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# Initial Approach to Safety on Cruises Ships: Structure of the Sector

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ABSTRACT: The importance of safety on ships is beyond dispute, however, there are some types of ship for which this matter deserves special consideration. One of these types of ships are passenger cruises, due to the high number of human lives that travel on board.
For this reason, we believe that a particular study of safety in cruise ships is needed.
The Port State Control (PSC) mechanism of coastal States to try to ensure security in their territorial waters in respect of the traffic of foreign ships may, a priori, be an impartial and reliable indicator of security, according to the deficiencies it detect in ships and the detentions that carried out.
Thus, we will use the PSC inspections in this paper.
The source of information about PSC inspections is EQUASIS, which is the information system of the majority of regional agreements PSC and US Coast Guard.
The study period is 5 years (2012-2016) and the cruise ships analysed are belonging to the International Association of Cruise Lines (CLIA).
The objective of this work is an initial approach to safety on cruise ships and the structure of the sector according several factors (company, cruise type, age and pavilion).

## 1 INTRODUCTION

The industry based on cruise ship tourism, born in 1958, has experienced a significant growth during the 90s (Monedero 2014). According to Cruise Lines International Association (CLIA, 2017), about 24 million passengers, plus a high number of crew members in this type of vessel since it must include catering and entertainment services. The rise on the number of cruises brings along a bigger concern about their safety, taking into account how several studies point at its worsening at this type of vessel (Det Norske Veritas, 2016; Vukonic, Bielic & Russo 2016). This type of accident in cruiser ships also represents considerable damage to the company's image, as studied by Mileski, Wang & Beacham (2014). The most relevant incident was the Costa Concordia disaster in 2012 (Vidmar & Perkovič 2015). On the other hand, Eliopoulou, Apostolos & Voulgarellis (2016) believe that active (ship's steering) and pasive (design and technology) safety measures have been very efficient at reducing both frequency and severity of accidents and their consequences respectively; although it is essential to keep control over cruiser ships by their flag states, either directly or through Authorized Organizations designated by them (Rodrigo 2015).

Because of the proliferation of Open Registers (Piniella 2009), several international agreements give a port's country's government the right to inspect ships called within their waters to make sure they

keep in line according to said agreements through a regional regime of Memorandum about Port State Control (PSC), the most important of which are the ones signed in Paris, Tokyo and Viña del Mar (Rodríguez-Díaz 2016; Rodrigo 2015). Unfortunately, for a long time the Open Registers have been associated to the concept of "Flag of Convenience" by the International Transport Federation (ITF), (Barton 1999).

It is rare to find specific studies analyzing the causes of an accident of a cruise ships, compared to how much is published about other types of vessel. There is no investigation yet that is wide enough about diagnosis (finding key factors or ships´s deficiencies that might pose a risk) and evaluation of safety specifically about cruiser ships, which would be the starting point when planning how to prevent future accidents, as described by Vukonic, Bielic & Russo (2016).

Our global study will attempt to analyze the safety levels of cruiser ships using PSC inspection deficiencies as indicators. On this article we will present a first approach to the structure of this sector, and the first conclusions that we have reached on what is a work in progress.

We looked directly at cruiser ships owned by companies that operate on a global scale, leaving out smaller, regional companies, companies dedicated to river cruises, as well those with tonnage under 10 000 GT, since their characteristics and usage are quite distinct (mostly private use or luxury, some sail-powered).

## 2 MATERIAL AND METHODS

The lack of sources about this topic forced us to make an exploration study first, to be able to make a descriptive study later.

The data from cruiser ships under our study (IMO number, Call sign, flag, gross tonnage and age), inspections, deficiencies and detentions when applicable, were obtained from EQUASIS (Electronic Quality Shipping Information System) database, which was created after the 1998 Lisbon International Conference, promoted by the EU or the USA Coast Guard among others.

The chosen samples include the entirety of the population, since it is relatively small; besides, cruiser ships are unequally distributed among companies regarding their number, net tonnage, routes and flag, which means that any other sampling method would skew the results.

The time interval covered in our study comprises 5 years (2012-2016).

About deficiencies, we have worked following the categories and sub-categories stablished by EQUASIS on their database. In any case, most deficiencies and their categories are very similar on each regional system.

Once considered, all these deficiencies are placed on a results table according to their category and number of incidences.

## 3 RESULTS AND DISCUSSION

### 3.1 *Shipping companies focused on Cruise Industry*

As presented on table I and figure 1, this is the distribution of the fleet among shipping companies by number and size of their ships. We can observe that the group of shipping companies focused on maritime cruises with global nature, according to CLIA's classification (2016), was formed by a total of 18 companies. The fleet managed by these companies comprises 178 cruise ships (39.73 %). Looking at their shares of the market, two companies represent 14 % each (Carnival y Royal Caribbean International). Following them, 6 companies hold an important segment covering nearly half of this fleet (47.8 %), and the rest (24.2 %) is completed by 10 smaller companies.

Table 1. Distribution of the studied fleet by company

| COMPANY | NUMBER OF CRUISES | PERCENTAGE OF THE FLEET |
|---|---|---|
| Carnival | 25 | 14.0 % |
| Royal Caribbean International | 25 | 14.0 % |
| Princess Cruises | 17 | 9.6 % |
| Costa Crociere Spa | 15 | 8.4 % |
| Holland America Line | 14 | 7.9 % |
| MSC Cruceros | 14 | 7.9 % |
| Norwegian Cruise Line | 13 | 7.3 % |
| Aida | 12 | 6.7 % |
| Celebrity Cruises | 9 | 5.1 % |
| Oceania Cruises | 6 | 3.4 % |
| Silversea New Build Ssix | 6 | 3.4 % |
| Disney Cruise Line | 4 | 2.2 % |
| Ponant | 4 | 2.2 % |
| Regent Seven Seas Cruises | 4 | 2.2 % |
| Seabourn Cruise Line | 4 | 2.2 % |
| Cunard | 3 | 1.7 % |
| Azamara Club Cruises | 2 | 1.1 % |
| Paul Gauguin Cruises | 1 | 0.6 % |

Source: Own elaboration from EQUASIS data

We had to discard Paul Gauguin Cruises and their only cruise ship, the Paul Gauguin, from the analytical data, since it is clearly not representative, because it is a cruise ship older than 20 years with a single inspection acknowledged.

### 3.2 *Typology of the fleet*

The main type of ship (Fig. 1) is the cruise we called "big" (79 ships representing 44.4 %) although the proportion of the sum of mega-cruisers of all three series (1st, 2nd and 3rd generations) are very close (68 ships, 38.2 %). Of lesser importance, medium-sized cruisers (24 ships, 13.5 %), and as a minority the small cruises (3.9 %). This structure of the fleet dependent on typology is not surprising, since maritime transport in other sectors like container ships has evolved towards gigantism, searching for a higher profitability, increasing offer and optimizing expenditure.

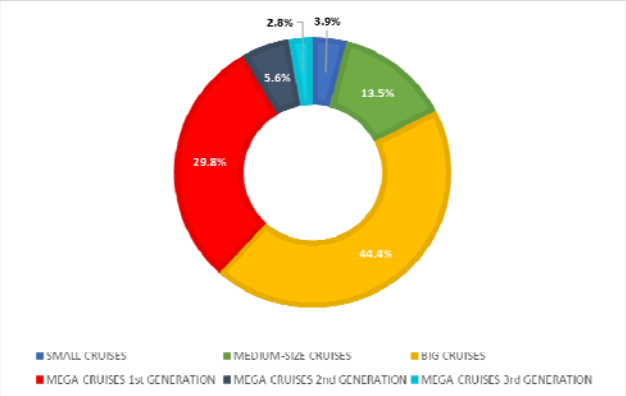


Figure 1. Distribution of the studied fleet by cruise type
Source: Own elaboration from EQUASIS data

Looking closely at their age (Table II), since service life of cruisers is estimated at a wide range between 20 and 30 years (Dinu & Ilie 2015), we can say that this fleet is predominantly modern, with 105 cruisers under half the age considered to be their maximum service life (nearly 59 %) and 51 cruisers in their "maturity", without having reached their minimum service life (more than 28 %). Only 22 are within the final interval of their service life (slightly above 10 %) and 4 of them above 25 years old (around 2 %).

Table 2. Distribution of the studied fleet by ship age range

| CRUISE AGE (years) | NUMBER OF CRUISES | PERCENTAGE OF THE FLEET |
|---|---|---|
| <5 | 26 | 14.6 % |
| 5-9 | 40 | 22.5 % |
| 10-14 | 39 | 21.9 % |
| 15-19 | 51 | 28.7 % |
| 20-24 | 18 | 10.1 % |
| ≥ 25 | 4 | 2.2 % |

Source: Own elaboration from EQUASIS data

Regarding their flags (Fig. 2), companies prefer open registers for their cruisers, with a share of 72 % of the fleet (Bahamas, Panama, Bermuda, Malta and Marshall Islands). Exceptionally, Italy and Netherlands hold a moderately notable number of registers (15,2 y 7,9 %); but the rest barely go beyond 2 % (like in France, the UK and USA).

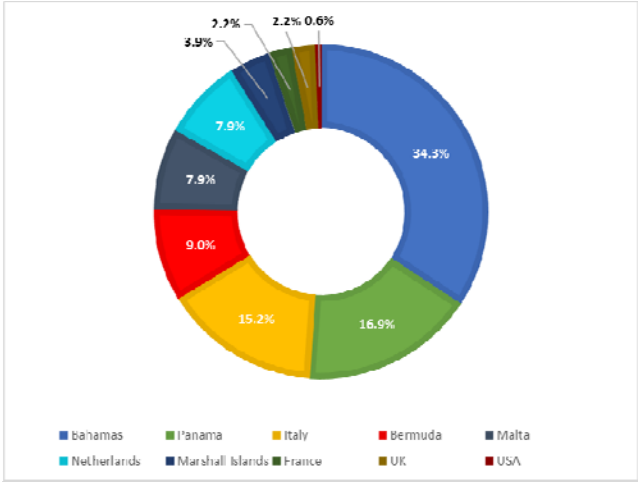


Figure 2. Distribution of the studied fleet by flag
Source: Own elaboration from EQUASIS data

### 3.3 *First approach to study safety deficiencies*

The number and ratio of deficiencies and inspections are presented as follows: companies (Table III), type of cruiser on average (Table IV), age range (Table V), and flag on average (Table VI), all of them in decreasing order by ratio, except for the age range.

Table 4. Number and ratio of deficiencies and inspections by type of cruise

| Cruise type | Average Age | Average Inspections | Average Deficiencies | Ratio |
|---|---|---|---|---|
| Medium-size Cruises | 14.5 | 21.0 | 23.0 | 1.09 |
| Small Cruises | 12.1 | 16.9 | 16.7 | 0.99 |
| Big Cruises | 14.7 | 16.9 | 16.3 | 0.97 |
| Mega-Cruises 2nd Generation | 4.5 | 8.1 | 6.3 | 0.78 |
| Mega-Cruises 1st Generation | 9.4 | 14.0 | 10.2 | 0.73 |
| Mega-Cruises 3rd Generation | 5.4 | 8.8 | 5.8 | 0.66 |

Source: Own elaboration from EQUASIS data

Table 3. Number and ratio of deficiencies and inspections by company

| COMPANY | AVERAGE GT | AVERAGE AGE | INSP. | DEFIC. | RATIO |
|---|---|---|---|---|---|
| Paul Gauguin Cruises | 19 170.0 | 20.0 | 1 | 5 | 5.00 |
| Azamara Club Cruises | 30 277.0 | 17.0 | 44 | 72 | 1.64 |
| Cunard | 11 0287.3 | 10.3 | 76 | 100 | 1.32 |
| Regent Seven Seas Cruises | 43 623.8 | 12.3 | 80 | 103 | 1.29 |
| Silversea New Build Six | 27 913.0 | 14.3 | 126 | 153 | 1.21 |
| Holland America Line | 71 620.9 | 14.0 | 299 | 345 | 1.15 |
| Royal Caribbean International | 13 4501.8 | 13.0 | 358 | 386 | 1.08 |
| Princess Cruises | 10 6474.2 | 12.7 | 360 | 356 | 0.99 |
| Norwegian Cruise Line | 106 821.2 | 11.2 | 175 | 162 | 0.93 |
| Oceania Cruises | 42 227.3 | 13.8 | 169 | 152 | 0.90 |
| Celebrity Cruises | 118 665.9 | 11.1 | 180 | 156 | 0.87 |
| Costa Crociere Spa | 92 227.8 | 13.6 | 174 | 129 | 0.74 |
| Ponant | 10 968.0 | 5.0 | 71 | 52 | 0.73 |
| Disney Sruise Line | 106 884.8 | 12.0 | 68 | 49 | 0.72 |
| MSC Cruceros | 108 035,3 | 8.6 | 108 | 73 | 0.68 |
| Carnival | 97 799.7 | 14.6 | 368 | 223 | 0.61 |
| Seabourn Cruise Line | 34 824.0 | 5.5 | 72 | 36 | 0.50 |
| Aida | 72 258.7 | 8.3 | 90 | 40 | 0.44 |

Source: Own elaboration from EQUASIS data

Table 5. Number and ratio of deficiencies and inspections by age range

| Age range (years) | Average Age | Average Inspections | Average Deficiencies | Ratio |
|---|---|---|---|---|
| <5 | 1.73 | 122 | 80 | 0.66 |
| 5-9 | 7.00 | 608 | 354 | 0.58 |
| 10-14 | 12.23 | 629 | 537 | 0.85 |
| 15-19 | 16.98 | 1 110 | 1 213 | 1.09 |
| 20-24 | 21.67 | 305 | 362 | 1.19 |
| ≥ 25 | 26.00 | 45 | 46 | 1.02 |

Source: Own elaboration from EQUASIS data

Table 6. Number and ratio of deficiencies and inspections by flag

| Flag | Average Age | Average Inspections | Average Deficiencies | Ratio |
|---|---|---|---|---|
| Netherlands | 13.26 | 21.36 | 24.64 | 1.15 |
| Bermuda | 12.81 | 23.69 | 26.44 | 1.12 |
| Bahamas | 12.00 | 15.87 | 15.95 | 1.01 |
| Malta | 5.00 | 17.93 | 16.71 | 0.93 |
| Marshall Islands | 12.00 | 24.71 | 21.86 | 0.88 |
| France | 11.22 | 17.75 | 13.00 | 0.73 |
| Italy | 10.64 | 9.78 | 6.26 | 0.64 |
| Panama | 14.00 | 11.90 | 7.00 | 0.59 |
| UK | 11.40 | 14.25 | 8.25 | 0.58 |
| USA | 10.50 | 0.00 | 0.00 | 0.00 |

Source: Own elaboration from EQUASIS data
Flags with red shadows are flags identified as convenient by the ITF at URL: http://www.itfglobal.org/es/transport-sectors/seafarers/in-focus/flags-of-convenience-campaign/ (checked on 28/12/2018)

To have a first approach to the discussion of the previous data, we firstly calculated the ratio of deficiencies by inspection in the whole fleet. We use in this case the data from Paris MoU, using the average between 2012 and 2016, which happens to be 2.53, to compare it with the data obtained from these companies through EQUASIS. This way, excluding as an abnormality Paul Gauguin Cruises because of their insignificant representation, we can consider that companies have a good behavioral index. The company with the highest relative number of deficiencies, Azamara Club Cruises, has a 1.64 ratio. The rest is placed within a low range, with two of them notable for being under 0.50 (Seabourn Cruise Line and Aida).

## 4 CONCLUSIONS

We must keep in mind that this publication is merely presenting the initial data of an investigation programmed to have a deeper analysis and prospective, plus a widening of the historical record.

The industry based on cruise ships, comprised by a total of 448 ships, is divided in two big groups: those specialized on specific regions, and those operating worldwide. Both of them run maritime and fluvial cruises, although most focus in one type or the other. Equally, luxurious or exclusive cruises are a very specific business that can fall within either category.

In particular, the worldwide, non-exclusive, maritime cruise which is object to this study, is controlled by a limited number of companies that exploit around two hundred ships of this type, which represent two fifths of the whole fleet, unevenly distributed. Not enough to speak of industry concentration, but there is a remarkable unbalance showing three quarters distributed among eight companies and the remaining quarter shared among ten smaller companies.

Cruises, just like the rest of maritime transport, tend to be gigantic and more than 80 % of them are classified as big or mega-cruisers, the latter even more numerous than the former, each new generation increasing their gross tonnage by 50.000 GT.

Regarding their age, with 60 % of the fleet under half of their service life, and with only 10 % at their final stages, we can consider them young.

We compared the ratio of deficiencies and inspections made on the cruiser ships of our study with those made on merchant ships, which in general show a x1.5 higher ratio against the worst cruiser, apparently meaning that this industry's reliability is very high. Said reliability could happen as a result of the "youthfulness" of cruisers, although it could be lessened depending on their flag.

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