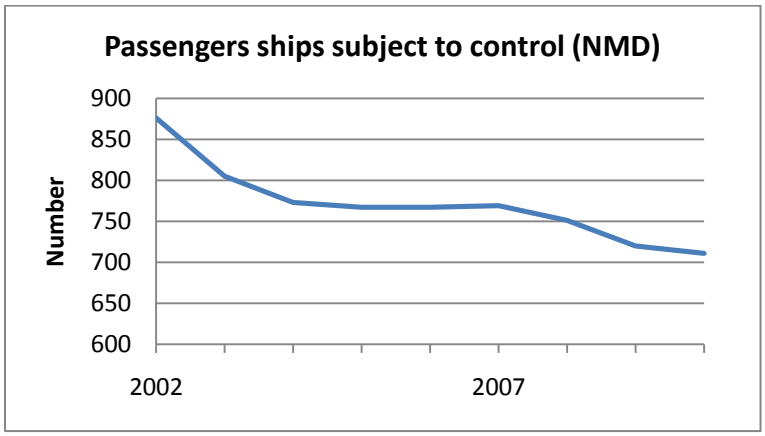

Figure 4.1 Passenger ships subject to control (NMD)

4.1 Accidents

4.1.1 Vessel type

A steady increase in ship accidents involving passenger ships has been recorded since 2006. The main contributor to this increase is domestic car ferries, in which contact damage with ramps is the most common accident type. In 2010, a total of 73 accidents, an increase of 25% compared to last years numbers, were recorded.

Figure 4.1 shows a marked decrease in the number of passenger ships subject to control in the same period. From 2006 to 2009, traffic on ferries measured by number of ferry crossings decreased by 3%. (Vegdirektoratet, 2009) (Directorate of Public Roads, 2009).

This means that the probability of contact damage increases. History shows, however, that the consequences of these accidents are minor with respect to occupational injury and pollution. Most contact damage on ferries causes limited damage to vessels and ramps. On the other hand, contact damage often causes traffic disruptions and costs for the ship-owner and society.

Figure 4.2 Accidents with passenger ships 2000-2010

By classifying all passenger ships into four main categories, we see that car ferries are the biggest contributor to the increase (see Figure 4.3).

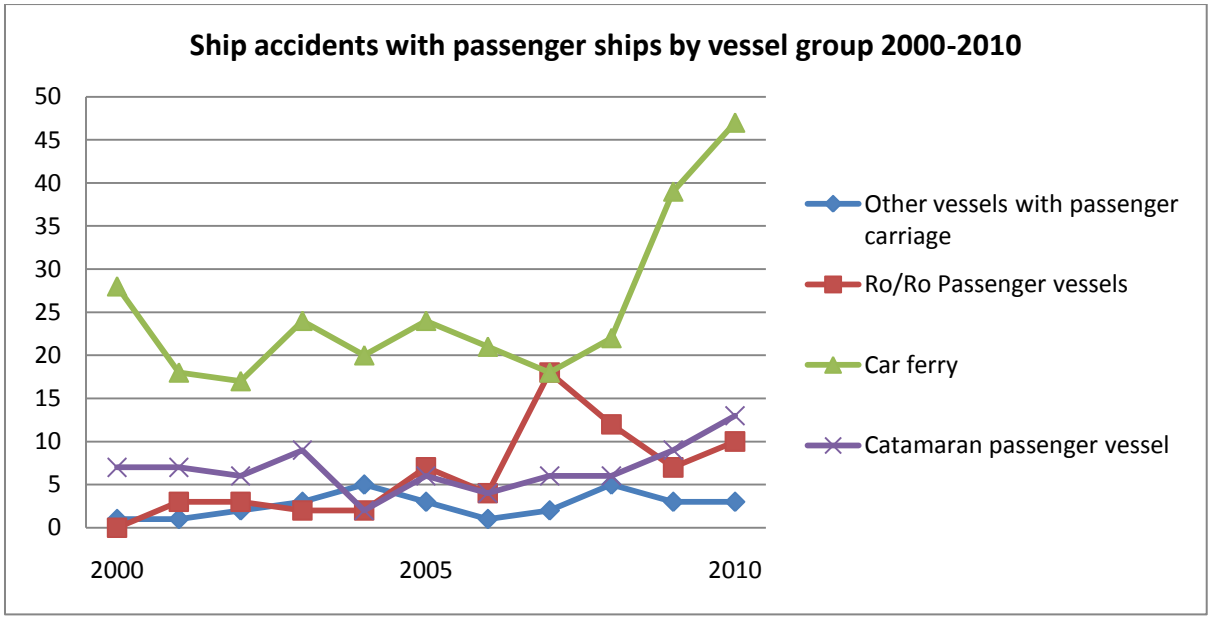

Figure 4.3 Accidents with passenger ships by vessel group, 2000-2010

Car ferries are defined here as ro-ro[5] ships that are part of the road network in domestic trade. Ro-ro passenger ship means other ro-ro passenger ships in both domestic and foreign trade. Examples include Hurtigruta, Color Line or Fjord Line vessels. Catamaran passenger vessels are mainly high-speed vessels, but also catamaran passenger vessels that do not meet the requirements for status as a high-speed vessel. The rest of the types of passenger ships are collected in the group "Other passenger-carrying vessels." This can typically be smaller shuttle boats or other similar vessels such as medical and ambulance vessels.

4.1.2 Type of accident

Contact damage and groundings are the most common types of accident that occur on passenger ships. The category "other accidents" below includes several subcategories, each of which does not provide statistical value. Contact damage with piers is the type of accident that has increased the most in the last five years (see Figure 4.4). A collision with ramps, or grounding in the immediate vicinity of the ferry landing that causes damage to equipment or injury to crew members, counts as contact damage. Contact damage mainly results in property damage. The incidents are usually not serious, since speeds are low. Accidents often cause the ferry service in question to close for a period and that the vessel has to be brought to a shipyard for repairs. In some cases minor injuries result from the collision.

[5] roro: roll on roll off

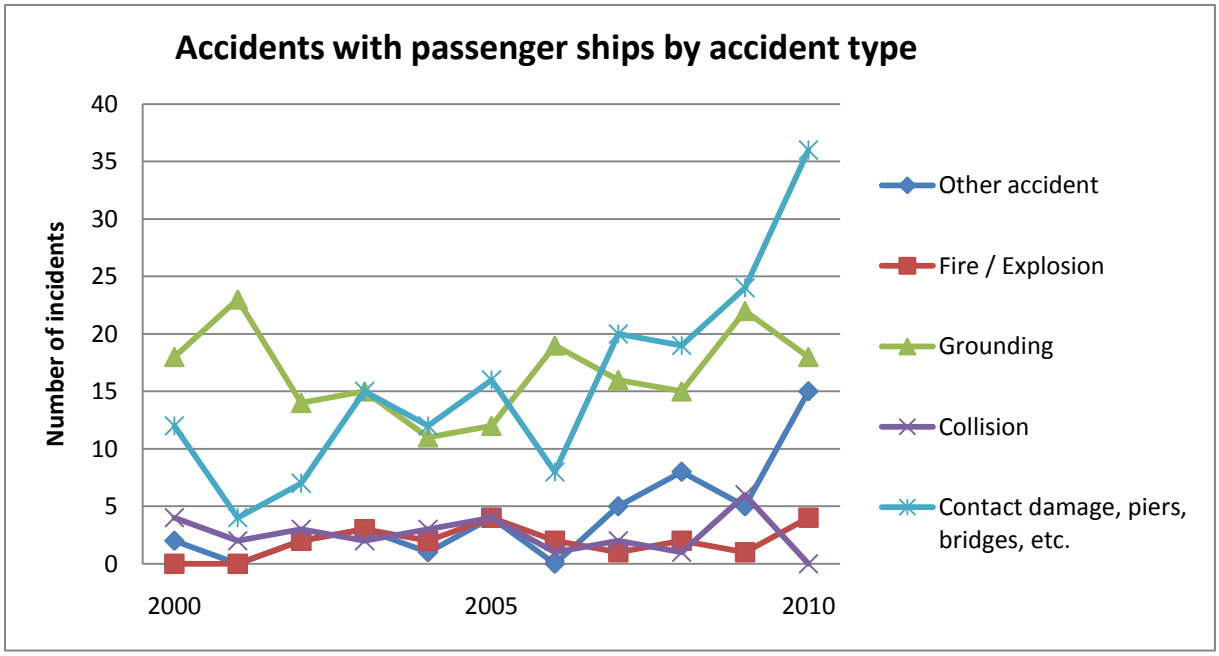

Figure 4.4 Accidents with passenger ships 2000-2010 by accident type

4.2 Consequences

The consequences of ship accidents involving passenger ships appear to be relatively minor. But because of the number of people who might be on board, the potential for a major accident is considerable in some contexts.

The statistics confirm that the safety of Norwegian passenger ships is good, with few injuries to passengers and little serious damage to vessels. However, there have been some serious occupational accidents. The greatest potential recorded for major accidents is grounding of high-speed vessels at high speed.

4.2.1 Occupational injuries and fatalities on board passenger ships

Thirteen fatalities on board passenger ships were recorded from 2000 to 2010. None of these were related to ship accidents and all were individual cases.

Seven of the incidents were occupational accidents, of which six were falling accidents and one victim was exposed to high voltage. In two cases, a passenger died from a fall on a staircase. One died as a result of a criminal act on board, one in connection with recreational activities during a shipyard stay and one person died of natural causes. One driver was perished in connection with boarding a ferry.

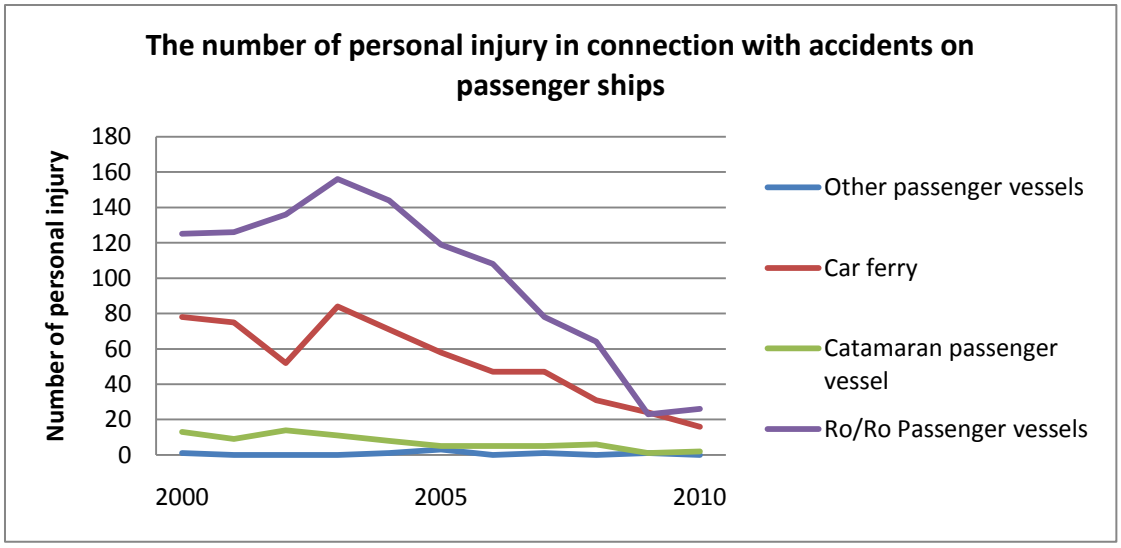

Figure 4.5 Number of injuries, all passenger types

Ro-ro passenger ships have the highest number of recorded injuries. This may correspond with the number of crews and passengers that the large foreign vessels have on board (see Figure 4.5).

4.2.2 Pollution

Seven environmental damage accidents with passenger ships were recorded in 2000-2010. All of these deals with accidental spills of diesel fuel or hydraulic oil and the amount is limited to between 10 and 200 litres.

4.2.3 Property damage

Figure 4.6 shows that 73% of all accidents with passenger ships result in none or minor damage to the ship.

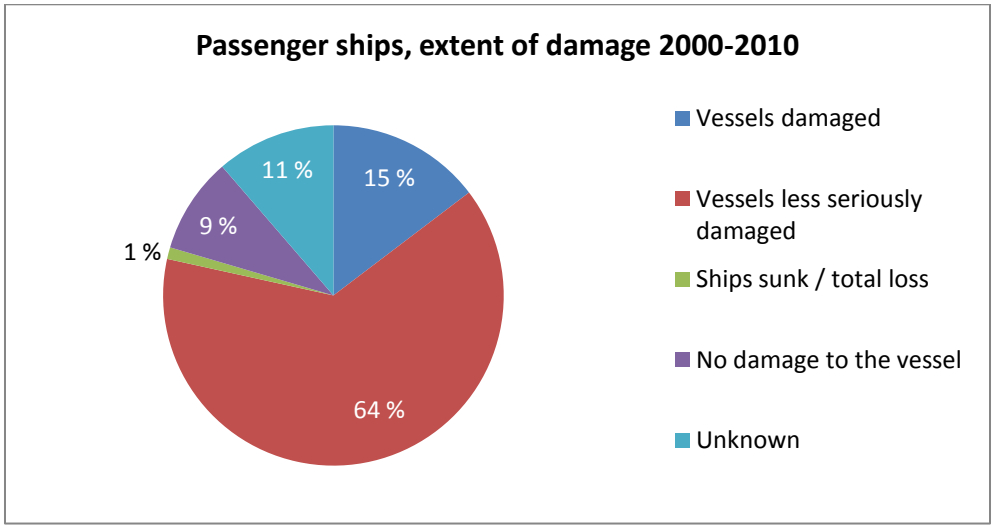

Figure 4.6 Extent of damage, all passenger types, averaged over the period 2000-2010

4.3 Causes - contact damage with car ferries

Statistics in Figure 4.4 show that contact damage with car ferries is the type of ship accident that is increasing the most. After reviewing all contact damage cases involving car ferries the last three years, technical failure was identified in approximately 40% of the incidents, while human factors

triggered the event in the remaining 60%. A study of the causes was carried out in connection with the recorded increase in these types of accidents. The causes are categorized and presented in Figure 4.7 and Figure 4.8.

In general, inspections and follow-up of these accidents revealed deficiencies in several areas. They include:

- Lack of identification of critical components in the maintenance system
- Lack of maintenance
- Inadequate training and drilling
- Lack of compliance with procedures

The ferries involved in the incidents are of an older vintage, but were approved according to the rules that applied when they were built. In recent times, new technology and new barriers have been introduced on the market that will prevent the kind of faults that have been identified in many of the incidents.

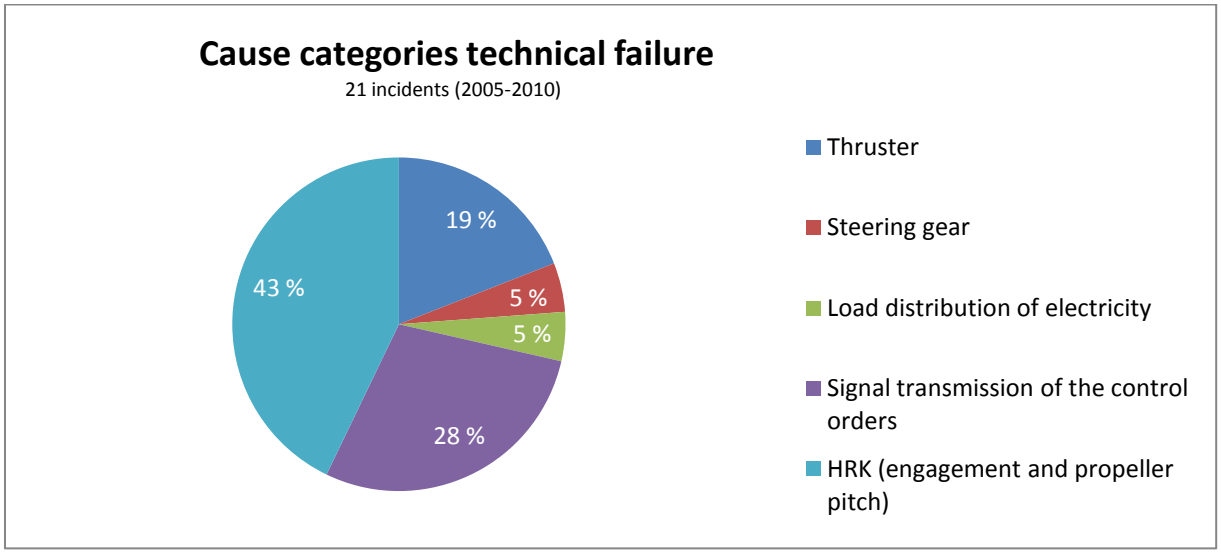

Figure 4.7 Cause categories, technical failure on ferries

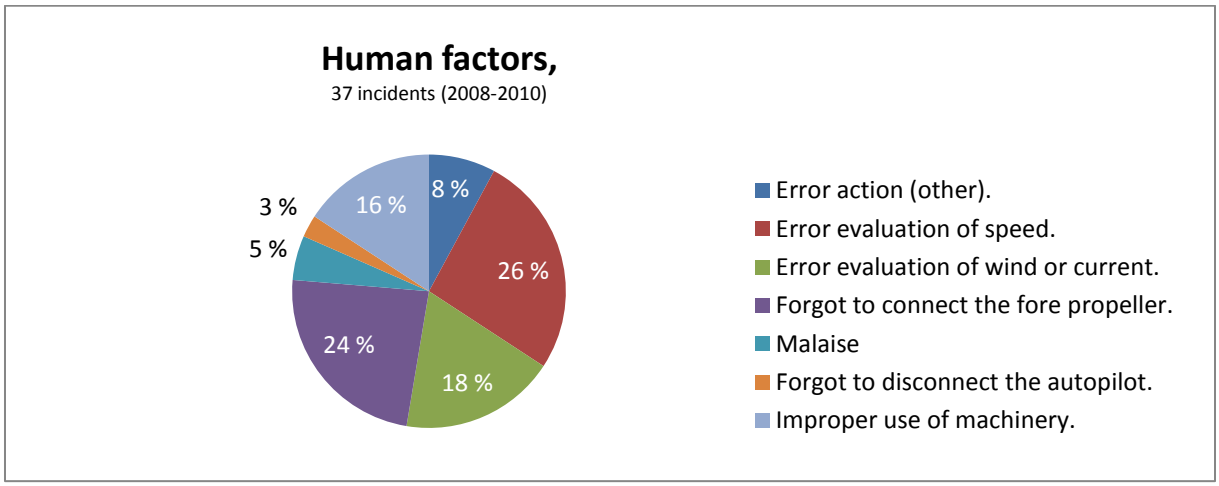

Figure 4.8 Human factors categorized with respect to identified causes

4.3.1 Report on contact damage and car ferries

In recent years, contact damage during car ferry arrivals at piers increased by almost four cases per year, with 2010 showing a sharp increase.

Technical failure is identified as a direct trigger of about 40% of the cases. Often, the components that fail are not identified as critical components. They are not covered by the vessel's maintenance system, and thus have no documented maintenance history. It also appears that the arrival phase is underestimated in terms of risk.

Most contact damage occurs on ferries with controllable-pitch propeller systems at both ends. Upon arrival vessels are vulnerable to technical and human errors. The margins are small and the vessels are not always designed with automatic redundancy.

When a technical error occurs, the emergency operation systems found on the bridge are not always used. While there are various reasons for this, there is often a lack of system understanding, training and practice. Fault condition drills are not held often enough, and the drills that are carried out often focus on the same fault condition every time.

The hydraulic reversing gear for engaging the propeller and changing the propeller pitch, often called "HRK" (in Norwegian), is with its associated components directly involved in about 43% of contact damage incidents. The system is used for two important actions upon arrival, and should therefore be emphasized as critical in the maintenance system and covered by a special technical inspection. Cases have been recorded in which vessels increase their speed after engaging the forward propeller because the propeller pitch is locked. This has caused contact damage with piers, although the vessel initially had a low enough speed to be able to stop using only the aft propeller. Such a situation usually causes the main engine to overload and stop.

Contact damage as a direct result of human action or lack of action accounts for about 60% of the incidents. Causes most often reported in this connection is that the vessel had too much speed, the navigator on duty forgot to engage the forward propeller, or that the wind and currents were underestimated. There are few barriers against such simple mistakes. This usually means that the navigator is dependent on remembering the "new and improved" procedures modified to compensate for the lack of redundancy and implemented as a follow-up measure after an accident.

It appears as though the ship-owners focus is to repair the damage, correct the apparent direct causes of the accident, and hope that this never happens again. There is, however, much to be learned from a thorough analysis of accidents and near accidents. The underlying causes may still remain latent in the vessel and it can be a matter of time before a new incident is a fact. Effective preventive measures must focus on human, technical, and not least organizational factors. The desire to reduce the number of contact damage events must be anchored in top management, be included in the ship-owners strategic plan and include the entire organization. In this context it is important for the crew to be involved in the process, so that their expertise can be used and they can take ownership of the changes.

4.4 Causes incidents with high-speed vessels

In recent years there have been several accidents with high-speed vessels that had the potential to become a major accident. The vessels operate at high speed in narrow waters and carry many passengers.

After the Sleipner accident in 1999, there has been a major focus on safe operation of high-speed vessels in Norway. Measures introduced include new rules, stricter training and crew check requirements, and improved marking of high-speed vessel fairways.

In spite of these measures several serious accidents with high-speed vessels occur every year.

4.4.1 Groundings and collisions with navigation markers

In 2010, NMD recorded 9 groundings (Figure 4.9). Four of the incidents occurred while the vessel was en route and at relatively high speeds. On 13 December 2009 the high-speed vessel "Helgeland" collided with a navigation marker. The accident is an example of a potentially large accident. Elements that were central to the AIBN's investigation were risk assessment with regard to high speed, critical operation, navigation with high requirements of navigators, voyage planning, communication and collaboration on the bridge. The AIBN's report after the accident was published in November 2010, with two safety recommendations to the ship-owner. (Statens Havarikommisjon, 2010) (Accident Investigation Board Norway, 2010)

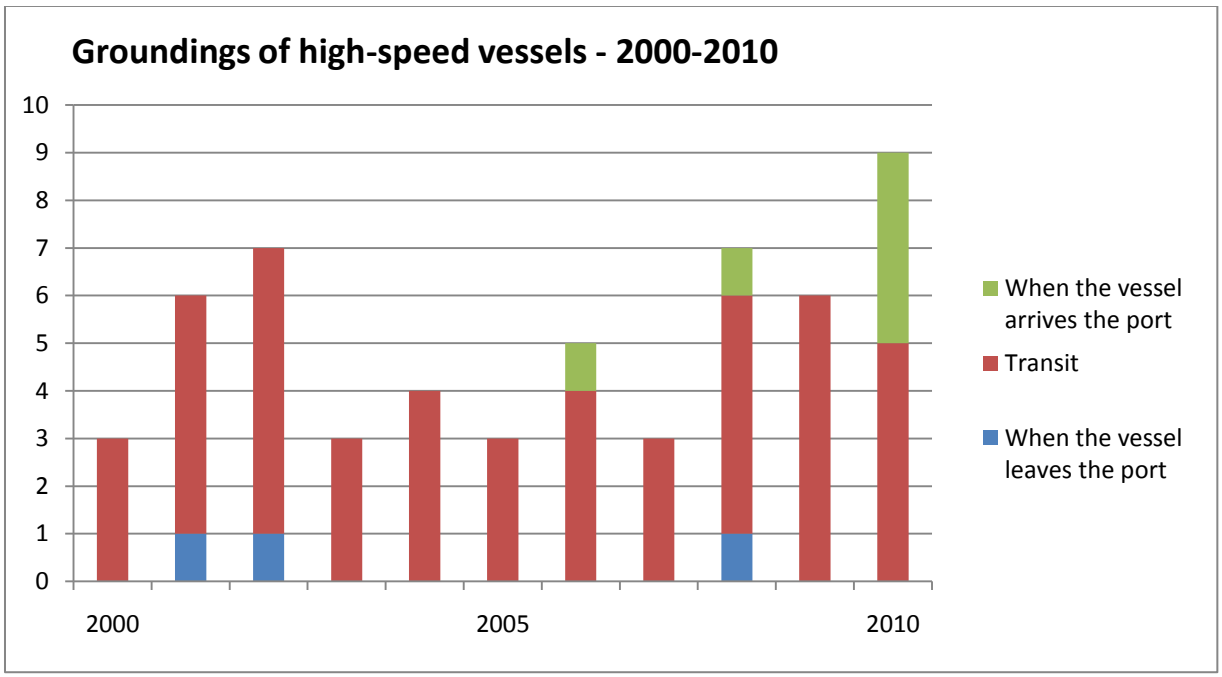

Figure 4.9 Groundings of high-speed vessels 2000-2010

While the causes of the various incidents are different and complex, it is often small deviations from the norm that trigger the event. Faulty navigation is the most frequent precipitating cause of the groundings.

Information after accidents shows that the operator believed that the vessel was on the right course, and therefore took insufficient account of external influences such as drift due to currents and wind. In several cases there are things that suggest that the crew on the bridge did not use available tools

to determine their position and course. In other cases, a route that had not been risk-evaluated by the ship-owner was chosen. In retrospect, it appears that navigation errors were also based on inadequate observation of the voyage en route. Active communication between the navigators or navigator and lookout also appears to be absent or deficient in several incidents. A change of focus for a few seconds, during which time concentration is transferred from steering the ship to other events on the bridge, has contributed to the occurrence of accidents. A change of focus may be due to the use of telephones, various alarms or other disturbing elements in the situation on the bridge.

4.4.2 Contact Damage

Several accidents relating to faulty use of the vessel's emergency operation system were recorded in connection with NMD's survey of ship accidents.

They include high-speed vessels that use control levers, where rpm and propeller pitch change simultaneously in a pre-programmed curve, and that in an emergency operation mode can only be used to change the propulsion engine's rpm. The propeller pitch must then be changed using push buttons, joystick or equivalent.

From June 2009 until January 2011, NMD recorded seven groundings/contact damage incidents, where different underlying causes cause the control system to be either automatically or manually set to the emergency operation position. In these situations the navigator on duty has either not been notified by the ship's alarm system that the emergency operation mode has been set, or has apparently not reacted to the alarms. The navigator continues seemingly to manoeuvre as normal, unaware that the propeller pitch is locked in the last position it had during normal operation. Control orders to move aft can result in the vessel accelerating forward instead. In all the recorded accidents this problem occurred while the vessel was pulling into the dock. In these situations there is very little time to correct the opposite effect in relation to expectations, and the vessel hits land or the pier at high speed.

Since the forward speed accelerates when the intention is to move aft, the potential impact is big. In one case in 2010, a vessel went aground at 15 knots, just seconds after the error occurred while it was standing still in the water. In 2010 NMD recommended that the industry raise awareness about this issue, and implement or ensure the quality of preventive measures against similar incidents.

5 Fishing vessels - accidents 2000-2010

Fishing vessels account for many of the serious accidents with respect to material and human consequences.

The 2000-2010 period saw an average of 10 ship lost, in which 7-8 fishermen died each year. The exception was 2008, with no fatalities among fishermen. This shows that the vision of zero fatalities in the fishing profession is achievable, but so far 2008 has been an exception.

In 2010 SINTEF Fisheries and Aquaculture prepared a report "Den norske fiskeflåten – en HMS status" (The Norwegian fishing fleet - an HSE status) for NMD. The report shows that in relation to other industries the risk of occupational fatalities in the fishing industry is very high (See Table 5.1).

Industry	Fatalities	Calculated risk	Risk ratio between fishing and comparable industries
Agriculture and forestry	106	0.13	4.8 times more dangerous
Fishing and hunting	87	0.63	NA
Aquaculture	9	0.16	3.9 times more dangerous
Offshore fleet	11	0.09	7.0 times more dangerous

Table 5.1 Fatalities 2000-2010 (Aasjord, 2010)

5.1 Number of fishing vessels

There has been a major decline in the number of registered fishing vessels in the period 2000 to 2010. Figure 5.1 shows a reduction in the number of vessels from 13,017 in 2000 to 6,311 in 2010.

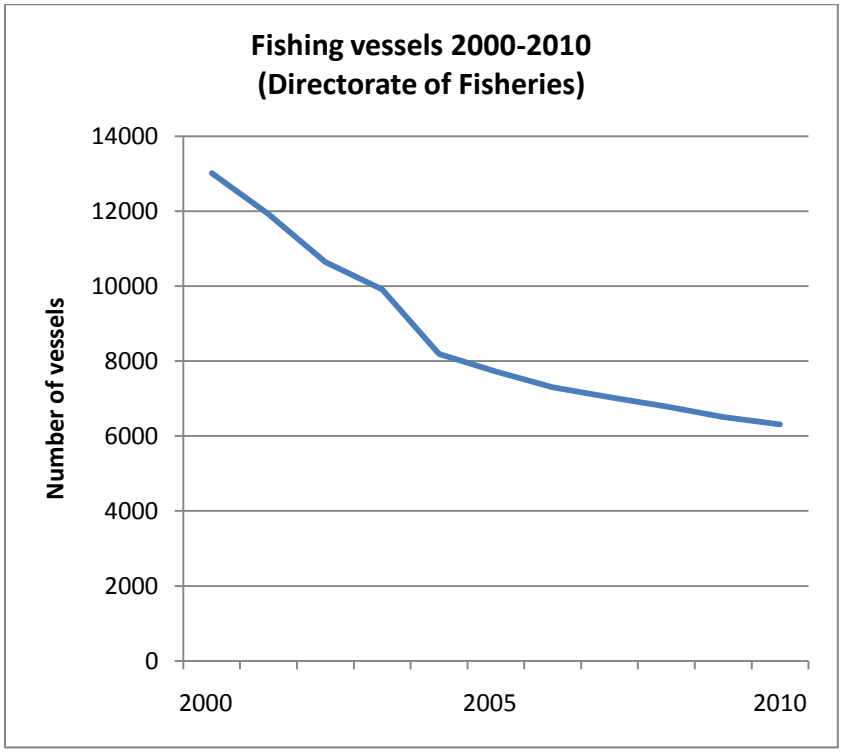

Figure 5.1 Number of fishing vessels 2000-2010.

For vessels over 28 m and the 10 to 10.99 m group the trend turned in 2008 and the number began to rise again (see Figure 5.2 and 5.3).

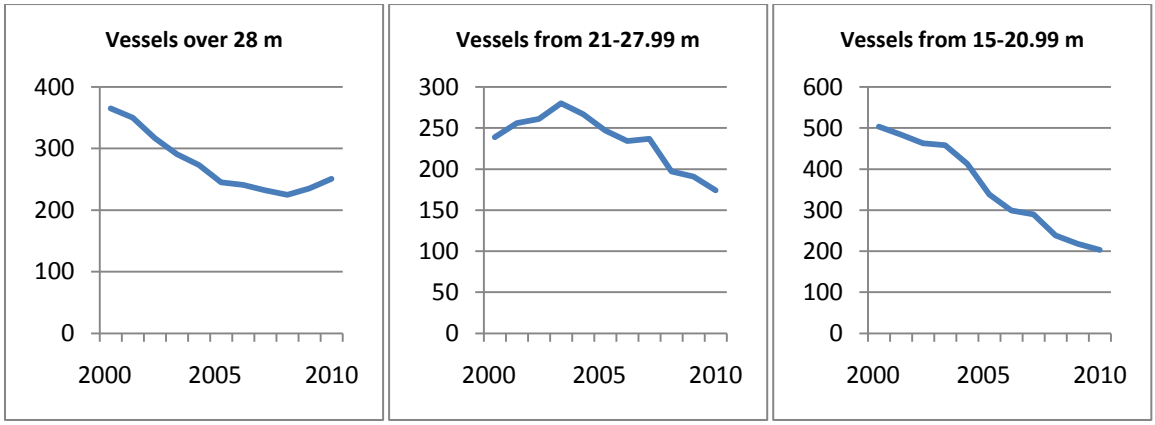

Figure 5.2 Number of fishing vessels of 15 m and above in the period 2000-2010.

For vessels less than 10 m, the decline was particularly large. The number of registered vessels here more than halved during the period, from 8,611 in 2001 to 3,496 in 2010 (see Figure 5.3).

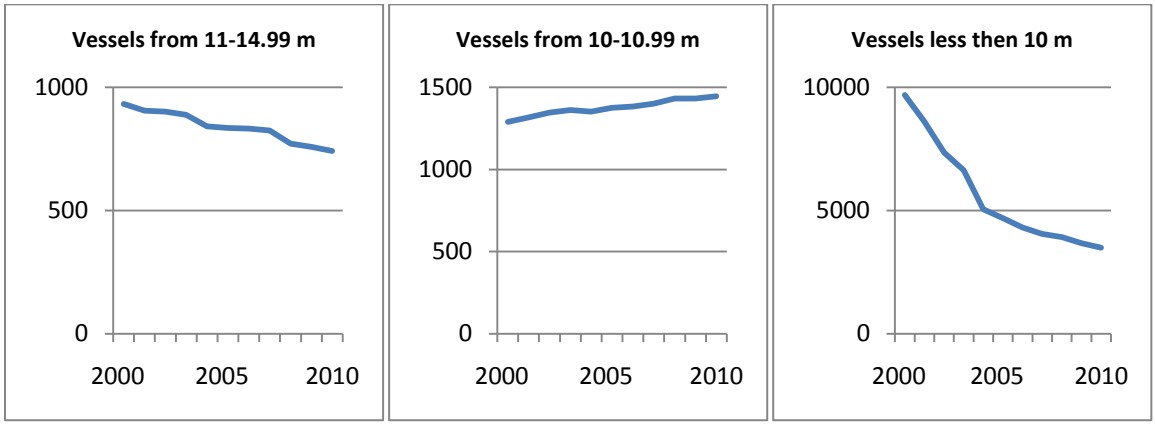

Figure 5.3 Number of fishing vessels under 15 m 2000-2010

Of a total of 6,311 fishing vessels in the Directorate of Fisheries' register, 5,427 were considered to be active at the end of 2010.

A decrease in the number of fishermen was also seen during the same period. From 2000 to 2010 the total number of fishermen decreased from 20,000 to just over 12,000 (see Figure 5.4). Half of the reduction occurred among those who have fishing as a secondary occupation (fishermen census sheet A).

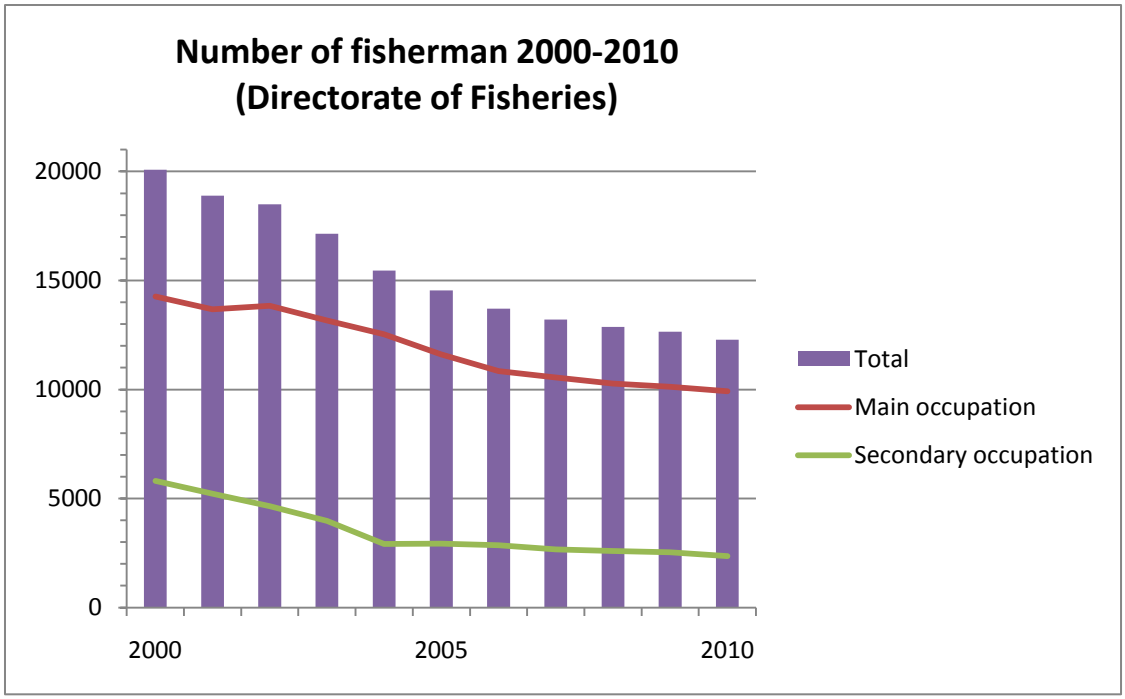

Figure 5.4 Number of fishermen in fishermen census in 2000-2010 (Directorate of Fisheries)

5.2 Fishing vessel accidents

Aside from occupational accidents, groundings are the most frequent type of accident among fishing vessels (see Figure 5.5). This applies to all size groups. On average 25 groundings occur each year. Fires and/or explosions and collisions occur relatively frequently, with about 10 incidents per year.

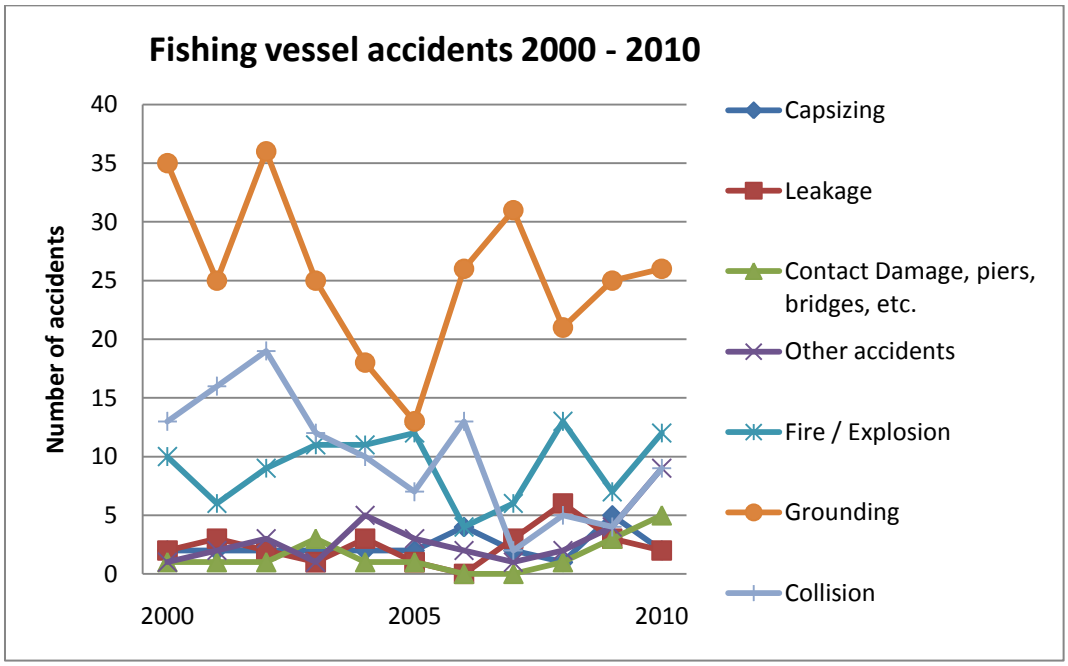

Figure 5.5 Number of accidents per year, by type. The figures cover all fishing vessels.

5.3 Causes

Table 5.2 shows the recorded causes of navigation-related accidents on fishing vessels in the period 2006-2010. We see that navigation errors, misjudgement and falling asleep while on duty are the

most frequently stated causes. The reports provide to a lesser degree knowledge about the underlying conditions for this. However, several cases have been uncovered where questions can be raised about whether the crew was capable enough in relation to the vessel's operating pattern. A vessel may fish for several days despite the fact that there is only one navigator on board. This may mean that the vessel is not operated by qualified personnel, and that the navigator on board does not have opportunities to get his required sleep and rest.

Direct cause	Number of accidents
Other conditions/actions	9
Violation of procedures	2
Misacting	11
Navigation error	55
Misjudgement	25
Asleep on duty	22
Not specified/clarified	62
Total	**186**

Table 5.2 Reported causes, accidents on fishing vessels 2006-2010

In some cases, it was also revealed that the bridge was unmanned during fishing operations because the navigator had left the bridge to help with the work on the deck.

The AIBN has carried out several safety studies related to fishing vessels and a type of boat described as a high-speed smack. The focus and safety recommendations of the investigation reports are related to the fact that the vessels were used as commercial boats even though they only met the requirements for pleasure craft. The smacks were not subjected to periodic regulatory control and unannounced inspections, and there was insufficient focus on structural engineering factors. The stability of the vessels was inadequate and did not satisfy the minimum criteria that applied to commercial vessels when the vessel was delivered.

Poor stability properties and the design of the vessels resulted in water flooding spaces below deck via air intakes that were placed incorrectly, poor drainage from the deck and the unfortunate and/or wrong placement of the catch on the deck. As a result, the vessels did not stand up well to turbulent seas. Ordinary operations on board, during what can be characterized as normal weather conditions, could therefore trigger tragic accidents. Both the Directorate's inspections after the accidents and the AIBN's safety studies demonstrated a lack of knowledge and understanding of relevant safety systems on fishing vessels. This applies particularly to smaller smacks. The fishing vessel is overloaded with a large share of the load on top of the deck. Since the vessels have poor stability in the first place, shipwrecks with tragic consequences have been the result in some cases. A lack of understanding of the use of safety equipment such as the emergency-stop on reeling equipment, and the use of rescue equipment, were also uncovered.

5.4 Consequences

The risk of injury is relatively high on fishing vessels. Fishing vessels are furthermore the vessel group with the most deaths.

5.4.1 Fatalities

In 2010, 8 fatalities on fishing vessels were recorded. There were no accidents in which several died in the same accident; all fatalities were single events.

NMD's accident database shows that a total of 80 people died on fishing vessels in the period 2000 - 2010. As Figure 5.6 shows, the number of fatalities from 2006-2010 more than halved compared with 2001-2005 on ships from 0 ->10.67 m and vessels from 15 ->24 m. When it comes to fishing vessels in the 10.67 ->15 group and larger than 24 metres, the number of fatalities increased in the second half.

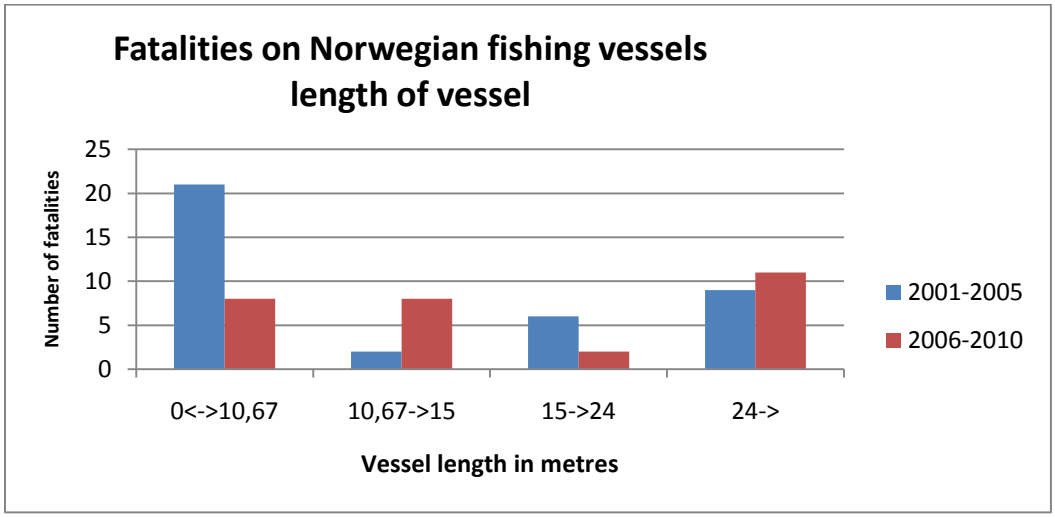

Figure 5.6 Fatalities on Norwegian fishing vessels by period and length of vessel

Only two accidents were recorded in which more than one person perished; they happened in 2002 and 2005 with the vessels "Sjøsprøyt" and "Teisten", both less than 10 metres.

If we look at the period 2000-2010 as one, the accident picture differentiates somewhat with regard to vessel size; accident group and loss of life (see Figure 5.7). Deaths in connection with ship accidents are relatively rare on larger vessels. A ship accident on small vessels leads more often to the loss of the vessel, which must be evacuated within a short time.

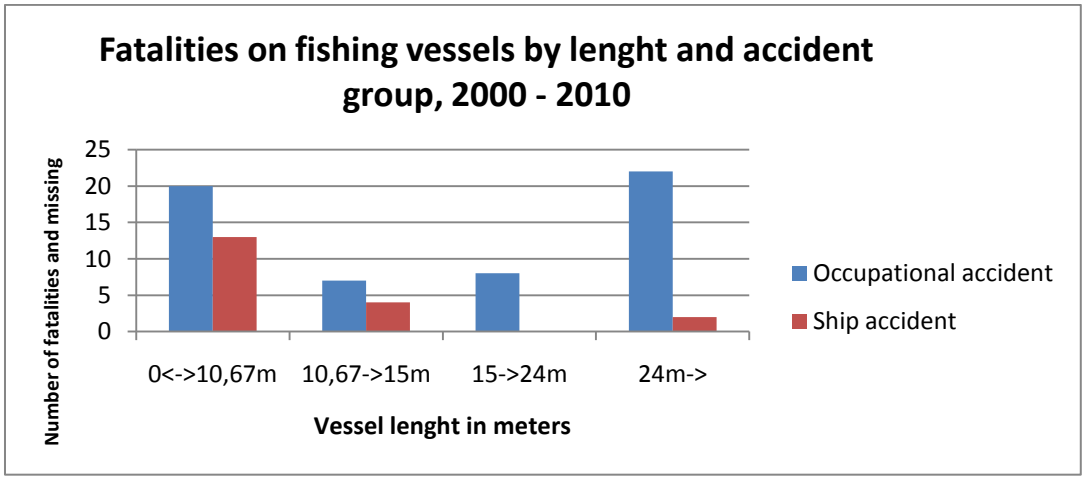

Figure 5.7 Fatalities on fishing vessels by length and accident group, 2000-2010

By far the most frequent cause of loss of life on fishing vessels, regardless of the vessel's size, is falling overboard. As Figure 5.8 shows, larger vessels have a higher proportion of deaths related to impact and crush injuries. This is probably related to the heavy equipment and higher automation of these vessels.

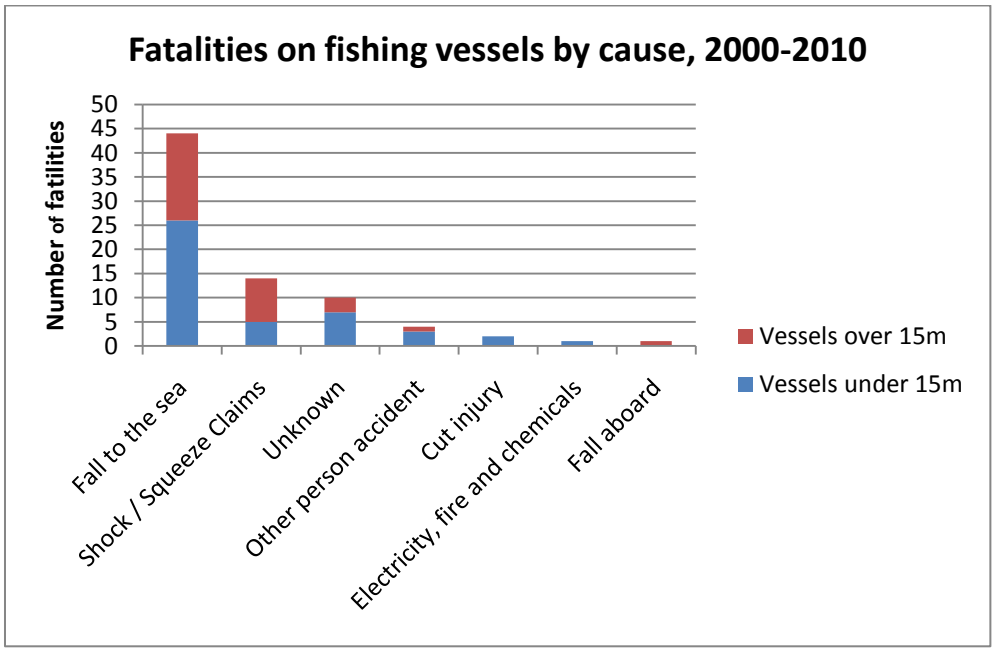

Figure 5.8 Fatalities on fishing vessels by cause in the period 2000-2010.

5.4.2 Occupational injuries

In its report, Den norske fiskeflåten – en HMS status pr 2010 (The Norwegian fishing fleet - an HSE status at 2010), SINTEF looked at occupational accidents compared to other comparable industries. The statistics in this report are based on data obtained from several sources, including accidents reported to NMD.

SINTEF's calculations show that the risk of occupational injury is lowest in the small coastal fleet (smack fleet) and highest in the ocean fishing fleet.

As Table 5.3 shows, the risk of injury in the fishing and hunting industry is higher than in other comparable industries.

Industry	Number of injuries	Calculated risk	Risk ratio between fishing and other industries
Agriculture and forestry	2,627	3.76	3.92 times more injury prone
Fishing and hunting	2334	18.64	NA
Aquaculture	660	14.55	1.28 times more injury prone
Offshore fleet	726	7.48	2.49 times more injury prone

Table 5.3 injuries in the period 2000 - 2010 (Aasjord, 2010)

5.4.3 Pollution

Four incidents of pollution and discharge of oil or diesel oil from fishing vessels were recorded in 2010. Discharges are not recorded in connection with accidents where fishing vessels sink or break down even though they could potentially lead to some form of contamination at a later date.

5.4.4 Property damage

In 2010 there were 10 vessels that sank or were a total loss. Figure 6.1 shows that this number has remained almost unchanged over the past 5 years.

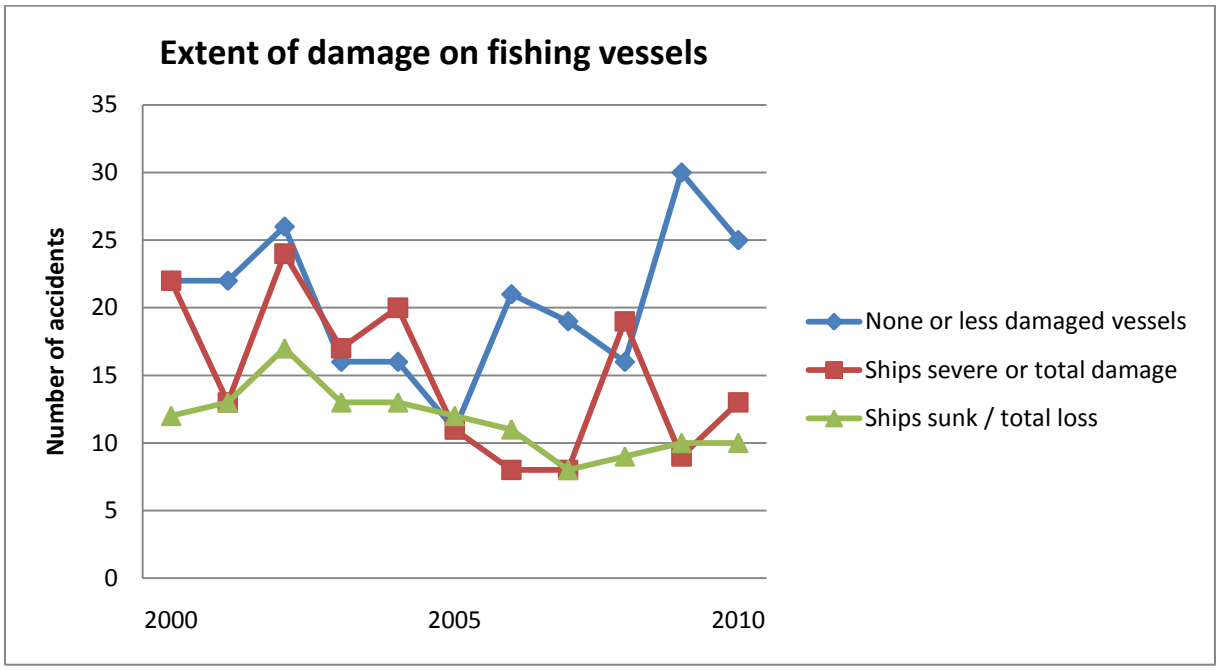

Figure 5.9 Extent of damage on fishing vessels in the period 2000-2010

Over half of the vessels that were lost during the period were vessels under 10.67 m. Most of these vessels were lost in fire and explosion accidents, groundings and capsizings. These types of incidents represent 2/3 of the ship lost in the vessel group.

Also on vessels between 10.67 and 24 metres losses connected with fires account for half of the cases. Fishing vessels over 24 metres are lost relatively less often in fires.

5.5 yrkesfisker.no

In 2010 a website was created to disseminate important information to fishermen and the fishing industry. Easy access is provided here to regulations, checklists, statistics and information about accident prevention on board.

The website is promoted in the various forums where fishermen and the industry meet.

6 Cargo ships - accidents 2000-2010

At the end of 2010 there were 1,331 cargo ships subject to control under Norwegian flag. Cargo ships subject to control means cargo vessels over 50 GT. While Figure 6.1 shows that the number of vessels in recent years has been relatively stable, the overall period showed a decline.

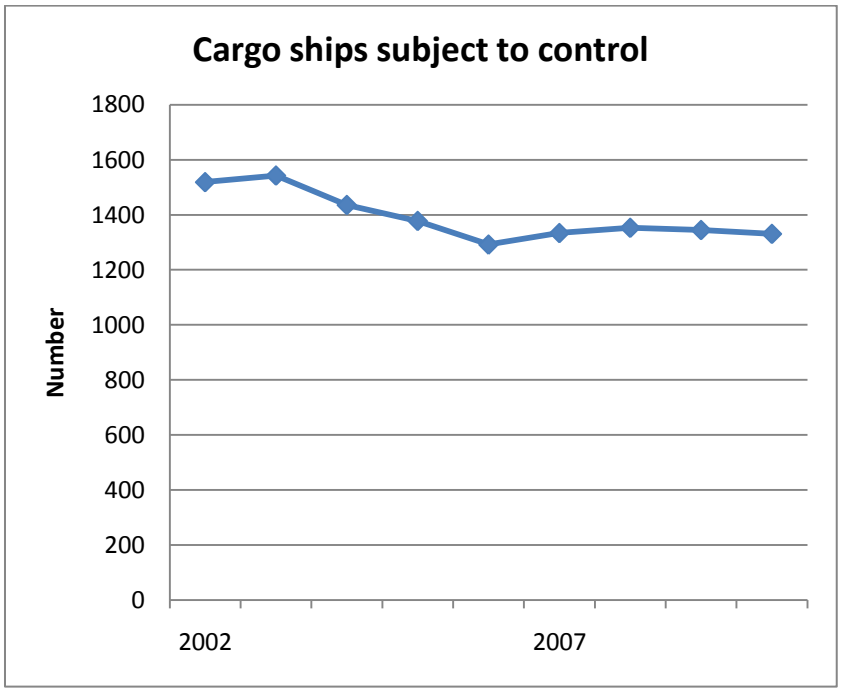

Figure 6.1 Cargo ships subject to control (NMD)

Statistics from the ship registers show an increase in the number of vessels registered in NOR and a decline in the NIS register. The increase in the NOR register is mainly the result of an increase in the number of leisure boats registered. (Skipsregistrene, 2011) (Ship Registers, 2011)

During the same period the carriage of goods by sea increased in Norway. (SSB, 2010) (Statistics Norway, 2010)

6.1 Accidents

The number of recorded accidents with cargo ships increased in the period 2005 to 2009. In 2010 the total number of ship accidents recorded was 97, down slightly from the previous year. This number includes both Norwegian and foreign flags. However, it is too early to determine whether the number of accidents is decreasing.

NMD recorded an increasing number of accidents with foreign cargo ships in Norwegian waters in 2001-2010, see Figure 6.2.

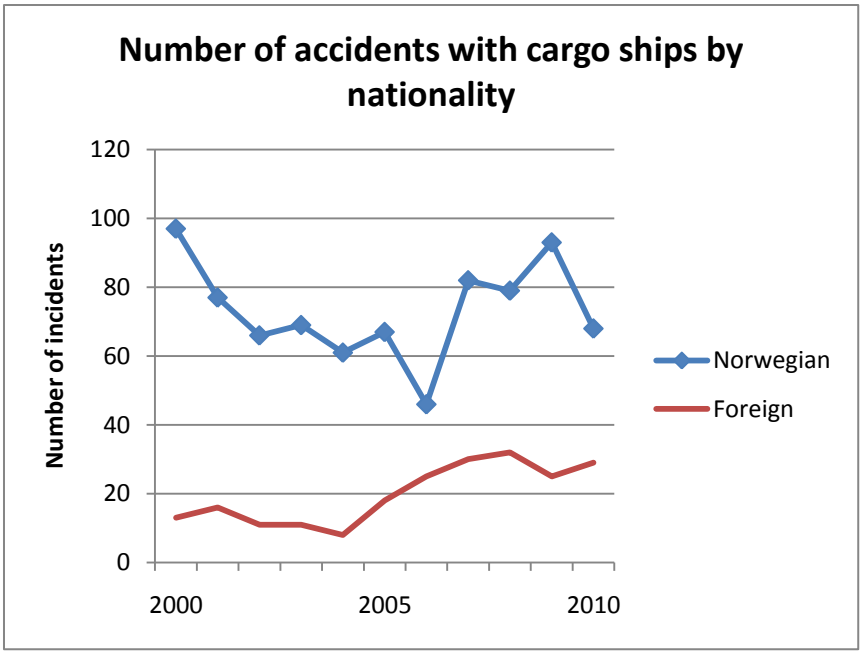

Figure 6.2 Number of ship accidents with cargo ships in the period 2000-2010

The vessel group cargo ship is a very diverse group that includes various combined ships, chemical tankers, and various categories of tankers and bulk carriers. To facilitate the presentation of statistics in this report, we have organized the vessels into six groups without taking into account the tonnage and length of the vessels (see Figure 6.3). You will see that vessels included in the general cargo ship category stand out with relatively more ship accidents than other cargo ship categories.

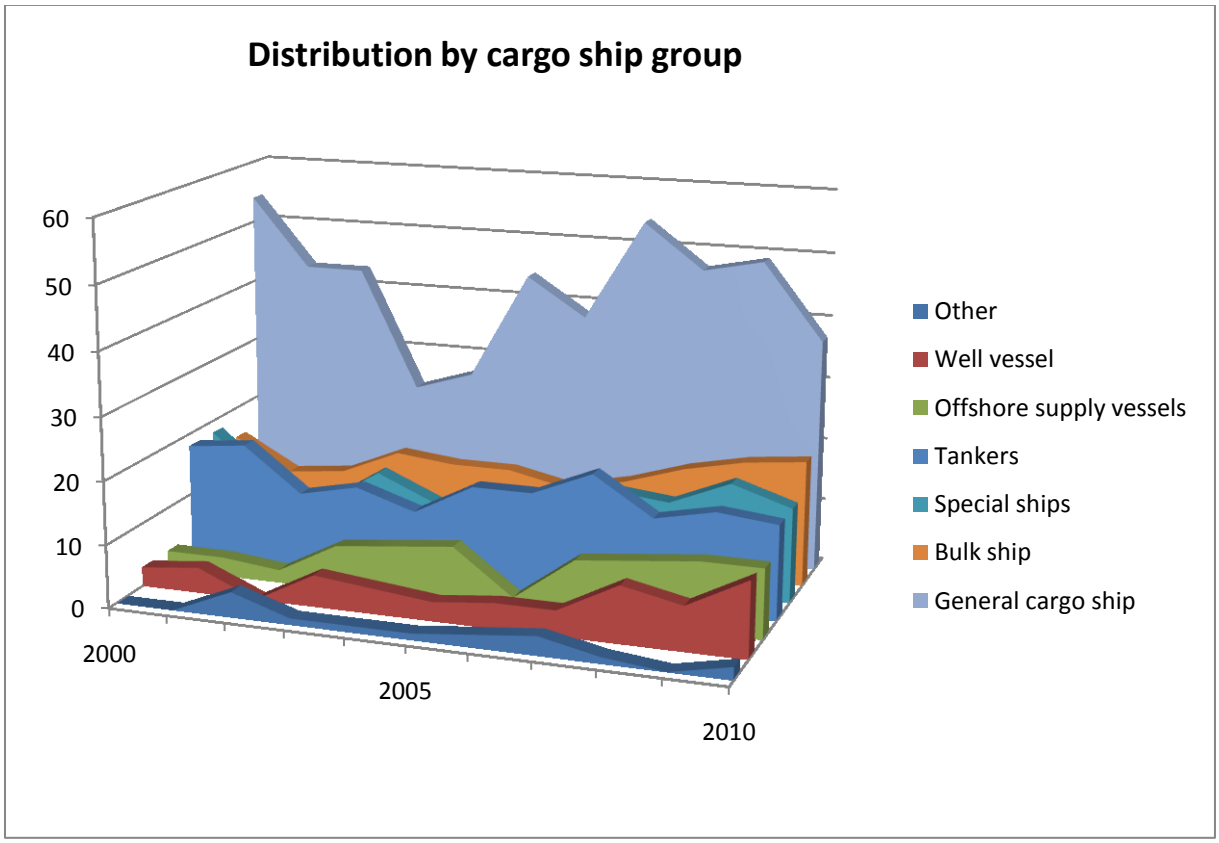

Figure 6.3 The distribution of accidents in the period 2000-2010 for the different categories of cargo ships

When it comes to the distribution of accident types for cargo ships as whole, groundings and collisions are the most prominent types of accidents, see Figure 6.4. The total number of groundings for all types of vessels was 101 in 2010, and in 47 of the incidents it was a cargo ship that ran aground.

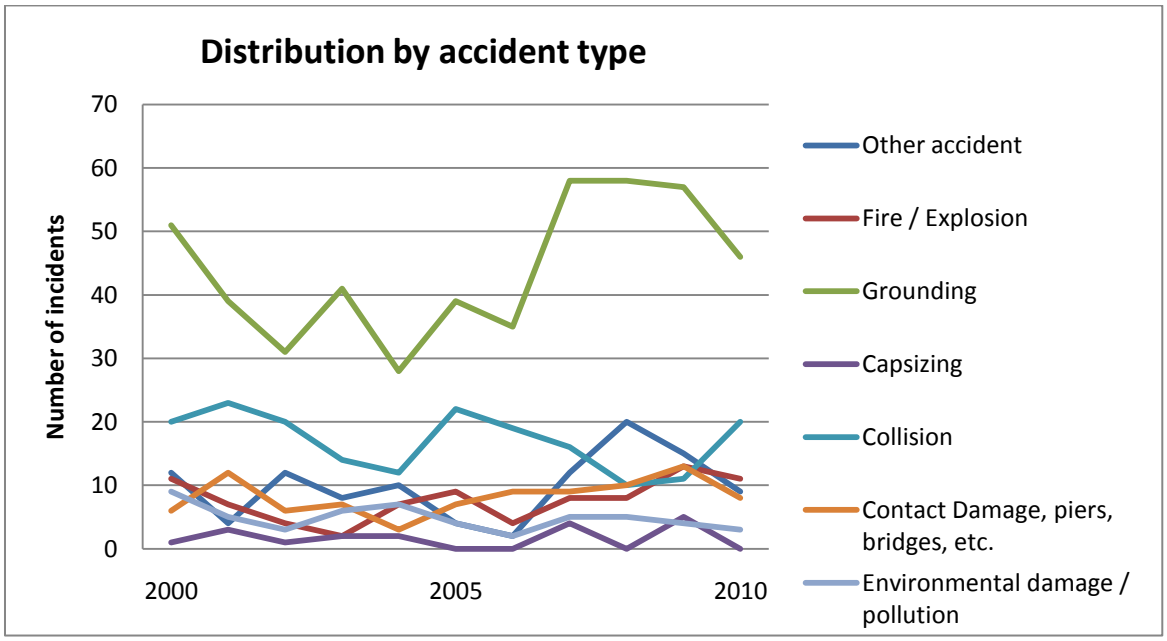

Figure 6.4 Number of accidents by accident type

Cargo ships are as mentioned a very diverse group that is difficult to define clearly. However, statistics based on vessel size can provide an indication of the vessel and the part of the industry that the figures come from. Figure 6.5 shows that most groundings occur in the group from 500 to 3,000 gross tonnes. While there are probably several reasons for this, it probably reflects the vessels' operating patterns, which include, among other things, frequent calls and sailing in narrow waters. Nearly 2 of 3 vessels in this group are general cargo vessels. The figures represent both Norwegian and foreign vessels.

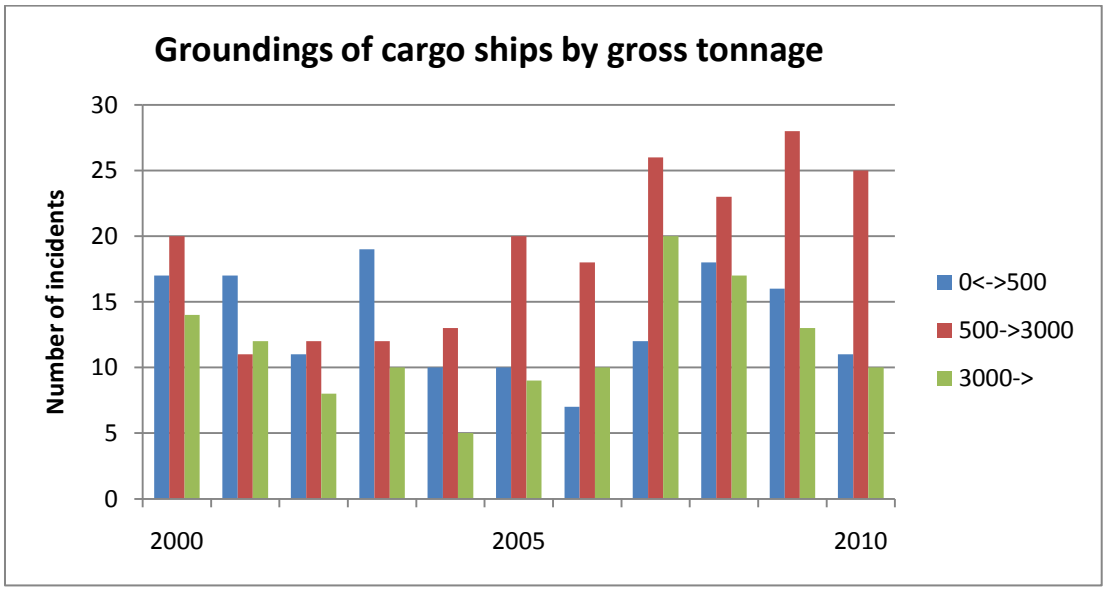

Figure 6.5 Number of groundings by vessel size in gross tonnes

Figure 6.6 shows that foreign vessels are responsible for a large proportion of groundings in Norwegian waters.

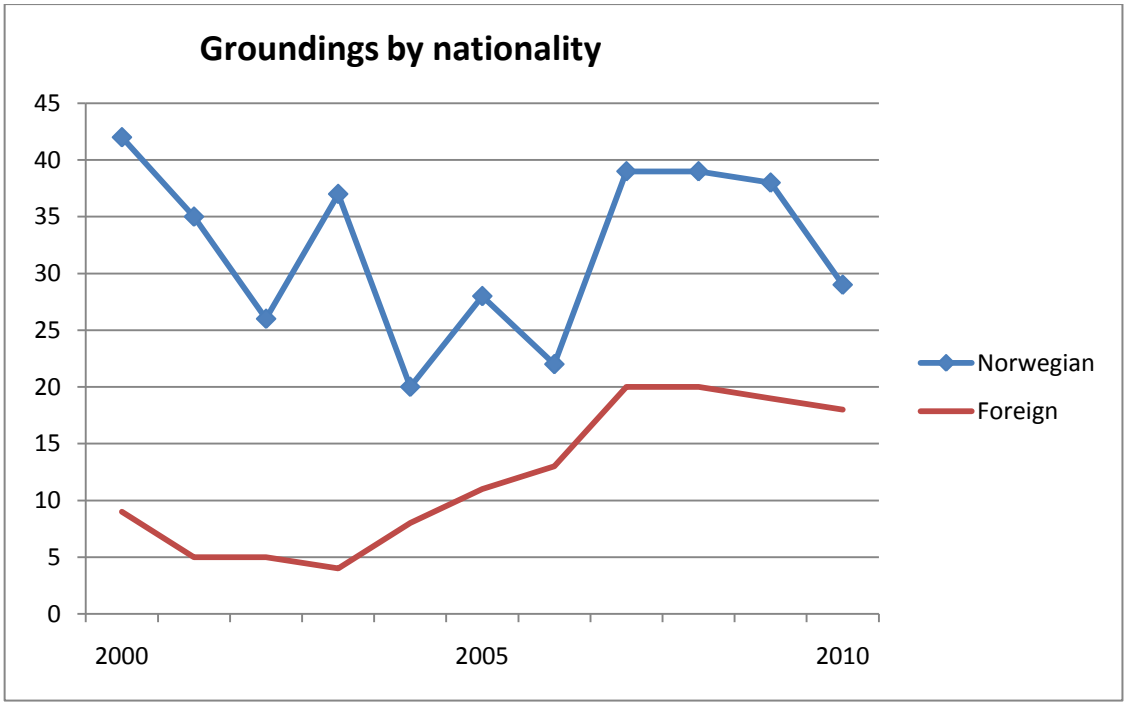

Figure 6.6 Number of groundings of cargo ships by ship nationality

6.2 Causes of groundings

Figure 6.7 shows that human error was recorded as a trigger in about 60% of the groundings of cargo ships. If we look closely at the other accidents, we will likely be able to find that a proportion of the accidents that specified technical failure and external factors as the cause, were also due to human error. Examples of external conditions are violent weather and currents.

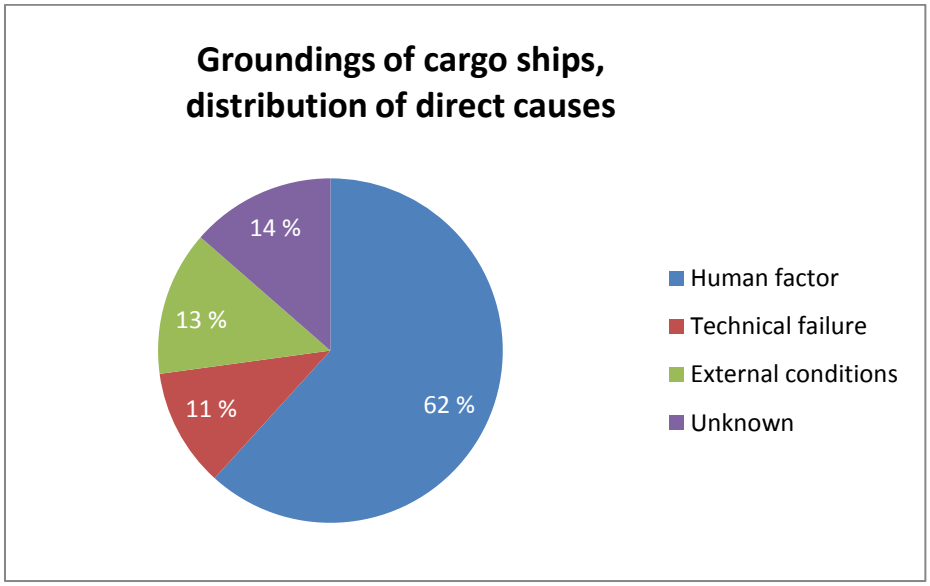

Figure 6.7 Groundings of cargo ships, distribution of direct causes

If we look closely at the underlying causes that are related to the incidents where human error is recorded, 38% were caused by navigation error, 22% misjudgement and almost 25% by the navigator falling asleep while on duty. Several of the accidents clearly show that the navigator was alone on the bridge, and that no lookout watch was set up. You can also see that the navigator was too relaxed and confident in relation to the environment and thus not vigilant enough. Missing or inadequate voyage planning and improper use of electronic maps have also been shown to be key causal factors in the accidents. However, it is important to mention that the operating pattern of the vessel types is a key factor in what appears in the statistics.

6.3 Consequences

Ship accidents with cargo ships often have less severe consequences. In most cases the discharges and material damage are limited. The most frequent type of accident, groundings, rarely results in occupational injury.

6.3.1 Fatalities

The number of fatalities on cargo ships has declined in recent years, both in connection with ship accidents and occupational accidents (see Figure 6.8). The risk that many lives can be lost in a single accident is still large. The period 2000-2010 saw several very serious accidents in which several lives were lost in a single accident. In 2000, six people lost their lives when "Nordfrakt" collided in Portuguese waters. That same year, three people died when "Steinfalk" sank. In 2003, "Kongsting" capsized, killing the entire crew of four. Eighteen people died when "Rocknes" capsized in 2004, and eight people perished in the "Bourbon Dolphin" accident in 2007. Six lives were lost in the 2009 capsizing of "Langeland" in Swedish waters.

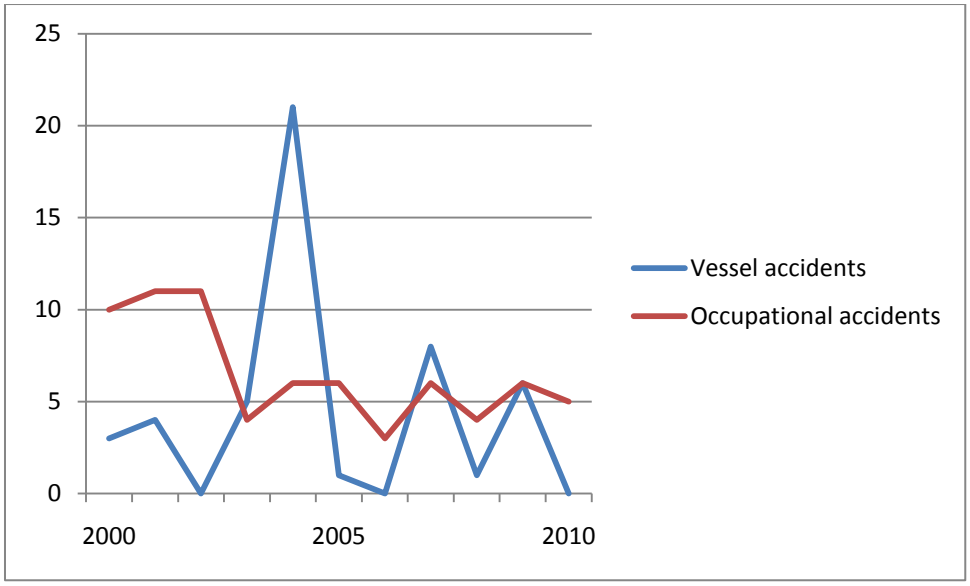

Figure 6.8 Fatalities in the period 2000-2010

6.3.2 Occupational injuries

Few people are injured in, or as a result of, a ship accident. As for the other vessel groups, injuries on board cargo ships are mainly related to occupational accidents. Figure 6.9 shows a clear decline in the number of occupational accidents. The number of recorded occupational accidents on cargo ships has ranged between 115 and 120 in recent years.

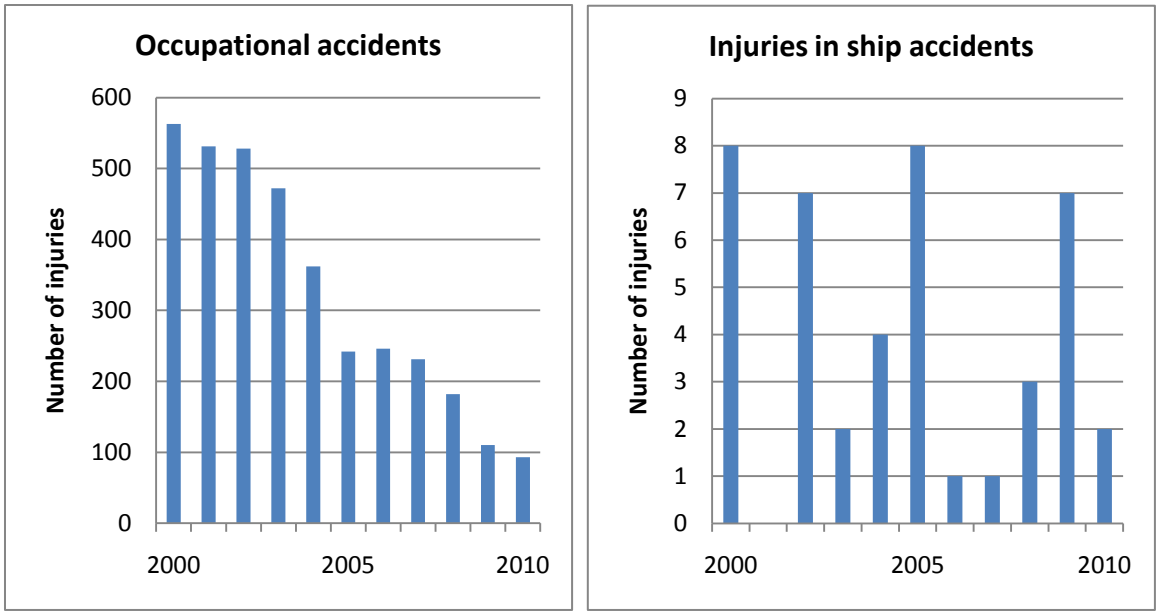

Figure 6.9 The number of occupational injuries and injuries related to ship accidents, cargo ships

6.3.3 Pollution

As Figure 6.10 shows, the number of recorded environmental discharges connected with cargo ship incidents ranged between 9 and 2 per year in the period 2000-2010.

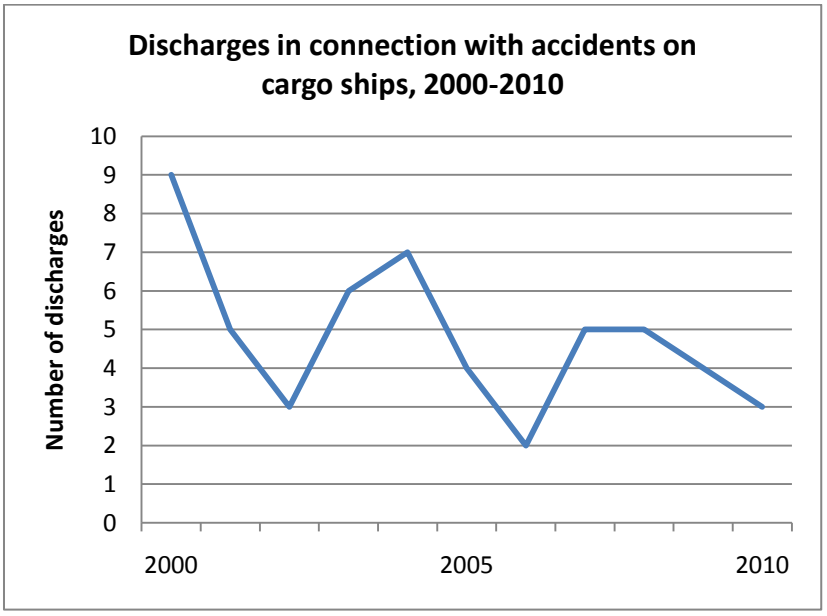

Figure 6.10 Discharges in connection with accidents on cargo ships 2000-2010

6.3.4 Property damage

According to recorded data, 46% of the vessels involved in an accident were less seriously damaged. Figure 6.11 shows that in 17% of ship accidents with cargo vessels, the vessel was severely damaged.

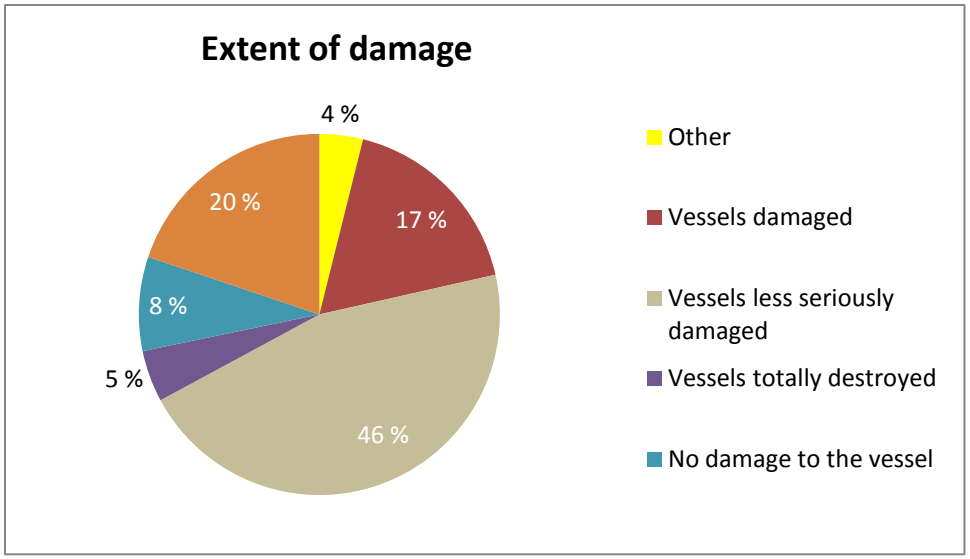

Figure 6.11 Extent of damage, ship accidents, cargo ships 2000-2010

6.4 R & D project on safety in cargo trade

NMD statistics show that the number of groundings of cargo vessels along the Norwegian coast has averaged about 35 per year over the past 10 years. The figure includes both Norwegian and foreign flag vessels. Groundings are considered serious accidents in which the potential consequences are total loss, risk of loss of life and environmental pollution. Reducing the number of groundings in this vessel group is therefore a very clear goal.

Current knowledge of practices and risk management on board the cargo vessels is largely based on experience. There is therefore a need for more fact-based knowledge of current operations and circumstances concerning the conditions and qualification crew members need to have to operate the vessels safely. To acquire this, NMD engaged NTNU Social Research to conduct an independent analysis of the daily operations of cargo vessels. The aim was to reveal facts that can be used to support conclusions, recommendations and actions of NMD.

A freight vessel in this context is defined as a vessel that is only designed for carrying cargo in short sea shipping. In Norway, this typically means the small coasting, great coasting or North Sea trades. The vessels are smaller, non-specialized cargo ships. They are usually divided into categories according to how they carry, load and unload goods. Although they are not a very homogeneous group, the vessels still have some common denominators. They are often operated by smaller shipping companies, have a crew of ten or fewer per shift, sail in challenging waters with many calls and have to deal with demanding groups of customers.

The study of ten freighter crews shows fatigue, heavy workloads and a sense of alienation about their situation, which increases the risk of operating failures on cargo vessels, and thus accidents. Some vessel types are particularly vulnerable because the framework conditions are not adapted to the work on board. The framework conditions cover, for example (in addition to weather conditions):

- Procedures and rules - and therefore flag state and ship-owner
- Characteristics of clients/customers
- Frequency of loading and unloading operations
- Scope of tasks in addition to the core work

- Crew size
- Employment contracts of seamen
- Allocation of pilot exemption certificates
- Resources in the ship owning company's organization
- Staffing, equipment and other capacity at terminal facilities

(Størkersen, Bye, & Røyrvik, 2011)

NMD sees many challenges in what is presented in the report. The industry must address the issues from its end, while the authorities must assess how supervision is to be carried out and regulations developed.

Furthermore, many of the problem areas touch on issues that to a greater or lesser extent figure in the political discussions in which trade unions, ship-owners and governing authorities are involved.

We are dependent on good cooperation with the industry to ensure the successful follow-up of the report. NMD therefore wishes to develop initiatives in partnership with the industry itself.

7 Reports issued by AIBN in 2010

The Accident Investigation Board Norway investigates maritime accidents pursuant to the Maritime Code.

All reports are published on the Board's website.

7.1 Federal Kivalina

The bulk carrier "Federal Kivalina" ran aground on the morning of 6 October 2008 on its way to Sunndalsøra to unload aluminium oxide. The vessel had a pilot on board. The incident resulted in a major action to salvage the cargo and vessel.

In the report the AIBN focused on the importance of establishing a well-functioning bridge team.

7.2 Nesebuen

One person was seriously injured while casting nets on board the fishing vessel "Nesebuen". The accident happened during the night of 6 January 2009 on the Eigersund Bank.

In its report the AIBN focused on crew training, risk assessment of work operations, as well as the marker buoys that were used on board. Three safety recommendations directed at the ship-owner and the Directorate of Fisheries were issued.

7.3 Richard With

The Hurtigrute ship "Richard With" went aground under adverse weather conditions during its arrival in the port of Trondheim.

The AIBN issued safety recommendations addressed to NMD and the classification society regarding the design of and follow-up of requirements for emergency power systems.

7.4 Crete Cement

The cement ship "Crete Cement" ran aground on 19 November 2008 on its way into the Oslo fjord. The vessel had a pilot on board.

The report contains five safety recommendations directed at the ship-owner, the Norwegian Coastal Administration, Norwegian Hydrographic Service and Bureau Veritas. The recommendations concern resources on the bridge, the pilot's workload, the publication of map corrections and the design of watertight bulkheads.

7.5 MS Øyfart

M/S "Øyfart" ran aground and sank in the area north of Grytøya in Troms after its engine failed on 6 January 2009.

The investigation of the accident revealed that the shipowner had no clear rules for necessary reserve stocks of fuel. In its safety recommendation the AIBN advised that shipowners with similar operations establish clear rules for reserve stocks of fuel to operate safely.

7.6 Nordic Sky

The vessel ran aground on 20 November 2008, in the waters by Gåsøy lighthouse in the Sunnmørsfjordene. Its speed at the time is believed to have been 25 knots.

In its report the AIBN issued 2 safety recommendations. The ship-owner was asked to reconsider the contents of the operating manual with respect to the ordinary seaman's role in navigating the vessel, and to describe the navigational interaction and communication between the members of the bridge crew. The ship-owner was also asked to consider implementing navigation exercises for the ordinary seaman in his check-off and exercise programme. The incident and the safety recommendations issued in the report have similarities with the grounding of the MS "Light Express" and the AIBN's SEA Report for 2009/02.

7.7 Fredrik André

One fisherman perished while fishing on 24 September 2009. The fisherman was alone on board. The safety investigation is based on conversations with family and fellow fishermen, electronic tracking, information from HRS-N (Joint Rescue Coordination Centre in Northern Norway), the police and persons involved in the search and rescue operation.

The AIBN finds it highly likely that the operator of "Fredrik André" fell overboard while casting nets. Safety recommendations were not issued after the accident.

7.8 Lill-Anne

On 11 March 2009 "Lill-Anne" sank in Vestfjorden between Myken and Røst. The owner of the smack was later found dead in the wheel house.

In the AIBN's opinion, a partially open deck hatch with a lack of protection played a decisive role in the shipwreck. The hatch was kept open to provide adequate ventilation for the engine on board. A safety recommendation was therefore issued to owners and operators of smacks. The report also emphasizes the importance of properly securing equipment and cargo. As part of an awareness-raising campaign, a safety recommendation was directed at NMD to inform installers of new engines of the importance of assessing whether existing ventilation arrangements are satisfactory for the air requirement specified by the engine manufacturer for ventilating the engine room.

7.9 Nysand

One person died on 24 October 2008 in connection with the departure of the vessel from the pier.

The safety investigation identified key deficiencies as regards safety management, work, health and safety on board, and inadequate follow-up and supervision by the authorities in this connection. The study also revealed that the regulations do not define the scope of safety management systems for cargo vessels under 500 gross tonnes (GT).

The AIBN submitted two safety recommendations as a result of this investigation. Both were directed at NMD.

7.10 Sundstraum/Kapitan Lus

The Norwegian vessel "Sundstraum" and the Malta registered vessel "Kapitan Lus" collided in Drogden outside Copenhagen at 13.16 local time (LT) on 3 July 2009.

In its report the AIBN recommended that the operator of "Sundstraum" consider using a pilot in the Øresund and similar waters in line with IMO recommendations, and make arrangements so that all ship crews undergo practical training in dealing with scenarios where ship control failures occur.

7.11 Star Ismene

In the accident on "Star Ismene" two people lost consciousness while sounding the fuel and ballast tanks.

The safety investigation revealed weaknesses in the design and solutions for access to and ventilation of the cargo holds. The ship's safety management system did not address the dangers caused by the design in given situations, and the supervisory authority had not detected this weakness in the safety management system. Four safety recommendations were issued to the ship-owner, the classification society and NMD.

7.12 Helgeland

The high-speed vessel "Helgeland" collided with a fixed navigation marker on 13 December 2009 by Lovund island on the Helgeland coast.

The AIBN identified safety problems related to the ship-owners arrangements to ensure adequate planning of the implementation and control of the voyage, and arrangements to ensure the necessary communication and interaction of the bridge crew. Two safety recommendations were directed at the ship-owner.

8 References, figures, tables

8.1 References

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8.2 Tables

8.3 Figures