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Accident rate on passenger ships and its relation to cabotage traffic.

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ABSTRACT

Tourism globally when undertaken using boats is not always as safe as we might expect. Our western culture makes us think that just as international safety regulations are scrupulously enforced in our countries, they are similarly enforced in other parts of the world, which is not true and also poses a risk to the people who travel as passengers in those areas. As tourists, we sometimes lose sight of what is safe and what is not safe in certain parts of the world. Our analysis tries to analyse to what extent there is a relationship between accidents on passenger ships and the flag they fly, because if this relationship is high, we have a problem in coastal shipping and therefore measures for international travel such as those enacted by the IMO are not effective.

1. Introduction.

The principal premise of this paper is to find out to what extent it is safe for passengers on passenger ships to sail in a particular part of the world. In a society like ours, where means of transport are essential for our work, but also for our leisure time, we are accustomed to standards of quality and safety that might lead us to think that the same is true anywhere in the world. With regard to the maritime sector, one of the most regulated sectors of transport and with a vast legislative framework, we assume that the laws and regulations have been created to preserve the lives of the people involved, seafarers, crew members, passengers and even port operations personnel. But we have to take into consideration that this is not necessarily the case in other countries. The increase in purchasing power in our society and the desire to get to know places we consider exotic, has meant that in recent decades many tourists have chosen to travel to remote areas of the world in search of new experiences. Many of us have acquaintances, friends, friends of friends who have travelled to some of these countries: Indonesia, Thailand, Egypt, the Philippines, Oceania, African states, Brazil, India, etc... On many occasions they have to use local means of transport to get around the country and they have the well-founded conviction that in the field of transport, and above all in air and sea transport, the rules apply in the same way everywhere. From this reflection comes the main question we are asking ourselves:

What is the risk or how dangerous can it be to use maritime transport as a passenger in certain countries of the world?

This also raises the question of how the accident rate on passenger ships has evolved since the 1950s, precisely after the creation of the International Maritime Organization.

Historically, there have been accidents at sea resulting in loss of human lives. The sea is a hostile and high-risk environment where it is not difficult to suffer loss of life if a number of measures are not taken and rules are not followed. While it is true that vessels are becoming increasingly modern and have better safety measures to limit the risks inherent in the environment in which they operate, it is no less true that many accidents are due to human causes, as we shall see in detail; a factor which is much more complicated to limit and which underlies our work.

It is not possible to adapt the experience gained in other sectors to the maritime sector, at least not directly, as maritime transport is an activity that significantly affects the lives of all the ”actors” involved in it, so it is necessary to have a concrete knowledge of the factors that may be decisive in the occurrence

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of accidents and, at the same time, those that will allow us to extrapolate the results obtained in other activities.

On this basis, this research is oriented towards a general analysis of the causes of maritime accidents with fatalities, worldwide, over a long period of time and the variation produced during this period of time, limiting it to a specific type of ship, such as passenger ships, and considering the passenger's point of view, promoting measures that are simple to implement, without high costs and based on common sense.

More often than might be desirable, accidents with fatalities were occurring on ships in countries where it seemed that administrations were incapable of acting, partly because they lacked the necessary means to do so, and partly because they were in the hands of corrupt people who allowed shipping companies to operate without any control and with human responsibility for their profit motive. A very rough calculation, based on data obtained from some cases of sinking in Bangladesh, led me to the conclusion that human life was worth approximately 600 USD (about 500 euros), as this was the compensation received by the families of those who died in some of these accidents, and in the best of cases (in most cases there was no compensation at all), with the inaction of the authorities, who allowed this to happen.

Many of these countries are "fashionable" among European and North American tourists with medium to high purchasing power. Everyone has an acquaintance, a friend or friends of acquaintances who in recent years have taken one of these "adventure trips", where the aim is to have as real an experience as possible, sharing their way of life with the local population. But this may also involve sharing their risks. In Indonesia, Philippines, Bangladesh, Central African countries and many other nations, many of them made up of a multitude of islands, it involves moving from one place to another in boats that do not comply with safety measures and where the profit motive of the local operators is the main reason.

Just one example, the two newspaper articles with two similar cases, which have occurred in recent years and which are a clear example of what we are talking about.

The problem with our occidental society is that we trust blindly in the administrations and in the fact that the regulations are applied and complied with, so that accidents are isolated issues and tend to happen due to a series of events that make them inevitable, but basically everything is under the control of the administrations and therefore our safety is safeguarded in all cases.

We have internalised this so much that when we travel to other countries, we think that everything is going to be governed by "occidental" regulations or by our culture of prevention and safety, and it may happen that we "get into" a boat that clearly does not comply with any type of international regulations, at the controls of a person we do not know and we have no evidence that the local administration has required any kind of training and test of navigation skills, entrusting to this person and his "substandard" vessel, the responsibility of our life, our couple or our children's safety...

Figure 1: Extract from El Periódico & El País Digital Edition.

Source: elperiodico.com & verne.elpais.com.

As we can see from the examples, these accidents are more common than it seems, and they only increase the number of deaths, without any remedy from the local administrations, firstly, and secondly, from the International Maritime Organisation, and finally, they serve to make us aware of the danger of travelling without taking into consideration basic safety measures.

It is therefore important to accurately characterise the factors that influence accidents and casualties on passenger ships, analysing those factors that are directly related to the occurrence of fatalities, in order to generate a structure to obtain information on these factors and to analyse the results, which will allow a proposal for measures aimed at reducing the number of casualties from accidents.

2. Literature review.

2.1. Transport of people by sea.

Passenger ships are still a type of merchant ship, but the function for which they have been built and equipped with services is for the transport of people. Within this category or typology, we should not include the majority of merchant ships, which have a few cabins (barely a dozen) for passengers (which have been booming in recent years as an alternative means of "tourism") (Greenberg, Chalk, Willis, Khilko, & Ortiz, 2006). These cabins used to be for the company's own staff, but when they are not in use, the shipping company can make them available to the public, although the transport of these cabins is secondary to that of the cargo. This category does include ships designed to carry passengers and cargo, both in considerable quantities. Until a few years ago, in the case of ocean liners, they were often called RMS (for the English Royal Mail Ship), as they allowed the transport of mail and cargo (Dasgupta, 2019), together with the luggage corresponding to the passengers, and it was quite common for them to be equipped with cargo holds, as well as means for loading and unloading these goods (cranes, slings, etc.) or other equipment necessary for handling this cargo. With the rise of cargo ships in recent decades, and mainly container ships, this cargo capacity has been eliminated to be used to increase the leisure space on board for passengers.

The transport of passengers by sea has not always been as we know it today. Although passenger ships are part of the merchant navy, during armed conflicts they have been "mobilised", for example for the transport or evacuation of troops, as hospital ships, etc. when the conflict required it. Taking people on board has not always meant that they "enjoy" the voyage or do so of their own accord. In ancient times (Rome, Greece, Egypt, etc.) (Juan, 2017), the ships were in responsible for transporting troops, but their means of propulsion was constituted by huge contingents of slaves who were in responsible for the oars, with holds where the refreshment galley slaves were "stored" in an inhumane manner (in many countries of Europe, The "galley sentence" was introduced in France in 1443 as a coercive measure against beggars, thugs, idlers, and later, by extension, against criminals who were tried and sent to the galleys by the courts of justice, sentenced to rowing in the royal galleys, often in exchange for the death penalty. The measure was extended to many European countries and in the case of Spain (Martínez Martínez, 2011), it would remain in force until 1803, as the galley fleet was no longer able to serve).

Later, with the advent of sailing, "human" propulsion was replaced by it, but now the slaves represented the merchandise, the "slave" ships that from the African continent, for example, and even the Canary Islands, were transported and sold in America and many other colonies scattered around the globe, crammed into ships with deplorable hygienic conditions, dehydration, all kinds of diseases and ill-treatment; with mortality rates of up to 30% (Rediker, 2008), until their abolition in the first half of the 19th century.

With the development of the steam and diesel engines, the days at sea become shorter (Hansen, 1991). The European wars and the hardships resulting from them generate a new type of passenger transport, the emigration ships. America, Australia and the new African, American and Oceania colonies are the main destinations to which entire European families emigrate in search of new opportunities or simply fleeing armed conflicts (Sánchez-Albornoz, 1988). Although conditions improved, it was not for everyone and, as in everything else, classes would continue to exist. This is how some of the most important accidents with fatalities in history (Sirius, Valbanera, Titanic, etc.) took place.

The last similar phenomena that can be observed nowadays is the irregular migration from underdeveloped and emerging countries in search of opportunities to richer nations, in many cases also pushed by major armed conflicts, such as the wars in Syria, or countries in the sub-Saharan Africa, Myanmar, etc... with migratory flows that mainly try to reach the European or Australian coasts, depending on their origin (Zlotnik, 2006). But with a slight difference with respect to previous migratory processes, it is now an impressive business controlled by the migration mafias, which make relatively short crossings, but in substandard vessels that offer no safety measures or guarantees for people, resulting in thousands of deaths annually, due to the precariousness with which these journeys are made (Sánchez, 2006).

There are different types of passenger ships, including ferries, vessels designed to make short crossings at any time of the day, transporting both people and vehicles. The majority of the trips they make are, in most cases, coastal shipping, which in certain countries is a considerable handicap in terms of preserving human life and safety. Then there are the ocean liners, which can be exclusively for passenger transport, or passengers and cargo, covering longer distance routes, and their design characteristics must therefore be adapted to these. The generalisation of air transport has meant that the liner business has declined, giving way instead to cruise ships, which make round trips with different stopovers, but not over long distances, focused directly on tourism and leisure, visiting multiple places in short periods of time, where comfort and the passenger's enjoyment of the best experience are the priority.

Liners and cruises have different characteristics, the former was focused, as we said, on long crossings between Europe and America, so that speed and luxury from a traditional point of view were a priority. With cruise ships, the characteristics of the client have changed and have become more common, in such a way that passengers, in addition to the places they visit (multiple ports of call on short crossings), seek to extend their leisure time on board, so that a large part of their space is dedicated to facilities of this type (swimming pools, theatres, dance halls, casinos, sports facilities, etc.), with comfort taking precedence over speed.

Until the decade of the 80's, cruise ships used to be smaller than ocean liners, but this changed and they became large and luxurious "floating hotels" (Cerchiello, 2017), so their size grew in this sense as well.

At an operative level and with regard to safety manoeuvres, passenger ships are currently subject to two basic requirements in accordance with the regulations of the International Maritime Organisation: the carrying out of emergency drills involving passengers (...) on a compulsory basis and within 24 hours of boarding and, secondly, that within 30 minutes of the abandon ship signals being activated, the ship can be completely evacuated. However, reality shows that both measures are insufficient, as recent accidents have shown.

In certain areas of the world, such measures may be ignored or non-existent, but so would be, so to speak, any IMO measure or regulation, where its regulations for cabotage shipping are totally ignored.

Since 2010, with the entry into force of the Manila amendments to STCW, the revision of the safety standards and regulations for passenger ships built after July 2010 is a requirement, so they must necessarily comply with them.

From 1 October 2010, the SOLAS Convention has made it a requirement that all passenger ships operating in international waters must be constructed or adapted in such a way that their design and construction excludes all materials which are likely to act as fuels in the event of fire (SOLAS, Chapter 2). However, those shipowners with vessels built before 1980 and who have to upgrade or withdraw their vessels from service, it is believed that it will be very difficult for them to be able to adapt to the regulations, so that as has happened in other cases, it is likely that these vessels will end up being sold on the second-hand market and continue their service in areas where IMO regulations are much more lax or definitely non-existent,

with almost non-existent maintenance and transferring the risk, as we have seen, to other parts of the world.

2.2. Regulations applicable to the maritime transport of passengers.

The following is a brief overview of some of the most important IMO conventions or instruments relating to the safety of passengers at sea.

1. International Convention for the Safety of Life at Sea (SOLAS Convention), 1974, as amended.
2. Athens Convention relating to the Carriage of Passengers and their Luggage by Sea, 1974 (Athens Convention 1974)
3. Agreement on Passenger Ships Engaged on Special Services, 1971, and Protocol on Habitable Spaces on Passenger Ships Engaged on Special Services, 1973.
4. Convention on Limitation of Liability for Maritime Claims, 1976.

2.3. Minimum Safety Crew.

Resolution A.865(20) deals with minimum training requirements for personnel designated to assist passengers in emergency situations on board passenger ships.

In determining the minimum safe manning, it must be ensured that they are capable of using the fire-fighting and emergency equipment on board, as well as life-saving appliances, but also of carrying out maintenance operations on such equipment at sea, and of mustering and disembarking all persons on board.

According to Annex 3 on Responsibilities for the Application of Minimum Safe Manning Principles, it is the responsibility of the Company to apply the principles, recommendations and guidelines contained in this resolution when preparing a proposal for the minimum safe manning of its ship (IMO, International Maritime Organisation, 2011).

In particular, it should assess the tasks, duties and responsibilities of the crew necessary for the safe operation of the ship, the protection of the ship and the marine environment, and for dealing with emergency situations.

The minimum safety crew proposal for a ship, submitted by a company to the Administration, should be assessed to verify that the proposed manning of the ship includes the required number of persons, in the required rank or position, to perform the tasks, duties and responsibilities necessary for the safe operation of the ship, the protection of the ship and the marine environment, and to deal with emergency situations.

When making a proposal for minimum safety crew provisioning, the company shall analyse the interdependencies and interactions of each operational process that influence the workload assigned to crew members, including analysis of intrinsic aspects related to the duration, frequency, competence and qualifications for the work, and importance of the operation to be executed.

The text also adds that the determination of the minimum safety crew of the ship should be based on the performance of the ship's operation and care of the persons on board.

According SOLAS 74, Regulation V/14.2, Minimum Safe Crew Certificate, every ship to which the provisions of Chapter I of the Convention apply shall carry an appropriate safety crew certificate, or equivalent, provided by the administration as proof that the ship carries the minimum safety crew onboard.

Circular FAL.2/Circ.127 MEPC.1/Circ.817 MSC.1/Circ.1462 1 July 2013 lists the certificates and documents required under IMO instruments (IMO, International Maritime Organization, 2017).

Administration have to request the company responsible for the operation of the ship to prepare and submit its proposal for the minimum safety crew of the ship in a specified format provided by the Administration.

Finally, Administration has to approve only a proposed minimum safety crew for a ship and issue a corresponding minimum safety crew certificate. In addition, it should always periodically review the minimum safety crew requirements.

2.4. On-board training and drills.

About the training of seafarers and the successful completion of the IMO Model Course Programme 1.28. on Crowd Control, Passenger Safety and Security Training and the IMO Model Course Programme 1.29. on Crisis Management Competence and Human Behaviour Training both contained in the "Passenger Ships" Specialty Certificate or equivalent according to STCW.

In application of the International Convention for the Safety of Life at Sea, it is necessary to review its requirements for the conduct on board Passenger Ships of the periodic drills prescribed in its Chapter III on Life-Saving Appliances and Arrangements, Section II Passenger Ships, and Regulation 30 (IMO, International Maritime Organization, 2004).

2.5. Periodical training exercises.

According to the International Convention for the Safety of Life at Sea, Chapter III on Life-Saving Appliances and Arrangements, Section II on Passenger Ships, and Regulation 30, it is mandatory for all passenger ships to carry out on board a series of periodic drills as Ship abandonment exercise or Fire-fighting exercise to be held weekly.

The entire crew need not participate in each periodical drill, but each crew member shall participate in one abandon ship drill and one fire drill each month as required by Regulation 19.3.2. Passengers will be strongly encouraged to attend such periodic exercises (IMO, International Maritime Organization, 1998).

In accordance with SOLAS, Chapter III on Life Saving Appliances and Arrangements, Section II on Passenger Ships, and Regulation 19, it applies to all ships to conduct on board training and also periodic emergency drills:

Regulation 19(2) deals with Familiarisation with safety facilities and muster drills, and describes a number of specifications which are shown below:

1. *Each crew member who has been assigned emergency tasks shall be familiar with these tasks prior to departure.*
2. *Any ship engaged on a voyage with passengers of more than 24 hours' duration shall, within 24 hours of embarkation, hold a meeting with the passengers to provide them with safety instructions on the use of life jackets and how to act in case of emergency.*

Information cards or posters or video programmes displayed on the ship's video screens may be used to supplement such instructions, but may not be used to replace the announcement.

Such instructions shall be given over the ship's public address system, in one or more languages, as required in Regulations 8.2 and 8.4.

2.6. Safety role and emergency instructions.

SOLAS, Part B on Requirements for Ships and Life-Saving Appliances, Section I on Passenger Ships and Cargo Ships, Regulation 8 describes the Emergency Obligations and Procedures Table.

Regulation 8 mentions that clear instructions to be followed in an emergency shall be provided for each person on board. These shall be clearly visible throughout the ship, including the navigating bridge, engine room and crew accommodation spaces, and shall be in the language or languages required by the ship's flag State and in English (IMO, International Maritime Organization, 1998).

In addition, as required by Regulation 37.4, emergency duty and instruction charts shall be posted in passenger cabins, assembly stations and other passenger areas to inform passengers of their assembly station, their essential behaviour in an emergency and, finally, how to put on life jackets.

Similarly, Regulation 37 above, on the Table of emergency obligations and instructions, specifies that the details of the general emergency alarm and public address system and the action to be taken by the crew and passengers when the alarm is sounded shall be specified in the Table of emergency obligations and instructions. It shall also specify the manner in which the order to abandon ship shall be given.

It is important that the crew operating the safety equipment on board are familiar with its operation. SOLAS 1974 therefore requires sufficiently detailed instruction manuals from suppliers to be carried on board for the safety equipment which the crew must operate in order to become familiar with its operation.

2.7. Crew muster list.

Rule 37 describes the responsibilities of the crew members in the muster list. In addition, that muster list shall specify the designated officers and substitutes for key persons likely to become incapacitated, to ensure that life-saving and fire-fighting appliances are maintained in good condition and ready for immediate use.

Finally, the muster list shall indicate the various tasks assigned to crew members in relation to passengers in an emergency, which shall include (IMO, International Maritime Organization, 1998):

1. *Notifying passengers.*
2. *Check that passengers are adequately warm and have put on their life jackets properly.*
3. *Gather them at the muster stations.*
4. *Keep order in corridors and stairways and, in general, monitor passenger movements.*
5. *Check that a supply of blankets is carried on survival craft.*

2.8. On-board communications.

The European Union, for example, provides that member states shall ensure that, on board passenger ships, personnel named in the relevant lists to assist passengers in emergency situations are readily identifiable and have sufficient communications skills for that purpose, taking into account an appropriate and adequate combination of any of the following criteria (Official Journal of the European Communities, 2001):

1. *The appropriate language(s) of the main nationalities of the passengers carried on a particular route;*
2. *The ability to use elementary english vocabulary to give basic instructions as a way of communicating with passengers in distress, may or may not the passenger and crew share common language.;*
3. *The eventual need to communicate during an emergency by some other means (e.g. demonstration, hand signals, bringing attention to the location of instructions, muster stations, life-saving equipment, evacuation routes) when oral communication is not possible.;*
4. *The languages in which emergency calls may be broadcast during an emergency or drill to provide life-saving guidance to travellers and to facilitate crew members in assisting passengers.*

2.9. On-board exercises or drills.

Exercises which form part of the employer's pre-identification of possible emergency situations should, as far as possible, be carried out at all times as if it were a real emergency.

The regulations in force, issued by the Maritime Safety Committee (MSC) of the International Maritime Organisation (IMO) and subscribed to by most countries through the ratification of the SOLAS Convention - Chapter III part B-1; regulation 19; points 2.2 and 2.3, establish that safety and emergency drills must be carried out with all embarked personnel, giving instructions to passengers on the use of life-saving equipment and how to act in case of emergency.

Each crew member must participate in at least one abandon ship drill and one fire drill per month (IMO, International Maritime Organisation, 1998). On passenger ships, crew drills shall be conducted within 24 hours of departure from a port provided that more than 25% of the crew have not participated in abandon ship and fire drills during the previous month.

Similarly, for any ship before putting to sea or after undergoing a major alteration, the crew shall carry out such drills. For those classes of ships where this is not practicable, the Administration may accept procedures which are at least equivalent.

2.10. Relationship between crew and passengers.

Given all of the previous considerations, we must be very clear about one thing, and from this point onwards we will only refer to the maritime environment, and that is that the passenger is under the supervision of the crew members during the entire voyage, including accessing or leaving the ship, either on arrival at port or, if necessary, during the voyage due to an emergency. Their mobility within the ship is limited for safety reasons, it is important to remember that we are in a hostile environment for human beings. During the voyage, access is basically restricted to the passenger decks, which include cabins, restaurants, leisure and recreation areas, etc. On Ro-Ro ships, at certain times during the voyage, a certain time interval was stipulated for passengers to access the garages, but also under the constant supervision of the crew.

3. Methodology.

We have collected a list of accidents involving passenger ships from 1950 to 2015, with the intention of obtaining a global overview of what we are encountering.

The case study or case analysis has been a research instrument or method that originated in medicine and psychology (Becker, 1974), and has subsequently been used in other disciplines by a variety of authors.

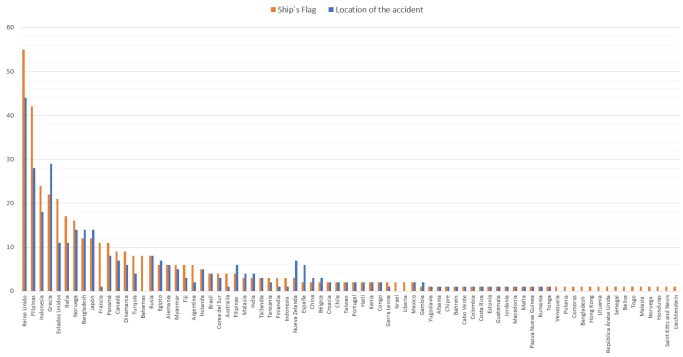
In order to complete this work, almost 471 passenger ships accidents were analysed, extracting the information from various databases and repositories, using ”files” which contain detailed information on each incident. The following list of main resources has been used for this purpose:

1. *GISIS (Global Integrated Shipping Information System).* https://gisis.imo.org/.
2. *EMCIP (European Marine Casualty Information Platform).* https://portal.emsa.europa.eu/emcip-public/.
3. *EQUASIS (Electronic Quality Shipping Information System).* https://www.equasis.org/.
4. *wrecksite.eu Database.* http://www.wrecksite.eu.
5. *Marinetraffic.com DB.* http://www.marinetraffic.com.
6. *Shipspotting Database.* http://www.shipspotting.com.
7. *FleetMon Database.* https://www.fleetmon.com.
8. *VesselFinder Database.* https://www.vesselfinder.com.
9. *Auke Visser Database.* http://aukevisser.nl.

4. Results.

The ratio between the ship’s flag and the place where the accident occurs is 0.953 (95.3%) (Figure 2). Such a high correlation practically indicates that most accidents take place in the same country/area as the flag, which is related to the fact that most passenger ship voyages are short and can therefore be considered as cabotage traffic, This can be a major handicap when it comes to certain countries applying international safety standards and a lack of control of vessels sailing in their waters, either due to a lack of resources or laxity on the part of the administrations, which in any case should be investigated.

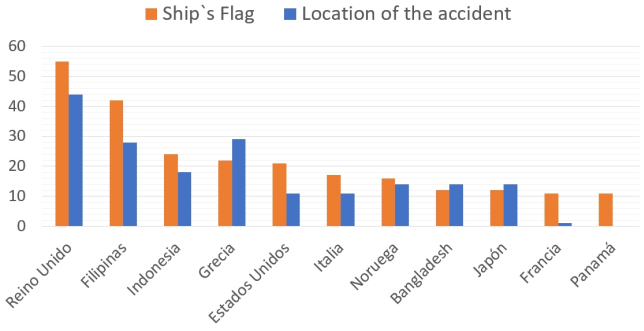
Figure 2: Relationship between ship’s flag and the place where the accident occurs.



Source: Authors.

In an extract of the places with the highest number of passenger ship accidents, we see that the ratio is 0.9145 (over 90% as well)(Figure 3). In the UK, a fairly small proportion of vessels are non-flagged, as in all other European countries. The United States has more accidents in its waters than vessels flying its flag, but we must consider that a large part of its fleet is flag of convenience, such as Panama, which is still a flag of convenience.

Figure 3: Extract Relationship between ship’s flag and the place where the accident occurs.

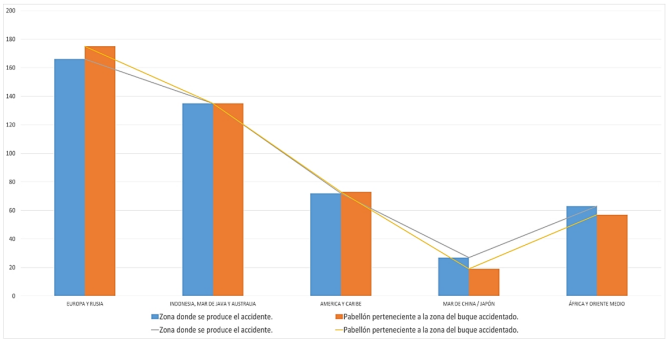


Source: Authors.

If we make the calculation by shipping area, the correlation coefficient is practically 1 (Figure 4), which clearly indicates that ships have accidents in the same place where they are registered or very close, which is indicative of a national or cabotage traffic without control measures, or at least that the regulations that are established by international organisations such as the IMO are not being efficiently transposed into national rules.

While high traffic density is an important factor in the occurrence of accidents, as may be the case in European countries, where the application of international regulations is scrupulously applied, especially if we compare it with other countries, even in our environment, such as North Africa and then extending to Central Africa, the area of Indonesia, the Java Sea and part of the Indian Ocean, as well as the Caribbean navigation area. The administrations with responsibilities in this area must take measures to alleviate the situation (Figure 5).

Figure 4: Relationship between ship's flag and the place where the accident occurs by zone.



Source: Authors.

Figure 5: Fatalities in maritime accidents involving passenger ships in the study period, by country of accident (1950-2016).

Source: Authors, powered by Microsoft Bing©.

Conclusions.

We can conclude from the results that there is an extremely high correlation between the place of the accident and the flag of the ships involved in the accident. As we have mentioned, this may be due to a deficient application of international rules and regulations (remember that, for example, the SOLAS Convention, perhaps the most important IMO Convention, applies to international voyages, although, as we can see, most of the accidents that occurred during this period can be considered to involve coastal shipping).

In countries with several islands such as Indonesia and most of South East Asia, the number of fatalities involved in accidents is significantly higher than in Western countries, even though the number of accidents recorded is lower (this may be related to the time period chosen, as over such a long period many standards have only recently been implemented in these regions).

We must analyse how the situation stands recently and whether the measures enacted by international bodies are effectively applied to vessels (let us not forget that many of the places where there are large numbers of fatalities have been and continue to be one of the main recipients of second-hand vessels from western countries or the japanese and korean market).

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