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Reporting and statistics of pilotage incidents within the Swedish Maritime Administration

An analysis of incidents during pilotage from 2004 to 2014

Diploma thesis in the Master Mariner Programme

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Gothenburg, Sweden 2014

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Pilot boat, photo by Filip Danielsson.

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Abstract

The Swedish Maritime Administration (SMA) asked for assistance in finding out whether incident reporting patterns could be made visible within their field of pilotage. Since regulations - both international and national - governs when and how a maritime incident report should be written certain aspects of the reports are important to consider. Research regarding reporting among pilots showed to be difficult to find, why studies examining incidents and incident reporting in general terms have been referred to.

The overall question of this study is whether or not statistical patterns can be traced from the reports received from the SMA. This question was further deepened looking for specifics in the material, such as degree of seriousness and influence of weather condition.

The material consisted of 94 reports received by the SMA during the fall of 2014. The reports dated from year 2004 to 2014 and was analysed in part using of a method called TRACEr. Here, information was sorted into different categories regarding for instance type of incident and location. This information was then presented in relevant diagrams for each of the investigated categories.

Results showed that bulk carriers and tankers were the most frequently appearing ship types in the statistics and that “Machinery damage” followed by “Contact” (with fixed or floating objects) are the most common causes of an event. Most of the incidents were of less serious nature while merely about 10 percent were categorised as serious and very serious casualties. Statistics on weather show that in almost two thirds of the incidents there was no significant weather effect.

Keywords: Swedish Maritime Administration, incident reporting, pilot, pilotage, near-miss, incident, accident, TRACEr.

Sammanfattning

Sjöfartsverket önskade hjälp att ta reda på om det gick att se mönster i de incidentrapporter som lämnas in i samband med olyckor inom organisationens lotsverksamhet. Eftersom det finns regelverk – både nationella och internationella – som styr vad en maritim incidentrapport ska innehålla för information måste dessa olika aspekter beaktas när man studerar rapporterna.
Forskning kring incidentrapportering inom just lotsning visade sig vara svårt att hitta, varför generella studier kring incidentrapportering har refererats till i denna rapport.

Den övergripande forskningsfrågan i denna studie är att se om det går att hitta statistiska mönster bland de incidentrapporter som Sjöfartsverket tillhandahöll. Frågan specificeras något genom att exempelvis studera måttet av allvarlighet i olyckorna samt vilka väderförhållanden som rådde vid olyckstillfället.

Underlaget till denna rapport består av 94 stycken incidentrapporter, tillhandahållna av Sjöfartsverket hösten 2014, skrivna av lotsar mellan åren 2004 och 2014. Rapporterna har delvis analyserats med hjälp av en metod som kallas TRACEr där information sorteras in i olika kategorier utefter exempelvis typ av incident och var den skedde. Informationen presenteras sedan i olika diagram och grafer, relevanta för varje undersökt kategori.

Resultatet visade att bulkfartyg och tankfartyg var vanligast förekommande i statistiken samt att maskinfel följt av kontakt (med kajer eller andra föremål) var de vanligaste orsakerna till att en olycka skedde. De flesta incidenterna var av mindre allvarlig art medan endast 10 procent kategoriserades som allvarliga eller mycket allvarliga olyckor. Statistiken över vädret visade att det i två av tre incidenter inte förelåg någon väderpåverkan.

Nyckelord: Sjöfartsverket, incidentrapporter, lots, lotsnig, incident, olycka, TRACEr.

Acknowledgments

The authors would like to thank Erik Waller, Pilotage Process Leader at Swedish Maritime Administration. The authors would also like to thank supervisors Linda de Vries and Joakim Dahlman at the Maritime Human Factors Institution at Chalmers University of Technology, as well as examiner Ida-Maja Hassellöv.

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1 Introduction

In early 2014, the Swedish Maritime Administration (SMA) made clear that they wished for assistance in investigating incidents within their field of pilotage. The stack of incident reports was becoming harder to grasp as different systems did not ideally cohere. The SMA had been working on renewing their reporting system for incidents and needed to clarify the framework of reports being made.

The Swedish Ship Safety Act (SFS 2003:364) 16 a §, states that a pilot who observes a vessel suffering severe abnormalities shall, without delay, report this to an authority nominated by the government, if the abnormality substantially can affect the safe navigation of the vessel or imposes a threat to the marine environment.

To report and follow-up divergences is also a requirement in the ISO 9000 standard, adopted by the SMA. ISO 9000 contains information on quality assurance and on how to continuously develop methods and processes, for example as a mean to trace divergences. ISO 9004 specifically addresses divergence follow-up and ways to introduce improvements in organisations. According to chapter 8 each organization shall "monitor and maintain relevant information, and analyse potential impacts on its strategy and policies" (International Organization for Standardization, 2014).

At present the SMA employs two different systems for reporting incidents. PRIS is a system used solely by the pilots. Information is not shared with any other branch in the organisation. The more recently developed C2 on the other hand aims to be a more universal system for reporting. Further, C2 is a system for reporting deviations and working with follow-up and improvements, not only within the field of pilotage but also within other departments in the SMA. The process of transferring information from PRIS into C2 while phasing out PRIS has been started. Also, according to Erik Waller (personal communication, May 9th 2014), information from other reporting sources within the SMA is supposed to be merged into C2 as well.

Simultaneously, information gathered in C2 could be used on a European level through a system called the SafeSeaNet. According to Erik Waller (personal communication, September 19th 2014) The Swedish Transport Agency is supposed to gather relevant information from C2 to be shared with other European countries through the SafeSeaNet. This information, in turn, shall serve as a tool where lessons can be learned from mistakes made by others and facilitate international cooperation with the purpose of increased maritime safety.

Based on the above, it is for the SMA to properly and efficiently report incidents and work with deviations in their organisation. Ultimately, the statistical part of this study will contribute paths to wider insight in the field of efficient reporting.

For the reader to keep in mind from heron is that the term "incident", when mentioned in general terms, will be an umbrella term for all types of incidents (see Method for definitions).

1.1 Purpose

Being written at request of the SMA, this study aims to make visible statistical patterns in pilotage incidents and incident reporting. These findings, in turn, will ultimately serve as a foundation in the SMA's deployment of the new reporting system C2.

In the process of developing C2, the SMA has expressed interest in finding out whether or not certain types of incidents are more frequently appearing than others and if certain kinds of vessels are represented more often in the statistics. Other factors have also been requested for, such as if the weather has been a factor of importance during the time of the event and what level of seriousness the incidents presented.

This type of knowledge would facilitate for the SMA define factors to be emphasized in the new C2 reporting format. Moreover, and more importantly, incident pattern analysis would increase the possibility to direct specific attention and preventive measures towards particular fields, resulting in increasing maritime safety.

Therefore, it is the aim of this study to trace patterns in the incident reports supplied by the SMA.

1.2 Questions

Since the general approach in this study is to investigate statistic data from incident reports within the SMA, the overall question reads: is it possible to detect certain patterns in SMA's incident reports?

This report is further concretised by studying the following:

- Is any ship type overrepresented in the statistical material on incidents?
- What are the most common causes of an incident when a pilot is onboard?
- Has the weather situation been a factor at the time of incident?
- Of the incidents reported, how many has been of more serious nature?

1.3 Delimitations

Being written on request by the SMA, this study focuses on incidents occurring during pilotage in Swedish national waters. This as the incident reports are all from where Swedish pilots have been onboard. In the background chapter however international studies and international legislation on incident reporting procedures are brought up.

The study only takes into consideration reports from the C2 system and from local Traffic Areas. Hence, no reports existing merely at local pilot stations in paper form are taken into

account. Neither are reports from the pilots own reporting system PRIS studied. Also, no incident reports older than year 2004 are included in this material.

This study covers 15 credits and has no financial claims.

2 Background

2.1 Legislation

The International Maritime Organization (IMO) has set up specific standards regarding incident reporting for pilots. Resolution A.960 states in chapter 7 that the pilot shall report to the appropriate authority "anything observed that may affect safety of navigation or pollution prevention." The same resolution also puts responsibility on the competent pilotage authority, saying that they shall make sure that "incidents involving pilotage are taken into account in maritime pilots' training programmes" (IMO, 2004).

By extension, IMO presents the Casualty-Related Matters: Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident where guidelines for how to conduct incident investigations are outlined. In chapter 5.4 of this code is further defined what is recommended to be included in an incident report. Information regarding name and flag of the ship as well as details about the marine casualty is mentioned. Notably, this Code does not specifically concern pilotage reporting but merely general ship incident reporting (IMO, 2008).

On a national level, The Swedish Maritime Code (MC 1994:1009) governs reporting legislation. Not specifically mentioning the pilot responsibility, chapter 6 section 14 goes into detail on when to report. It lists situations and incidents where reporting becomes mandatory. A wide range of incidents has to be reported, from "if the vessel has collided with another vessel or has run aground" to "if the vessel or cargo or property outside the vessel has or can be supposed to have suffered significant damage".

Being more specific, the Swedish Ship Safety Act (SFS 2003:364) addresses pilot responsibility on reporting. Section 16 a states: "a pilot [...] who in his normal duties observes apparent anomaly at a vessel, shall immediately report this to the authority appointed by the government" [*own translation*]. Pilots are obliged to report any event that can "harm the marine environment" [*own translation*] or "severely affect the safe navigation of the vessel" [*own translation*].

2.2 Contemporary research

The above are all legislative documents that have to be implemented in the daily work for the pilots within the SMA. But what about research in the field of reporting? How do we achieve efficient reports and do reports have a desired effect on improved safety? And are there detectable patterns amongst maritime incidents?

Anderson et al (2013) performed a qualitative study within the field of healthcare and found that "incident reporting can be a powerful tool for developing and maintaining an awareness

of risks". Many of the respondents in the study perceived incident reporting as something overall positive in their respective organisation. They emphasized that incident reporting could work as a "catalyst for changing the way practitioners think about risks". It was found, however, that attitudes toward incident reporting was not viewed upon as solely positive. Some participants were less willing to use the incident reporting system and "skeptical of its value" (Anderson et al, 2013).

In a former study Cooke & Rohleder (2006) constructed an organizational response system called "incident learning" which stressed the importance of this topic. An incident learning system was described as a "set of organizational capabilities that enable the organization to extract useful information from incidents of all kinds". Among other things, Cooke & Rohleder called for a need for an organization to value the risk management system as highly as the business quality management system. Moreover, they identified a number of parameters to be included in a successful incident learning system. "Reporting, investigation, identifying causal structure, making recommendations, communicating and recalling incident learning, and implementing corrective actions" were all considered crucial (Cooke & Rohleder, 2006)

While a lot of researchers focus on incidents where something actually went wrong, others stress the importance of near-misses, where something could have gone wrong. In line with the IMO guidelines on near-misses were they state that "near-misses should help to improve safety performance since near-misses can share the same underlying causes as losses" (IMO 2008), Storgård et al (2012) found that "near miss reporting had helped to increase safety awareness and safety level" among Swedish and Finnish companies (Storgård et al, 2012). Taylor et al (2014) really pinpoints the importance of including near miss information in safety management systems when arguing that "near-miss data enable the identification of various hazards within an organization or industry while providing an opportunity for surveillance and risk reduction" (Taylor et al, 2014).

As seen in Cooke's & Rohleder's study above, a basis for being able to utilize information from incidents and learn a lesson thereof is the incident report itself. We need to decide what to report and what not to. Also, what information is included in the report is of similar importance as is the information to be left out. In his doctoral thesis at Lunds University, Anders Jacobsson (2011) defines the questions to be asked for efficient reporting; "Do we report the incidents that are worth reporting (that have a learning potential)?" and also "How big is the number of unreported cases, the "hidden number"?" (Jacobsson, 2011).

Answering Jacobsson's later question is Hassel et al in a study from 2010. They analysed and compared accidents from 2005 to 2009 from standalone databases and found that "unreported accidents makes up roughly 50% of all occurred accidents" (Hassel et al, 2011)

Although this is not a study in how to construct an incident reporting form, Jacobssons questions illustrates possible pitfalls in the statistical material received from the SMA. It is therefore necessary to try to keep in mind the above when analysing information in the reports. If incidents and /or information is not reported correctly, the result in this study might not cohere with the actual situation. Information from the reports will be a topic of discussion later on.

Preparing for this report, scientific research on reported incidents patterns showed to be less available than research focusing on the incident investigation. Statistical findings from the American Bureau of Shipping (2004), however, states that of accidents found in publicly available databases, human error was "*primarily* responsible for […] 46 percent of maritime accidents" (Baker & Seah, 2004). Almost as many, 40 percent showed to be due to engineering failures.

A case study published by Nielsen & Jungnickel in WMU Journal of Maritime Affairs back in 2003 showed somewhat deviating results. Only taking into account incidents of more severe type from "formal inquiries in the former German Democratic Republic", Nielsen & Jungnickel found that 28 percent of them were collisions whereas only a total of 1.9 percent were engine room related. 33.2 percent of the vessels included were "dry cargo ships". It was not specified in the result whether or not a pilot was onboard during the time of the incident (Nielsen & Jungnickel, 2003).

Also published in the WMU Journal of Maritime Affairs but in 2014 Batalden & Sydnes investigated, among other things, how many of the maritime incidents are considered to be either "very serious", "serious" or "less serious". Results, based on reports from vessels either registered in the UK or sailing UK national waters, showed that 55.6 percent of the incidents were categorised as either "very serious" or "serious" whereas 44.4 percent landed in the "less serious" category (Batalden & Sydnes, 2014).

3 Method

3.1 Data collection

In order to clarify the objective for restructuring their incident reporting system, C2, a semi-structured interview with Erik Waller at the SMA, was held in the early stage of this study (Denscombe, 2009). Prior to the interview the same informant communicated basic relevant data and set out his requests on the study. All information concerning SMA's reporting systems and procedures presented in this report are received during communication with Erik Waller, pilotage process leader at the SMA.

Initially, incident reports from two of the SMA's reporting systems, Traffic Area reports and C2, were cluster selected [*own translation*] (Denscombe, 2009) together with the SMA. The timespan of the reports ranged from 2004 to 2014. In total 94 reports (of which 62 from the C2 system and 32 from the Traffic Area offices) were used in the statistics. In some of the reports received from the SMA no pilot was on board the vessel at the time of the incident, why these reports were excluded from this study.

3.2 Data analysis

Information from the reports was sorted using an Excel form. ID number and date were used to be able to trace the reports. The Excel matrix was divided in such a way so that the first part contains information provided in the reports, either through written text or in predefined fields. The second part of the matrix contains processed information, i.e. information that the writers of this study have interpreted based on the report material.

In the process of structuring and analysing data from the SMA reports a technique called TRACEr - Technique for Retrospective and predictive Analysis of Cognitive Errors - was utilized (Shorrock & Kirwan, 2002). Shorrock & Kirwan emphasise that the TRACEr methodology is a useful tool for analysing accidents and also pinpoint areas where improvement is needed. It should be noted here that this methodology was initially developed for air traffic control, but has also been applied efficiently for analysing maritime incidents, for example by Vantikos et al (2012).

Simplified, the TRACEr method maps out the details of each incident by schematically structuring information from the general to the specific, as shown in the figure below.

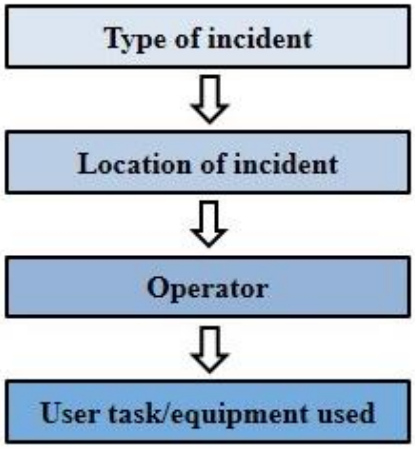

Figure 3-1. The TRACEr methodology

The "Type of incident" is primarily defined, followed by "Location of accident". Going more into detail and defining the "Operator" responsible and the "User task/equipment" does TRACEr. For this study though, the last two categories was omitted for a number of reasons; for one, this kind of information was seldom stated in the reports. Secondly, statistical relevance was found limited for the purpose of this study since the focal point was on a structural level. Also, the risk of blaming a specific individual for the incident was desirably avoided. Finally, the reports were not the result of a juridical process and therefore no definite responsibility could be established even though sometimes stated in the reports.

3.2.1 Type of incident

Incident type is defined using the United States Department of Labor's categories as follows:

- "Accident" - The National Safety Council defines an accident as an undesired event that results in personal injury or property damage.
- "Incident" - An incident is an unplanned, undesired event that adversely affects completion of a task.
- "Near-miss" – Near-misses describe incidents where no property was damaged and no personal injury sustained, but where, given a slight shift in time or position, damage and/or injury easily could have occurred (United States Department of Labor, 2010).

These categories were chosen in favour of the SMA's own way of identifying incidents as merely "incidents" and "accidents" [*own translation*] since it was perceived as more detailed and well defined. Due to insufficient information in numerous reports, this division had to be complimented with the category "undefined".

In order to further specify the nature of incidents and to comply with the request of the SMA, a casualty type category was added. Here the level of seriousness for each event was interpreted based on the information given in the reports. The categories of seriousness were

taken from the IMO “Casualty-Related Matters: Reports on Marine Casualties and Incidents" (IMO, 2008):

- "Very serious casualties" are casualties to ships which involve total loss of the ship, loss of life, or severe pollution [...]
- "Serious casualties" are casualties to ships which do not qualify as "very serious casualties" and which involve a fire, explosion, collision, grounding, contact, heavy weather damage, ice damage, hull cracking, or suspected hull defect, etc., resulting in immobilization of main engines, extensive accommodation damage, severe structural damage, such as penetration of the hull under water, etc., rendering the ship unfit to proceed∗ , or pollution (regardless of quantity); and/or a breakdown necessitating towage or shore assistance.
- "Less serious casualties" are casualties to ships which do not qualify as "very serious casualties" or "serious casualties" and for the purpose of recording useful information also include “marine incidents” which themselves include "hazardous incidents" and "near misses".

3.2.2 Nature of incident

Even for the next category of processed information, IMO’s definitions were used. In the Casualty Analysis Procedure (document FSI 17/WP.1, annex 2) is defined eleven common causes of incidents. These are;

- Collision
- Stranding or grounding
- Contact
- Fire or explosion
- Hull failure or failure of watertight doors, ports etc.
- Machinery damage
- Damages to ship or equipment
- Capsizing or listing
- Missing
- Accidents with life-saving appliances
- Other

Most of these categories was found rather self-explaining except the difference between “Contact” and “Collision”. In the Casualty-Related Matters: Reports on Marine Casualties and Incidents, IMO defines “Collision” as “striking or being struck by another ship” whereas “Contact” is “striking any fixed or floating object” (IMO 2008).

The above causes of incidents were chosen to be listed twice, the second time being the resulting event. For example, “Machinery damage” sometimes resulted in a “Contact” or “Stranding or grounding”. This way of using the same categories twice was motivated by an ambition of being as detailed as possible in the incident statistics.

3.2.3 Ship type

For identifying ship type, the International Chamber of Shipping’s list of ship types were used (International Chamber of Shipping, 2013). This list was chosen in favour of the ship list

published by IMO (2014) due to too many irrelevant ship types for the frame of this study. Also here however, the category “Undefined” needed to be supplemented due to insufficient information in some of the reports. The categories “RoRo Ship” and ”Pilot Boat” were added to the original ISC categories. In its original form RoRo ships are included in the “Ferry or Cruise Ship” category, but extracted in this report for clarification and since explicitly requested by the SMA. Hence “Ferry and Cruise Ship” include merely passenger ships and RoPax vessels. (Officers and masters on ferries regularly entering Swedish ports normally have pilot exemption for the area they are navigating within. Therefore no pilots from SMA are on board during port entries.) "Pilot Boat" was added as an own category since it was considered highly relevant to separate from the more generic category “Specialist Ship”, where it is included in the International Chamber of Shipping definition. With the changes made the categories are listed below.

- Tanker
- Bulk carrier
- Container ship
- RoRo ship
- Ferry or Cruise ship
- Pilot boat
- Specialist ship

The ship type data in this report is retrieved from different sources. “Swedish Maritime Administration” means that the ship type is directly mentioned in the reports. This category also includes cases where a ship name was written out, e.g. “M/T XXX”. From the abbreviation M/T was understood that the vessel was a tanker (Motor Tanker). “Other” means that ship type was not directly mentioned in the reports but retrieved from the Internet using the ship’s name or/and call sign. “Undefined” means that ship type was not mentioned in the reports nor was it possible to find any information on the Internet.

3.2.4 Weather at time of the incident

Definitions regarding weather were applied on wind effect and taken from the Swedish Meteorological and Hydrological Institute (SMHI, 2014), divided as:

- Light (0-3.3 m/s, 0-2 Beaufort)
- Moderate (3.4-7.9 m/s, 3-4 Beaufort)
- Fresh (8.0-13.8 m/s, 5-6 Beaufort)
- Strong (13.9-24.4 m/s, 7-9 Beaufort).

For the categories “Current” and “Visibility” no scientifically established division was made. Also in part requested by the SMA, more simplified categorisations were created. “Current” was merely defined as if there was current present at the time of incident, not specified in speed. The same goes for visibility which was divided into “Clear”, “Moderate” and “Poor”. Also for “Wind”, “Current” and “Visibility” the option “Undefined” had to be included due to insufficient information in many reports.

To give a more contextual picture of the weather conditions it was decided to construct a forth topic, namely if there was a significant weather effect at the time of incident. This topic is an often subjective interpretation of the information presented in the reports, where both exact values and descriptive text has been taken into account. The category undefined is used simply when it is not possible to make a credible interpretation due to deficient information.

3.2.5 Cross-analysed data

Based on the findings from the raw data in the SMA reports, statistical calculations using Excel was made. Each category was displayed in a circle diagram for clarity and some categories were also cross-analysed, partly requested by the SMA. The crossed-analysed topics were:

- Nature of incident (Initial) based on Type of incident
- Ship type based on Type of incident
- Ship type based on Type of incident = “Machinery damage”

4 Results

4.1 Introduction

The result is presented as circle diagrams showing data either directly derived from the reports, such as ship type, or interpreted data from the reports such as type of incident ("Accident", "Incident" or "Near-miss" and "Level of seriousness").

The first part of this chapter presents results interpreted and implemented according to the TRACEr methodology as explained in method chapter. Consequently this part of the report presents statistical result of "Type of incident", "Nature of incident" and "Location of task error".

Following is an analysis regarding weather as a contributing factor to the incident. In the final part of this section, some cross-run results are presented. Here, for example, comparisons are made for "Nature of incident" between each of the incident types "Accident", "Incident" and "Near-miss".

4.2 Type of incident

4.2.1 Accident, Incident or Near-miss

Information from the reports are here interpreted and structured according to the categories used by the United States Department of Labor (2010). (Note here as described earlier in this report that the word "incident" is used both as general term for all reports as it is used as definition for a specific type of event.) The figure below shows the result when this definition is applied on the result.

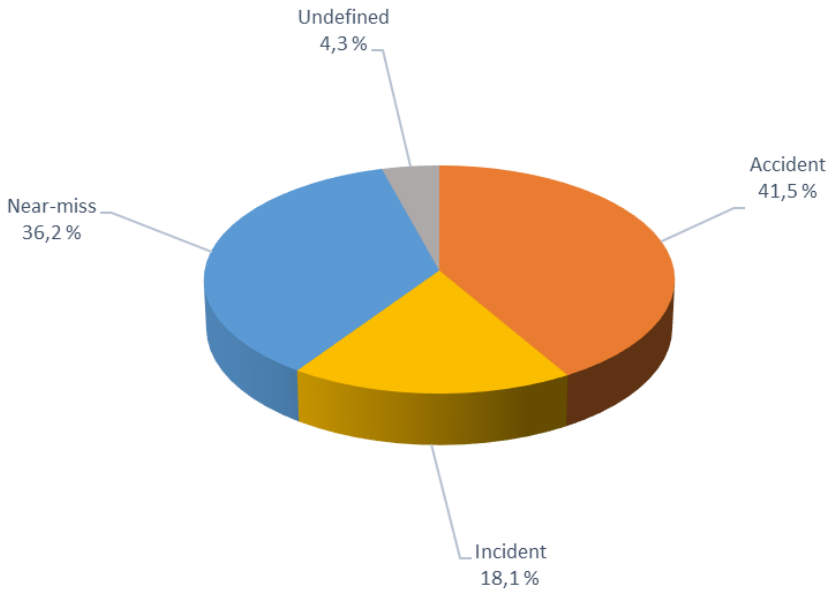

Figure 4-1. Accident, Incident or Near-miss

The figure shows that the largest number of the incidents in the reports was defined as "Accidents". Note that this may seem somewhat more serious than it actually is since all incidents where even the slightest material damage occurred are sorted under "Accidents".

4.2.2 The SMA categorisation of the reports

For comparison, how SMA originally named the reports was also studied. SMA only used the categories "Accident" or "Incident" in the heading of the reports. This information is compiled in the below diagram.

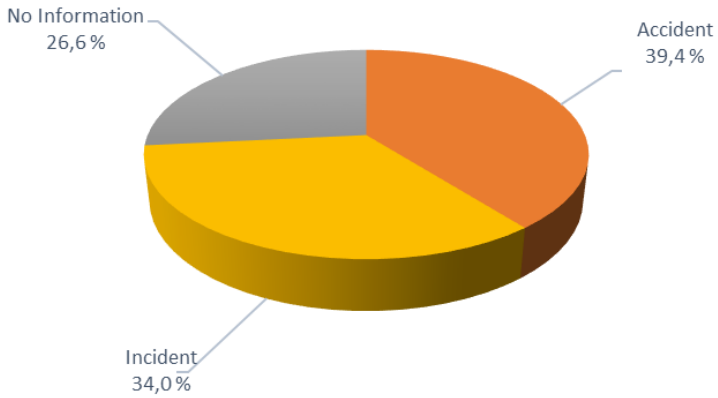

Figure 4-2. Type of incident according to SMA

It may be somewhat misleading to derive any conclusions from this, partly since a large number of reports did not contain any information on this topic (the "No Information" field in the figure). However, as seen in the figure, the category "Accident" was basically of the same percentage as the corresponding field in figure 4-1. On the other hand, when looking at what SMA has categorised as "Incidents" a large number of those incidents have in this report been categorised as near-misses.

4.2.3 Level of seriousness

Another way to clarify the seriousness of the incidents is by the definition set by IMO as referred to in the method chapter. When the reports were interpreted according to this definition the result in the diagram below was achieved.

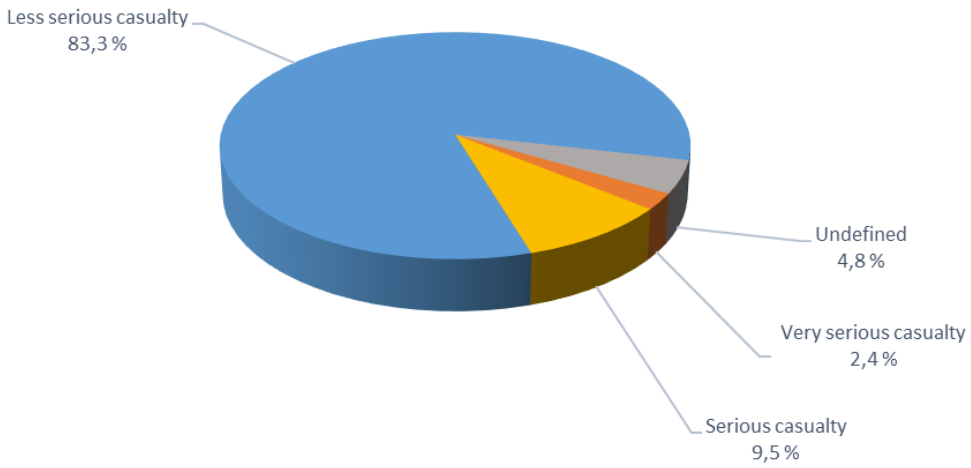

Figure 4-3. Level of seriousness

Following the definition a vast majority of the incidents were categorised as "Less serious casualty". 2.4 percent of the incidents, that is two incidents, were categorised as "Very serious casualty". Both these cases were capsizing (Report ID 7396/2013 and 05-28054).

9.5 percent of the incidents were categorised as "Serious casualty". Those reports described either stranding or grounding situations in which the ship suffered severe structural damage, or accidents with life-saving appliances.

4.3 Nature of incident

4.3.1 Nature of incident (initial)

Figure 4-4 shows the nature of incident according to the definitions set by IMO as referred to in the method chapter.

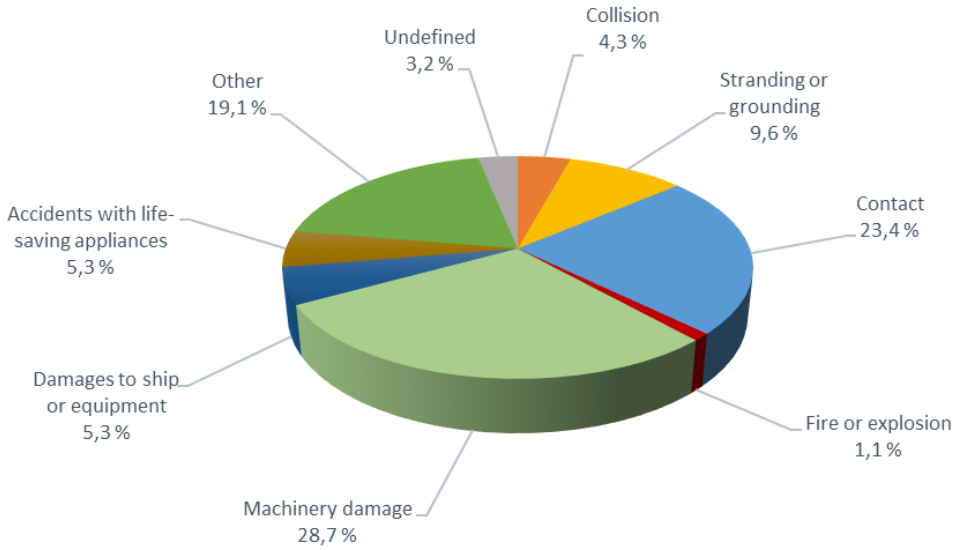

Figure 4-4. Nature of incident (initial)

The diagram reveals that the largest category of incidents during pilotage was “Machinery damages” (28.7 %) followed by “Contact” (23.4 %). “Other” was also a large partition, partly because many navigational near-misses are placed in this category (where nothing actually “happened”).

4.3.2 Nature of incident (consequence)

Figure 4-5 shows the incidents where the initial incident triggered a secondary (more serious) incident, as discussed in the method chapter. Out of the 94 reports, only 8 reports were included in this result.

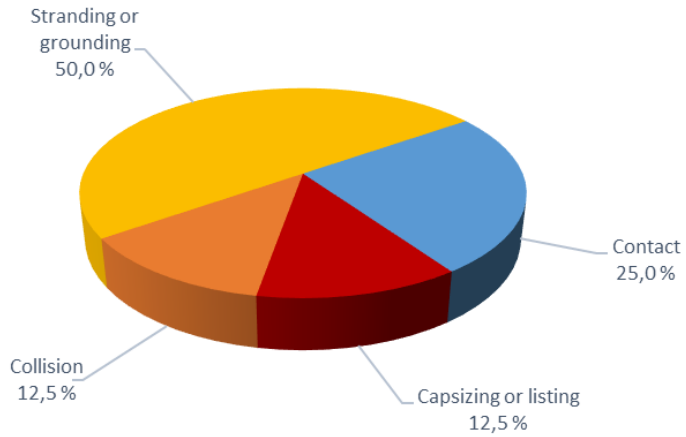

Figure 4-5. Nature of incident (consequence)

Seven of the eight incidents presented here were consequences of “Machinery damages”. The eighth incident, a capsizing represented as the red area of 12.5 percent in the figure, was the result of a collision. (Report ID 7396/2013).

4.4 Location of task error

“Location of task error” refers to where the error causing the incident occurred. The result broadly cohered with the result presented in the “Nature of incident” (initial) section above.

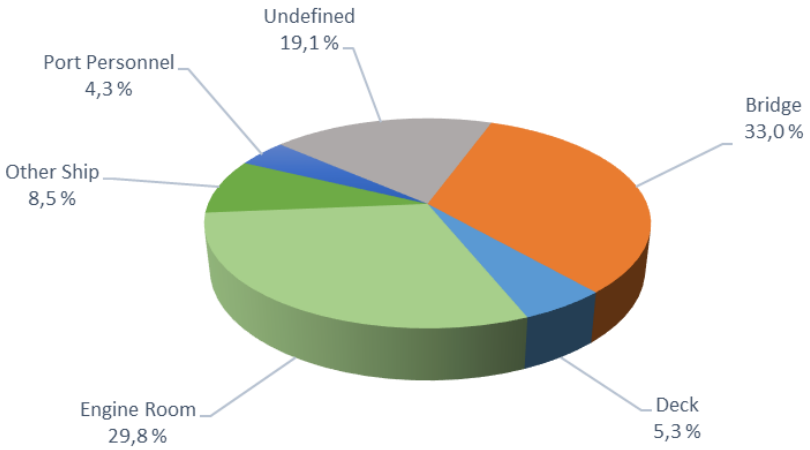

Figure 4-6. Location of task error

When comparing with the “Nature of incident” (initial), the category “Machinery damage” (28.7 %) formed a basically equally sized area as “Engine Room” (29.8 %) in the figure above. The categories “Contact”, “Stranding or grounding” and “Collision” (total sum of 37.3 %) can be compared to “Bridge” (33.0 %) in the figure above as the later incidents naturally relates to navigational matters in most cases.

Note that this result was not directly mentioned in the reports. Instead it has been retrieved from an overall assessment of all information in each report. In almost one fifth of the reports it was not possible to retrieve this kind of information.

4.5 Ship type

Figure 4-6 shows the ship type distribution as defined by International Chamber of Shipping with the categories “Pilot Boat” and “RoRo Ship” added as described in the method chapter.

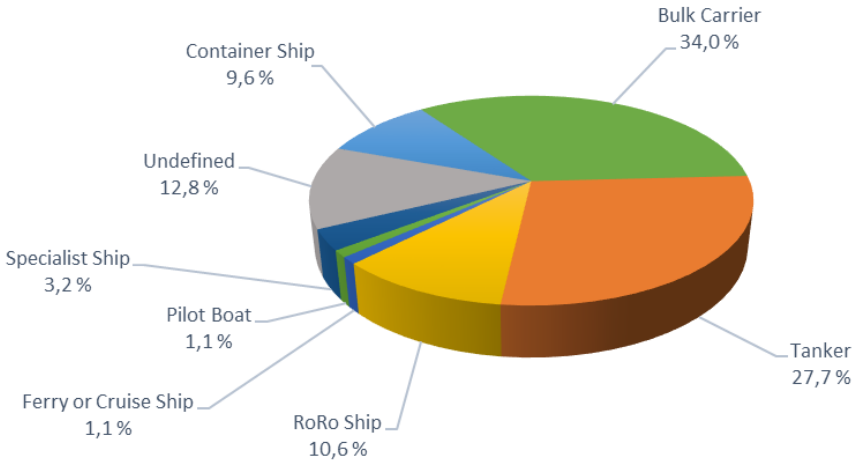

Figure 4-7. Ship type

As seen in the diagram most of the ships involved in the incidents described in the reports were bulk carriers and tankers.

Only one report involved a “Ferry or Cruise Ship”. This was a Malta flagged cruise ship that suffered a blackout in 2013. The same applied for the category “Pilot Boat”, involved in only one incident. This incident was a pilot boat involved in a man over board situation.

The “Undefined” category of 12.8 percent represents the reports where no information of ship type could be found.

4.5.1 Ship type, source

The ship type data in figure 4-6 was retrieved from different sources as described in the method chapter. The percentage of each source is shown in the figure below.

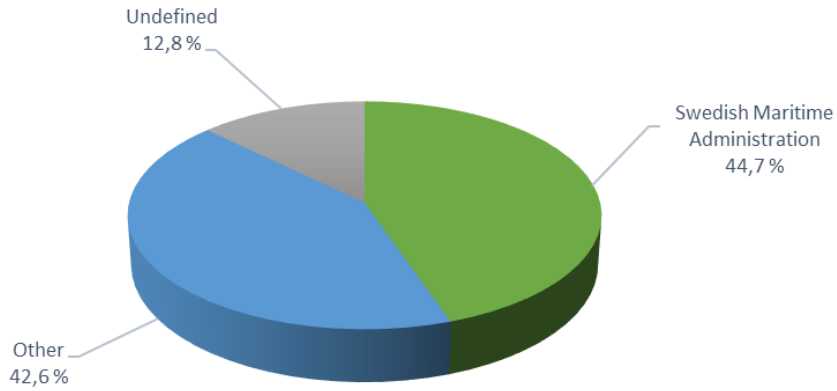

Figure 4-8. Ship type, source

As seen in the figure only near half of the reports mentioned ship type directly. In an almost equal number of reports it was possible to find the ship type information from the Internet using the ship's name or call sign. In 12.8 percent of the cases it was not possible to determine the ship type due to lack of information, directly corresponding with the "Undefined" area in figure 4-7.

4.6 Weather at time of the incident

4.6.1 Wind

Figure 4-9 shows the distribution of wind speed according to the definitions set by the SMHI.

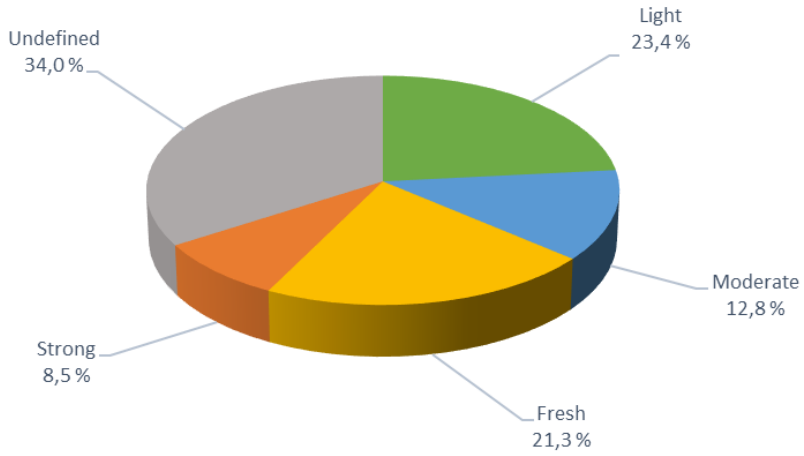

Figure 4-9. Wind speed at time of the incident

"Undefined" means that wind force is not mentioned in the reports. In some cases where wind was only mentioned vaguely, for example "light winds", it has been interpreted and placed in in the most relevant of the four above categories. It is important to note here however that many of these reports concern incidents where wind is not relevant, that is, mostly "Machinery damages".

4.6.2 Current at time of the incident

The current at time of the incident is, as discussed in the method chapter, presented as merely "Current" or "No Current". When the information in the reports was interpreted accordingly the result in the figure below was achieved.

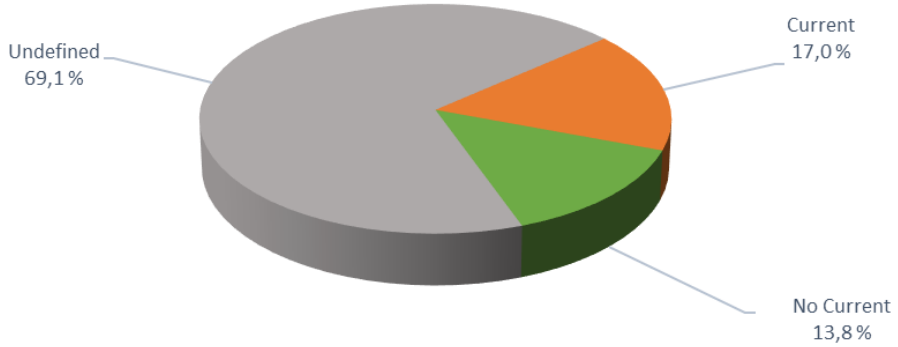

Figure 4-10. Current at time of the incident

As seen in the figure, “Undefined” was the most common type of information. Probably, in most of these reports, “Undefined” means the same as “No current” since no information about current was mentioned. Perhaps, information regarding current was considered irrelevant to mention.

4.6.3 Visibility at time of the incident

Information about visibility was sorted from “Clear” to “Poor” as seen in the figure below.

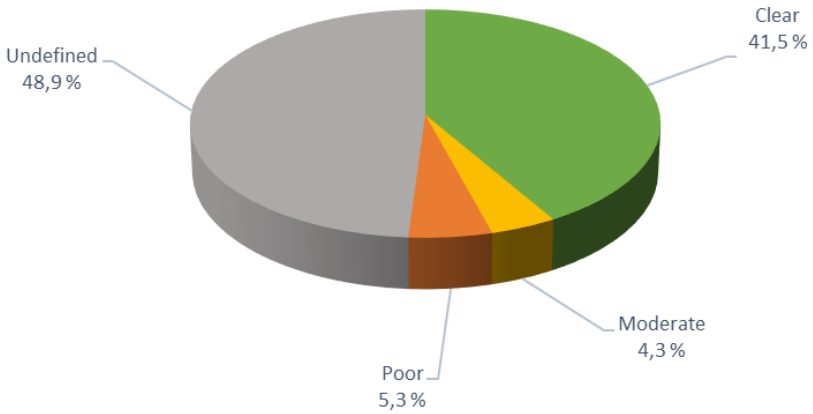

Figure 4-11. Visibility at time of the incident

The figure reveals that almost half of the reports did not include any reference to visibility. As for information regarding current, this could be due to an idea that visibility might not be considered relevant to mention. In 5.3 percent of the incidents the visibility was “Poor” and probably relevant to the incident. For example, in some reports where the ship came in contact with jetties etc. poor visibility could be a contributing factor to the incident.

4.6.4 Significant weather effect?

The “Significant weather effect” tries to depict if one or several of the above mentioned weather factors contributed to the incident. When taking all weather factors into account the result shown in the figure below was achieved.

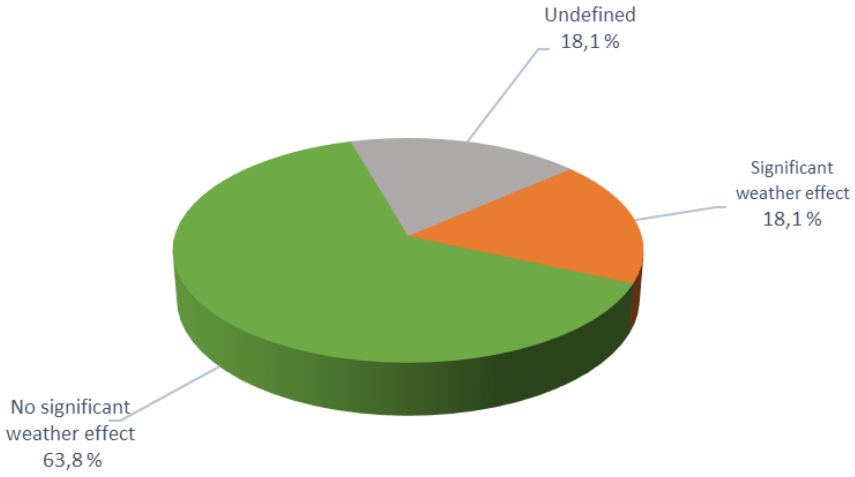

Figure 4-12. Significant weather effect

This is a somewhat subjective judgement as mentioned in the discussion chapter. Seen in the figure above however, the result was much clearer than the individual results from wind, current and visibility. The diagram reveals that in almost one fifth of the incidents, aggregated weather factors contributed, more or less, to the incident.

4.6.5 Nature of incident in cases where there was a significant weather effect

When looking specifically at the incidents where there was a significant weather contributing to the incident, the result below is achieved.

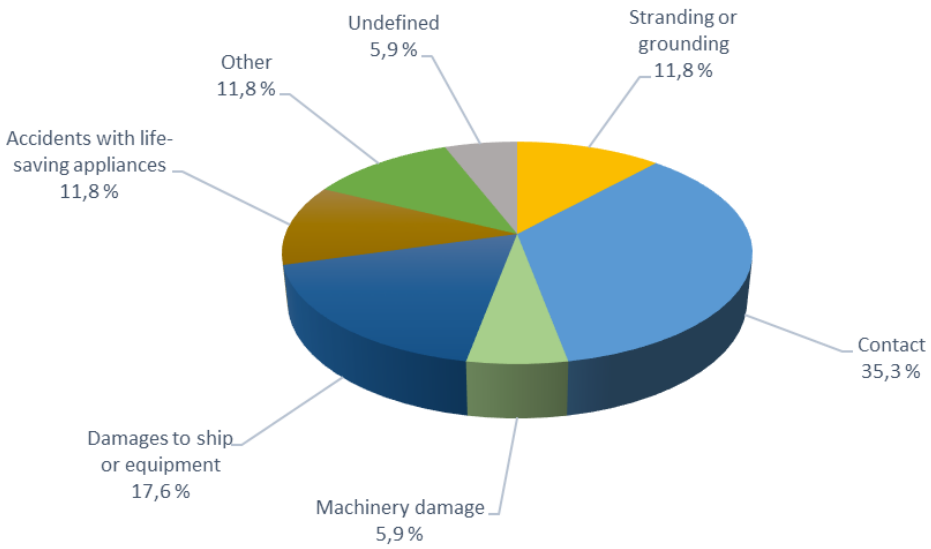

Figure 4-13. Nature of incident in cases where there was a significant weather effect

The diagram shows that those incidents are mostly “Contact”, “Damages to ship and equipment” and “Stranding or grounding”, i.e. such incidents that logically can occur due to weather factors.

4.7 Nature of incident (initial) based on Type of incident

Here, the "Nature of incident" was studied for each of the "Type of incident" categories "Accident", "Incident" and "Near-miss", with the aim of investigating if the "Nature of incident" categories differ between the three different "Types of incident".

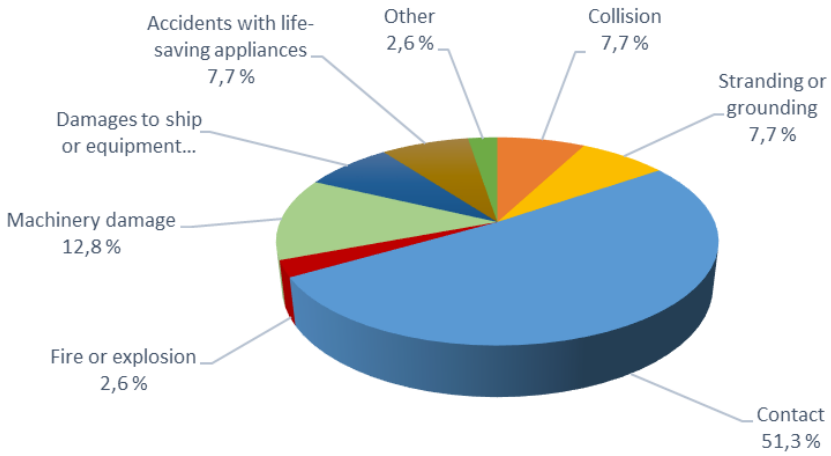

Figure 4-14. Nature of incident (initial) based on Type of incident = "Accident"

When looking at "Accidents", "Contact" was the largest category as displayed above. This since in many of these cases either the ship or jetty equipment were damaged. Naturally, the other "Types of incidents" represented here are also resulting in some sort of material damage (since in the definition of "Accident").

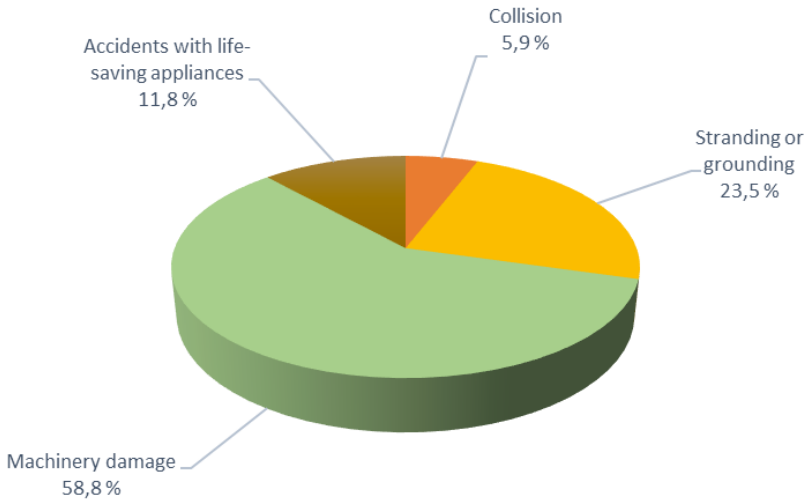

Figure 4-15. Nature of incident (Initial) based on Type of incident = "Incident"

For incidents on the other hand, the largest partition were “Machinery damages”. A large number of the “Machinery damages” fall within the definition of “Incident” since they result in a significant loss of time.

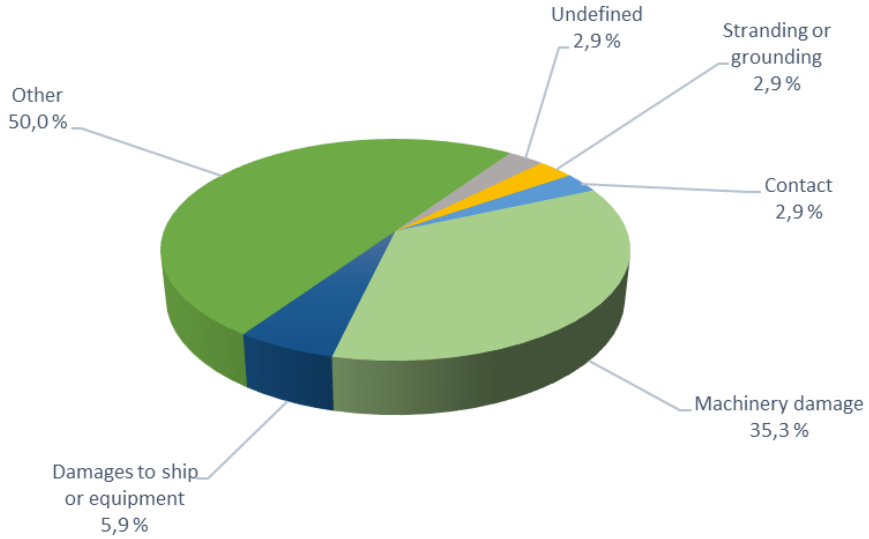

Figure 4-16. Nature of incident (Initial) based on Type of incident = “Near-miss”

Figure 4-16 reveals that “Machinery damages” were also common among “Near-misses”. In this case the “Machinery damages” are probably mostly cases where the crew managed to start the engine more or less immediately for the ship to continue without significant delay.

50.0 percent of incidents among “Near-misses” were categorised as “Other”. In this category falls many navigational events such as near groundings or near collisions including either other ships and other equipment.

4.8 Ship type based on Type of incident

In this section the ship types involved were compared for each of the “Type of incident” categories (“Accident”, “Incident”, “Near-miss”). The results is presented in Appendix 1.

4.9 Ship type based on Nature of incident = “Machinery damage”

Since the “Nature of incident” category “Blackout” formed a large part of all incidents it is of interest to investigate whether there are some ship types that suffer more from blackouts than others. The result from this is presented in Appendix 2.

5 Discussion

5.1 Findings

Presented in the Result are all the statistical findings in this study. These findings were sometimes in line with the research presented in the Background chapter and sometimes not. Overall, the results gave rise to few surprises and uncertainties.

Many of the reported incidents in the material received from the SMA showed to be due to "Machinery damage", such as a blackout. This correlated with the findings of Baker & Seah (2004) who found that 40 percent of all incidents were due to engine failures.

As found by Nielsen & Jungnickel (2003), results in this report also showed that bulk carriers were frequently occurring in incident statistics. On the contrary, no research was found showing that tankers were also frequently appearing in incident statistics, as shown here. However, since no statistic on the total distribution of ship types entering ports of Sweden could be found, it is not possible to say that there is an overrepresentation of these kinds of vessels.

Regarding the level of seriousness of the incidents reported, the results showed that very few were categorised as very serious incidents and that the majority of them fell under less serious incidents. This shows no correlation to the study of Batalden & Sydnes (2014), who concluded that 55.6 percent of the incidents investigated were of serious or very serious kind. Less than 12 percent of the incidents in this study showed the same level of seriousness. Interestingly, the vessels in Batalden & Sydnes study did not have a pilot onboard. Maybe it is too hasty to say that the pilot is the sole explanatory factor here, but it surely is an aspect of interest.

5.2 Information deficiencies in the incident reports

The Casualty-Related Matters: Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident presented by the IMO (2008), suggests relevant information to be included when reporting a marine incident. Out of the reports received from the SMA, a large number was lacking some of the suggested information. This was especially true for reports dated before 2007. In a few cases the majority of items in chapter 5.4 of the IMO code had been left out. Exemplified by report ID 3119/2006 information deficits ranged from the flag state of the vessel to identification of other ships involved. Report ID 2486/2005 was another example where merely location and ship name was stated beyond a brief description of what took place.

In their study Cooke & Rohleder (2006) concludes that incident reporting is crucial for a successful incident learning system. Obviously though, reports with severe information deficiencies are difficult, maybe even impossible, to analyse and hence find lessons to be

learned from. Reports with little or no relevant information will have little learning potential, merely being a number in the statistics over reported incidents.

The reason to why informational deficiencies appear will be a speculative one. Why do the SMA reports dated after 2007 generally contain more information that the ones dated before? A possible explanation could be that the maritime industry has undergone a change during the last decade where focus on safety culture and documentation have had a greater role than before. Reporting is a step in tracing and evaluating incidents, aiming to achieve a safer workplace. Regulations on how to report is will constantly contribute to more thorough reports.

Another possible factor to affect the willingness to report in general and the information accuracy in particular is the attitude toward incident reporting. Anderson et al (2013) found that the number of responses being positive toward incident reporting varied between different organizations. Naturally, attitudes will also differ from individual to individual within each organisation. Whether or not this is true for the reports received from the SMA will be left out of this discussion since no interviews with the concerned pilots has been done.

5.3 Possible pitfalls in interpretation

An important aspect of this study was to investigate how various ship types were represented in the incident statistics. Due to insufficient information in a number of reports however, this turned out to be problematic. In order not to have to state "Undefined" in the ship type category, other sources than the reports were used to find ship type information out. This was not the case with any other category merely putting "Undefined" where reports did not clearly state otherwise. Since ship type was considered to be of major importance for the result and also desired by the SMA this exception was made. A drawback with this method however, was that in a number of cases different ships owned the same name. Where no call sign was reported, no absolute certainty was obtained creating a possible source of error.

Interpretations had to be done regarding other information as well, even though sufficient information existed. It was sometimes difficult to decide whether the "Incident type" should be an "Incident" or "Near-miss". In the definitions for "Incident" is stated that it shall affect completion of the task "adversely". What does adversely mean? Is half an hour of a blackout adversely and if not, where is the line to be drawn? This may have resulted in subjective inconsistencies in the statistical result.

5.4 Different categorisation

Relating to the difficulty to interpret information from the reports is the fact that the SMA until present has chosen to categorise their reports as merely either incident- or accident reports. Aiming to variegate these categories somewhat by introducing "Near-misses" in this report they are still, as seen above, a blunt tool in some cases. In their new C2 format, the SMA introduces the category "safety deficiency" (Personal interview with Erik Waller,

December 3rd 2014). This seems to be a sharper tool, mainly because it – in contrast to "Near-misses" – also includes events that has not yet become a problem or led to an event. For example, a slippery pilot ladder can give rise to important lessons learned even though nothing happened. As brought up in the Background chapter, researchers stress the importance of reporting these types of events as well for increased future safety.

5.5 Other sources of error

In correlation with Nielsen's and Jungnickel's study from 2003, bulk carriers (or "dry cargo ships") was found to be most frequently appearing in the result in this report. This, however, was true only for "Incidents" and "Near-misses" whereas for "Accident" the most common ship type was tankers. Reasons to this are of course hard to tell but a factor could be the mere overrepresentation of tankers trafficking Swedish waters. Unfortunately, no statistical evidence on this matter was possible to get hold of and hence this becomes a mere speculative theory.

The statistical findings regarding ship type could in some cases have been a falsified by the fact that the incident was due to a mistake made by another ship than the one piloted. In these cases (e.g. report ID 6791/2012) the "Location of error" did not occur on the same vessel as from which the incident report was written. Thus, a bulk carrier in this incident is referred to the piloted vessel reporting the incident and not the vessel causing the incident. However, the number of reports this being the case are limited.

5.6 Future fields of research

While working with the statistic material, questions arose of whether to expand the study to include a broader field of interest, namely; what happens with the reports once they are filed? As brought up in the Background a vital key to increased maritime safety is the monitoring and follow-up of historic incidents and near-misses. So, how does the SMA make use of the information in the reports? In what way are lessons learned from analysing incidents?
Have new routines or working methodologies been deployed as a result of historic incidents?

Also not covered in this study, an interesting approach for a future work would be to investigate incidents in general in the same fashion, that is, not just incidents occurring with pilots onboard. Since quite a lot of reports from the SMA had to be cancelled due to no pilot being onboard, a somewhat deviating result would possibly have been achieved. For example, it could be seen that bulk carrier were overrepresented in "Near-misses" due to navigational errors.

5.7 Method discussion

Regarding the methodology in this report, here follows a discussion regarding its accuracy.

First of all, even though no significance analysis has been performed, the number of reports received from the SMA – 94 reports – may be considered to be on the low side. Also, the

reports were merely collected from two different traffic areas. Saying that this report investigates pilotage incidents occurring at Swedish national waters is therefore an exaggeration.

In the initial phase of this study the TRACEr methodology was considered to be an appropriate choice for sorting information from the incident reports into relevant categories. During the evolvement of interpreting the information in the reports combined with dialog with the SMA however, the two last categories were considered as less relevant for this study and hence omitted.

Applying the categories in Casualty-Related Matters: Reports on Marine Casualties and Incidents (IMO, 2008) for the initial event without using the second category named "Consequence", may be questioned. Though the purpose was to achieve a more detailed mapping of incidents it is also an arguable sign of inconsequence, as in the TRACEr discussion above.

Another possible topic of confusion is the use of the word incident in this report. Sometimes "Incident" is an umbrella term for all reports and sometimes it refers to a specifically defined type of event.

Though not within the frame of this study, a greater sense of understanding to why some of the reports contain limited amount of information could have been achieved if a case study had been utilized. Possibly interviews with pilots could have been done regarding their attitudes toward reporting or asking questions about ways to facilitate gathering of incident information. Due to the delimitations of this study though, no such attempts were made.

6 Conclusions

This study set out to investigate statistical patterns in incident reports from the SMA. While no evident general patterns could be concluded, some traits are as follows.

Results in this study show that there is a slight overrepresentation of bulk carriers and tankers in the reported incidents from 2004 to 2014 in general. When separated into different incident types however, the same pattern is not as apparent.

Even though 41.5 percent of the events in the reports are found to be “Accidents”, a majority of all events are found to be “less serious casualties”. “Contact”, with a minor damage on either ship or foreign object, is most often the nature of event here. For “Incidents” however, machinery damage is the overrepresented cause. Two reports in total were categorized as “Very serious casualties”.

“No significant weather effect” was found in 63.8 percent of the reports. The weather showed to have been a factor in approximately one out of five events, as common is the cases were no information on weather was available.

In conclusion, what stands out in this study is that a most of the incidents occurring during pilotage are of less serious nature. No deaths or major injuries were found and seldom severe damages to vessels and other equipment.

For future research it would be interesting to see if the same patterns are found internationally, and if not; why? Also, a study comparing incidents during pilotage with incidents in general would be of great interest.

7 Recommendations

Based on the statistical findings from the incident reports supplied by the SMA, three major suggestions for improved incident report writing is here outlined.

First and foremost, the reports should gain accessibility if there was a clearer and more coherent common outline. As for now the reports from C2 seems to be more uniform than the ones from the different Traffic Areas, where much of the information is given in open text. Though this is has beneficial aspects as well, it is sometimes difficult and time-consuming to grasp the details of the incident. Though there are predefined categories such as “ships name” and “wind speed” to fill in, this information is often mentioned somewhere else in the report or on a different form. For the reader this is confusing and does not serve the incident analysis phase in the lesson learned process.

Secondly, in order to keep track of what types of vessels are involved in incidents this should be stated more explicit. In the older Traffic Area reports there is not even a defined category for ship type, merely ship name and what cargo has been carried at the time of incident. In the C2 format, on other hand, a predefined field for ship type exists. In neither C2 nor the Traffic Area reports however is made clear what ship categories to be used for different ship types. Should, for example, a RoPax vessel and a cruise ship be in the same category or should they be separated. This might seem as a minor detail but when working with the material this was found crucial for an accurate analysis. It is here recommended that the SMA implement suitable pre-set categories for ship types.

Finally the information in the reports is often, frankly speaking, poor. In the worst reports, neither ship name nor date was specified. Although most of the reports did not lack this particular basic information, almost all reports do lack some data. Most commonly perhaps is the leaving out of weather conditions, showing in the statistics where as much as 69.1 percent of information regarding current remains undefined. In 12.8 percent of the cases, type of vessel is not mentioned at all in the reports. Whether or not this particular information is of less or greater importance is not a subject of discussion here. However, since asked for in the report forms one could claim that it is desired data for the SMA.

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Appendix

Appendix 1 Ship Type based on type of incident

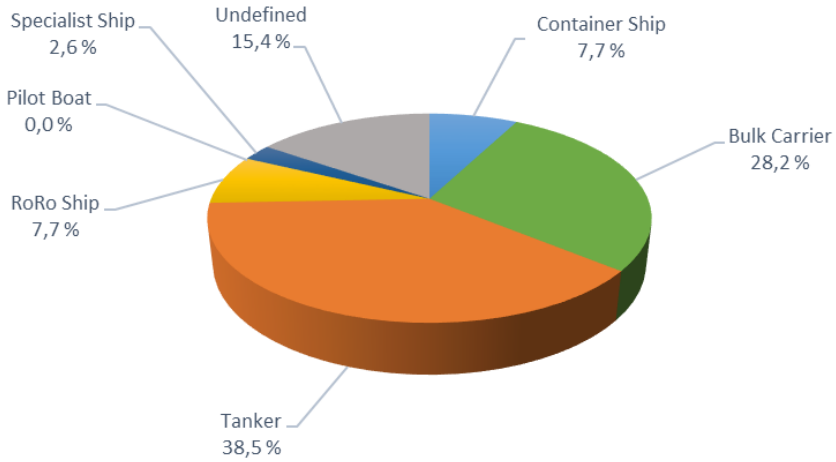

Figure A-1. Ship Type based on type of incident = "Accident"

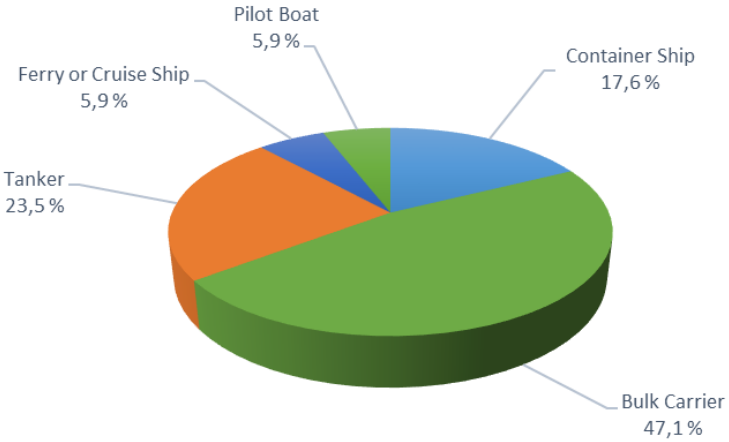

Figure A-2. Ship Type based on type of incident = "Incident"

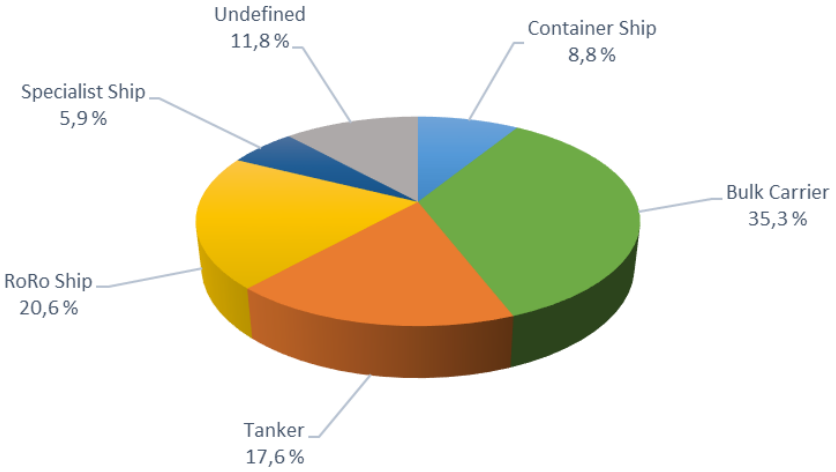

Figure A-3. Ship Type based on type of incident = "Near-miss"

Appendix 2 Ship Type based on nature of incident = “Machinery damage”

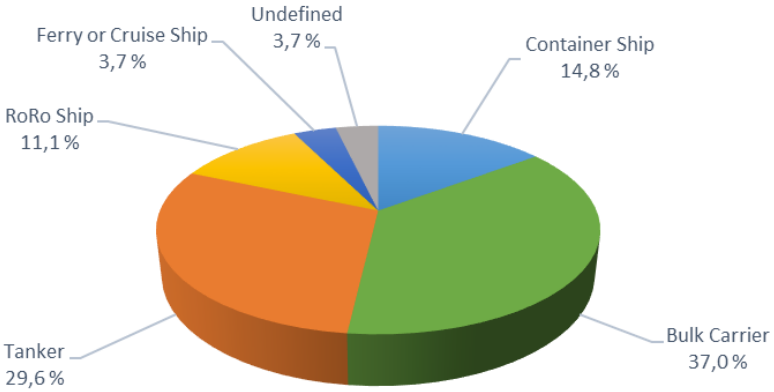

Figure A-4. Ship Type based on nature of incident = “Machinery damage”