TRANSNAV
http://www.transnav.eu
the International Journal
on Marine Navigation
and Safety of Sea Transportation
Volume 16
Number 1
March 2022
DOI: 10.12716/1001.16.01.18

Statistical Analysis of Bulk Carrier Accident from 2011 to 2020

T. Nwigwe & M. Kiyokazu
Tokyo University of Marine Science and Technology, Tokyo, Japan

ABSTRACT: The high rates of casualties in bulk carrier shipping have attracted a worldwide concern for safety and regulatory control from numerous governmental and private agencies. Between 2011 and 2020, a total number of 34 bulk carriers' ships has been identify as total loos, resulting to the death of 128 seafarers. In this study, the statistically analysis of bulk carrier accident occurring from 2011 to 2020, in terms of their frequency, types of accident, locations of incidents and the factors that influence their occurrence has been reviewed. This study will contribute to decision-making and guidance on rational safety resource allocation that will help reduce the high casualty rates in bulk carrier.

1 INTRODUCTION

The total world bulk carrier fleet has continued to increase over the years with an average age of 14.4 years. Bulk carrier shipping accounts for more than 35 percent of the world seaborne trade (Fig 1). They are often described as the workhorse of the industry, and they provide the most efficient means of transportation of important cargo like coal, iron ore, grains, and bauxite across the world in bulk quantity. But despite their importance, they have been associated with a high risk of accident and casualty rate, compared to other class of ships in the world fleet. As at the end of July 2020, the data collected towards these studies, shows that 34 total losses of bulk carrier were recorded which were caused by liquidation and cargo shift, foundering, stranding and fires/explosions. Several reports and publication of accident analyses of bulk carrier losses has linked the increasing risks of bulk carrier failures to their age, corrosion, hull plate damage caused by crabs and forklift, cargoes failure and improper loading. The demand for improved safety of bulk carrier ship requires a comprehensive safety analysis to enable the understanding of several factors contributing to such accident and how to properly mitigate them in the future. The goal of this study is to give a statistical analysis of bulk carrier accident occurring from 2011 to 2020 and investigating the safety level of bulk carrier shipping within this period [1–3, 5].

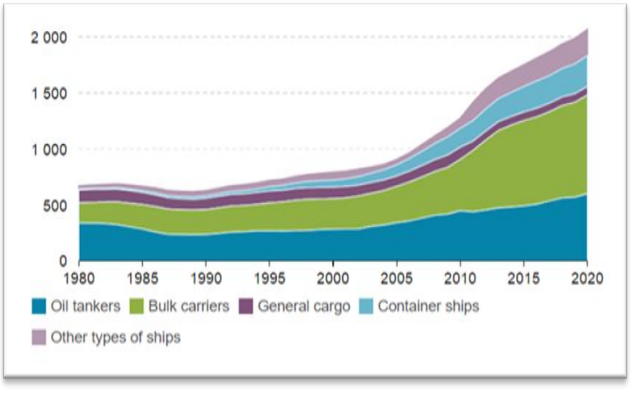


Figure 1. World fleet by vessel type

2 MATERIALS AND METHOD:

This study focused on accidents associated with bulk carrier ships above 10,000dwt. The total bulk carrier loose that occurs between 2011 to 2020 were statistically analyzed in terms of frequency, class of bulk carrier, and kind of accident. The statistical data supporting this study were compiled from Published article by INTERCARGO London, IMO GISIS database and Lloyd's list intelligence casualty run on May 1, 2021. The data included in this study comprises only bulk carriers above 10,000dwt and within a shorter period of 10 years, but the decision was selected for this study because of the availability of data. Some losses may be unreported as at this time, especially for the most recent period.

3 ANALYSIS AND DATA PRESENTATION

The data for the annual distribution of bulk carrier accidents that resulted in total loose from 2011 to 2020 as presented in figure 2 shows that the total-loss bulk carrier accidents are steadily decreasing. The information presented can help in assessing the factors which are more likely to contribute to the accidents and the results of the analysis have been grouped accordingly, based on the type of bulk carrier ship, Losses by incident category, trade route, average age of bulk carrier vessel, cargo type and Losses by flag of registration. Figure 2 shows the total bulk carrier (over 100dwt) identifies as total loss and the size of bulk carrier ship involve in the accident between 2011 and 2020. It is evident from this table that there has been a continuously decline in the number of vessels lost within this period. During this period, 34 incidents were recorded, which were caused by liquidation and cargo shift, foundering, stranding and fires/explosions and in total resulted to 128 loose of life as seen in Figure 3. The comparison based on the size of bulk carrier is seen in Figure 4 and it is evident that the handy size class account for majority of the loses with this period. The contributing factors has been linked to the root causes of this incidence, including navigation problem, cargo failure, poorly maintained equipment, incorrect operation, age, and human element which was recorded as the highest among all. The second highest contributor is found to be cargo failure and foundering followed by grounding and then collision and contact. The contributing factors has been linked to the root causes of this incidence, including navigation problem, cargo failure, poorly maintained equipment, incorrect operation, age, and human element was recorded as the highest among the root cause of the accident. The second highest contributor is found to be cargo failure and foundering followed by grounding and then collision and contact. A great concern has been raised as to how similar accidents involving bulk carriers may be prevented or minimized in the future if a proper understanding of their contributing factors is known. To direct the attention towards improving safety and mitigation plans for preventing bulk carrier accident, the contributing factors have been investigated and are summarized below [4].

Year	10k-34,999 dwt	35k-49,999 dwt	50k-59,999 dwt	60k-79,999 dwt	80k+ dwt	Total
2011	6	2	1	1	1	11
2012	1	0	1	1	0	3
2013	1	2	2	0	1	6
2014	1	1	0	0	0	2
2015	2	0	1	2	0	5
2016	0	1	0	0	2	3
2017	0	0	1	0	1	2
2018	0	0	0	0	0	0
2019	0	0	1	0	0	1
2020	0	0	0	0	1	1
Total	11	6	7	4	6	34

Figure 2. Bulk carrier (over 100dwt) identifies as total loss

CAUSED OF ACCIDENT	LOSS OF LIFE	LOSS OF SHIP	LIKELY CAUSE	TOTAL LOSS
Cargo shift/ liquefaction	61	5	Cargo failure	5
Collision	0	2	Human element	1
			Machinery failure	1
			Unknown	1
Fire/explosion	0	1	Unknown	1
Flooding	22	4	Structural	1
			Unknown	3
Grounding	10	17	Human element	12
			Machinery failure	1
			Navigation	3
			Unknown	1
			Weather	1
Structural	0	1	Unknown	1
Unknown	35	4	Unknown	4
TOTAL	128	34		34

Figure 3. Total losses by incident type

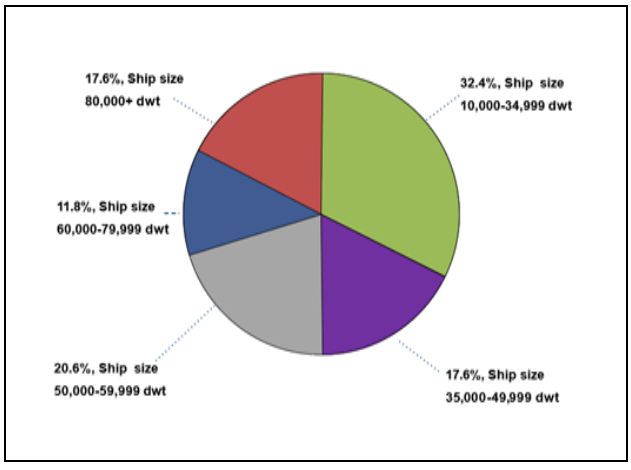


Figure 4. Total loss by bulk carrier size

3.1 *Loss by cause of accident*

The distribution of accident categories is shown in Figure 3. The database takes into consideration seven types of possible causes which include cargo shift and

liquidation, collision, fire and explosion, flooding, grounding, structural failure, and unknown causes., cargo failure and liquefaction accounts for the highest loss of life with five casualties resulting in 61 lives (47.7%) of the total loss of life in the past ten years. The most common cause of bulk carrier ship losses has been grounding, with 17 losses (50.0 %) of total losses four ships have been losses due to flooding (11.8%) resulting to 4 losses of life. Loss of lives resulting from four ships lost with unknown causes accounted for 35 lives, or 27.3% of total lives lost.

3.2 *Losses by bulk carrier type*

The distribution of accident categories based on the class of bulk carrier are seen from Fig 5 to Fig 9. The highest frequency of total losses case is recorded for the handy size bulk carrier, (10,000-34,999 dwt), as a total of 11 out of the 34 recorded casualties were related to the Handy size bulk carriers. This figure represents 32.4% of the total 34 total losses, with one loss related to suspected cargo failure (liquefaction) and the consequential loss of six lives. These vessels are often operating in short sea shipping routes, particularly in the Far East Asia and can carry a multitude of cargos based on their design and therefore more predisposed to trading in this way. Also, six Handymax size bulk carrier (35,000-49,999 dwt) was lost, representing 17.6% of the total, with one loss related to suspected cargo failure and liquefaction resulting to the consequential loss of 15 lives. Seven Supramax vessels (50,000-59,999 dwt) were lost, representing 20.6% of the total, with three losses related to suspected cargo failure (liquefaction) and the consequential loss of 40 lives. The lowest number of casualties were recorded in the Panamax size bulk carrier (60,000-79,999-dwt) range, representing 11.8% of the total while 17.6% of the total lost were recorded in the Post Panamax and capsize size bulk carrier (80,000+ dwt) with four vessels were lost.

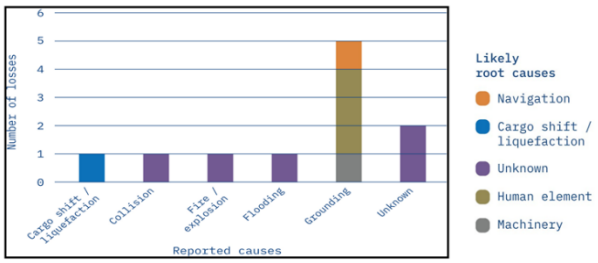


Figure 5. Total loss by type of bulk carrier based on size. Casualties of 10,000- 34,999 dwt bulk carriers

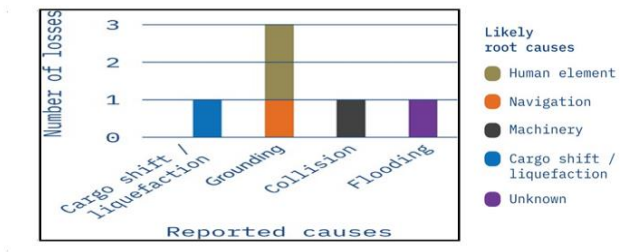


Figure 6. Total loss by type of bulk carrier based on size. Casualties of 35,000-49,999 dwt bulk carriers

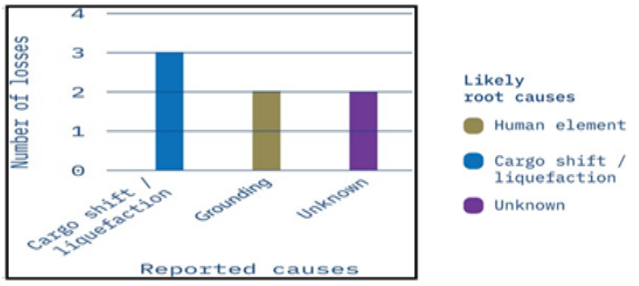


Figure 7. Total loss by type of bulk carrier based on size. Causality of 50,000-59,999 dwt Bulk carriers

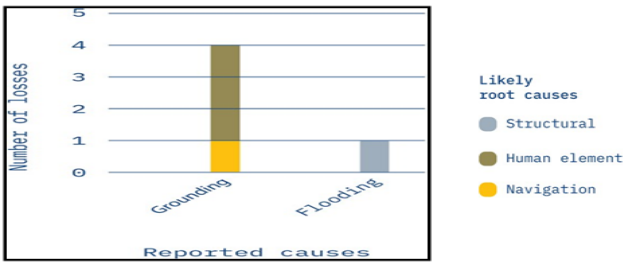


Figure 8. Total loss by type of bulk carrier based on size. Casualties of 60,000-79,999 dwt Bulk carriers

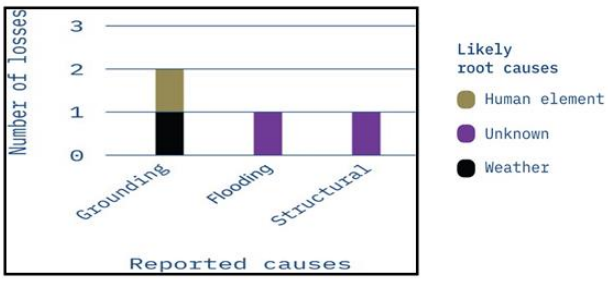


Figure 9. Total loss by type of bulk carrier based on size. Casualties of more than 80,000dwt of bulk carrier

3.3 *Losses by registration of flag state*

Among the top five flag states include Panama, Hong Kong, Malta, Cyprus, and China, Panama has steadily dominated the list of total loss of bulk carrier, most merchant ships flying Panama's flag belong to foreign owners wishing to avoid the stricter marine regulations imposed by their own countries. Panama operates an open registry, and its flag offers the advantages of easier registration and the ability to employ cheaper foreign labor and the foreign owners pay no income taxes. Several reports indicates that the higher number of loose in the Panama registry may be due to the poor standards of regulation enforcement leading to accidents, and the larger number of older fleets operating the Panama flag registry with poor maintenance.

3.4 *Loss by average age of vessel*

Although, accidents are associated with all age of bulk carrier vessels and can be due to various causes, but the investigation of the accidents data in this study has shown that, most of the total bulk carrier losses

were above 20 years. It can be seen in Fig 5b, that the average age of bulk carrier lost between 2011 and 2020 is 20.9 years. The age of vessels has been seen to be related to other factors like poor maintenance, corrosion effect and others.

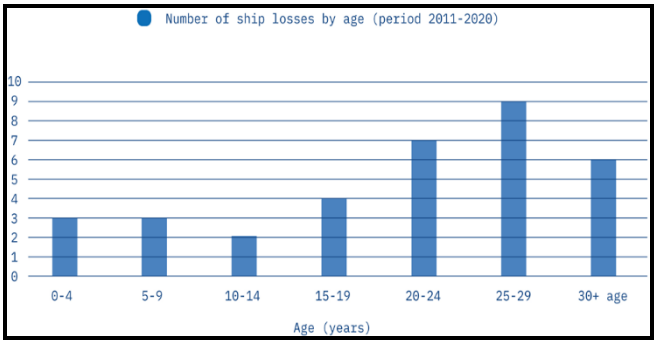
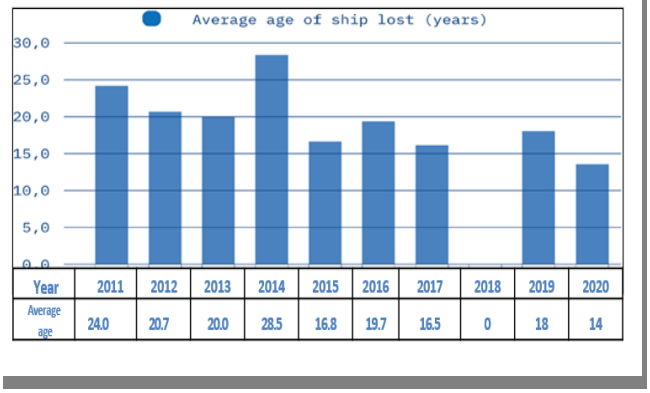


Figure 10. Total loss by age of bulk carrier



Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Average age	24.0	20.7	20.0	28.5	16.8	19.7	16.5	0	18	14

Figure 11. Average age of ships lost

3.5 *Loss by Cargo Type*

The larger bulk carriers, especially those carrying high-density cargoes of iron, nickel and bauxite were mainly at risk of catastrophic incidents, involving Capsize resulting to the lives of 61 seafarers. Fig. 10 shows the percentage causes of all casualties for each of the main types of cargo. It is also clear that bulker losses based on cargo type are taking place within specific trades route, and with similar destinations as can been seen that 70% of the casualties involving ships that were carrying cargoes of scrap and iron ore refer to a foundering. By contrast, this was true for only about 40% of the bulk carriers which were carrying steel products, other metals and ores, and coal, while for the ships carrying other typically less dense cargoes of grain, chemicals, fertilizers and ballast the proportions of casualties due to a sinking were lower again.

4 DISCUSSION

The analysis of bulk carrier accident carried out on a sample of 34 accidents has shown a clear declining trend regarding the frequency of accident occurrence over the last 10 years, although, there has been a reduction in the last 3 years from 2018 down to 2020, but more measures still need to be done to prevent more future occurrence. It is evident to note from the statistical data that older ships were particularly at risks when compared to newer ships as can been seen in fig 5b and the average age of the vessels which sank between 2011 to 2020 were above 20 years old. Among the several contributing factors, age of the bulk carrier is a minor risk factor for accidents as can been seen from fig 5 that within this study period, the average age distribution cuts across both new and old ships. The most frequent cases of loss were because of grounding which represent 17 cases, out of which 12 cases were caused by human factors. Handy sizes bulk carrier makes up nearly half (46 per cent) of the world's bulk carrier fleet and as well as representing the oldest vessels which are mainly at higher risks compared to newer bulk carrier. Handy size class bulk carrier has accounted for majority of total bulk carrier losses resulting to 32 percent., and ageing vessels have been most at risk. Also, China, Indonesia, and Philippines remain the top loss hotspot for bulk carrier lost, over the past decade, accounting for closely 80% of all total loss's cases recorded.

5 CONCLUSIONS

This study presented the statistics analysis of Bulk carrier accident from 2011 to 2020. A total of 34 incidence resulting to total loses of bulk carriers were identified within this study period and the causes of these accident were cargo shift and liquefaction, collision, structural failure, grounding, and fire explosion. By comparing the result of the analysis with the accident records of the previous decade and considering the results in relation to the increasing number of bulk carrier ships in the world's merchant fleet over the past 10 years, there is an overall decline in the number of bulk carriers lost and the number of deaths recorded from 2011 to 2020. Although, there has been an improvement in safety but despite the encouraging statistic, bulk carrier accident continues to occur with high casualty levels compared to other class of ships. The understanding of the contributing factors resulting to the likelihood of a bulk carrier accident will facilitate the development of mitigation methods and regulations that will reflect the realities of the bulk carrier shipping industry and additional regulatory measures in terms of improved design, and safety practice will help mitigate these accidents causes. Also, the introduction of the International Safety Management (ISM) code, the increasing role of port State control about vessel inspections and detentions and the importance of corporate social responsibility (CSR) within most shipping companies will play a great role in preventing bulk carrier accident.

AKNOWLEGMENT

The author is grateful to Professor Minami Kiyokazu for his assistance and support towards this research. Also, I want to appreciate the contribution of Biola Onyeanusi for her helpful comments on an earlier draft of this paper.

REFERENCE

1. Roberts, S.E. et al.: Casualties and loss of life in bulk carriers from 1980 to 2010. Marine Policy. 42, 223–235 (2013). https://doi.org/10.1016/j.marpol.2013.02.011.
2. Weintrit, A., Neumann, T.: Advances in marine navigation and safety of sea transportation. Introduction. Advances in Marine Navigation and Safety of Sea Transportation - 13th International Conference on Marine Navigation and Safety of Sea Transportation, TransNav 2019. 1 (2019).
3. Weintrit, A., Neumann, T.: Marine navigation and safety of sea transportation: Maritime transport & shipping. Presented at the (2013).
4. Weintrit, A., Neumann, T.: Safety of marine transport introduction. In: Safety of Marine Transport: Marine Navigation and Safety of Sea Transportation. pp. 1–4 (2015). https://doi.org/10.1201/b18515.
5. Bulk Carrier Casualty Report - Years 2011 to 2020 and trends. International association of dry cargo shipowners.