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Ship Casualties- Reasons and Statistical Analyse

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ABSTRACT:The paper deals with most recently caused ship accidents and their number in the World Ocean. A lot of them are a result of bad technical conditions or human mistakes. The first reason is due to ship age, non- qualitative maintenance, and non- qualitative repair of ship hull through its life cycle, while the second reason is mainly of labor safety neglect. Analyzed period covers 27 years, from 1994 up to 2021. The analyze is done for two ships, group-merchant and special ships. The paper described damage to the ship hull and its structural members that caused ship accidents and environmental pollution in relation to the age of ships. The number and degree of marine casualties were analyzed. Moreover, statistical analysis presents the often casualties and areas in the World Ocean by ship and damage types. Finally, probabilistic density distributions of damages were shown by Fisher distribution curves. The damages on Fisher distribution curves are presented independently of one another.

KEYWORDS:ship hull, damages, accidents, environmental, pollution, World Ocean.

I. INTRODUCTION

A lot of ship accidents in the world's oceans were caused mainly by two reasons; human onboard mistake or bad ship hull technical condition. The second reason was due to ship age, non- qualitative maintenance, and non- qualitative repair of ship hull through its life cycle.

There were a couple of scientific publications analyzed different ship damages and reasons resulted in accidents. Literature review of causes for ship accidents was done in [6]. The authors of this publication summarized the factors causing ship accidents whose goal was to detect its root cause with the aim of applying appropriate corrective actions to reduce the rate of ship accidents and the risks posed. According to their review, the main factor for ship accidents is the human factor, but it is not just its own.

Statistical analysis of ship accidents occurred in the period 1990-2012 and assessment of safety level of different cargo and passenger ship types was done in [5]. Analysis shows that the most recent damage with lost of human life is in passenger and cruise ships.

Cargo ships damages and lost human life are with lowest frequency. In [4] was developed and analyzed method for protecting hull structures by means of cathode polarization from local corrosion damages at the potential of the uncharged surface on the juvenile surface steel. This method was applied to different steel grades used in shipbuilding and ship repairing. The results of experimental data show that this will allow increasing inter-docking periods of ships and marine structures.

II. HULL DAMAGES

The damage in a ship's life cycle is an unavoidable event as much as being careful to be a crew member. They can be divided into two main groups:

- Damages on ship plating and
 - Damages in ship structural members;
- Damage to ship plating can be caused by:
- Heavy corrosion;
 - Collision;
 - Cracks;



-grounding etc.

While damage to structural members can be caused by:

-Collision;

-Grounding;

-Mainly by buckling;

The cracks in structural members are the next level in the buckling development process. Buckling process is widely described in modern classification organizations rules. This process is entrained to bad hull condition damages from one side and increase ships age and material fatigue from other. The figures from 1 to fig.5 clear shows typical ship hull damages.

Fig.1.Ship collision[9]



Fig.2.Crack in ship hull[10]





Fig.3. Intensive ballast tank corrosion[7]



Fig.4. Intensive weld seam corrosion[8]



Fig.5. Intensive plating corrosion[8]

III. STATISTICA DATA AND ANALYZE OF SHIP ACCIDENTS

The number of serious accidents for the six years period (2014-2020) is 25%, very serious is 3% and less serious is 57%, fig.6.

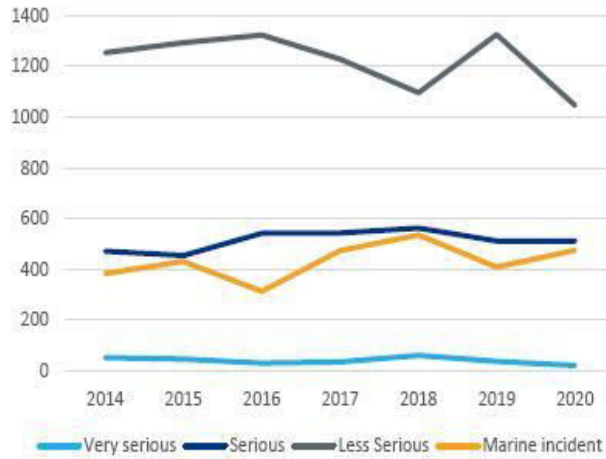


Fig.6. Types of casualties[2]

Reduction of serious casualties was noticeable in 2020, while the number of marine incidents increased in the same period. The peak number of serious casualties was noticeable between 2016-2018. Main ship types involved in marine casualties and accidents were classified into several main groups: cargo ships, fishing vessels, passenger ships, service ships and others. For six years period 2014-2020, cargo ships are most recently involved in marine accidents and casualties, followed by passenger ships. During six years period the number of cargo ships casualties take first place, followed by passenger ships. The fishing vessel casualties take third place.

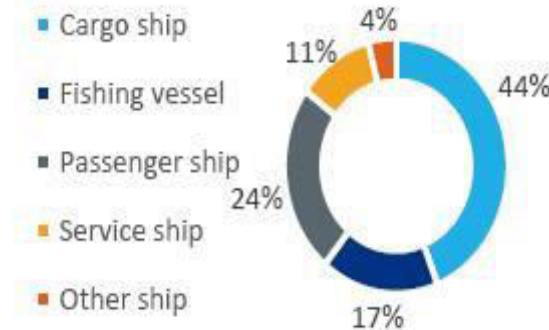


Fig.7. Ship types accidents 2014-2020[2]

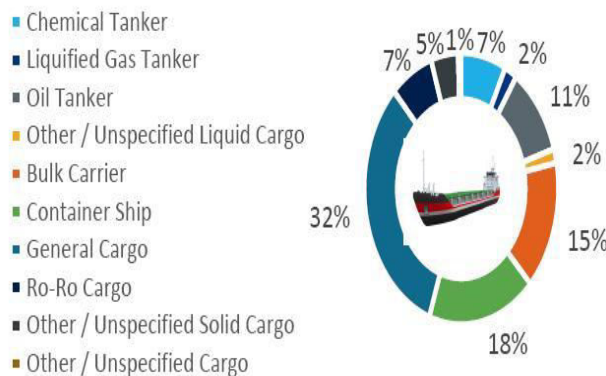


Fig.8. Merchant ship types involved in accidents [2]

According to [1] the age of the world fleet dramatically increased. About 40% of ships are of age more than 25 years old.



The heightening of ship age is a precondition for accidents. From table 1 it was clear that about 40% of the world's fleet was at an age more than 25 years old. First place in this ranking was for general cargo ships, led by oil and chemical tankers and bulk carriers. Take into account that ship was designed to live about 30-35 years; we can claim that a lot of world fleet is till to end of his life.

Through the ship's life cycle, her hull condition lost its main property- strength. Possible reason for this was intensive corrosion of plating and hull members, although cathode protection. This was precondition for ship accidents and environmental pollutions.

Table 1. Ships age

Ship age category	Total, %
0-4 years old	9.6
5-14 years old	31.9
15-24 years old	18.3
+25 years old	40.2
Total	100

For ship damage analysis was used information about main reasons like grounding(2), collision(1), fire on board(3), capsizing(4) and hull failure(5).

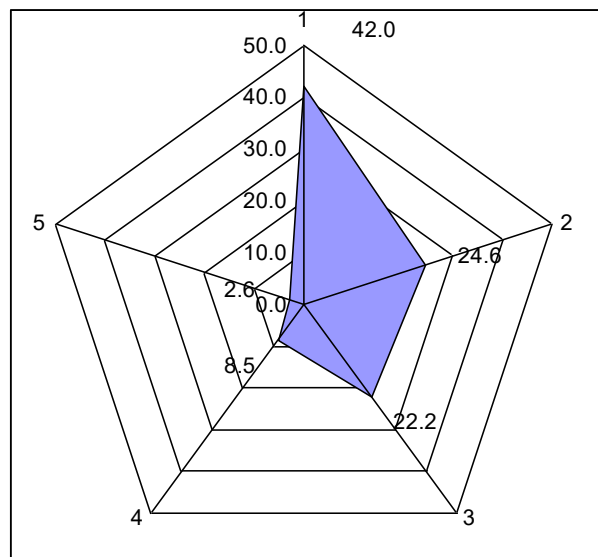


Fig.9. Distribution of ship damages from 1994-2021[3]

Distribution of ship hull damages, on fig.9. Shown the most recent damage was from collision, about 42% form all damage. Grounding is a second damage reason leading form fire on board and capsizing. With about 3 % are the damages caused by bad hull condition. Their less than a percent value didn't correspond to neglect. Capsizing is a probability caused by bad technical conditions.

About 60% of the casualties happened in the open sea. 43% of accidents are happened when the ship was en route, fig. 11. The main reasons for this are heavy weather conditions, human mistakes and bad technical hull conditions. The last reason is as a result of ships building quality, age, maintenance, type of cargo and operation area. About 35% percent are in port. In loading and discharging the ship was appeared factors for accidents in this area. They did not correspond with typical accidents. Damages in port waters was involved mainly by cargo loading and discharging, non- correct ballast operations, fire on board and etc.

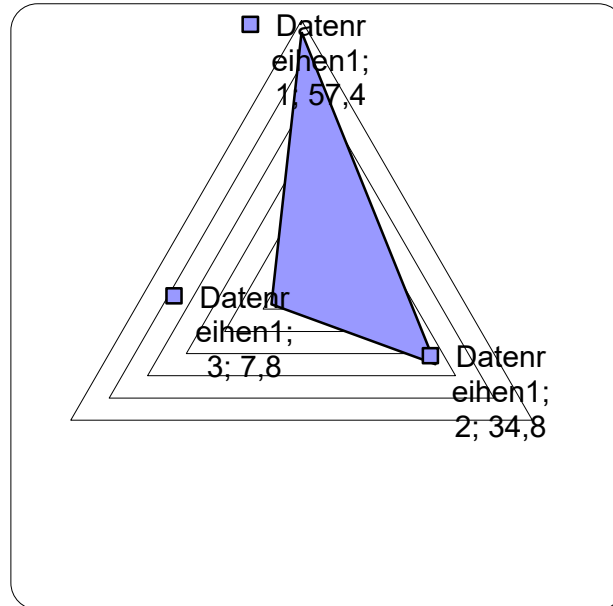


Fig.11. Damages area distribution from 1994-2021 [3]

For a period from 1997-2022 the number of very large casualties with container and passenger vessels take first place, fig.12. and fig.13.

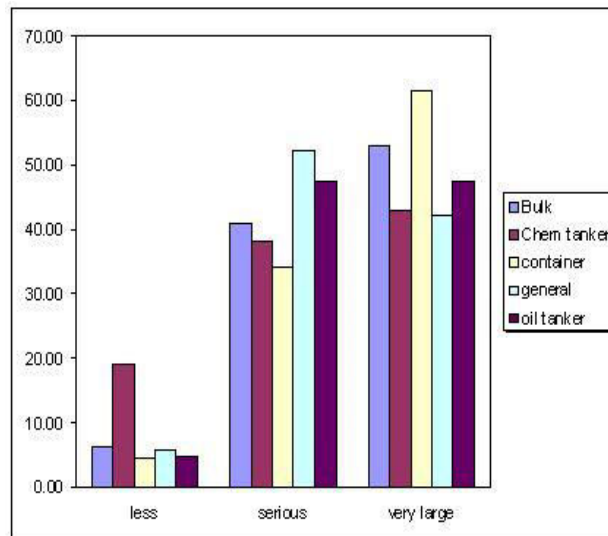


Fig.12. Type of damage statistics 1997-2022

The very large casualties in „special” fleet passenger vessels take first place, after that are towing vessels. In less casualties ranking the number of fishing vessels casualties in smallest, Ro- Pax vessels take first place, fig.13.

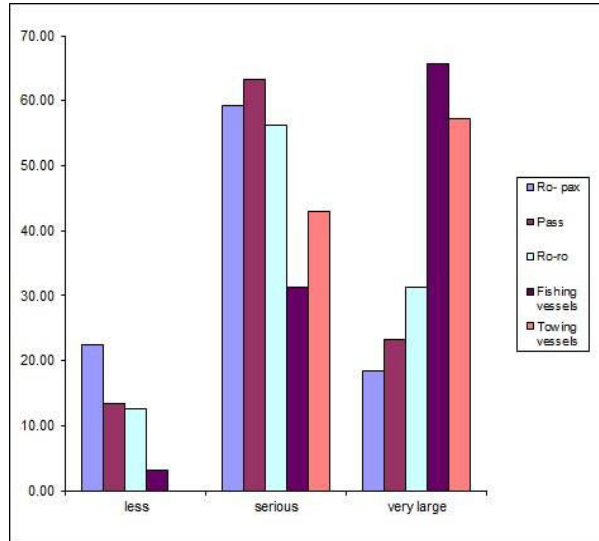


Fig.13. Type of damage statistics 1997-2022

The probably density distribution of main damage was presented by Fisher distribution, fig. 14.

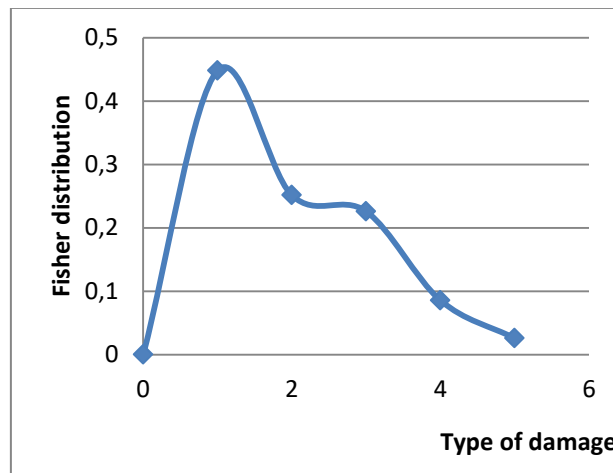


Fig.14. Damage density distribution by Fisher

Density Fisher distribution is the independence curve. It shows damage to reasons for independence from one another. The curve is non-symmetrical and it is positive-skewed.

IV. CONCLUSION

Collision, grounding and fire on board are the most common ship damages in relation to human mistake, heavy weather and bad hull technical condition. The most frequent ship damage and casualties happened in open sea. A lot of ships involved in accidents are at the age of more than 25 years. This is serious reason for taking into account about condition of world fleet.

General cargo ships are involved in 32% of marine casualties, while container vessels take 18%, followed by bulk carriers with 15%. LNG tankers and chemical tankers were involved in 7% of the accidents, followed by oil tankers.

Most often very large accidents are involved at container vessels and bulk carriers. Serious accidents are often on general cargo ships and chemical tankers, followed by bulk carriers.



V. ACKNOWLEDGMENT

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