European Maritime Safety Agency
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# ANNUAL OVERVIEW OF MARINE CASUALTIES AND INCIDENTS 2022

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20 EMSA

Photo credits: AIN/Croatia, DMAIB/Denmark and GAMA/Portugal.

Front page: Sinkage of fishing vessel Aggersøe on 18th of July 2021, Denmark. Photo credit DMAIB/Denmark.

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*Photo credit by FEBIMA. Belgium.*

# EXECUTIVE SUMMARY

This publication presents statistics on marine casualties and incidents which involved ships flying a flag of one of the EU Member States and occurred within EU Member States' territorial sea or internal waters as defined in UNCLOS or involved substantial interests of EU Member States, as reported by Member States in the EU database for maritime incidents EMCIP (European Marine Casualty Information Platform).

In this document **EU** and **EU Member States** are the **27 EU Member States plus the EEA EFTA States** (Iceland and Norway) to which the Directive applies. **EU 27** is used explicitly when referring to the **27 EU Member States** without the EEA EFTA States.

The figures from EMCIP database cover the period from **1st of January 2014 to 31st of December 2021**.

Data from 2014 to 2020 have been re-analysed to consider only the marine casualties and incidents involving at least one of the EU Members States (EU 27 plus EEA EFTA). There was a small reduction in the number of marine casualties and incidents considering 27 Member States instead of 28, but trends and conclusions are very similar, confirming that reporting is a global work without primacy of any Member State.

2021 appeared to have been a positive year considering the reduction and stabilisation of most of the indicators, such as the number of occurrences, ships lost, fatalities or injuries. After traffic reduction in 2020, due to COVID pandemic, traffic increased in 2021 and cruise ships and ferries activities started again, but pre-COVID levels were not reached.

In 2021, 2,637 marine casualties and incidents were reported, representing a reduction of 166 marine casualties and incidents in comparison with the year 2019, after a 6-year period of stable number of occurrences (average of 2,665 casualties between 2014 and 2019). In 2020, there was an exceptional decrease of 200 marine casualties and incidents compared to year 2019. With an increase of 90 marine casualties between 2020 and 2021, the number of marine casualties and incidents in 2021 was still under the average number of occurrences before the pandemic. The total number of marine casualties and incidents reported in the period from 2014 to 2021 was 21,173.

In 2021, the number of ships involved in marine casualties and incidents increased in comparison with 2020 and decreased in comparison to 2019 for all ship types excepting fishing vessels. For fishing vessels, the number of ships involved in marine casualties and incidents in 2021 decreased in comparison to 2020 and increased in comparison to 2019.

After a peak of 106 very serious casualties reported in 2018 and a total of 75 in 2019, the number of very serious marine casualties was 51 in 2020 and 52 in 2021, confirming the reduction in the trend.

To draw objective comparisons between the different ship types, ratios between the number of marine casualties and incidents involving each ship type and its corresponding fleet size were calculated. These ratios are called ship occurrence indicators (see Appendix 4). Due to data availability, indicators calculations were limited to ships flying an EU 27 Flag, and with an IMO number when it related to cargo ships, passenger ships and service ships. For fishing vessels, only EU 27 flag vessels with a length above 15 meters were considered.

Ship occurrence indicators show the number of marine casualties and incidents in one year per one thousand EU27 flag ships under the scope of Directive 2009/18/EC. The average ship occurrence indicator in the period from 2014 to 2021 was 115, with a maximum of 125 in 2020, a minimum of 99 in 2020 and 108 in 2021. Both passenger ships and cargo ships had the greater average ship occurrence indicators, 191 and 152 respectively. However, a decrease of annual indicators was observed since 2015 for both ship types. Regarding service ships, this category had the lowest indicator, with an average of 38 occurrences over the period from 2014 to 2021. Finally, the occurrence indicator about fishing vessels was 51 with an increase over the period from 2014 to 2021.

From 2014 to 2021, internal waters (port area and other) were the locations where more than half of the reported marine casualties and incidents took place, followed by territorial sea and open sea.

From 2014 to 2021, departure phase was the segment of a voyage with the lowest average, 8.4% of the ships involved in marine casualties and incidents, and 'en route' portion was the one with a higher average, with an average of 44.0% of the ships involved in marine casualties and incidents. 45.3% of the ships involved in marine casualties and incidents were in departure, arrival, anchored or alongside voyage segments, in internal waters. 10.8% of the ships involved in marine casualties and incidents were in unknown voyage segments.

EU waters in North Atlantic, with an average of 19.5% of the marine casualties and incidents, and EU waters in Mediterranean Sea, with an average of 14.3% of the marine casualties and incidents, were the geographical areas

with the higher number of occurrences, with an exception for passenger ships with a greater number of occurrences in EU waters: being in the Mediterranean Sea and the Baltic Sea.

After a decrease in the traffic density around Europe in 2020, more intense for passenger ships than for cargo ships and fishing vessels, traffic density values increased again in 2021 with values still under the levels in 2019.

EU Member States investigative bodies have launched 984 investigations over the period from 2014 to 2021 and 832 safety investigation reports were made public. In 2021, 84 investigations were reported to have been launched, meaning a decrease of 7.7% in comparison with the year 2020 and a decrease of 28.2% in comparison with the year 2019.

From 2014 to 2021, there was a total of 563 lives lost in 376 marine casualties. After a continuous important decrease until 2017 when 45 fatalities were recorded, an increase up to 67 was recorded in 2019. 43 fatalities were recorded in 2020 and 36 in 2021. 89.3% of the victims were crew members. The main event resulting in fatalities was collision, when it related to a ship, and slipping / falls when it related to a person.

From 2014 to 2021, there was a total of 6,155 injuries in 5,394 marine casualties and incidents. From 2014 to 2019 the average of injuries was 825, there was a decrease to 587 in 2020 and a new increase to 621 in 2021, a 25.8% less injuries than in 2019. 84.6% of the injuries were crew members. The main event resulting in injuries was collision, when it related to a ship, and slipping / falls when it related to a person.

Fatalities and injuries indicators based on the number of the person on board for each person category (crew member, passenger or other) in the EU fleet were developed. The trends of these indicators for crew and passengers were like the trends in number of fatalities and injuries.

In 2021, 14 ships were lost, 650 ships were damaged, 219 ships were considered unfit to proceed, 759 required shore assistance, 368 ships required towing and 21 ships were abandoned. There were 340 Search and Rescue (SAR) operations. In general, this means a reduction in the consequences to ships, in comparison with previous years and an increase in the support to vessels after the marine accidents and incidents.

A significant decrease in the reported number of pollutions was noted in year 2019, 2020 and 2021. However, in 2021 the number of pollutions was higher than in the two previous years. This reduction was significant for passenger ships, service ships and fishing vessels.

From analysis conducted in safety investigations, it was determined that, from 2014 to 2021, 59.6% of accident events was due to human action and 68.3% of the contributing factors were related to human behaviour. Analysing both human action events and human behaviour contributing factors jointly, human element relates to 81.1% of the investigated marine casualties and incidents. These trends are common for all ship types.

Over the period from 2014 to 2021, the total number of safety recommendations issued, and actions taken reported was 2,329. 45.5% of the issued safety recommendations and actions taken were dealing with ship related procedures.

*Photo credit GAMA/Portugal.*

# Chapter 1 INTRODUCTION

## 1.1 Background

The main purpose of accident investigation is to improve maritime safety and prevent pollution by ships to reduce the risk of future marine casualties, by:

- understanding why marine casualties and incidents occur;
- preventing or lessening the seriousness of marine casualties or marine incidents in the future; and
- developing lessons learned after accidents at sea.

At international level, the IMO adopted the Casualty Investigation Code in 2008 through resolution MSC.255(84) and made it mandatory. The Code put forward standards and recommended practices for safety investigations into marine casualties or marine incidents.

At EU level, Directive 2009/18/EC[1] (AI Directive) established the fundamental principles governing the investigation of accidents in the maritime transport sector. It aims at facilitating the expeditious holding of safety investigations and proper analysis of marine casualties and incidents to determine their causes, ensuring the timely and accurate reporting of safety investigations and proposals for remedial action.

Following the entry into force of the AI Directive EU Member States shall, among other obligations:

- establish independent, impartial and permanent accident investigative bodies;
- require to be notified of marine casualties and incidents. This obligation covers casualties and incidents that:
  - involve ships flying the flag of one of the Member States;
  - occur within Member States' territorial seas and internal waters;
  - involve other substantial interests of the Member States;
- investigate casualties depending upon their severity: casualties which are classified as very serious shall be investigated; serious casualties shall be assessed in order to decide whether or not to undertake a safety investigation;
- publish investigation reports; and
- notify the European Commission of marine casualties and incidents via EMCIP.

EMCIP is the European Marine Casualty Information Platform, a centralised database for EU Member States to store and analyse information on marine casualties and incidents.

EMCIP is filled out with data by the competent national authorities. It is this data which forms the basis of the Annual Overview of Marine Casualties and Incidents.

In this publication, the terms Europe, **EU** and **EU Member States** are the **27 EU Member States plus the EEA EFTA States** (Iceland and Norway) to which the Directive applies. **EU 27** is used explicitly when referring to the **27 EU Member States** without the EEA EFTA States.

In comparison with previous years, this document is shorter, the total number of figures has been reduced and tables have been substituted by dynamic extraction of data to comma separated values files. Despite the reduction in total length, number of figures and tables, analysis provided in edition 2021 are also included in this new edition, and some new elements have been added: fleet data, fatalities indicators, injuries indicators and traffic density analysis.

A double check quality procedure has been implemented to guarantee data quality and validation.

This publication accomplishes the minimum accessibility requirements and is fully readable using read out loud systems for pdf files, promoting inclusion.

There is a box with three points in the right button corner of each figure. By clicking that box, the user can choose between downloading a comma separated value (csv) file with the data in the figure or show the figure alone in a new pdf file. EMSA will deliver this new edition in pdf format without paper publication, promoting sustainability.

[1] Directive 2009/18/EC of the European Parliament and of the Council of 23rd of April 2009 establishing the fundamental principles governing the investigation of accidents in the maritime transport sector and amending Council Directive 1999/35/EC and Directive 2002/59/EC of the European Parliament and of the Council.

## 1.2 Scope

EMSA was given the mandate to publish a yearly overview of marine casualties and incidents under the Agency's founding Regulation (EC) No 1406/2002, as amended.

This publication contains statistics on marine casualties and incidents which: involve ships flying a flag of one of the EU Member States; occur within EU Member States' territorial sea or internal waters as defined in UNCLOS; or involve other substantial interests of EU Member States.

This publication covers the period from **1st of January 2014 to 31st of December 2021**.

The figures extracted from the database on **1st of July 2022** and presented in this publication are likely to be slightly different to those presented in previous annual overviews of marine casualties and incidents and those presented throughout the year in various fora or in the next editions to be published, due to the following reasons:

- the data can be subject to changes over time as EU Member States add or update information on older cases; and
- in January 2021 the number of Member States reporting in EMCIP was reduced by one. Therefore, and in order to have meaningful data analysis, all data in this publication, from 1st of January 2014 to 31st of December 2020 has been analysed considering only the occurrences involving at least one of the 27 Member States of EU 27 and the 2 maritime EEA EFTA States as, being Flag State, Coastal State or Substantially interested State.

The figures are presented in this publication to provide a general overview of the safety of maritime transport when it comes to European interests. However, the publication is limited by the quantity and nature of information presently contained in EMCIP and it is, therefore, not intended as a complete overview and comprehensive technical analysis. Should further information about specific cases be required, readers are invited to contact the national competent investigative bodies (whose contact details can be found in Appendix 6 of this publication).

## 1.3 Reading guide

This publication is organised to cover the main aspects of maritime safety as given in the Directive and as included in EMSA's remit. In this edition, Chapter 2 covers general figures and the activities of the EU investigative bodies, comparing data for the whole fleet and the main ship types: cargo ships, fishing vessels, passenger ships, service ships and other ships.

Chapter 2 is divided into the following sections:

- Reporting of marine casualties and incidents;
- Ships involved in marine casualties and incidents;
- Location of marine casualties and incidents;
- Safety investigations and investigation reports;
- Consequences of marine casualties and incidents;
- Nature of marine casualties and incidents;
- Events and conditions that led to marine casualties and incidents; and
- Safety recommendations and actions taken.

More information on EMSA's activities related to marine accidents can be found at:

- http://www.emsa.europa.eu/implementation-tasks/accident-investigation.html; and
- https://portal.emsa.europa.eu/emcip-public/#/dashboard.

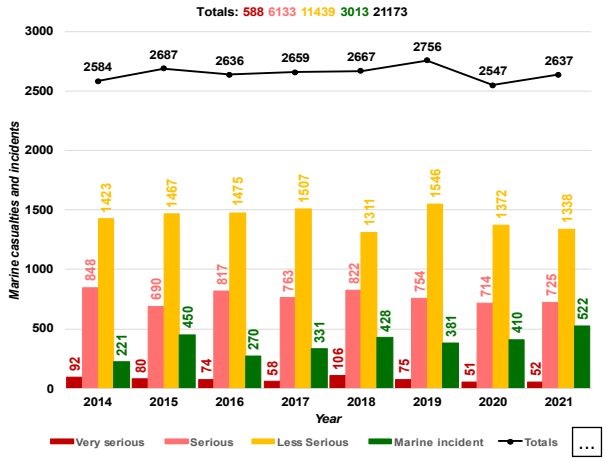
A list of abbreviations and definitions as well as extra information on the casualty categories used in publication can be found in Appendix 1. The codification model used by EMCIP is in Appendix 2. The list of ship types used in EMCIP are shown in Appendix 3. The methodology to determine EU 27 ship occurrence indicators is in Appendix 4 and the methodology to determine fatalities and injuries indicators per category of person on board EU ships is in Appendix 5. The list of investigative bodies in EU can be found in Appendix 6.

# Chapter 2 INFORMATION ON MARINE CASUALTIES AND INCIDENTS

## 2.1 Reporting of marine casualties and incidents

This section provides general information about the number of marine casualties and incidents and their severity for the different ship types considered. All definitions are in Appendix 1.

Figure 2.1–1 Evolution of number of marine casualties and incidents, organized by severity




The total number of reported marine casualties and incidents over the period 2014-2021 is 21,173, with a yearly average of 2,647 casualties and incidents. The total number of reported marine casualties and incidents in 2021 is 2,637.

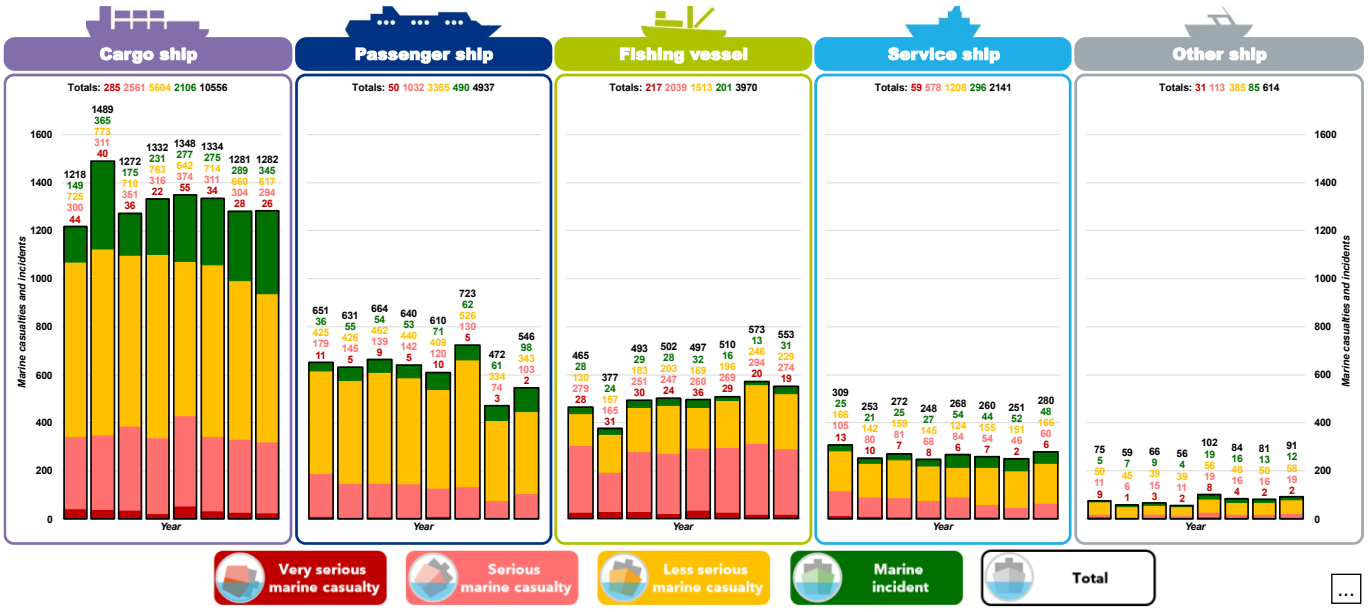
In relation to the severity, 54.0% of the reported marine casualties and incidents were less serious, 29.0 % were serious and only a 2.8% were very serious. There was only 14.2% of reported marine incidents, when the number of incidents was expected to be higher than the number of accidents.

After a peak in 2019, there was a small reduction in the number of reported marine casualties and incidents in 2020. The number of reported marine casualties and incidents in 2021 is like the reported in 2020 for all the ship types, with an increase in the number of reported marine incidents.

Considering the ship types, the number of marine casualties and incidents were distributed from high to low as cargo ships, passenger ships, fishing vessels, service ships and other ships.

Comparing with 2020, in 2021 there is a significative increase in the number of marine casualties and incidents involving passenger ships, service ships and other ships, there is a reduction in the number of marine casualties and incidents involving fishing vessels, and cargo ships have almost the same number of occurrences.

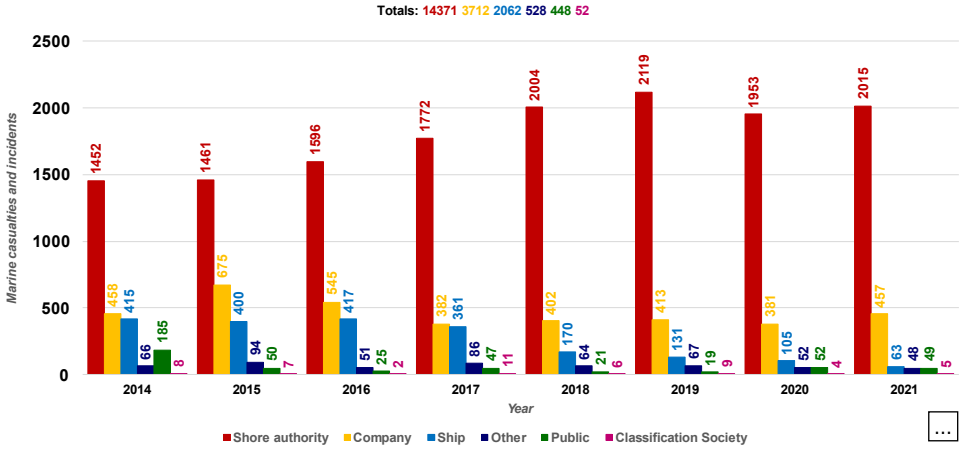
Figure 2.1–2 Evolution of number of marine casualties and incidents, organized by severity and ship type



The evolution of the number of marine casualties and incidents for a ship type counted the number of marine casualties and incidents involving at least one ship of this type. Collisions involve more than one ship, so there were marine casualties and incidents involving more than one ship type and, therefore, the sum of the number of marine casualties and incidents for the different ship types is higher than the total number of marine casualties and incidents.

Notifying entities are shore authority, company, ship, classification society, public and other. More than one entity can notify a single marine casualty or incident but only one of these entities is reported in EMCIP as notifying entity.

Figure 2.1–3 Evolution of number of marine casualties and incidents, organized by notifying entities




Shore authorities were the main reporting entity in 2021 and during the period from 2014 to 2021.

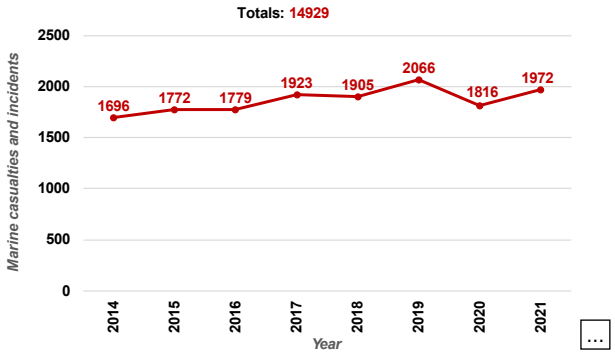
In average, during the period from 2014 to 2021, 70.5% of the marine casualties and incidents reported in EMCIP have an EU State as coastal State.

In 2021 an EU State is reported as coastal State in 74.8% of the reported marine casualties and incidents.

2021 is the second year of the period with more marine casualties and incidents involving an EU State as coastal State, only after 2019.

The growing trend has recovered after the reduction in 2020.

Figure 2.1–4 Evolution of number of marine casualties and incidents involving an EU State as coastal State

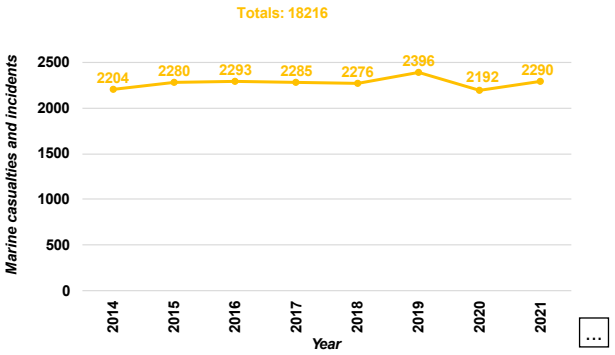



Before 2019 the number of marine casualties and incidents involving at least one EU flagged ship was between 2,200 and 2,300. In 2019 the maximum was exceeded and in 2020 the number was under the minimum. In 2021 the number was again in the same interval than before 2019.

In 2021, 86.8% of the marine casualties and incidents involved at least one EU flagged ship.

The average percentage of marine casualties and incidents involving at least one EU flagged ship in the period from 2014 to 2021 was 86.0%.

Figure 2.1–5 Evolution of number of marine casualties and incidents involving at least one EU flagged ship

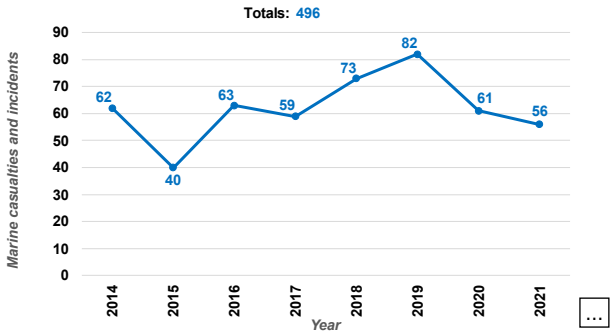


The evolution of the number of marine casualties and incidents involving at least one EU substantially interested State (other than coastal or flag State) has been erratic.

The average value of the number of marine casualties and incidents involving at least one EU substantially interested State, other than coastal or flag State, in the period from 2014 to 2021 is 62, representing in average of 2.3% of the reported marine casualties and incidents.

In 2021, the number of marine casualties and incidents involving at least one EU substantially interested State, other than coastal or flag State, was 56, being 2.1% of the marine casualties and incidents reported in the year. This is a little under the average values.

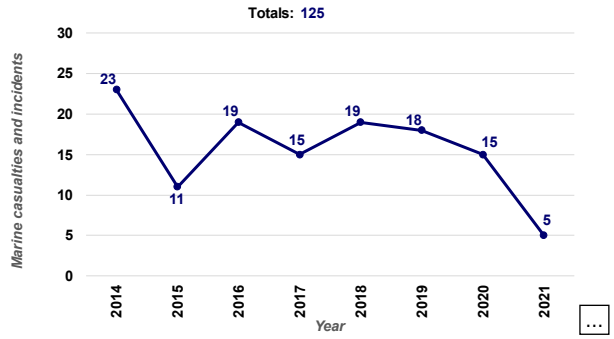
Figure 2.1–6 Evolution of number of marine casualties and incidents involving at least one EU substantially interested State




Some marine casualties were reported to EMCIP because there was at least one EU substantially interested State but there were not EU flagged ships or EU coastal States involved. In these marine casualties and incidents reported only because there was at least one EU substantially interested State involved, EU States are not usually the leaders of the investigation but the reporters in EMCIP.

With a maximum of 23 marine casualties and incidents in 2014, 2021 shows a minimum, with only 5 marine casualties reported only because there was at least one EU substantially interested State involved.

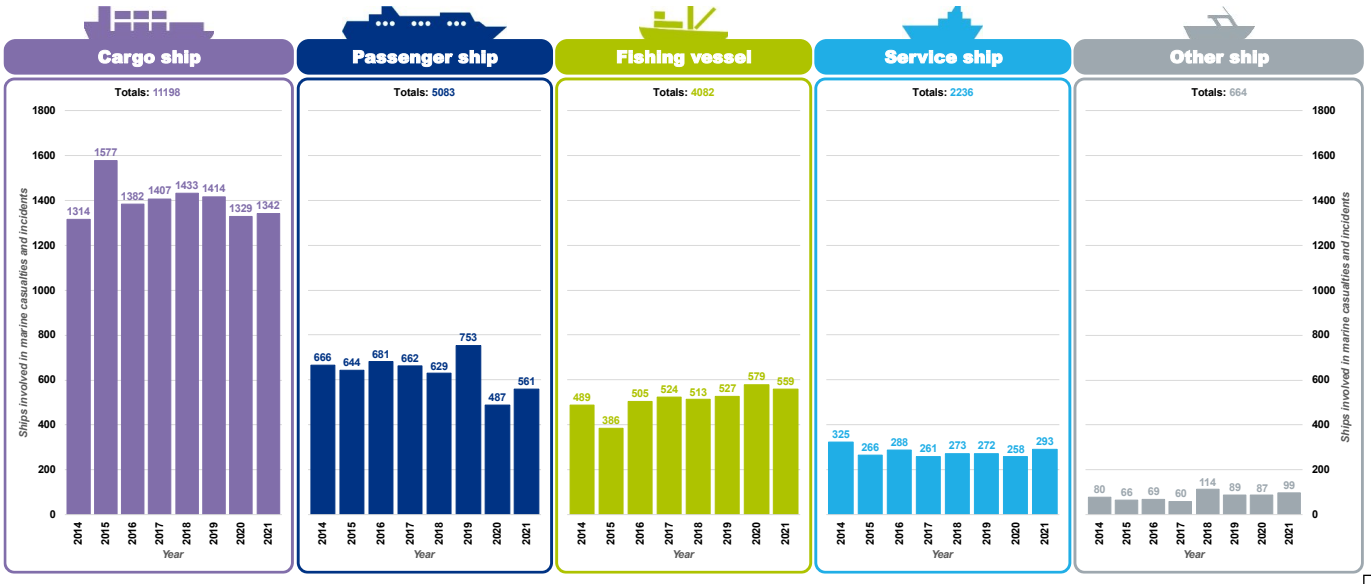
Figure 2.1–7 Evolution of number of marine casualties and incidents reported only because there was at least one EU substantially interested State involved




## 2.2 Ships involved in marine casualties and incidents

This section focuses on the ships involved in marine casualties and incidents. Ships have been classified by the main categories: cargo ship, fishing vessel, passenger ship, service ship and other ship.

Figure 2.2–1 Evolution of ships involved in marine casualties and incidents, organized by ship types

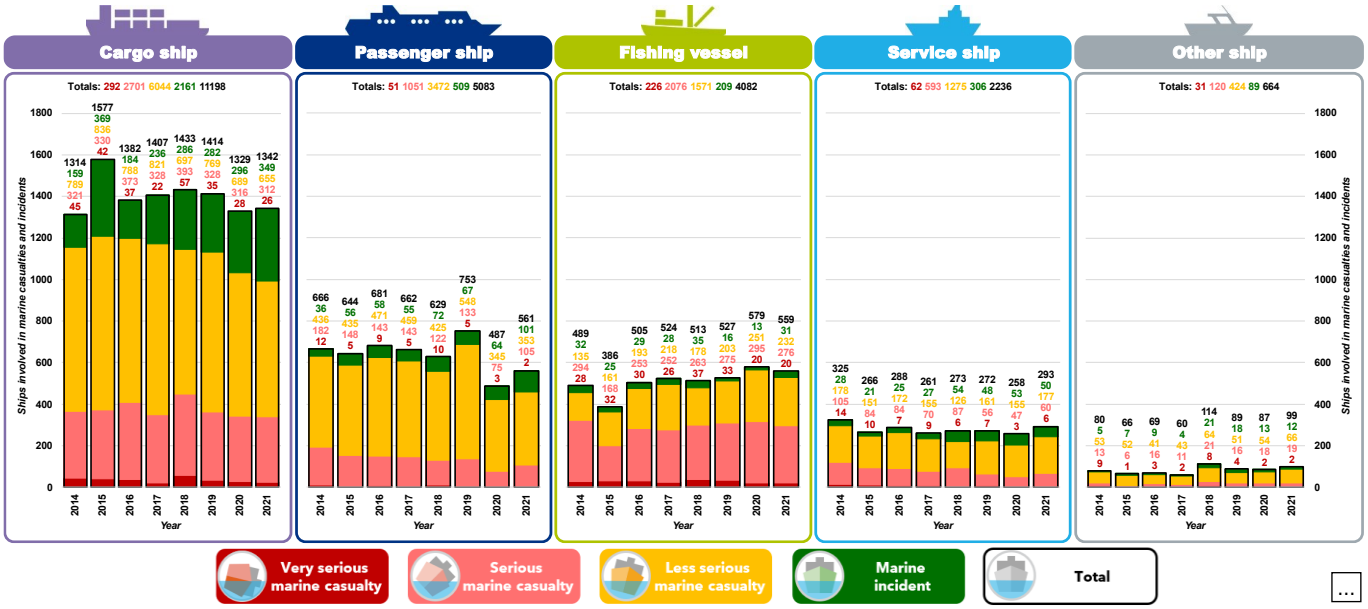


The average number of ships involved in reported marine casualties and incidents during the period from 2014 to 2021 is 1,400 for cargo ships, 635 for passenger ships, 510 for fishing vessels, 280 for service ships and 83 for other ships.

In 2021, the number of ships involved in reported marine casualties and incidents is under the average for cargo ships, passenger ships and service ships. The number of fishing vessels is over the average, but it is lower than in year 2020.

In the following figures all the ships involved in reported marine casualties and incidents were organized by severity.

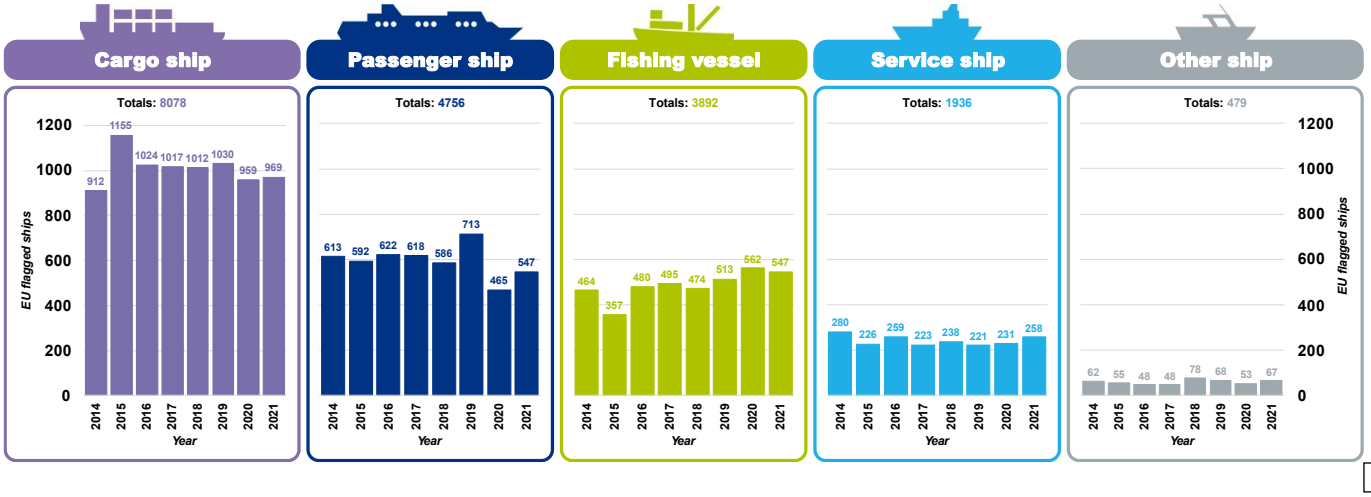
Figure 2.2–2 Evolution of ships involved in marine casualties and incidents, organized by severity




The trends of this figure are like in Figure 2.1–2. The difference is that Figure 2.2–2 was counting ships, and for each ship type the total was the same than the total number of ships in Figure 2.2–1, while in Figure 2.1–2 marine casualties and incidents were counted.

In the following figure only the EU flagged ships involved in reported marine casualties and incidents were considered.

Figure 2.2–3 Evolution of EU flagged ships involved in marine casualties and incidents, organized by ship type




Trends for EU flagged ships are the same than for all ships, presented in Figure 2.2–1.

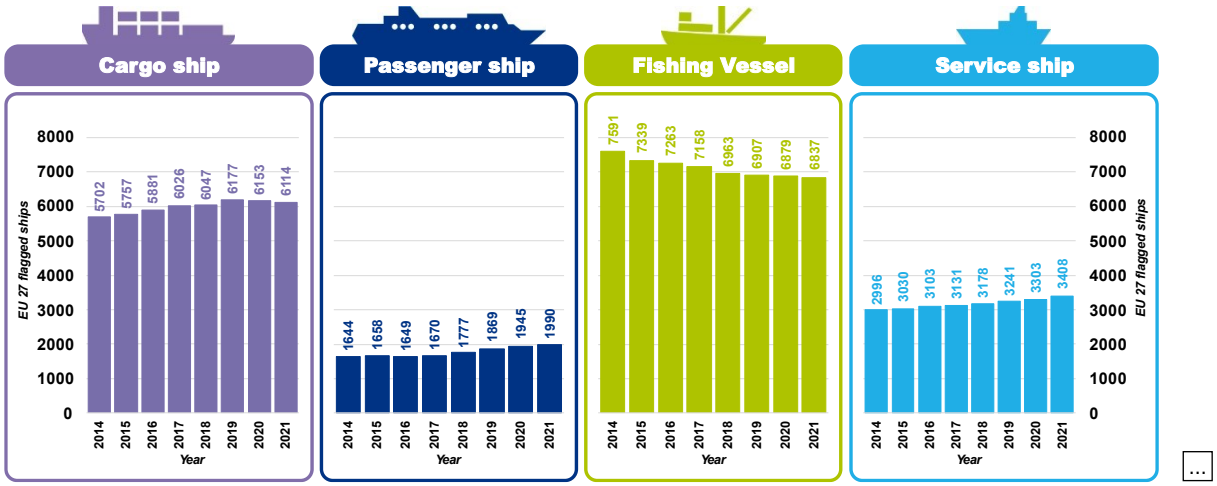
To evaluate the accident rate for a ship type it is necessary to consider the number of reported accidents and incidents for that ship type and the number of ships of that type in the fleet. The evaluation of the accident rate is done by means of the ship occurrence indicator obtained following the methodology described in Appendix 4. This indicator is only available for EU 27 ships.

EU 27 ship occurrence indicator is somehow providing an estimation on how many marine casualties and incidents occurred per 1 thousand ships of a determined ship type in the EU 27 fleet.

Other ship type is not considered because there is not a consistent data source for the fleet of this too heterogenous ship type.

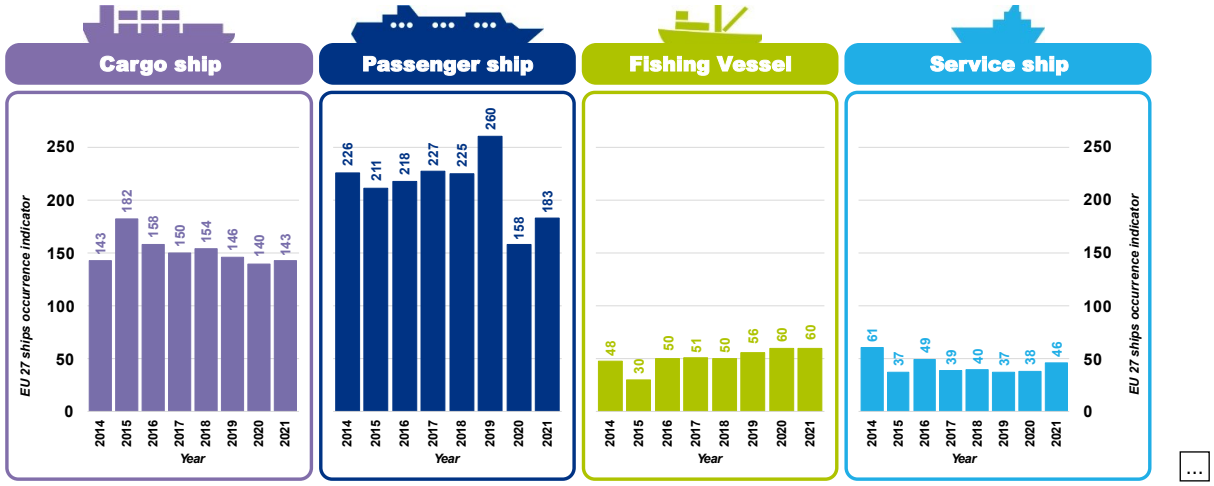
Fleet data is fully available for EU 27 flagged fishing vessels under the scope of Directive 2009/18/EC (LOA greater than 15 meters) and EU 27 flagged ships not being fishing vessels with IMO number, and only this kind of ships were considered for the analysis of the ships involved in reported marine casualties and incidents for the indicator calculation.

Figure 2.2–4 Evolution of EU 27 flagged ships, organized by ship type




EU 27 flagged passenger and service ships fleets have been continuously growing in the period from 2014 to 2021. EU 27 flagged cargo ships fleet was growing from 2014 to 2019 and is decreasing since 2020. EU 27 flagged fishing vessels fleet is continuously decreasing since 2014.

Figure 2.2–5 Evolution of EU 27 ship occurrence indicator, organized by ship type




EU 27 ship occurrence indicator changes the order of the different ship types, compared with Figure 2.2–3. Passenger ships exceed cargo ships and service ships remain at same level than considered fishing vessels.

## 2.3 Location of marine casualties and incidents

This section analyses the location and voyage segments of the reported marine casualties and incidents and maritime traffic around Europe.

Figure 2.3–1 Evolution of marine casualties and incidents, organized by navigational area

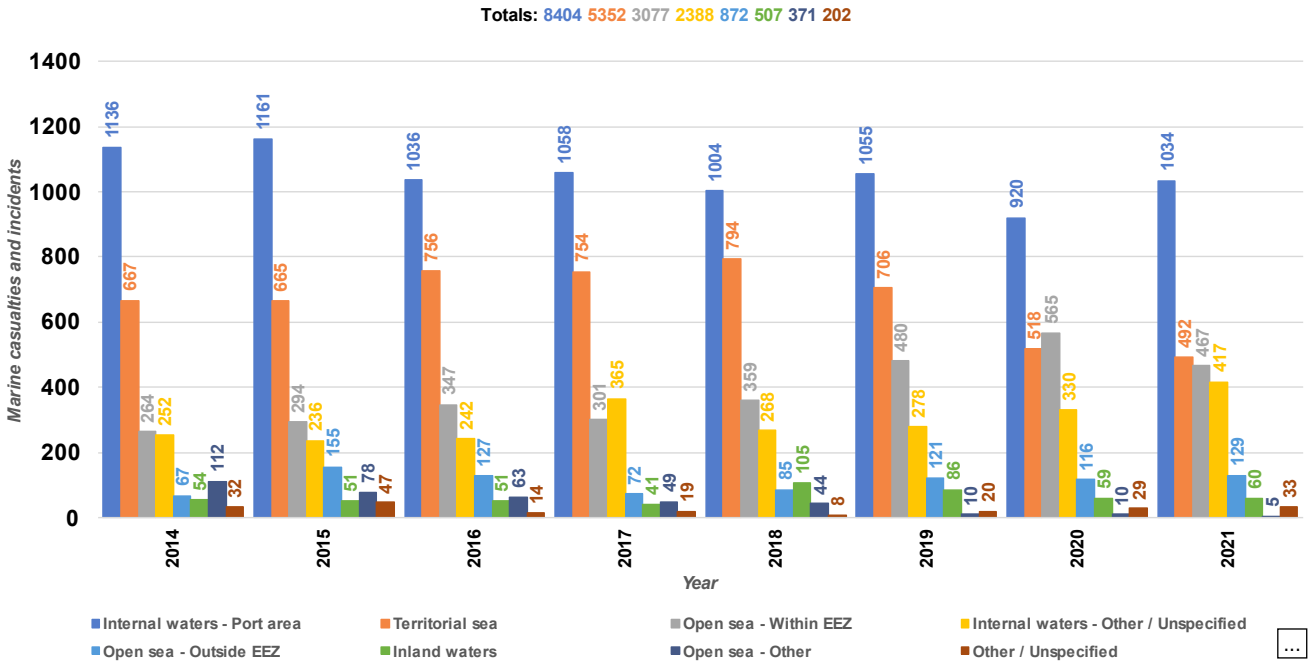
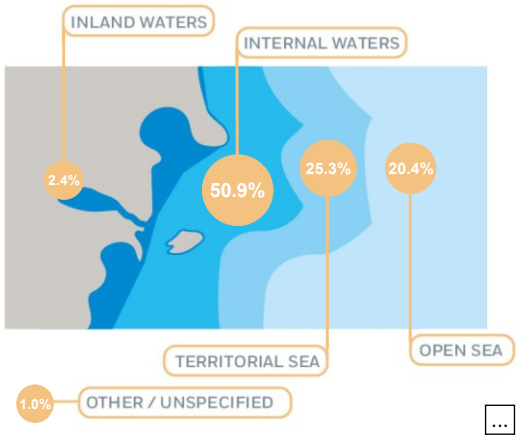



Figure 2.3–2 Percentage of marine casualties and incidents for the period 2014-2021, organized by navigational area




From 2014 to 2021 more than half of the reported marine casualties and incidents took place in the 'Internal waters' area, followed by 'Territorial sea' and the 'Open sea' ones. Furthermore, the sub-category 'Internal waters – port area' was the area with more occurrences.

In 2021, 'Internal waters' is the area with 55.0% of the reported marine casualties and incidents, and the sub-category 'Internal waters – port area' - represents 39.2% of the occurrences. 'Open sea' and 'Territorial sea' locations represent respectively 17.9% and 17.7% of the reported marine casualties and incidents.

Compared to 2020, there is an increase in the number of reported marine casualties and incidents in the 'Internal waters' area, while the occurrences in 'Open sea' and 'Territorial sea' areas decreased.

Occurrences by navigational area and ship types in the period from 2014 to 2021 will be analysed in the following figures.

*Photo credit by DMAIB/Denmark.*

Figure 2.3–3 Marine casualties and incidents from 2014-2021, organized by navigational area and ship type

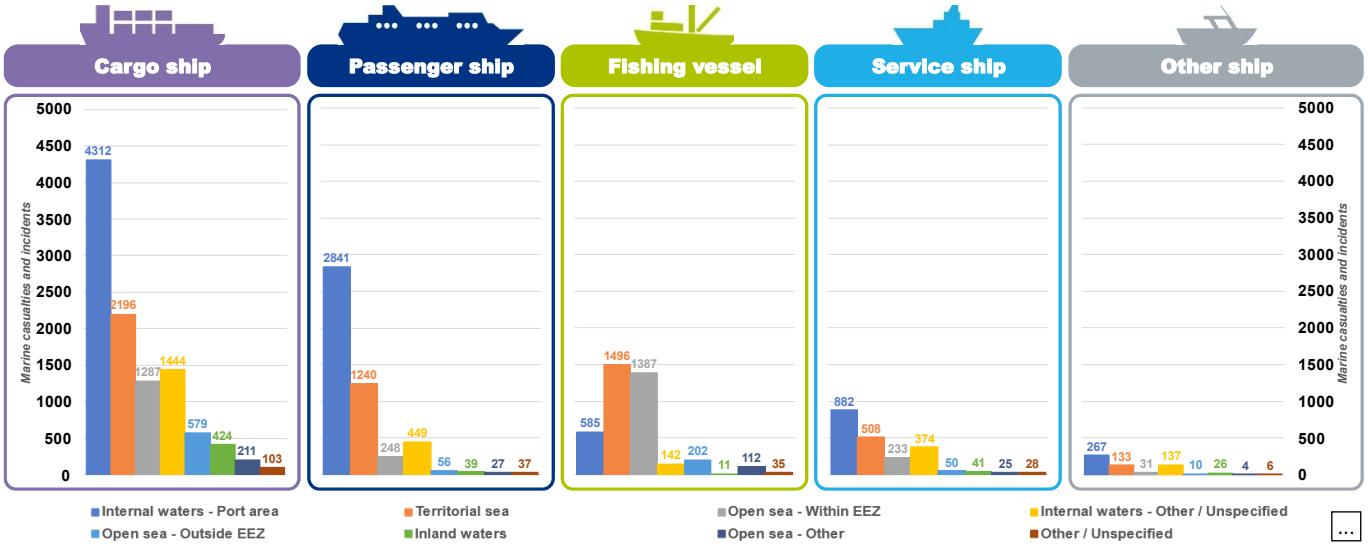
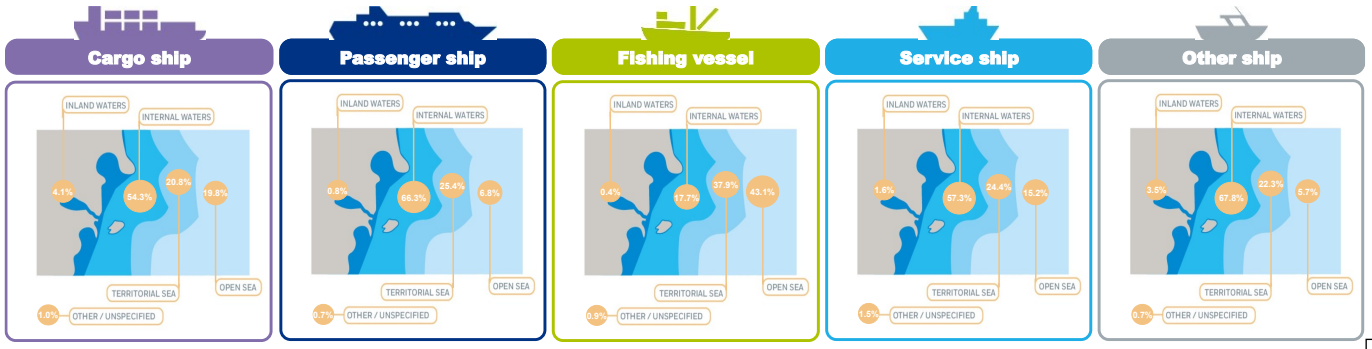
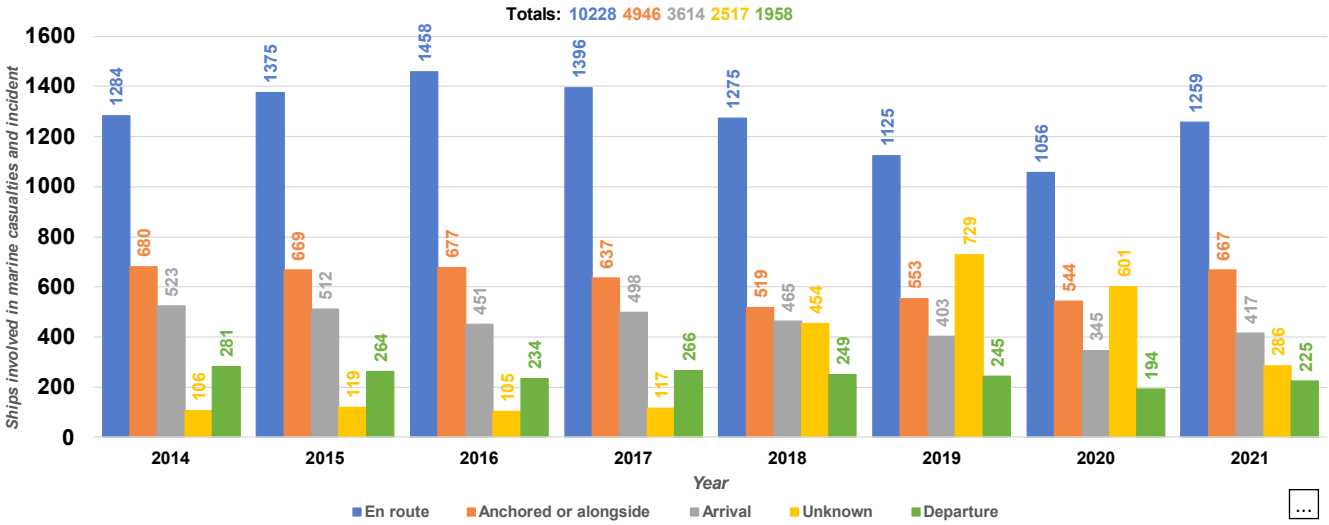



Figure 2.3–4 Percentage of marine casualties and incidents for the period 2014-2021, organized by navigational area and ship type




All the ship types, excepting fishing vessels, present the same trends commented previously for the period from 2014 to 2021. For fishing vessels, ‘Open sea’ area was where 43.1% of the marine casualties and incidents occur, 34.9% in ‘Open sea’ – within EEZ, followed by Territorial sea’ with 37.9% of the occurrences. Only 17.7% of the reported marine casualties and incidents for fishing vessels occurred in internal waters.

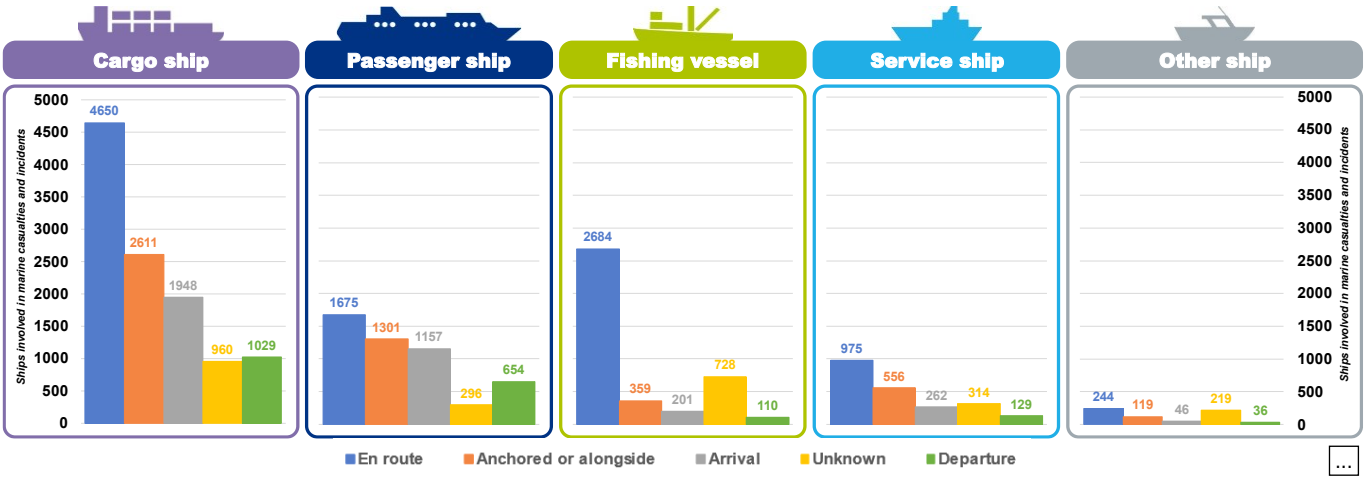
Figure 2.3–5 Evolution of marine casualties and incidents, organized by voyage segment



Considering the voyage segment where the marine casualty or accident happened over the years, while the 'Departure' was the segment over the years with the lowest average of 8.4%, 'en route' phase is the segment with the highest average of 44.0%. 'Anchored or alongside', when the ship was not sailing, is the second segment with more occurrences with an average of 21.3%.

Trends are the same in 2020 and 2021, but in 2021 there is an increase in the voyage segment 'en route' and a decrease in the voyage segment 'Anchored or alongside'.

Figure 2.3–6 Marine casualties and incidents from 2014-2021, organized by voyage segment and ship type

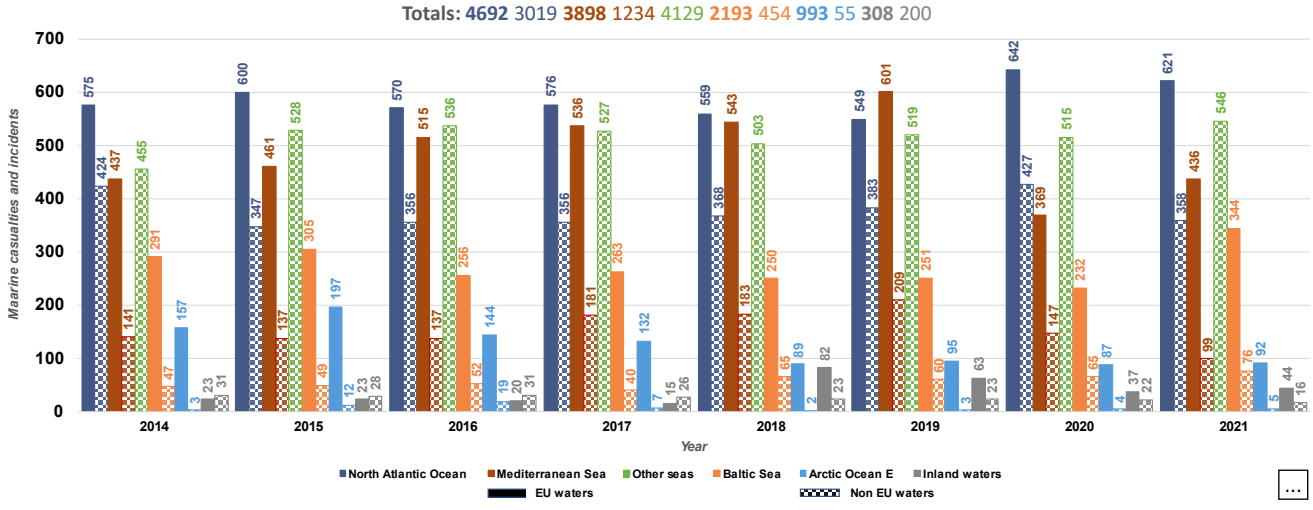



Conclusions obtained for Figure 2.1–1 are valid for all ship types, with only one peculiarity for fishing vessels where the average of casualties and incidents 'en route' reached 65.8%.

Five marine geographical areas are considered in Europe: North Atlantic Ocean, Mediterranean Sea, Baltic Sea, Artic Ocean East and Inland waters. In all these five regions it is possible to find EU waters and waters outside EU limits. All other marine geographical areas are considered as other seas.

The evolution of marine casualties is presented in a table and a map:

*Figure 2.3–7* Evolution of marine casualties and incidents, organized by geographical area



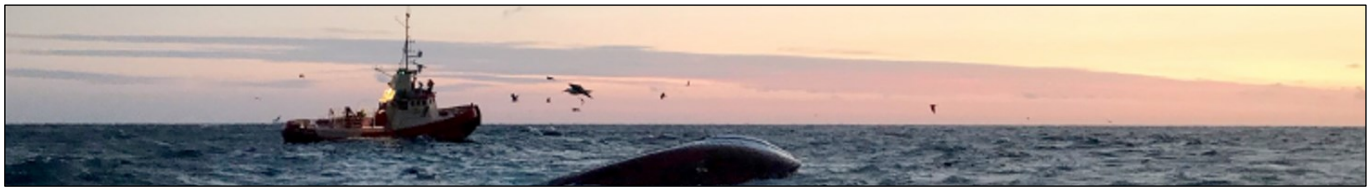
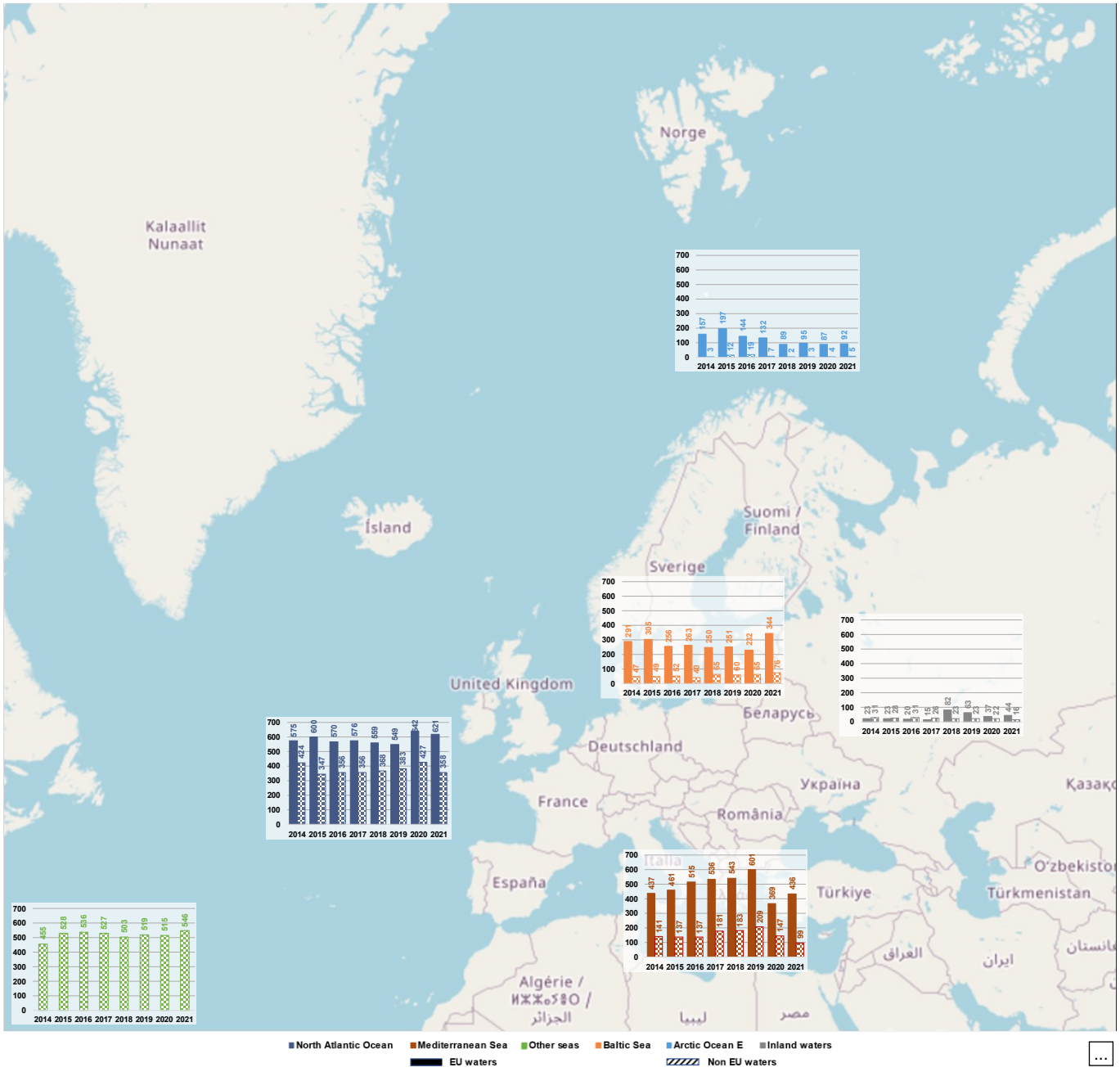



*Photo credit by DMAIB/ Denmark.*

*Figure 2.3–8* Map of marine casualties and incidents, organized by geographical area




Accidents and incidents in EU waters are distributed from high to low in North Atlantic Ocean (average 22.2%), Mediterranean Sea (average 18.4%), Baltic Sea (average 10.4%), Artic Ocean East (average 4.7%) and Inland waters (1.4%).

Accidents and incidents reported in EMCIP in non-EU waters are distributed from high to low in other seas (average 19.5%), North Atlantic Ocean (average 14.3%), Mediterranean Sea (average 5.8%), Baltic Sea (average 2.1%), Inland waters (average 0.9%) and Artic Ocean East (average 0.3%).

After a significative reduction of marine accidents and incidents in the Mediterranean Sea in 2020, the number of occurrences increased in 2021 reaching levels like in 2014.

In 2021 there is a significative increment in the number of marine accidents and incidents in the European waters of the Baltic Sea.

Analysing the data by geographical area and ship type the following map and figure were obtained.

*Figure 2.3–9* Map of marine casualties and incidents from 2014-2021, organized by geographical area and ship type

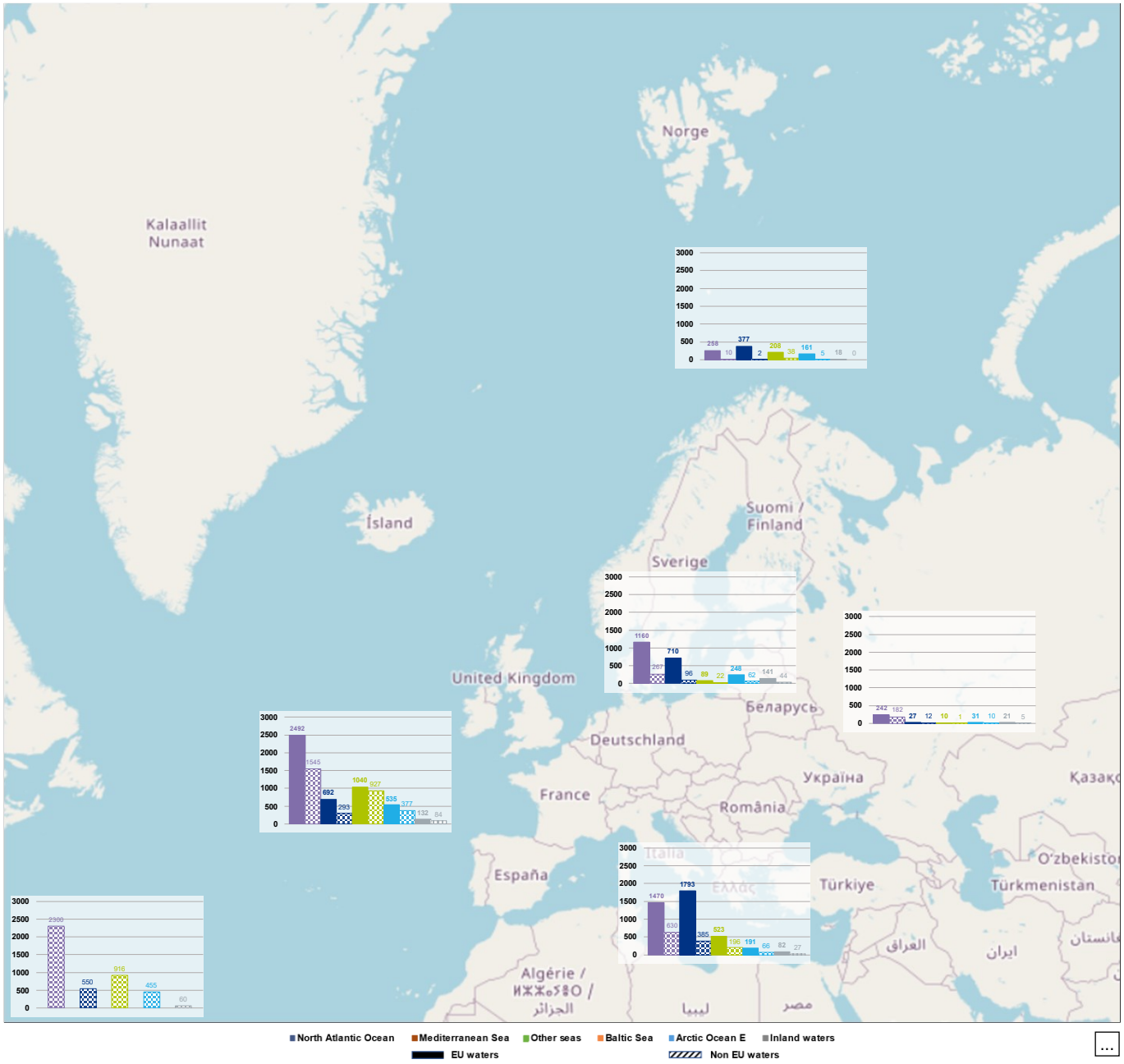
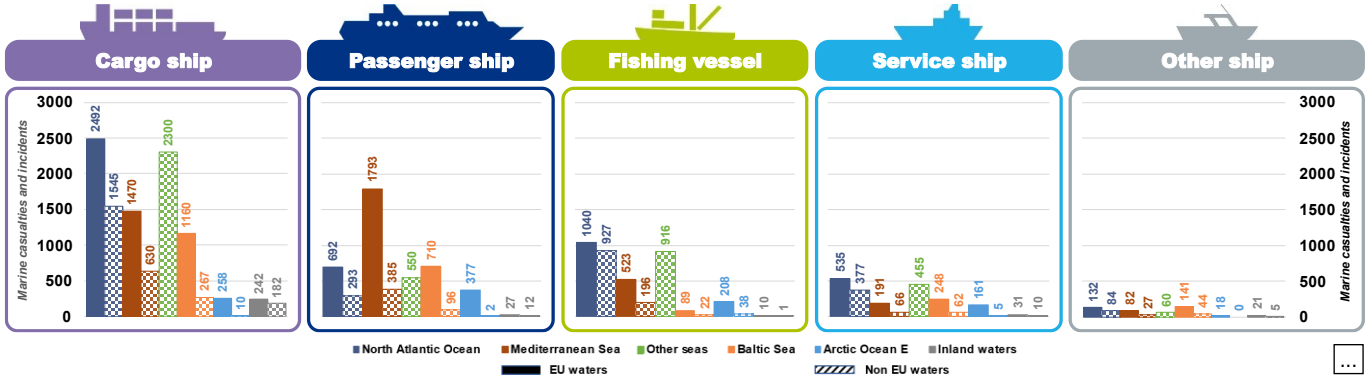



Figure 2.3–10 Marine casualties and incidents from 2014-2021, organized by geographical area and ship type

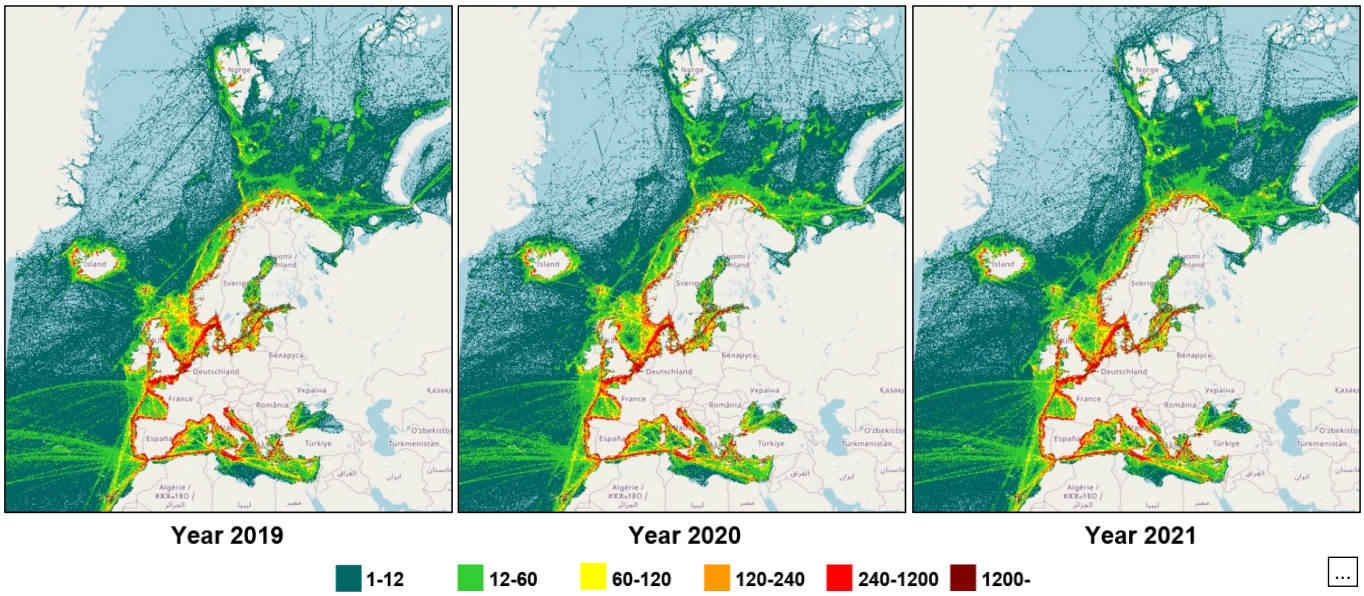


Marine casualties and accidents for all ship types, excepting passenger ships, have a similar distribution, following the same trends like in Figure 2.3–7 and Figure 2.3–8.

For passenger ships, significative increases in traffic were shown in Mediterranean Sea and Baltic Sea, as there are many passenger ships routes in those areas.

At this point, it is good to check the traffic density around Europe using the new traffic map functionality in EMCIP. Traffic density data is available only since 2019 so, only data from 2019, 2020 and 2021 will be shown.

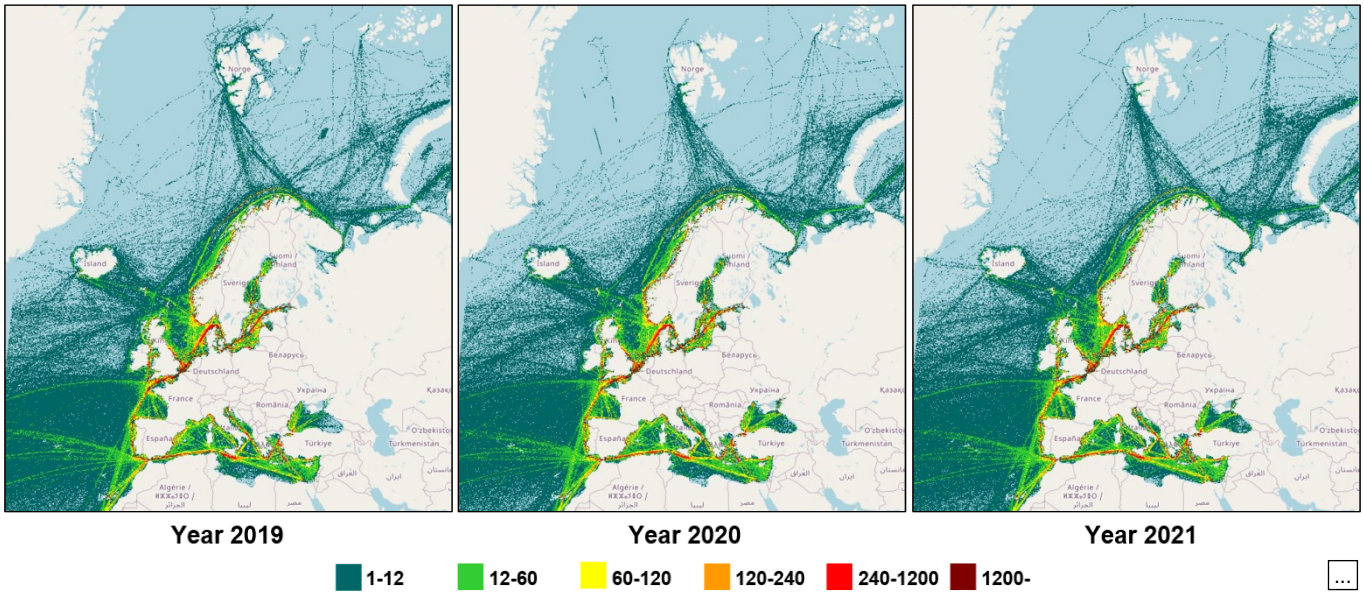
Figure 2.3–11 Traffic density around Europe in 2019, 2020 and 2021




With a small reduction in 2020 compared with 2019, global traffic density around Europe did not show many differences when comparing 2020 and 2021. COVID pandemic impact has not been very significative in the global traffic density.

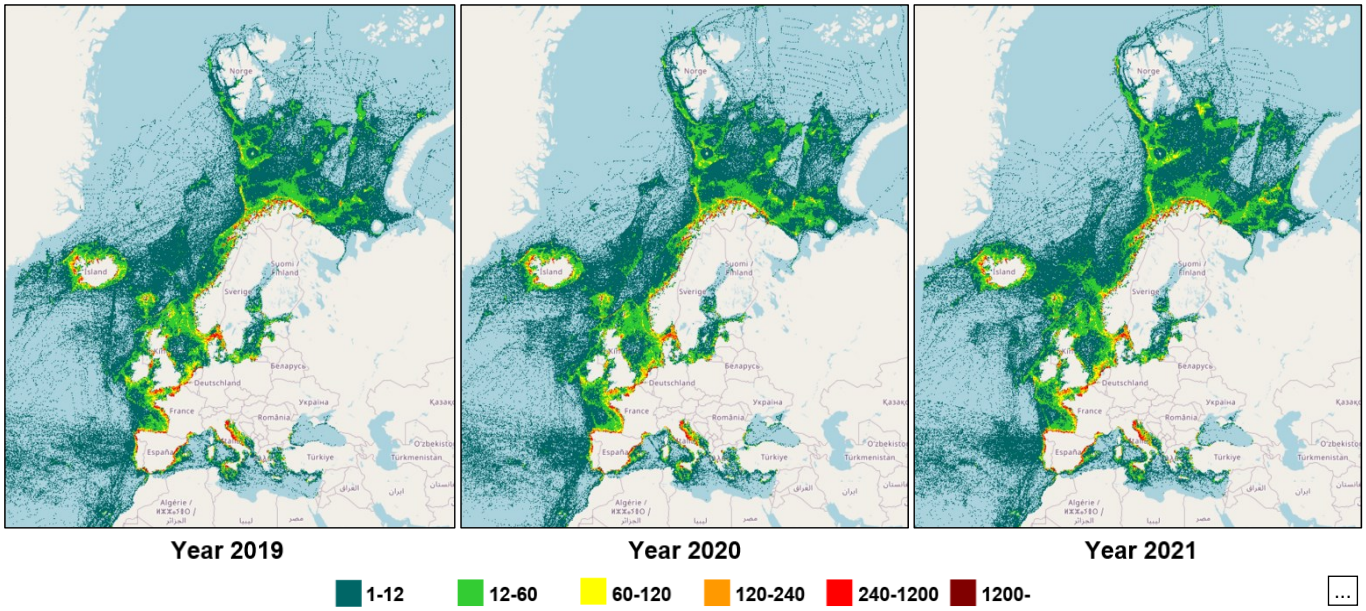
In the following figures the traffic will be analysed for cargo ships, fishing vessels and passenger ships.

Figure 2.3–12 Traffic density around Europe in 2019, 2020 and 2021 for cargo ships



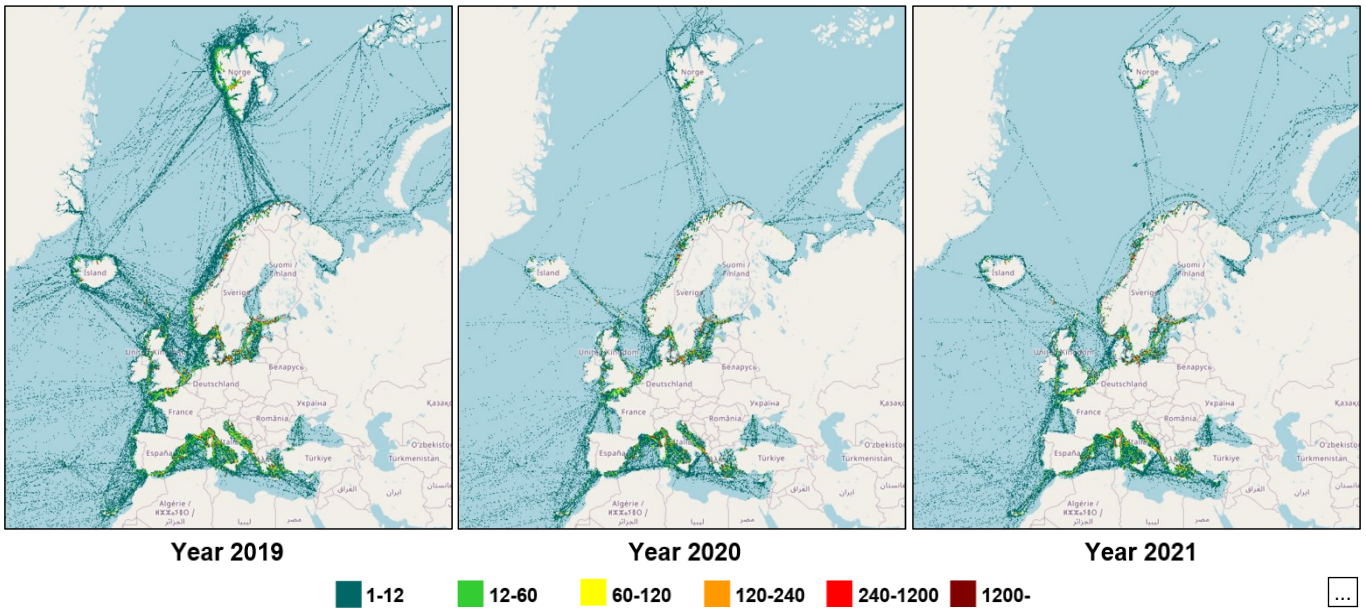
Traffic density around Europe for cargo ships did not change very much during years 2019, 2020 and 2021. Traffic density was high with some differences with the global traffic density. Differences with global traffic are very evident in the Northern areas where navigation was mainly for fisheries.

Figure 2.3–13 Traffic density around Europe in 2019, 2020 and 2021 for fishing vessels




Traffic density around Europe for fishing vessels did not change significatively the years 2019, 2020 and 2021.

Figure 2.3–14 Traffic density around Europe in 2019, 2020 and 2021 for passenger ships




In 2021, traffic density around Europe for passenger ships is significatively lower than traffic density for cargo ships or fishing vessel. Traffic density decreased for passenger ships in 2020, as an effect of COVID 19 pandemic, and increased again in 2021, but without reaching the levels of 2019.

Comparing traffic densities for cargo ships, Figure 2.3–12, fishing vessels, Figure 2.3–13, and passenger ships, Figure 2.3–14, the number of marine casualties and incidents in passenger ships was relatively high.

## 2.4 Safety investigations and investigation reports

This section describes the activities undertaken by the investigative bodies of EU Member States regarding the investigations performed and reports published.

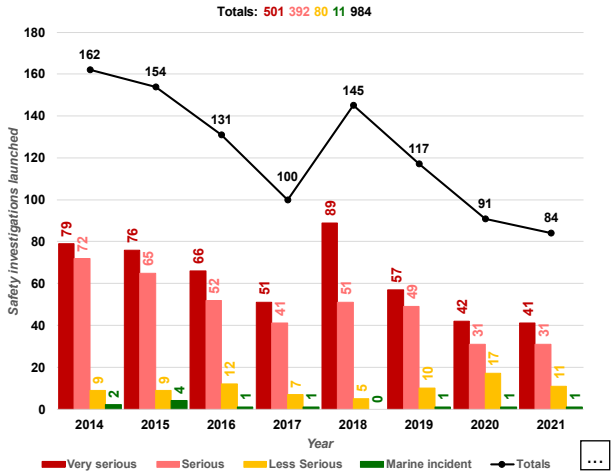
Art. 2.4 of Reg.(EC) 1406/2002 as amended, provides that the Agency shall carry out analysis of safety investigation reports with a view to identifying added value at Union level in terms of any relevant lessons to be drawn.

Based on the content of the investigation reports in EMCIP, EMSA has already carried out three analysis studies on marine casualties and incidents involving, respectively, fishing vessels, Ro-Ro ships and container ships.

These studies are available on the EMSA website at:

| | |
|---|---|
| Fishing vessels: | https://www.emsa.europa.eu/publications/reports/item/3253 |
| Ro-Ro ships: | https://www.emsa.europa.eu/publications/reports/item/3388 |
| Container ships: | https://www.emsa.europa.eu/publications/reports/item/4276 |

Figure 2.4–1 Evolution of number of safety investigations launched, organized by severity



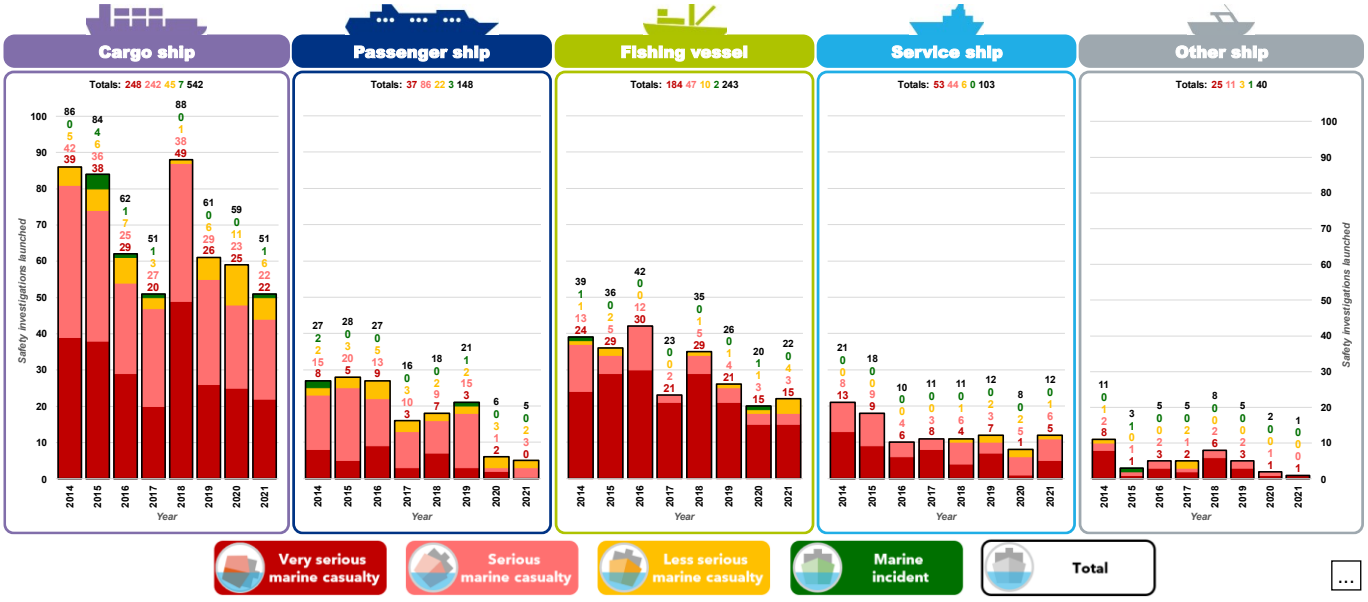

The total number of safety investigations launched in the period from 2014 to 2021 is 984. There is a decreasing trend in the period, with the exceptions of years 2018 and 2019.

The evolution of the number of safety investigations launched, organized by severity, can be compared with the total number of reported marine casualties and incidents, organized by severity, in Figure 2.1–1.

In the period from 2014 to 2021, on average, a safety investigation has been launched for 85.2% of the very serious marine casualties, for 6.4% of the serious marine casualties, for 0.7% of the less serious marine casualties and for 0.4% of the marine incidents.

In 2021 a safety investigation has been launched for 78.8% of the very serious marine casualties, for 4.3% of the serious marine casualties, for 0.8% of the less serious marine casualties and for 0.2% of the marine incidents.

Figure 2.4–2 Evolution of number of safety investigations launched, organized by severity and ship type

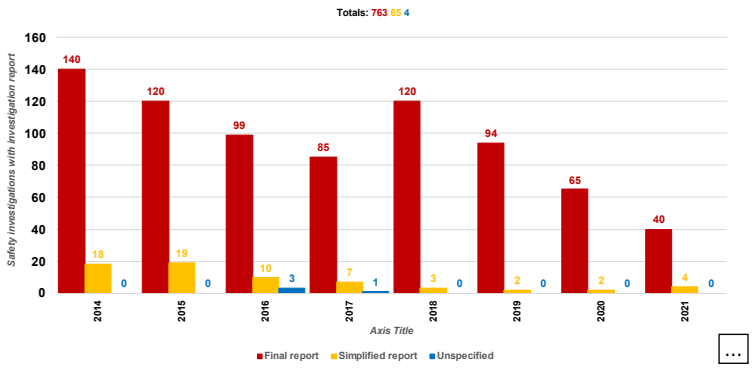


The evolution of the number of safety investigations launched, organized by severity and ship type, can be compared with the total number of reported marine casualties and incidents, organized by severity and ship type, in Figure 2.1–2.

In the period from 2014 to 2021, in average, a safety investigation has been launched:

- for 87.0% of the very serious marine casualties, for 9.4% of the serious marine casualties, for 0.8% of the less serious marine casualties and for 0.3% of the marine incidents in cargo ships;
- for 74.0% of the very serious marine casualties, for 8.3% of the serious marine casualties, for 0.7% of the less serious marine casualties and for 0.6% of the marine incidents in passenger ships;
- for 84.8% of the very serious marine casualties, for 2.3% of the serious marine casualties, for 0.7% of the less serious marine casualties and for 1.0% of the marine incidents in fishing vessels;
- for 89.8% of the very serious marine casualties, for 7.6% of the serious marine casualties, for 0.5% of the less serious marine casualties and for 0.0% of the marine incidents in service ships; and
- for 80.6% of the very serious marine casualties, for 9.7% of the serious marine casualties, for 0.8% of the less serious marine casualties and for 1.2% of the marine incidents in other ships.

Figure 2.4–3 Evolution of number of safety investigations with investigation report, organized by report type




91.6% of the investigation reports are final reports, only an 8% are simplified reports and very few are unspecified in EMCIP database.

In 2021, the number of final reports is reduced and the number of simplified increases, in comparison with 2020. Nevertheless, it is to note that the data was extracted the 1st of July 2022 and some investigation reports from 2021 are still pending.

When comparing the investigation report types for the different ship types, it shows that cargo ships have the greater number of investigation reports, mainly final reports, followed by fishing vessels, passenger ships, service ships and finally other ships.

Figure 2.4–4 Evolution of number of safety investigations with investigation report, organized by report type and ship type

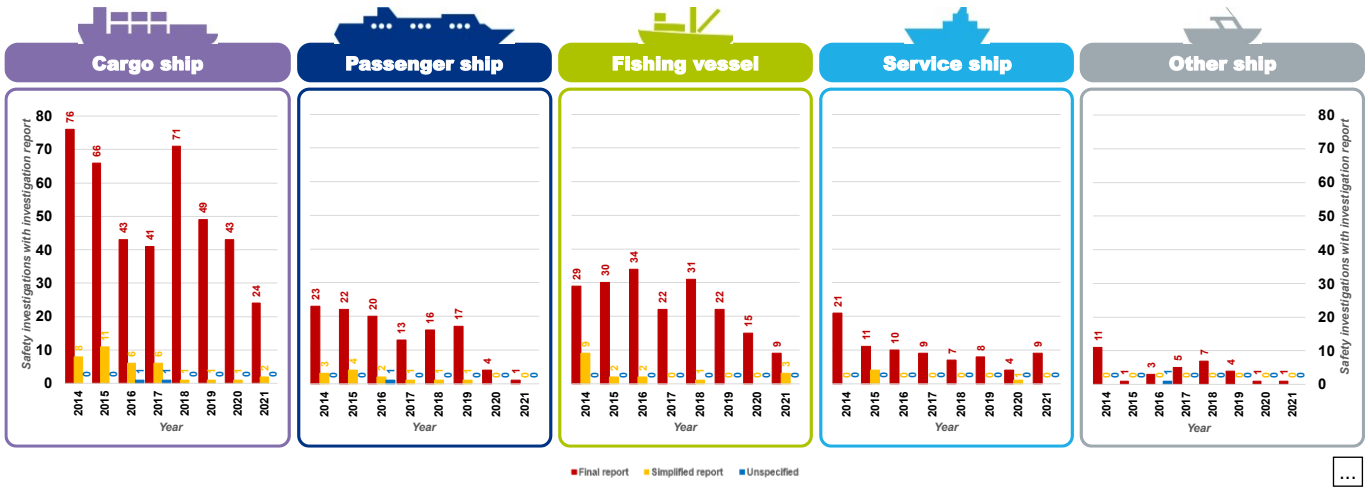



*Photo credit by DMAIB/Denmark.*

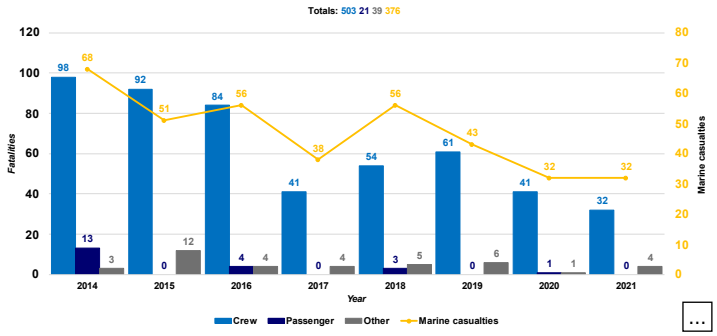
# 2.5 Consequences of marine casualties and incidents

This section contains information about the consequences of casualties to ships, persons, and the environment.

## 2.5.1 Consequences to persons

### *2.5.1.1 Fatalities*

Figure 2.5–1 Evolution of fatalities, organized by category of the person on board




In the period from 2014 to 2021 the total number of reported fatalities in marine casualties and incidents is 563, for 376 marine casualties, with a decreasing trend in the period.

The average in the period from 2014 to 2021 is of 70 fatalities per year. The higher value was reached in 2014 with 114 fatalities and the lower value is in 2021 with 36 fatalities.

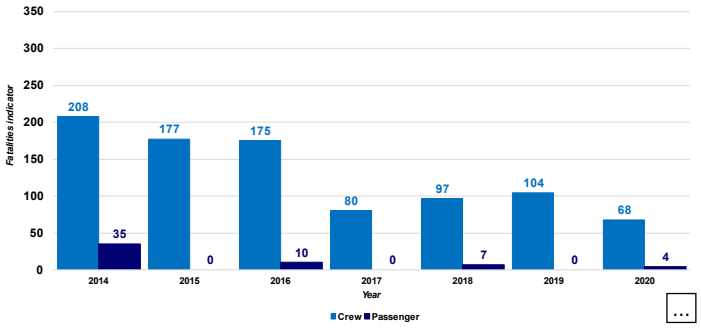
Attending to the category of the person on board crew members represent 89.3%, other kind of person on board 7.0% and passengers 3.7% of the total fatalities.

To have a better understanding of the risk of a fatality on board it is good to use an indicator, dividing the number of fatalities in every category of person on board by the number of persons in that category.

Every year EMSA publish the seafarers' statistics in EU. These statistics are based in the STCW Information System and provide data only for seafarers with STCW certification. This was the source of information for the analysis so, excepting for the fishermen, only crew with STCW certification considered by the EU Member States (EU 27 and EEA EFTA States) was included for the analysis.

- Number of fishermen in EU were only estimations.
- Official data for passengers in 2021 has not been published by Eurostat.
- When this document was published data about seafarers and fishermen for 2021in EU was not available so, 2021 was not considered in this analysis.
- It was not possible to determine the number of other kinds of person on board, so it was not considered in the analysis.

Figure 2.5–2 Evolution of fatalities indicator, organized by category of the person on board




Fatalities indicator is obtained following the methodology described in Appendix 5.

Fatalities indicator is somehow providing an estimation on how many fatalities occurred per one million persons of the category on board EU fleet.

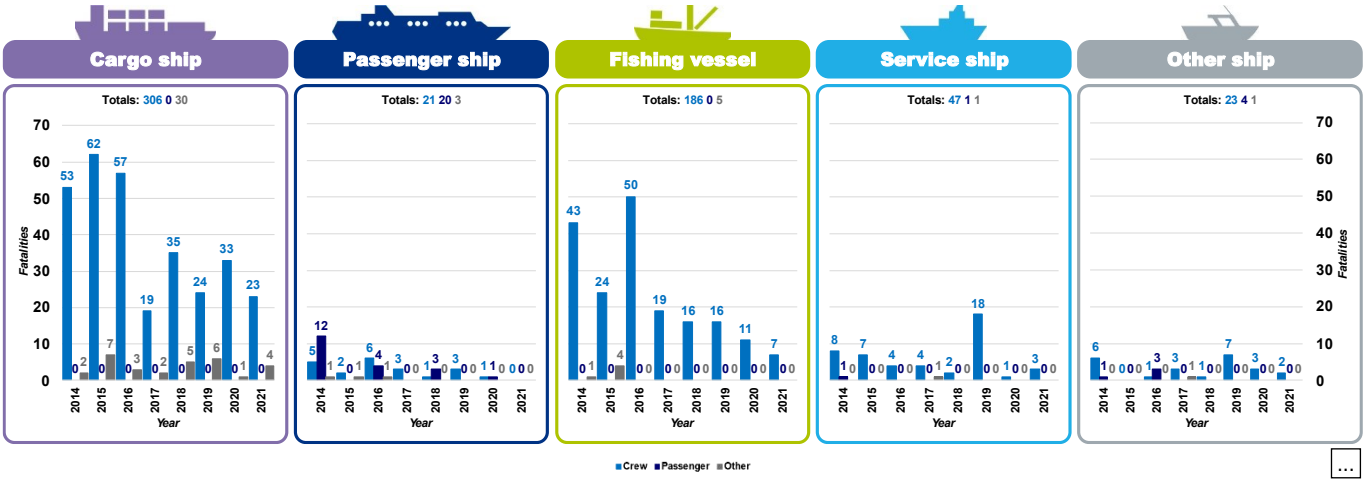
The trend is the same that the one showed in Figure 2.5–1. The risk to have a fatality is on average, 16.0 times lower for passengers and crew members, with a minimum of 6.0 times lower in 2014 and a practical maximum of 17.5 times lower in 2016.

Fatalities indicator shows a decreasing trend in the period from 2014 to 2020.

*Photo credit by DMAIB/Denmark.*

The evolution of fatalities in marine casualties and incidents can be analysed for the different ship types.

Figure 2.5–3 Evolution of fatalities, organized by category of the person on board and ship type

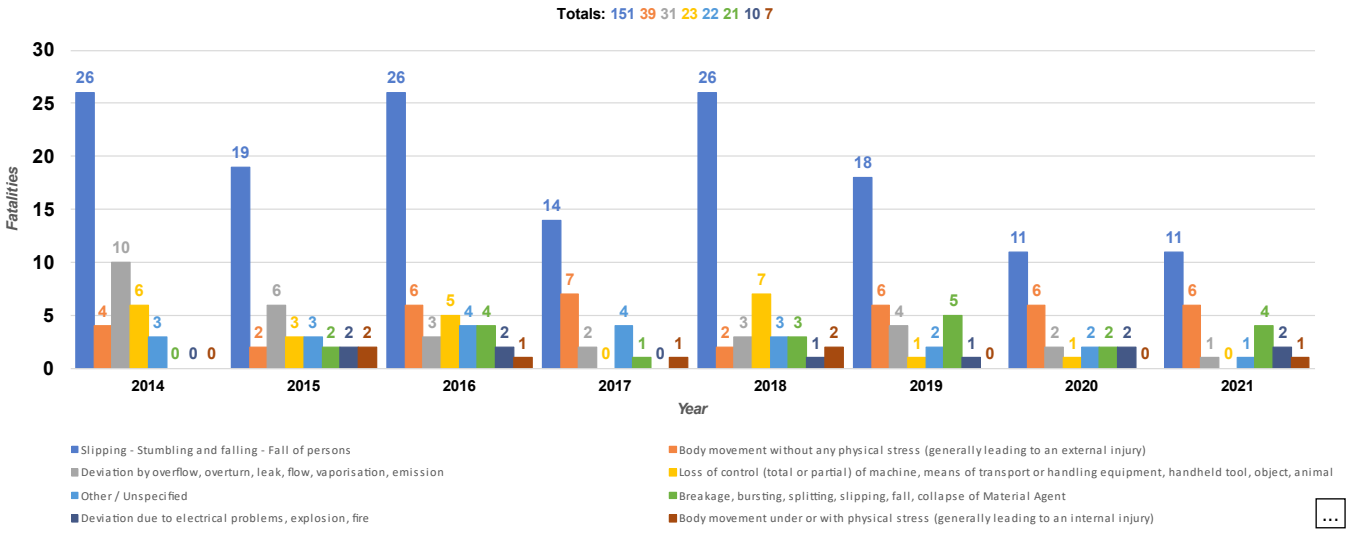



Overall fatalities were decreasing over the years, through 2014 to 2021, for all ship types, but this tendency was not constant.

Fatalities in passengers are only detected, as expected, in passenger ships and some ships declared as other ships. The number of fatalities in passengers was higher than the number of fatalities in crew only in years 2014 and 2018.

Occurrences with persons are classified by deviation, as explained in Appendix 1.

Figure 2.5–4 Evolution of fatalities in occurrences with persons, organized by deviation



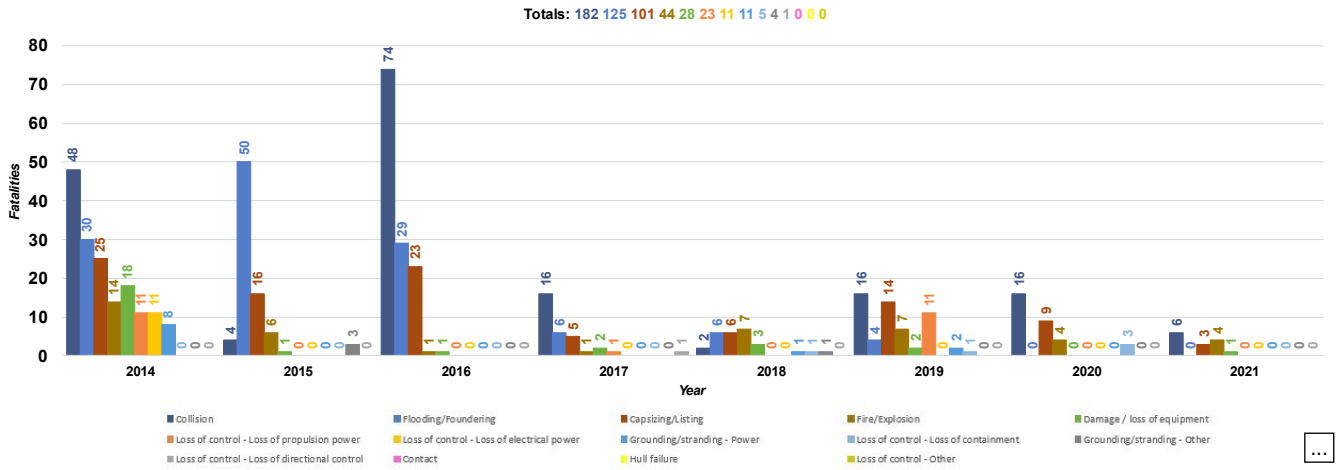

The total number of reported deviations for fatalities in occurrences with persons in the period from 2014 to 2021 is 304.

Slipping - stumbling and failing - fall of person was by far the main deviation. It caused 151 fatalities, 49.7% of the total, over the period from 2014 to 2021. Among the falls, the subcategory ‘Fall overboard’ is responsible for 91 fatalities and the subcategory ‘Fall of person to a lower level’ is responsible for 51 fatalities.

The second deviation is ‘Body movement without any physical stress (generally leading to an external injury)’. It has caused 39 fatalities, 12.8% of the total.

Occurrences with ships are catalogued by casualty event type, as explained in Appendix 1.

Figure 2.5–5 Evolution of fatalities in occurrences with ships, organized by casualty event type




The total number of reported casualty event types for fatalities in occurrences with ships in the period from 2014 to 2021 is 535.

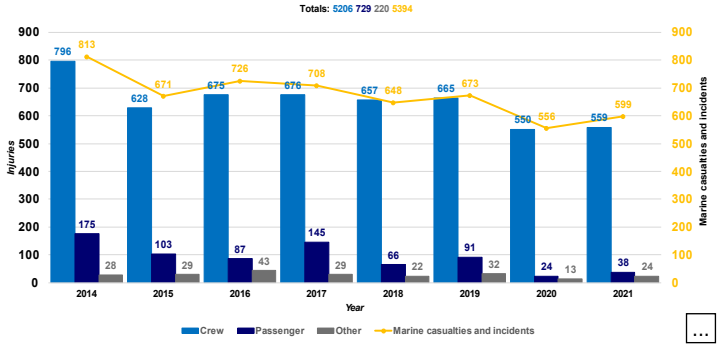
Fatalities mainly occurred during ‘Collisions’ and ‘Flooding/foundering’, represent respectively 34.0% and 23.4% of the fatalities. These two casualty event types represent together the 57.4% of the fatalities. Collisions were exceptionally low in years 2015 and 2018.

Capsizing/listing is the next casualty event with the 18.9% of the fatalities.

In the year 2014 there were exceptionally many casualty events with type damage/loss of equipment.

### *2.5.1.2 Injuries*

Figure 2.5–6 Evolution of injuries, organized by category of the person on board




In the period from 2014 to 2021 the total number of reported injuries is 5,394 marine casualties and incidents is 6,155, with a decreasing trend in the period.

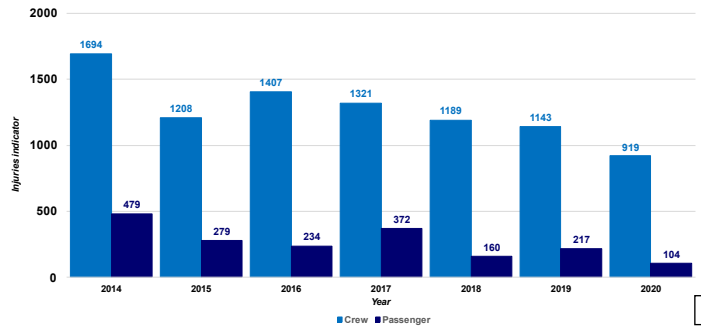
The average in the period from 2014 to 2021 is 769 injuries per year. The higher value was reached in 2014 with 999 injuries and the lower value was in 2020 with 587 injuries. The total number of injuries in 2021 is of 621, a little higher than in 2020.

Attending to the category of the person on board crew members represent 84.6%, passengers 11.8% and other kind of person on board 3.6% of the total injuries.

To have a better understanding of the risk of an injury on board it is good to use an indicator, dividing the number of injuries in every category of person on board by the number of persons in that category.

- Every year, EMSA publishes the seafarers’ statistics in EU. These statistics are based in the STCW Information System and provide data only for seafarers with STCW certification. These are the sources of information for this analysis so, excepting for the fishermen, only crew with STCW certification considered by the EU Member States (EU 27 and EEA EFTA States) is included for this analysis.
- Number of fishermen in EU are only estimations.
- Official data for passengers in 2021 has not been published by Eurostat.
- When this document was published data about seafarers and fishermen for 2021in EU was not available so, 2021 was not considered in this analysis.
- It was not possible to determine the number of other kinds of person on board, so it is also not considered in this analysis.

Figure 2.5–7 Evolution of injuries indicator, organized by category of the person on board




Injuries indicator is obtained following the methodology described in Appendix 5.

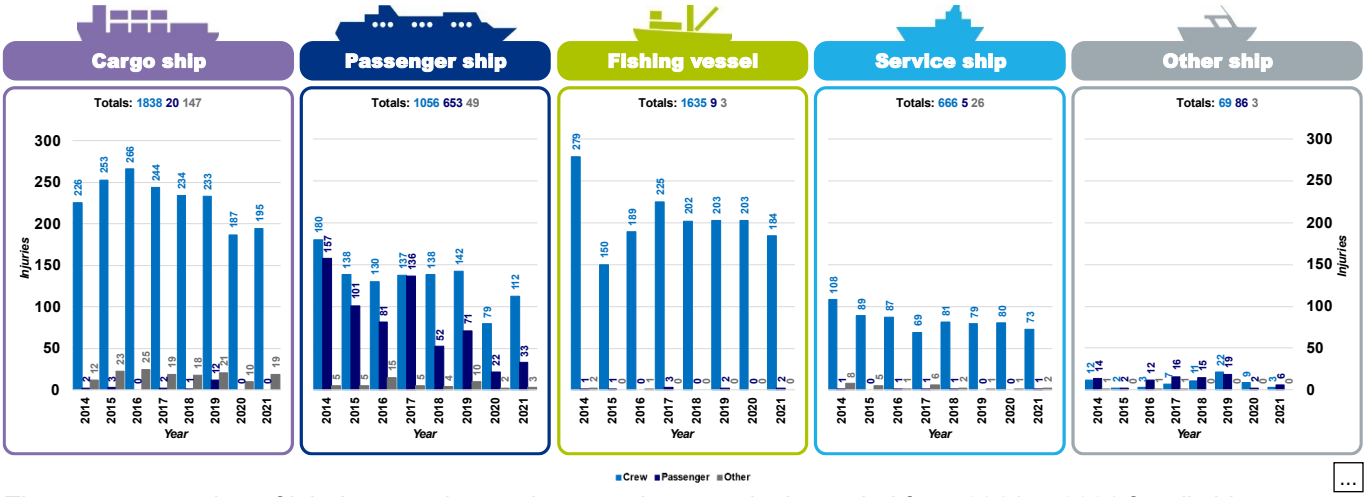
Injuries indicator is somehow, providing an estimation on how many injuries occurred per one million persons of the category on board EU fleet.

The trend is the same showed in Figure *2.5–6*. The risk to have an injury is, in average, 4.8 times lower for passengers than for crew members, with a minimum of 3.5 times lower in 2014 and a maximum of 8.8 times lower in 2020.

Injuries indicator shows a decreasing trend in the period from 2014 to 2020.

The evolution of injuries in marine casualties and incidents can be analysed for the different ship types.

Figure 2.5–8 Evolution of injuries, organized by category of the person on board and ship type



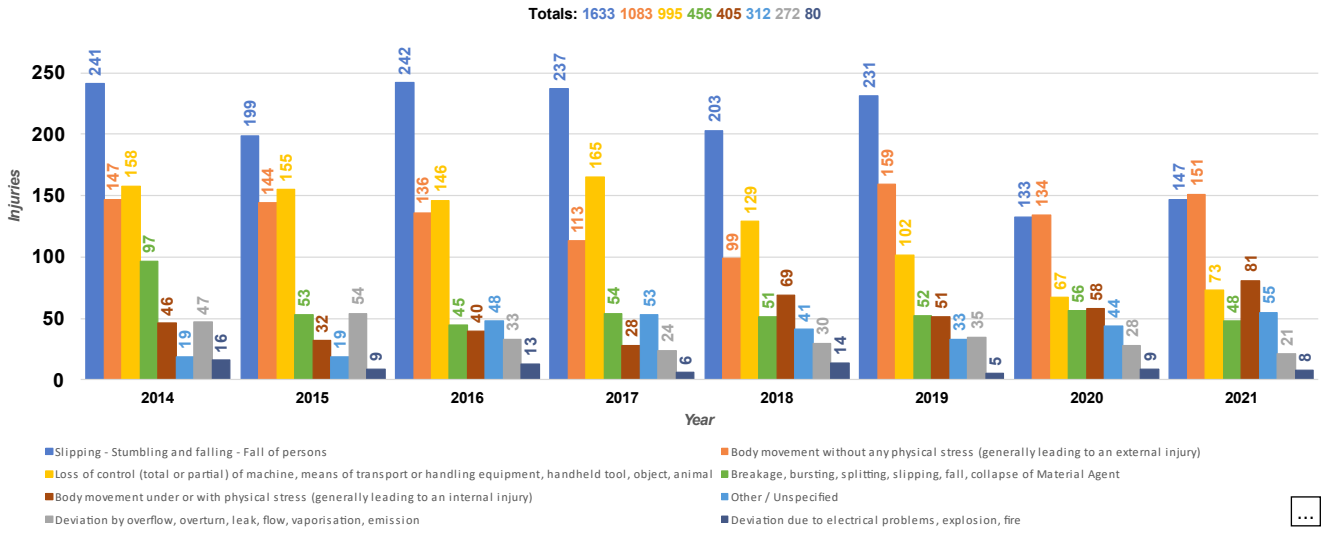

The average number of injuries was decreasing over the years in the period from 2014 to 2021 for all ship types, but the tendency is not constant.

Injured passengers are only detected, as expected, in passenger ships and some ships declared as other ships. The number of injured passengers is lower than the number of injured crew members in all the period from 2014 to 2021, but there was an exception in year 2017 when they were very similar.


*Photo credit by AIN/Croatia.*

Occurrences with persons are classified by deviation, as explained in Appendix 1.

Figure 2.5–9 Evolution of injuries in occurrences with persons, organized by deviation



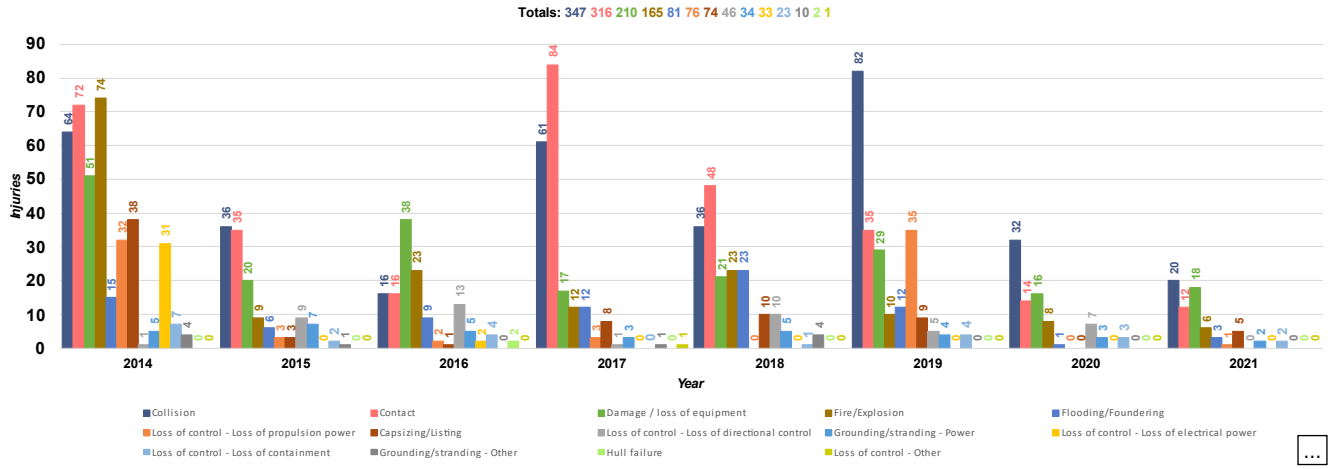

The total number of reported deviations for injuries in occurrences with persons in the period from 2014 to 2021 is 5,236.

'Slipping - stumbling and failing - fall of person' is by far the main deviation as it is for the fatalities. It caused 1,633 injuries, 31.2% of the total, over the period from 2014 to 2021. Among the falls, the subcategories (not included in the graphic for simplification) 'Fall of a person on the same level' is responsible for 809 injuries and 'Fall of person to a lower level' is responsible for 702 injuries.

The second deviation is 'Body movement without any physical stress (generally leading to an external injury)', as it is for the fatalities. It caused 1,083 injuries, 20.7% of the total.

Occurrences with ships are classified by casualty event type, as explained in Appendix 1.

Figure 2.5–10 Evolution of injuries in occurrences with ships, organized by casualty event type



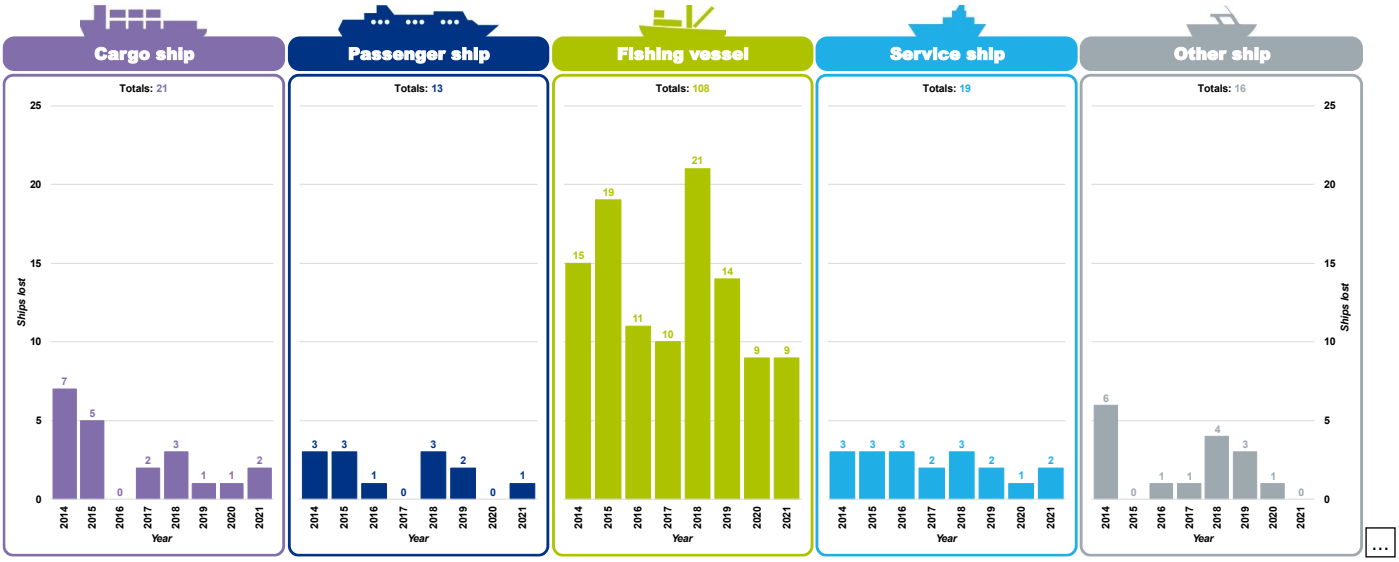

The total number of reported casualty event types for injuries in occurrences with ships in the period from 2014 to 2021 is 1,418.

There is, at least, one injury for all the casualty event types. Injuries mainly occurred during 'Collisions', 'Contacts', 'Damages or loss of equipment' and 'Fire/explosion', with 347 (24.5%), 316 (22.3%), 210 (14.8%) and 165 (11.6%) total injuries. 'Flooding and foundering', being one of the two most important casualty event types for fatalities, is the next casualty event with 81 (5.7%) total injuries.

There were exceptionally high values for the injuries related to contacts in 2017 and to the injuries related to collisions in 2019.

## 2.5.2 Consequences to ships

Figure 2.5–11 Evolution of ships lost, organized by ship type

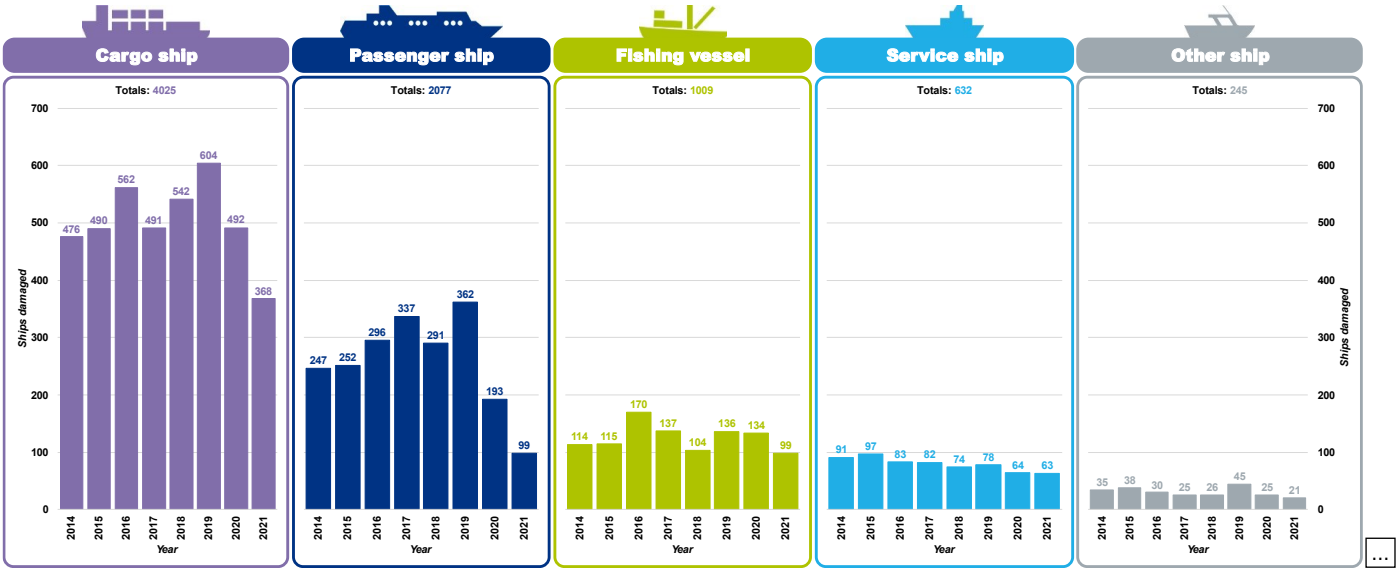



The total number of ships lost in the period from 2014 to 2021 is 177.

There is, a non-linear decreasing trend in the number of ships lost for all the ship types in the period from 2014 to 2021.

Fishing vessels represent 61.0% of the ships lost in the period from 2014 to 2021. This trend has been maintained over the years with a minimum of 44.1% in 2014 and a maximum of 75% in 2020. In 2021 fishing vessels are the 64.3% of the ships lost.

Figure 2.5–12 Evolution of ships damaged, organized by ship type

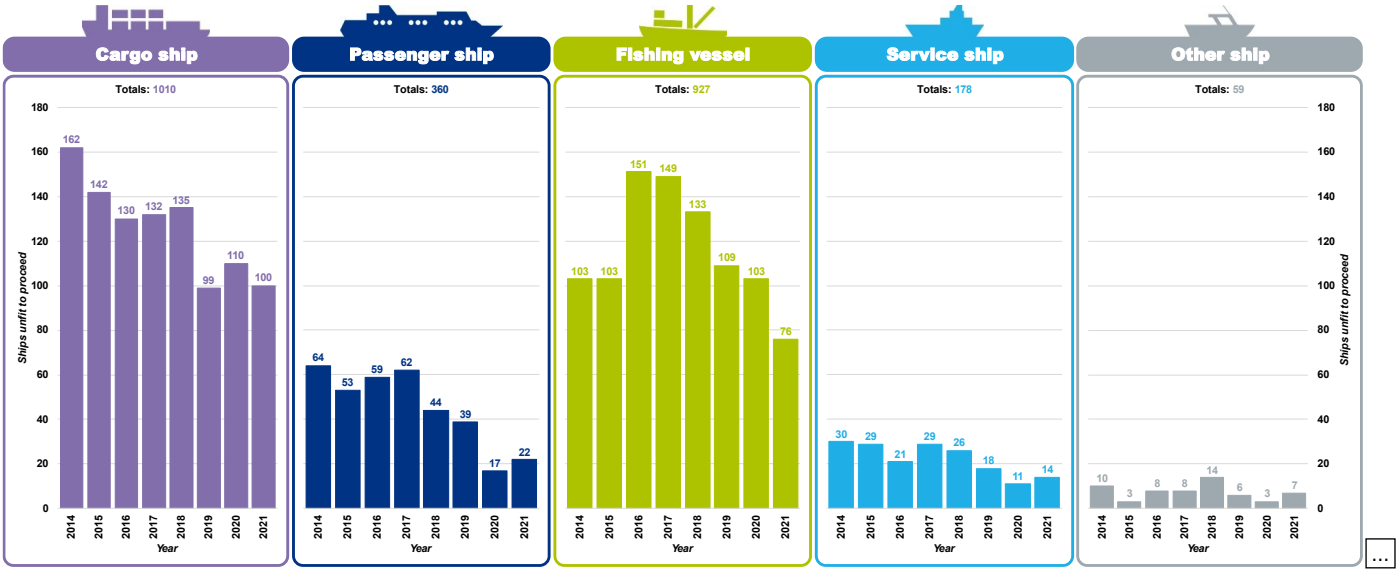



The total number of ships damaged in the period from 2014 to 2021 is 7,988.

There is a decreasing trend in the number of ships damaged for all the ship types since 2014.

50.4% of the damaged ships are cargo ships, 26.0% passenger ships, 12.6% fishing vessels, 7.9% service ships and 3.1% other ships.

Figure 2.5–13 Evolution of ships considered unfit to proceed, organized by ship type

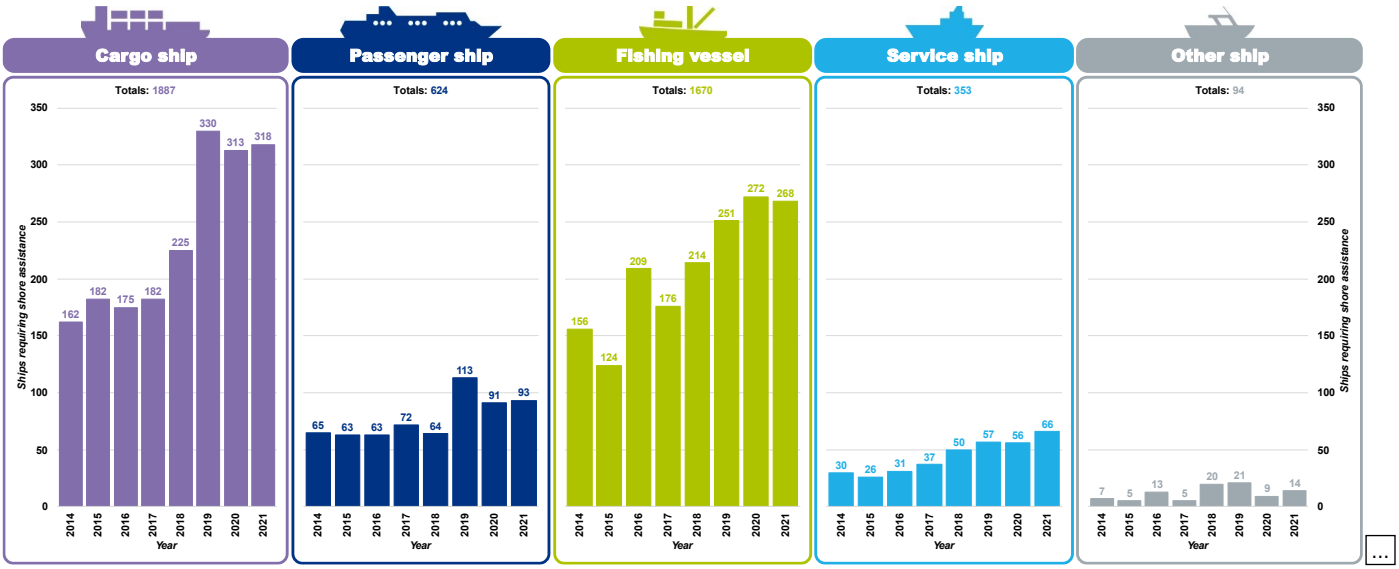



The total number of ships considered unfit to proceed in the period from 2014 to 2021 is 2,534.

There is a decreasing trend in the number of ships considered unfit to proceed for all the ship types since 2014.

Fishing vessels are close to cargo ships as regards the number of ships considered unfit to proceed. 39.9% of the ships unfit to proceed are cargo ships, 36.6% fishing vessels, 14.2% passenger ships, 7.0% service ships and 2.3% other ships.

Figure 2.5–14 Evolution of ships requiring shore assistance, organized by ship type

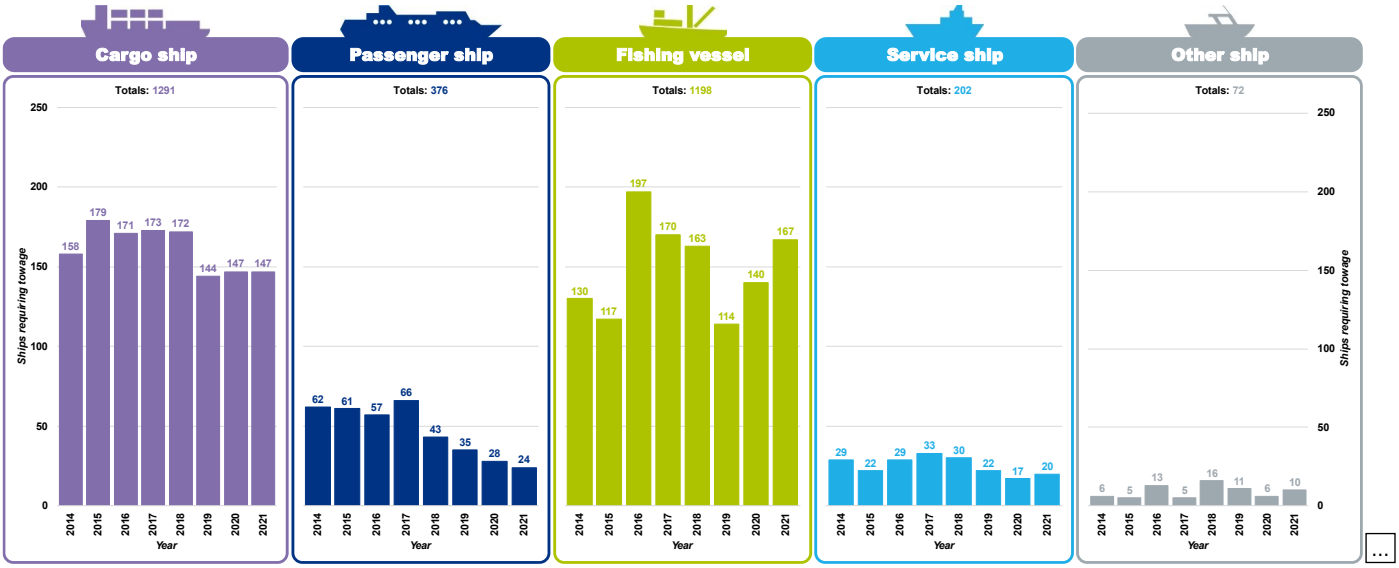



The total number of ships requiring shore assistance in the period from 2014 to 2021 is 4,628.

There is an increasing trend in the number of ships requiring shore assistance for all the ship types since 2014.

Fishing vessels are close to cargo ships in the number of ships requiring shore assistance. 40.8% of the ships requiring shore assistance were cargo ships, 36.1% fishing vessels, 13.5% passenger ships, 7.6% service ships and 2.0% other ships.

Figure 2.5–15 Evolution of ships requiring towage, organized by ship type

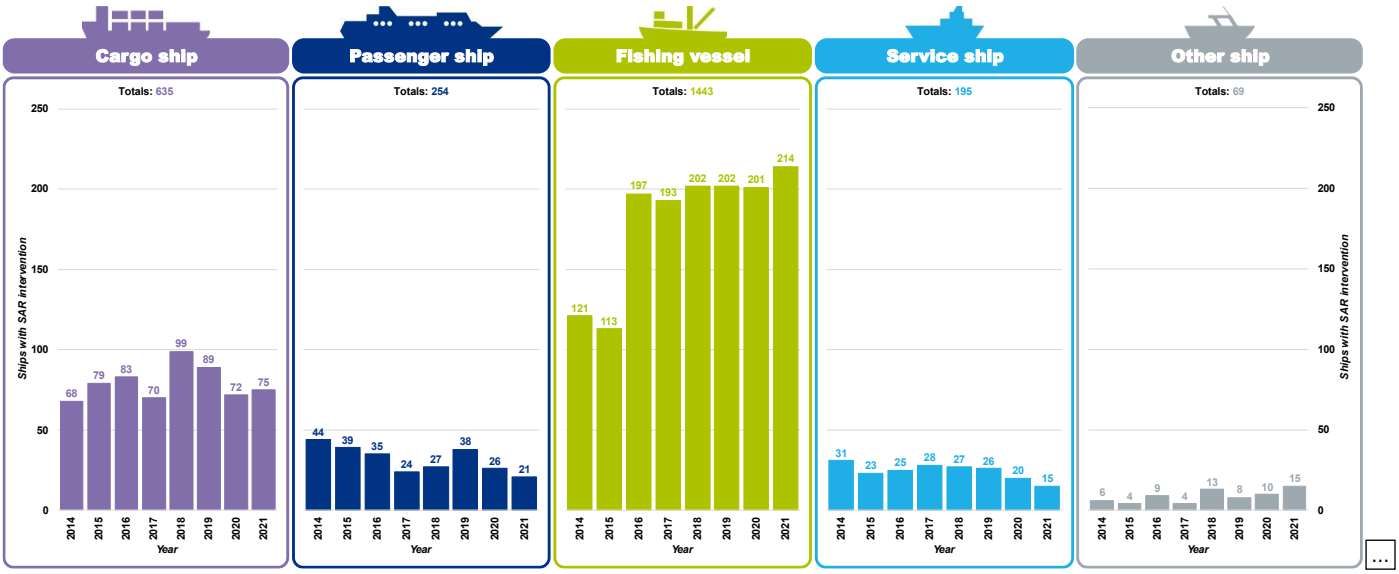



The total number of ships requiring towage in the period from 2014 to 2021 is 3,139.

There is a decreasing trend in the number of ships requiring towage for cargo ships and passenger ships and an increasing trend for fishing vessels, since 2014.

Fishing vessels are close to cargo ships in the number of ships requiring towage. 41.1% of the ships requiring towage are cargo ships, 38.2% fishing vessels, 12.0% passenger ships, 6.4% service ships and 2.3% other ships.

Figure 2.5–16 Evolution of Search and Rescue (SAR) operations, organized by ship type

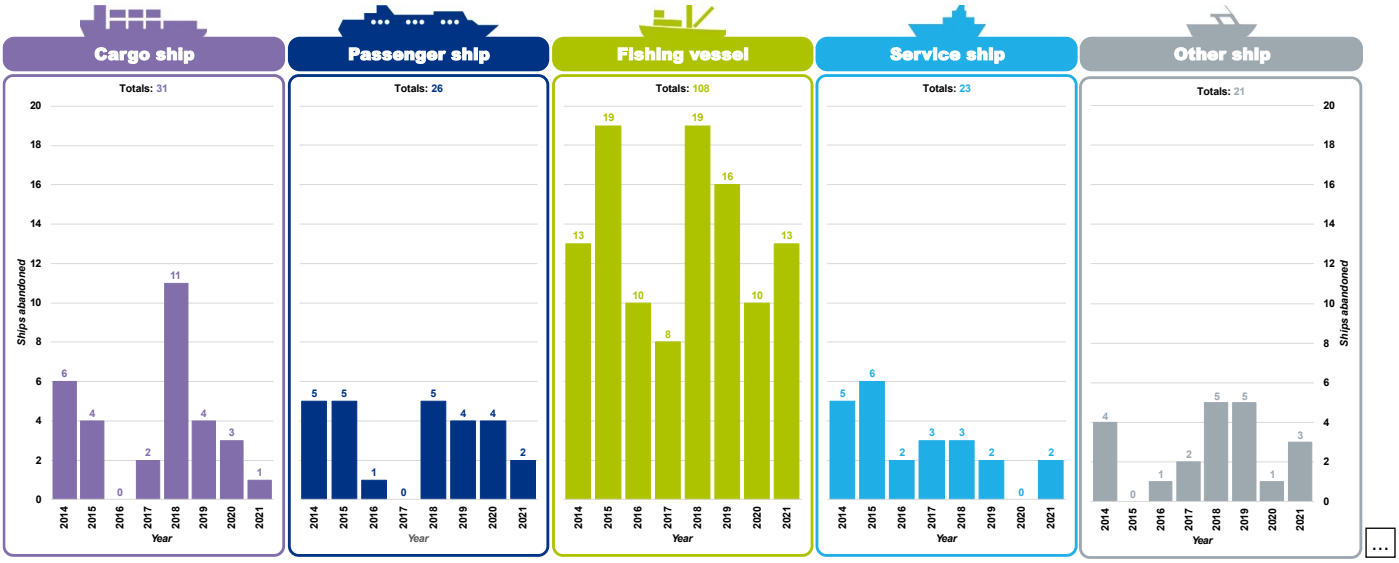



The total number of Search and Rescue (SAR) operations in the period from 2014 to 2021 is 2,596.

There is an increasing trend in the number of Search and Rescue (SAR) operations for fishing vessels since 2014. While, in the same period, the trend is oscillating for cargo ships and other ships and is decreasing for passenger ships and service ships.

Fishing vessels is the ship type with the higher number of SAR operations, with 55.6% of the total operations, followed by cargo ships with 24.5%, passenger ships with 9.8%, service ships with 7.5% and other ships with 2.6%.

Figure 2.5–17 Evolution of ships abandoned, organized by ship type




The total number of ships abandoned in the period from 2014 to 2021 is 209.

There is not a clear trend in the number of ships abandoned in the period from 2014 to 2021.

The 51.7% of the ships abandoned are fishing vessels.

## 2.5.3 Consequences to the environment

In the period from 2014 to 2021, 495 cases of pollution were reported.

Marine pollution by ship's bunkers (fuel) and other pollutants (e.g., cargo residues, lubricating or hydraulic oils) corresponded to the 64.2% of all pollutions.

A significant decrease in the reported number of pollutions was noted in year 2019, 2020 and 2021, but in 2021 the pollutions were higher than in the two previous years.

There were 264 (53.4%) cases of pollution for cargo ships, 83 (16.8%) for fishing vessels, 71 (14.3%), 66 (13.3%) for passenger ships and 11 (2.2%) in the period from 2014 to 2021.

The reduction in the cases of pollution was significant for passenger ships, service ships and fishing vessels.

Figure 2.5–18 Evolution of pollution, organized by type of pollution

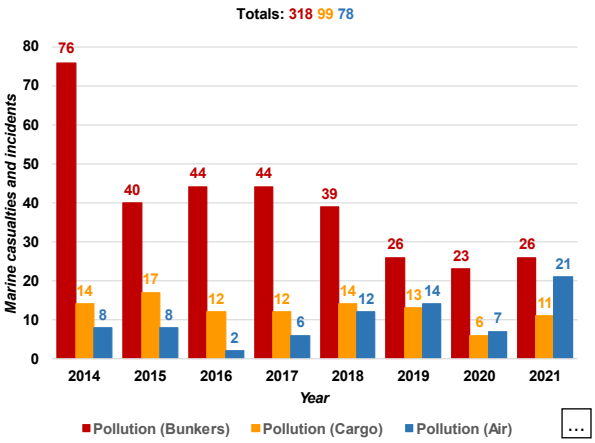
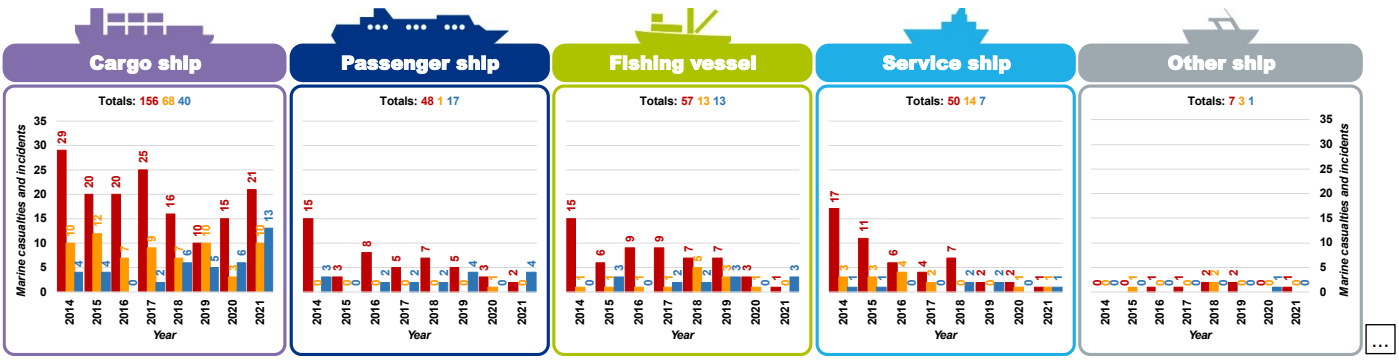



Figure 2.5–19 Evolution of pollution, organized by type of pollution and ship type



There are 115 oil pollution responses reported in the period from 2014 to 2021, with a maximum of 24 responses in year 2018 and a minimum of 4 responses in years 2016 and 2017.

There were 18 oil pollution responses in 2021.

Reviewing the evolution of oil pollution responses by casualty event, loss of control - loss of containment was the casualty event with most oil pollution responses in the period from 2014 to 2021, growing from no events in year 2014 until a maximum of 16 events in year 2020. In 2021 there was a reduction in oil pollution responses caused by casualty event loss of control - loss of containment, with 5 events.

Damage and loss of equipment was also growing significantly during the last years.

Figure 2.5–20 Evolution of oil pollution response

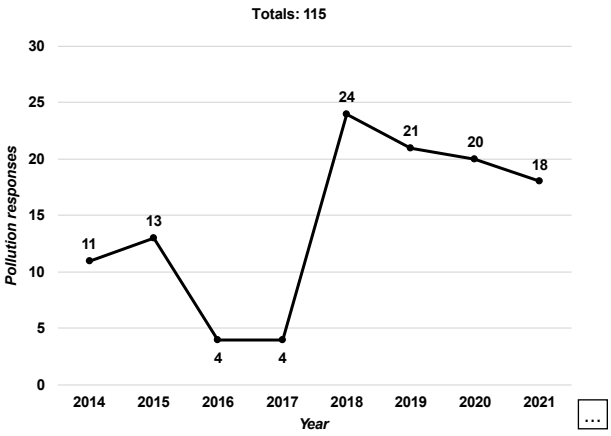
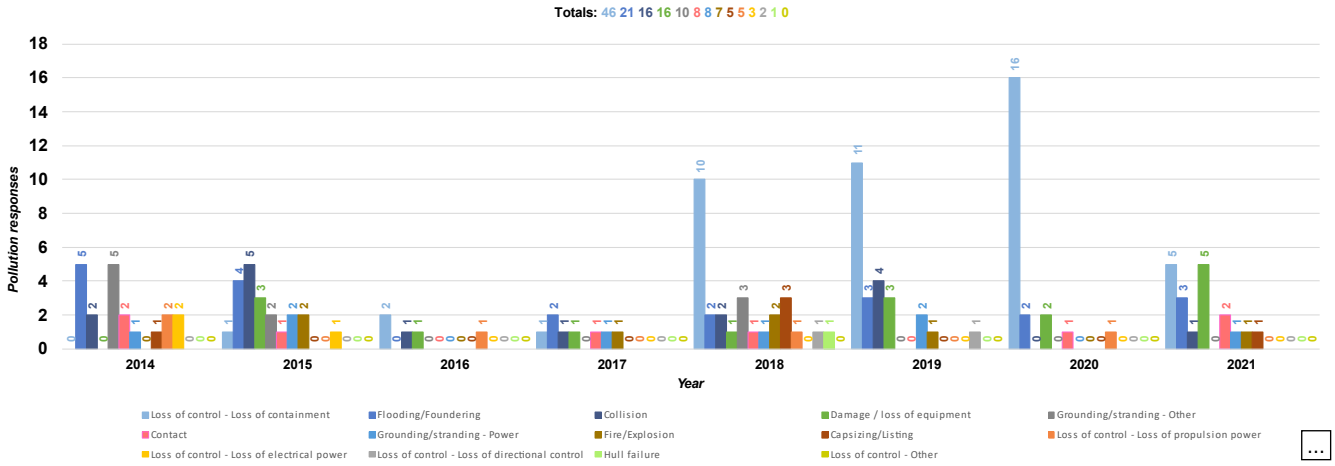



Figure 2.5–21 Evolution of oil pollution response, organized by casualty event




## 2.6 Nature of marine casualties and incidents

This section analyses marine casualties and incidents organized by their nature as: occurrences with persons or occurrences with ships.

Figure 2.6–1 Evolution of marine casualties and incidents, organized by nature type

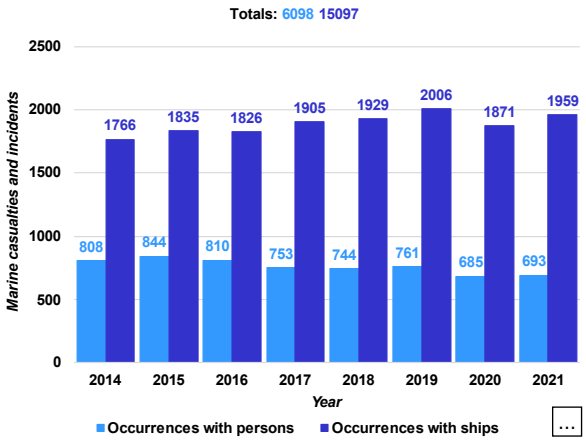



Figure 2.6-1 counts marine casualties and incidents with at least one occurrence with persons or at least one occurrence with ships.

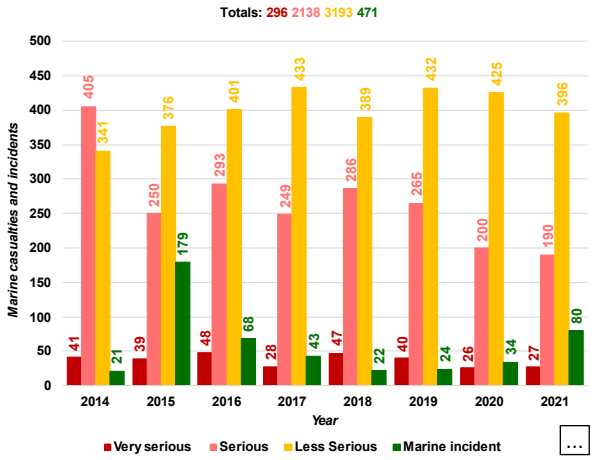
Some marine casualties and incidents have one or more occurrences with persons and one or more occurrences with ships so, the total count of occurrences in figure 2.6-1 was 21,195, greater than the 21,173, total count of occurrences in Figure 2.1–1.

Accidents with persons not related to ship operations have not been considered in the analysis, as well as accidents with ships non – accidental events.

Occurrences with ships are continuously decreasing over the years and occurrences with persons were increasing between 2014 and 2019, reduced in 2020 and then increased again in 2021.

## 2.6.1 Occurrences with persons

Figure 2.6–2 Evolution of marine casualties and incidents with occurrences with persons, organized by severity



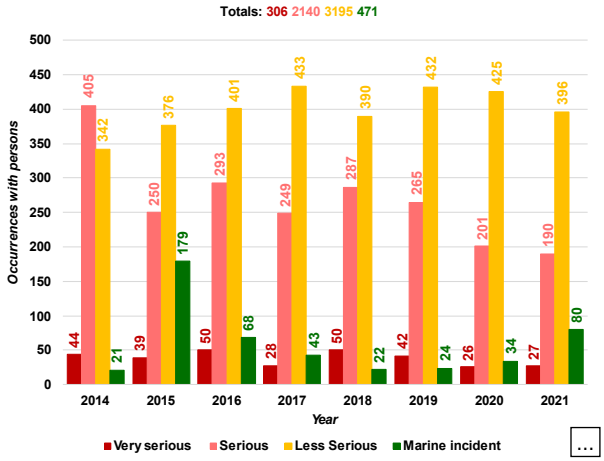

The 6098 marine casualties and incidents with at least one occurrence with persons in Figure 2.6–1 have the following distribution by severity: 52.4% were less serious marine casualties, 35.1% were serious marine casualties, 7.7% were marine incidents and 4.8% were very serious marine casualties.

The number of less serious casualties with at least one occurrence with persons increased from 2014 to 2017 and after a decrease in 2018, it increased again from 2019 to 2021.

The number of serious casualties with at least one occurrence with persons has a decreasing trend from 2014 to 2021.

The number of very serious casualties and marine incidents with at least one occurrence with persons does not show a clear trend from 2014 to 2021.

Figure 2.6–3 Evolution of *occurrences with persons, organized by severity*



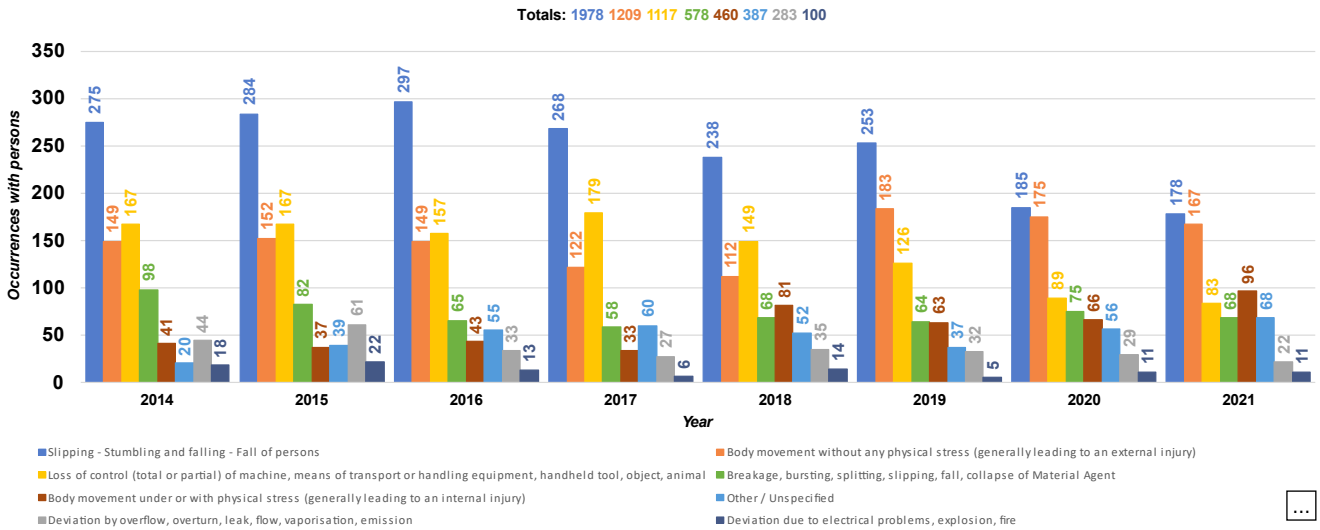

The total number of occurrences with persons is 6,112, which is greater than the total number of marine casualties with occurrences with persons in Figure 2.6–2 because some marine casualties have more than one occurrence with person.

The trends are the same than in Figure 2.6–2.

The total number of occurrences with persons was organized in Figure 2.6–3 by deviation. This data correlates with data in Figure 2.5–9 and presents the same trends.

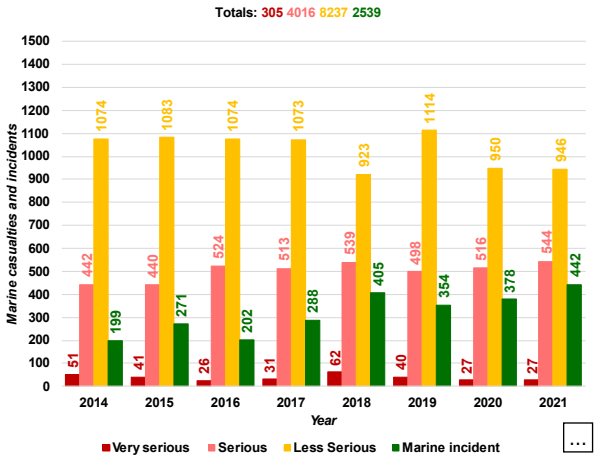
'Slipping - stumbling and failing - fall of person' is by far the main deviation over the period from 2014 to 2021. The second deviation is 'Body movement without any physical stress'.

Figure 2.6–4 Evolution of occurrences with persons, organized by deviation



## 2.6.2 Occurrences with ships

Figure 2.6–5 Evolution of marine casualties and incidents with occurrences with ships, organized by severity



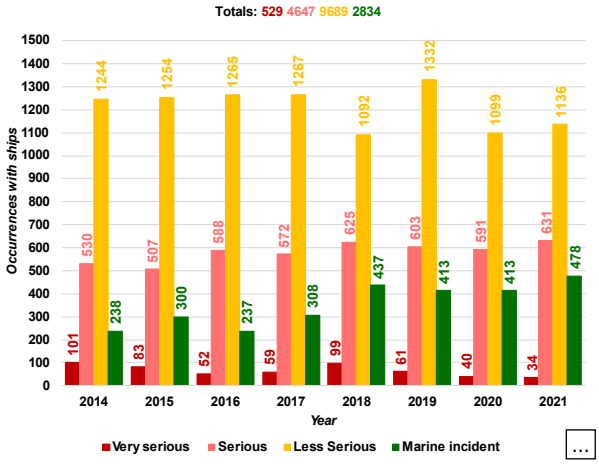

The 15,097 marine casualties and incidents with at least one occurrence with ships in Figure 2.6–1 have the following distribution by severity: 54.6% were less serious marine casualties, 26.61% were serious marine casualties, the 16.8% were marine incidents and 2.0% were very serious marine casualties.

The number of less serious casualties with at least one occurrence with ships was almost constant from 2014 to 2017, and after a decrease in 2018, it grew again maintaining the constant value from 2019 to 2021.

The number of serious casualties and marine incidents with at least one occurrence with ships had an increasing trend from 2014 to 2021.

The number of very serious casualties with at least one occurrence with ships had a slow decreasing trend from 2014 to 2021.

Figure 2.6–6 Evolution of occurrences with ships, organized by severity

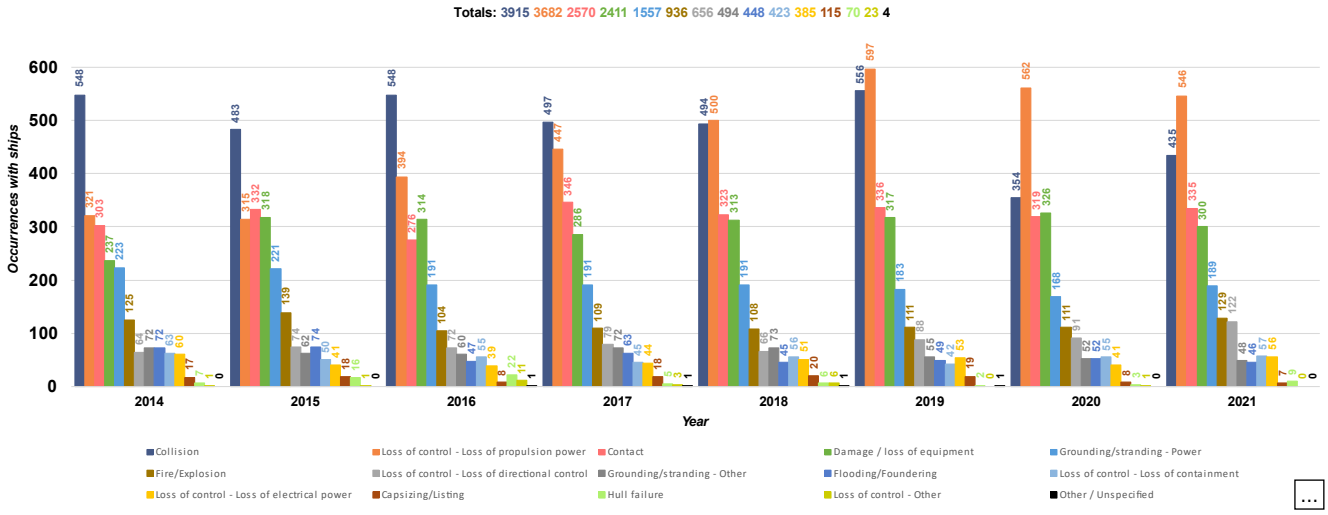



The total number of occurrences with persons was 17,699. This is greater than the total number of marine casualties with occurrences with persons in Figure 2.6–5 because some marine casualties have more than one occurrence with person.

The trends are the same than in Figure 2.6–4.

The total number of occurrences with persons is organized in Figure 2.6–7 by deviation. ‘Collision and loss of control - loss of propulsion power’ is the main casualties with ships, exceeding ‘Loss of control - loss of propulsion power’ for the first time since 2018.

Figure 2.6–7 Evolution of occurrences with ship, organized by type of casualty with ship



## 2.7 Events and conditions that led to marine casualties and incidents

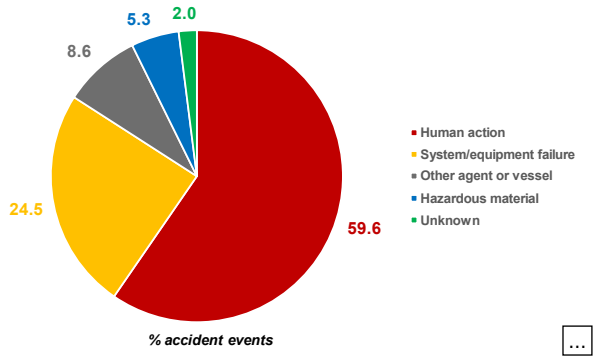
Investigators looked for the factors contributing to marine casualties and incidents in the analysis phase. Such causes were made up of accident events (underlying factors) and contributing factors. The reporting scheme used in EMCIP follows this approach. A detailed model of EMCIP can be found in Appendix 2.

In this section all the accident events and contributing factors in the analysed period, 2014 to 2021, were considered and for simplification they were not analysed by year.

### 2.7.1 Accident events

Each marine casualty and incident reported in EMCIP can have one or more accident events. More than one accident events can be associated to a casualty event. The five accident event types are: 'Human action', 'System or equipment failure', 'Other agent or vessel', 'Hazardous material' and 'Unknown'.

*Figure 2.7–1 Percentage of accident events for the period 2014-2021, organized by accident event types*




The percentage of accident events for the period from 2014 to 2021 was obtained from the count of every single accident event reported in EMCIP of each type.

For the period from 2014 to 2021, 'Human action' is the main accident event type with 59.6% of the total, followed by 'System/equipment failure' with 24.5%, 'Other agent or vessel' with 8.6%, 'Hazardous material' with 5.3% and 'Unknown' with 2.0%.

The percentage of accident events for the period from 2014 to 2021 for the different ship types shows similar trends for all ship types with small variations in the percentages. 'Human factor' is always the main accident event type, and 'System/equipment' failure is higher for passenger ships and fishing vessels and lower for cargo ships.

Figure 2.7–2 Percentage of accident event types for the period 2014-2021, organized by accident event types and ship types

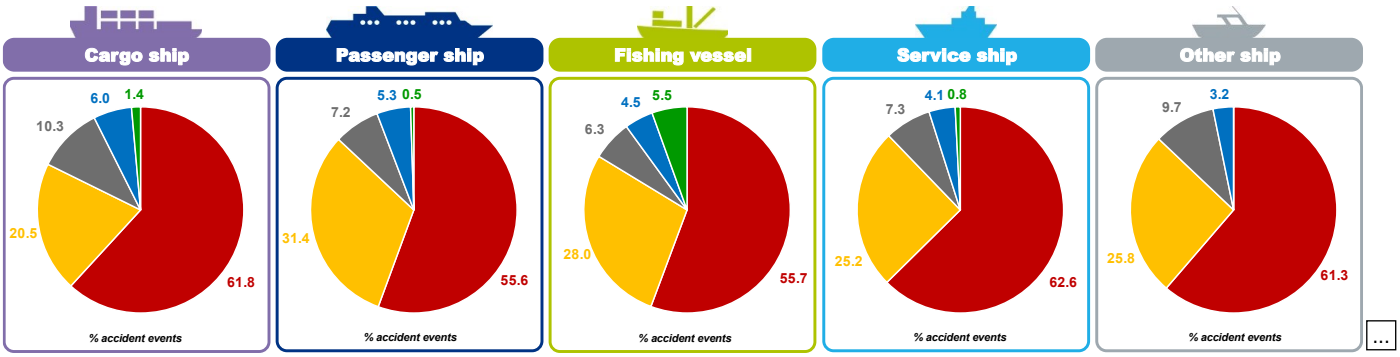
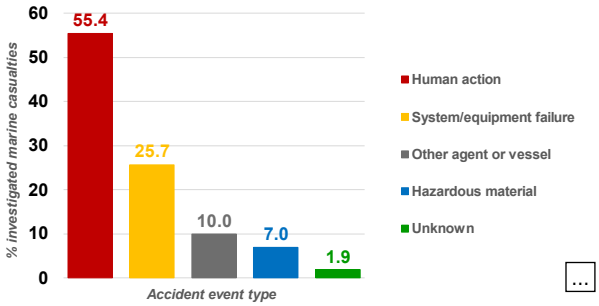



Figure 2.7–3 Percentage of accident events related to the investigated marine accidents and incidents for the period 2014-2021, organized by accident event types




The distribution of accident events related to the investigated marine accidents and incidents for the period from 2014 to 2021, determines the percentage of investigated marine accidents and incidents having at least one event type of the defined type. This distribution was organized by accident event types. In this case, marine accidents were counted instead of accident events. The trends obtained were the same than in Figure 2.7–1.

The distribution of accident events related to the investigated marine accidents and incidents for the period from 2014 to 2021 was obtained separately for every ship type, with the same trends than in Figure 2.7–2.

Figure 2.7–4 Percentage of accident events related to the investigated marine accidents and incidents for the period 2014-2021, organized by accident event types and ship types

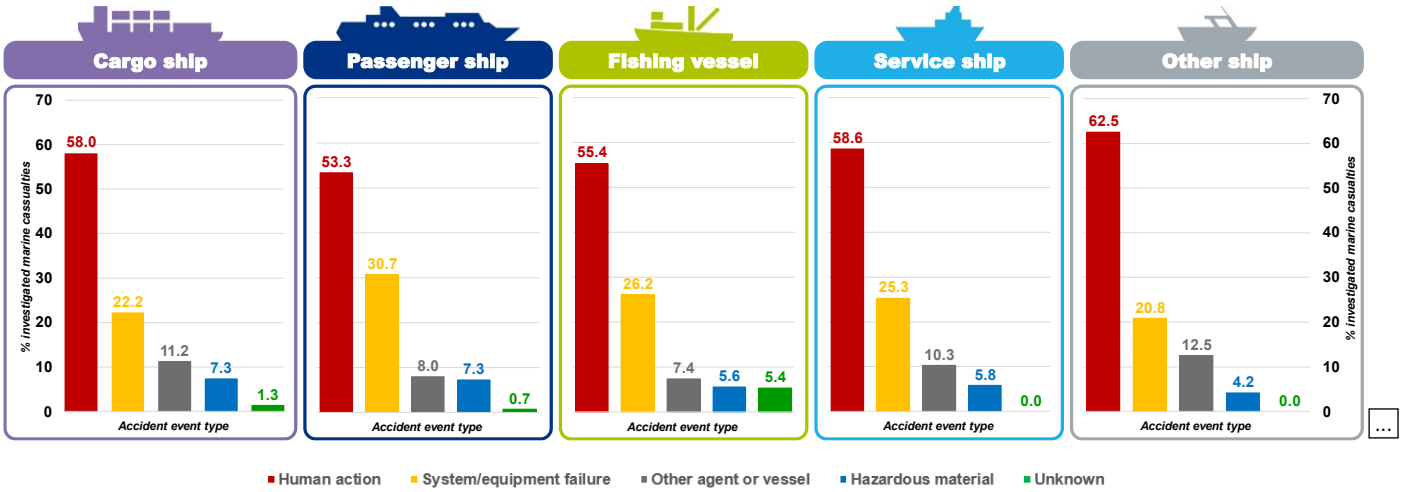
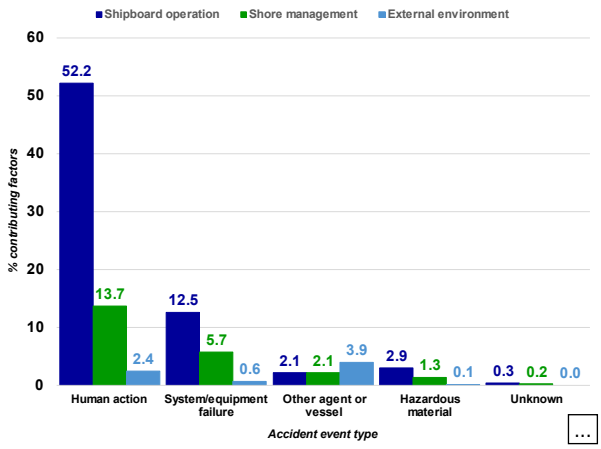



*Photo credit GAMA/Portugal.*

## 2.7.2 Contributing factors

Each accident event can have one or several contributing factors. As explained in Appendix 2, contributing factors have the following three types: 'External environment', 'Shore management' and 'Shipboard operation'.

Figure 2.7–5 Percentage of contributing factors for the period 2014-2021, organized by contributing factor types and accident event types




The distribution of contributing factors for the period from 2014 to 2021 determines the percentage of contributing factors and is organized by contributing factor types and accident event types.

'Shipboard operation' was the most important contributing factor type, with 70% of all the contributing factors.

'Human action' was the main accident event type, with 68.3% of all the contributing factors, followed by 'System/equipment failure' with 18.8% of all the contributing factors.

When this distribution was analysed individually for every ship type for the period from 2014 to 2021, almost the same trends were found for all the ship types.

Figure 2.7–6 Percentage of contributing factors for the period 2014-2021, organized by contributing factor types, accident event types and ship types

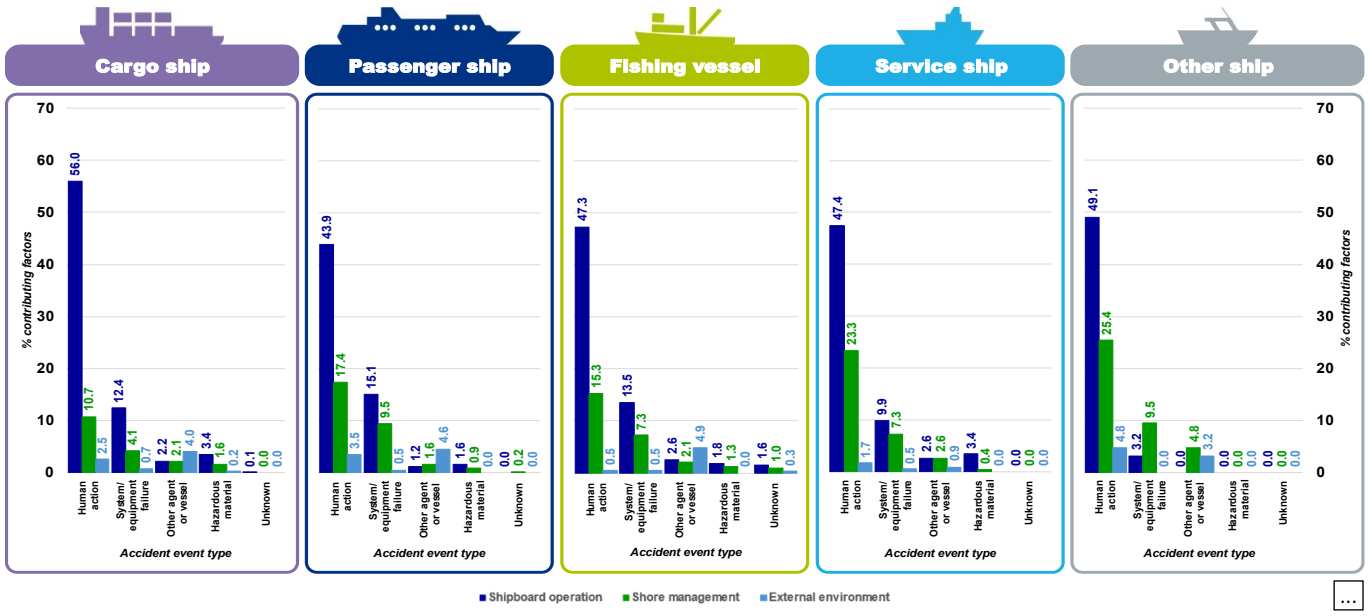
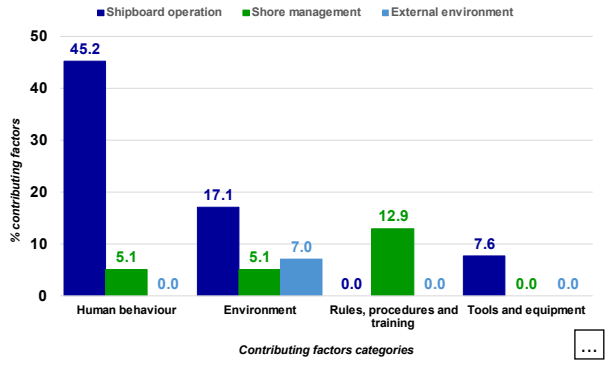



Figure 2.7–7 Percentage of contributing factors for the period 2014-2021, organized by contributing factor categories and contributing factor types



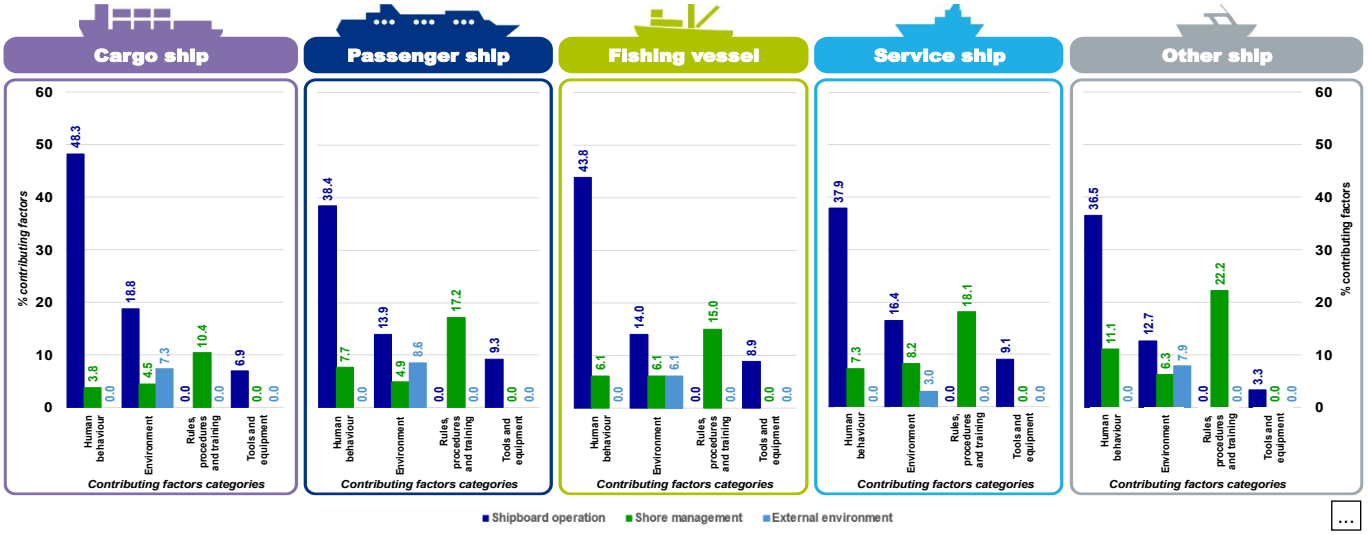

As explained in Appendix 2, for simplification in the analysis the 185 possible contributing factors are grouped in four contributing factor categories: ‘Human behaviour’, ‘Environment’, ‘Rules procedures and training’ and ‘Tools and equipment’.

For the period from 2014 to 2021, the percentage of contributing factors organized by contributing factor categories and contributing factor types were obtained.

‘Human behaviour’ was the most important contributing factor category, with 50.3% of the contributing factors. It was followed by ‘Environment’ with 29.2% of the contributing factors.

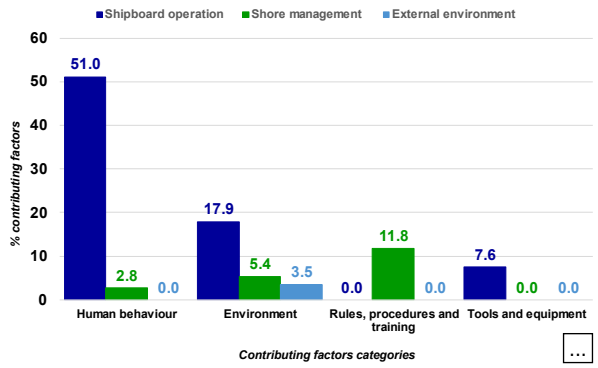
The analysis obtains a similar trend for all the ship types.

Figure 2.7–8 Percentage of contributing factors for the period 2014-2021, organized by organized by contributing factor categories, contributing factor types and ship types



This analysis can be done individually for the four main accident event types.

Figure 2.7–9 Percentage of contributing factors involved in human action accident events for the period 2014-2021, organized by contributing factor categories and contributing factor types




Regarding ‘human action accident’ events for the period from 2014 to 2021, ‘Human behaviour’ is the main contributing factor category, with 53.8% of the contributing factors.

It is followed by ‘Environment’ with 26.8% of the contributing factors.

Similar trends are obtained for the individual analysis of each ship type.

Figure 2.7–10 Percentage of contributing factors involved in human action accident events for the period 2014-2021, organized by contributing factor categories, contributing factor types and ship types

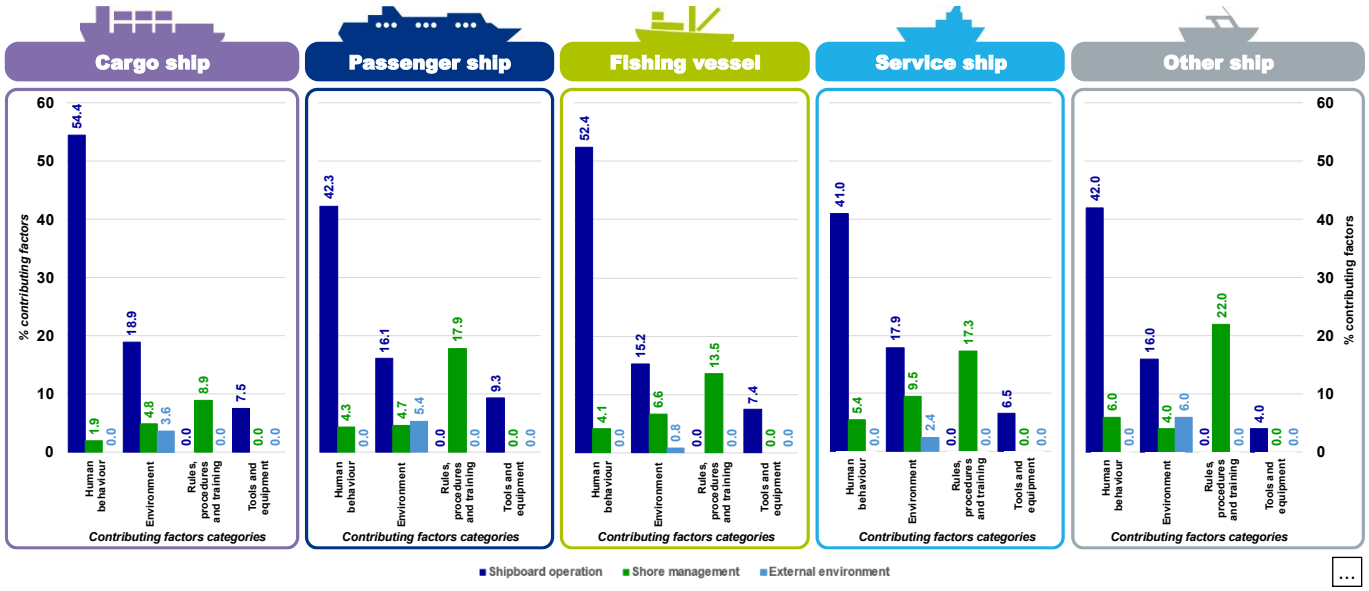
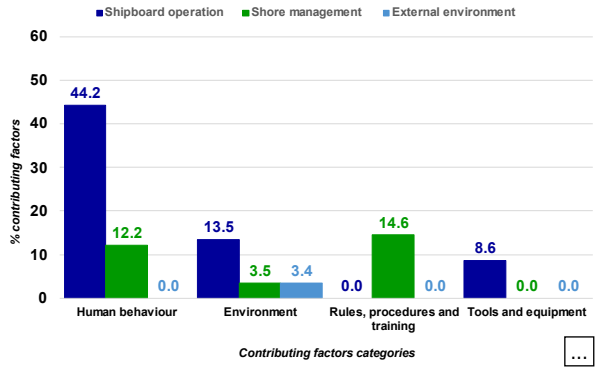



Figure 2.7–11 Percentage of contributing factors involved in system/equipment failure accident events for the period 2014-2021, organized by contributing factor categories and contributing factor types




Concerning ‘System/equipment failure accident’ events for the period from 2014 to 2021, ‘Human behaviour’ is the main contributing factor category, with 56.4% of the contributing factors.

It is followed by ‘Environment’ with 20.4% of the contributing factors.

Similar trends were obtained for the individual analysis of each ship type with an exception in human behaviour for shore management.

Figure 2.7–12 Percentage of contributing factors involved in system/equipment failure accident events for the period 2014-2021, organized by contributing factor categories, contributing factor types and ship types

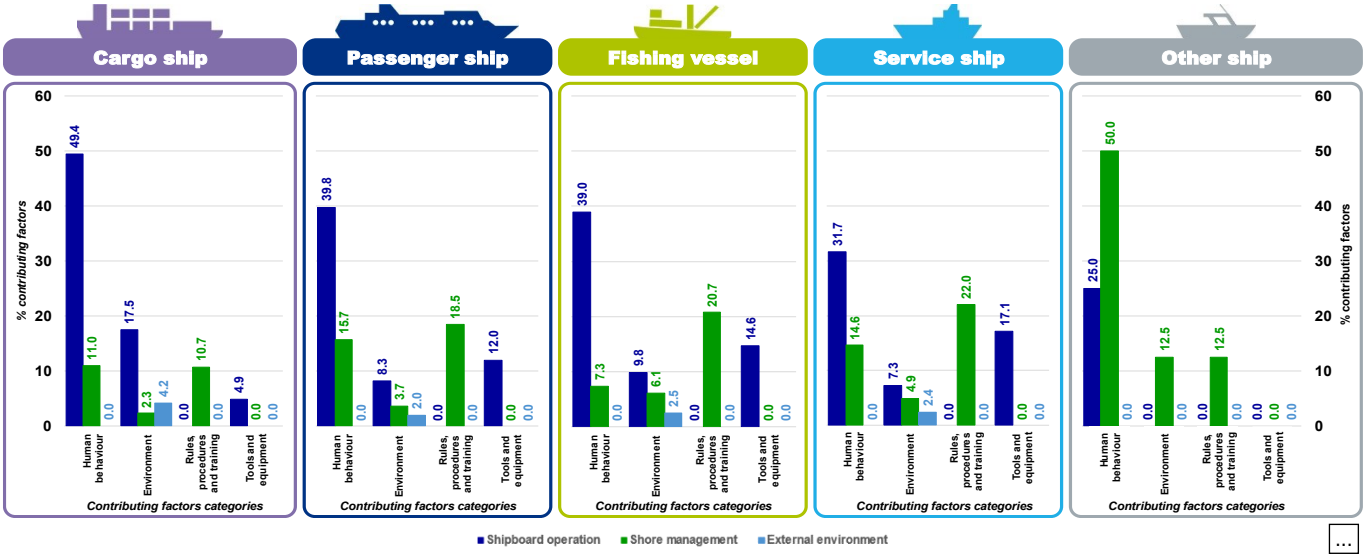
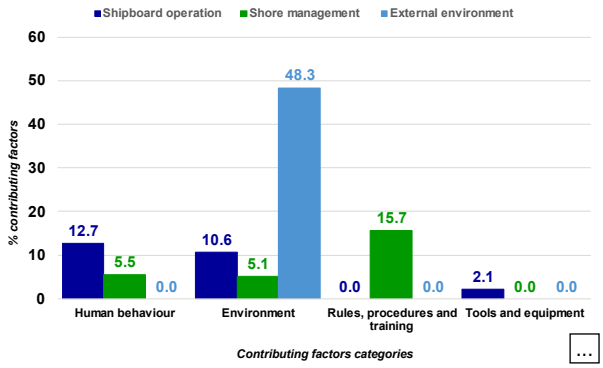



Figure 2.7–13 Percentage of contributing factors involved in other agent or vessel accident events for the period 2014-2021, organized by contributing factor categories and contributing factor types




For ‘Other agent or vessel accident’ events for the period from 2014 to 2021, ‘Environment’ is the main contributing factor category, with 64.0% of the contributing factors.

It is followed by ‘Human behaviour’ with 18.2% of the contributing factors.

Similar trends are obtained for the individual analysis of each ship type.

Figure 2.7–14 Percentage of contributing factors involved in other agent or vessel accident events for the period 2014-2021, organized by contributing factor categories, contributing factor types and ship types

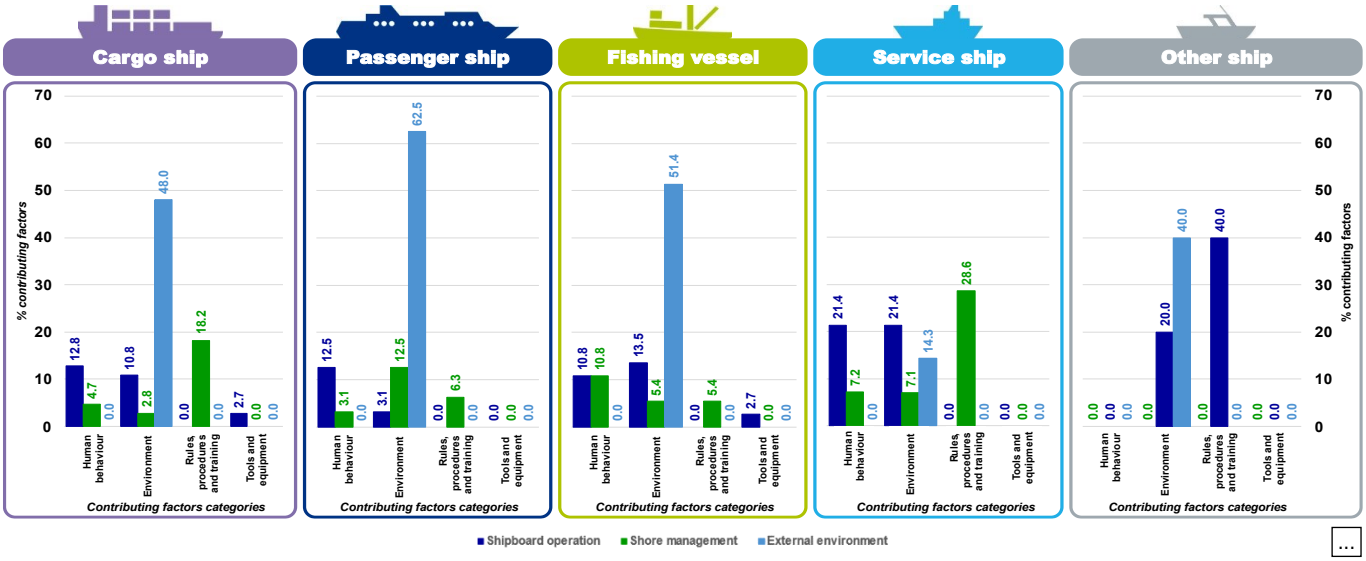
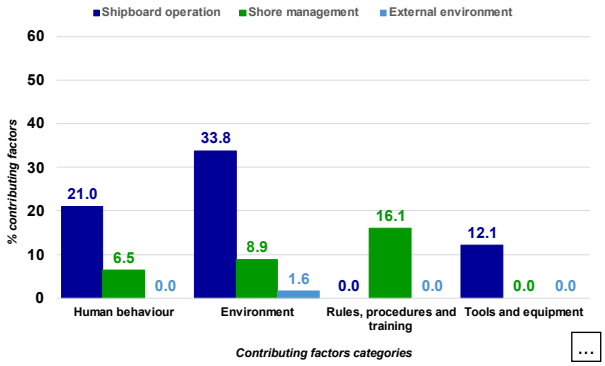


Figure 2.7–15 Percentage of contributing factors involved in hazardous material accident events for the period 2014-2021, organized by contributing factor categories and contributing factor types

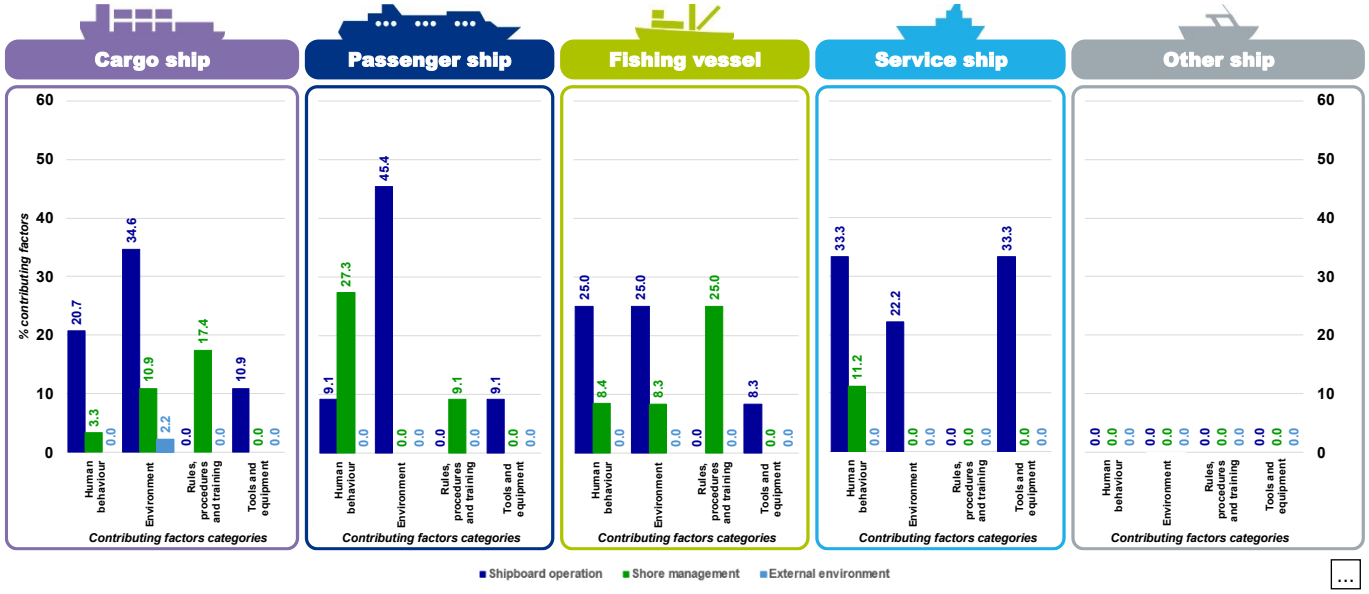



Regarding hazardous material accident events for the period from 2014 to 2021, 'Environment' is the main contributing factor category, with 44.3% of the contributing factors.

It is followed by 'Human behaviour' with 27.5% of the contributing factors.

Similar trends are obtained for the individual analysis of each ship type, with some exceptions.

Figure 2.7–16 Percentage of contributing factors involved in hazardous material accident events for the period 2014-2021, organized by contributing factor categories, contributing factor types and ship types




## 2.7.3 Influence of human element

Contributing factors catalogued as 'human behaviour' and contributing factors related to human action accident events are considered as influenced by human element.

Considering all these contributing factors is possible to determine the percentage of contributing factors influenced by human element.

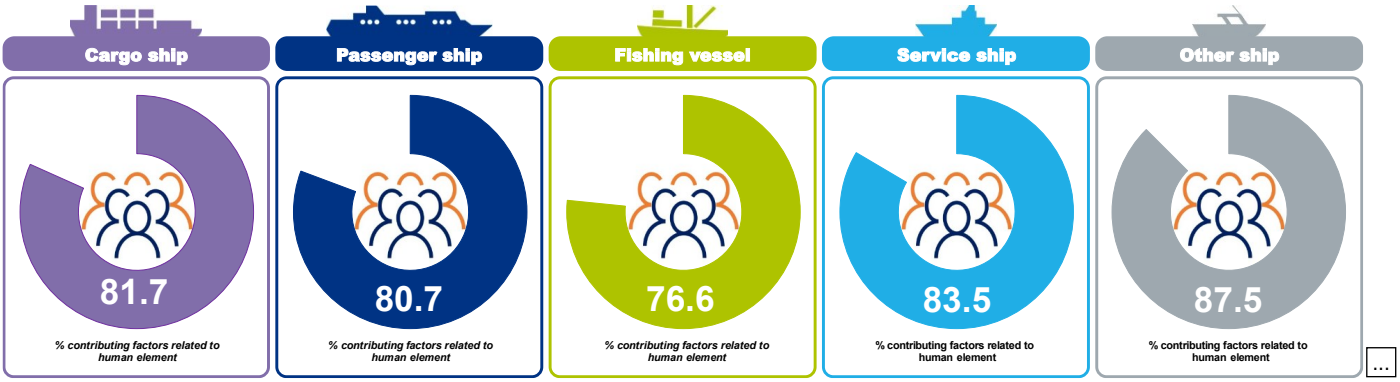
For the analysed period, the medium percentage of this influence of human element in the analysed contributing factors is of 81.1%.

Occurrences involving fishing vessels have the lower human element influence with 76.6% and this influence reaches a maximum for ships classified as other ships with 87.5%.

Cargo ships, passenger ships and service ships have an influence around 81% or greater.

Figure 2.7–17 Percentage of contributing factors related to human element

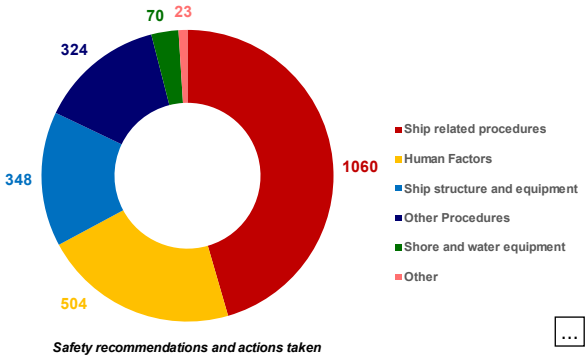
Figure 2.7–18 Percentage of contributing factors related to human element, organized by ship type




## 2.8 Safety recommendations and actions taken

This section analyses the safety recommendations and actions taken reported in EMCIP. Safety recommendations are organized by the same focus areas and addressee types.

Figure 2.8–1 Evolution of safety recommendations and actions taken, organized by focus area




'Ship related procedures' is the main focus area of the safety recommendations and actions taken reported since 2014, with 45.5% of the safety recommendations and actions taken, followed by 'Human factors' with 21.6%, 'Ship structure and equipment' with 15.0%, 'other procedures' with 13.9%, 'Shore and water equipment' with 3.0% and 'Other' with 1.0%.

Each focus area is divided in sub-categories, and they were analysed for each focus area excepting other.

For the focus area 'Ship related procedures', 42.9% of the safety recommendations and actions taken are in the subcategory 'Operation'.

Figure 2.8–2 Evolution of safety recommendations and actions taken for ship related procedures focus area, organized by focus area sub-categories

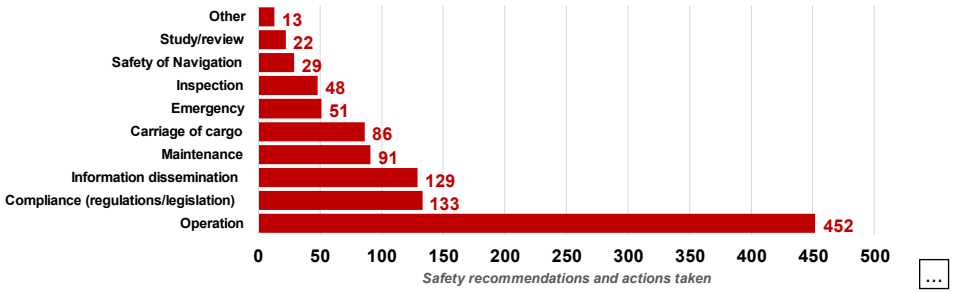
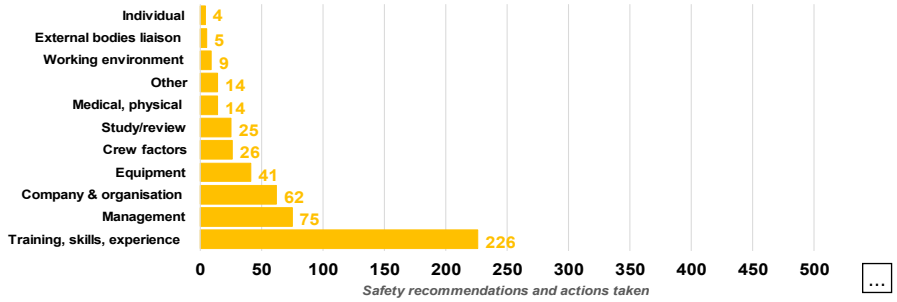



*Photo credit GAMA/Portugal.*

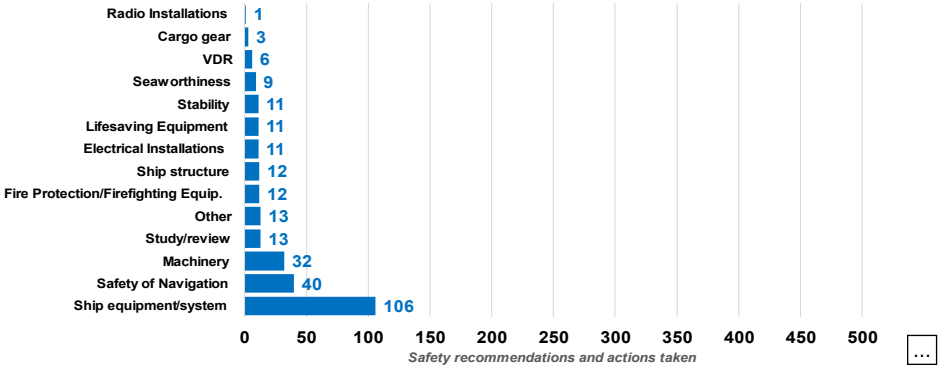
Regarding the focus area ‘Human factors’, 45.1% of the safety recommendations and actions taken are in the subcategory ‘training, skills and experience’.

Figure 2.8–3 Evolution of safety recommendations and actions taken for human factors focus area, organized by focus area subcategories



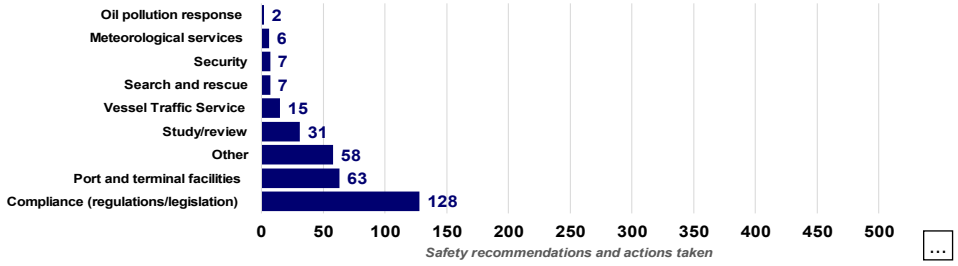

For the focus area ‘Ship structure and equipment’, 37.9% of the safety recommendations and actions taken are in the subcategory ‘ship equipment/system’.

Figure 2.8–4 Evolution of safety recommendations and actions taken for ship structure and equipment focus area, organized by focus area subcategories




Concerning the focus area ‘Other procedures’, 40.4% of the safety recommendations and actions taken are in the subcategory ‘compliance’ (regulations/legislation).

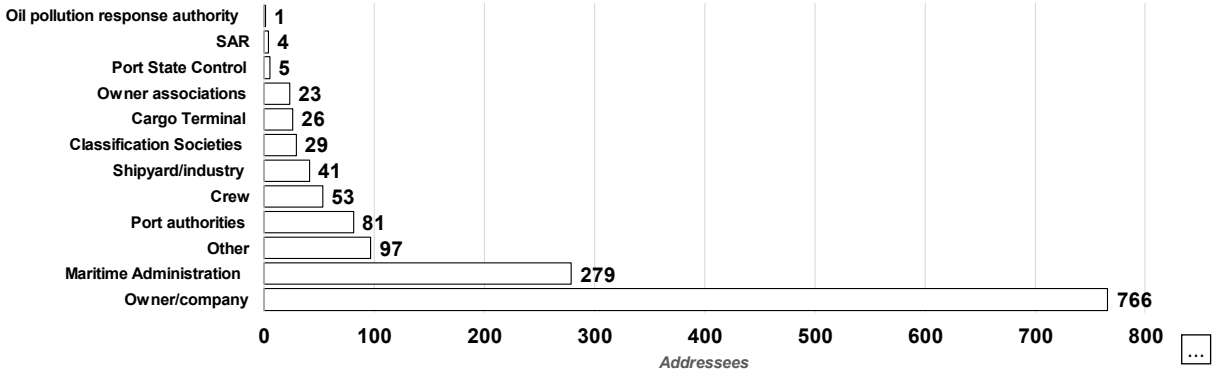
Figure 2.8–5 Evolution of safety recommendations and actions taken for other procedures focus area, organized by focus area subcategories




For the focus area ‘Shore and water equipment’, 38.6% of the safety recommendations and actions taken are in the subcategory ‘Other equipment’.

Figure 2.8–6 Evolution of safety recommendations and actions taken for shore and water equipment focus area, organized by focus area subcategories

Figure 2.8–7 Evolution of safety recommendations and actions taken, organized by addressee categories




'Owner/company' is the main addressee, with 54.5% of the safety recommendations and actions taken, followed by 'Maritime Administration', with 19.9% of the safety recommendations and actions taken.


*Photo credit DMAIB/Denmark.*

# APPENDICES

## Appendix 1 List of abbreviations and definitions

### Abbreviations

**AI**: Accident Investigation

**DG MARE**: EC's Directorate General for Maritime Affairs and Fisheries

**EC**: European Commission

**EEA**: European Economic Area

**EEZ**: Exclusive Economic Zone

**EFTA**: European Free Trade Association

**EMSA**: European Maritime Safety Agency

**EMCIP**: European Marine Casualty Information Platform

**EU**: European Union. For the analysis means EU 27 Member States and EEA EFTA States.

**EU 27**: Refers to the 27 Member States of the EU

**Eurostat**: Statistical office of the EU

**IMO**: International Maritime Organization

**LOA**: Length Over All

**MARINFO**: Information for the maritime industries of Europe.

**MEPC**: IMO's Marine Environment Protection Committee

**MSC**: IMO´s Maritime Safety Committee

**SAR**: Search and Rescue

**STCW**: International Convention on Standards of Training, Certification and Watch keeping for Seafarers

**UNCLOS**: United Nations Convention on the Law at Sea

## Definitions

**Definitions from the IMO Casualty Investigation Code and the Directive 2009/18/EC**

Specific terms used in this publication are also used for marine safety investigation purposes and have the following meanings:

1. **Coastal State**:
   means a State in whose territory, territorial sea and internal waters as defined in UNCLOS, a marine casualty or incident occurs.
2. **EMCIP**:
   is the European Marine Casualty Information Platform, a centralised database for EU Member States to store and analyse information on marine casualties and incidents.
3. **Flag State**:
   means a State whose flag a ship is entitled to fly.
4. **Less serious marine casualty**:
   casualty to ships which do not qualify as very serious marine casualty or serious marine casualty:
5. **Marine casualty**:
   means an event, or a sequence of events, that has resulted in any of the following which has occurred directly in connection with the operations of a ship:
   .1 the death of, or serious injury to, a person;
   .2 the loss of a person from a ship;
   .3 the loss, presumed loss or abandonment of a ship;
   .4 material damage to a ship;
   .5 the stranding or disabling of a ship, or the involvement of a ship in a collision;
   .6 material damage to marine infrastructure external to a ship, that could seriously endanger the safety of the ship, another ship or an individual; or
   .7 severe damage to the environment, or the potential for severe damage to the environment, brought about by the damage of a ship or ships.

   However, a marine casualty does not include a deliberate act or omission, with the intention to cause harm to the safety of a ship, an individual or the environment.
6. **Marine incident**:
   means an event, or sequence of events, other than a marine casualty, which has occurred directly in connection with the operations of a ship that endangered, or, if not corrected, would endanger the safety of the ship, its occupants or any other person or the environment.
   However, a marine incident does not include a deliberate act or omission, with the intention to cause harm to the safety of a ship, an individual or the environment.
7. **Marine safety investigation**:
   means an investigation or inquiry into a marine casualty or marine incident, conducted with the objective of preventing marine casualties and marine incidents in the future. The investigation includes the collection and analysis of evidence, the identification of causal factors and the making of safety recommendations as necessary.
8. **Marine safety investigation report**:
   means a report that contains:
   .1 a summary outlining the basic facts of the marine casualty or incident and stating whether any deaths, injuries or pollution occurred as a result;
   .2 the identity of the Flag State, owners, operators, the company as identified in the safety management certificate, and the classification society (subject to any national laws concerning privacy);
   .3 where relevant the details of the dimensions and engines of any ship involved, together with a description of the crew, work routine and other matters, such as time served on the ship;
   .4 a narrative detailing the circumstances of the marine casualty or incident;
   .5 analysis and comment on the causal factors including any mechanical, human and organizational factors;
   .6 a discussion of the marine safety investigation's findings, including the identification of safety issues, and the marine safety investigation's conclusions; and
   .7 where appropriate, recommendations with a view to preventing future marine casualties or incidents.

9. **Material damage**:
in relation to a marine casualty means:

.1 damage that:
.1.1 significantly affects the structural integrity, performance or operational characteristics of marine infrastructure or a ship; and
.1.2 requires major repair or replacement of a major component or components; or
.2 destruction of the marine infrastructure or ship.

10. **Serious marine casualty**:
this term shall be understood in accordance with the updated definition contained in Circular MSC-MEPC.3/Circ.3 of the IMO Maritime Safety Committee and Marine Environment Protection Committee of 18th of December 2008; it says:
Serious marine casualties are casualties to ships which do not qualify as very serious marine casualty 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.

11. **Serious injury:**
means an injury which is sustained by a person, resulting in incapacitation where the person is unable to function normally for more than 72 hours, commencing within seven days from the date when the injury was suffered.
12. **Severe damage to the environment**:
means damage to the environment which, as evaluated by the State(s) affected, or the Flag State, as appropriate, produces a major deleterious effect upon the environment.
13. **Substantially interested State**:
means a State:

.1 which is the Flag State of a ship involved in a marine casualty or incident; or
.2 which is the Coastal State involved in a marine casualty or incident; or
.3 whose environment was severely or significantly damaged by a marine casualty (including the environment of its waters and territories recognized under international law); or
.4 where the consequences of a marine casualty or marine incident caused, or threatened, serious harm to that State or to artificial islands, installations, or structures over which it is entitled to exercise jurisdiction; or
.5 where, as a result of a marine casualty, nationals of that State lost their lives or received serious injuries; or
.6 that has important information at its disposal that the marine safety investigating State(s) consider useful to the investigation; or
.7 that for some other reason establishes an interest that is considered significant by the marine safety investigating State(s).

14. **Territorial sea**:
refers to the area within which the sovereignty of a Coastal State extends, beyond its land territory and internal waters and, in the case of an archipelagic State, its archipelagic waters, to an adjacent belt of sea, described as the territorial sea. It is a belt of coastal water extending at most 12 nautical miles (22.2 km; 13.8 mi) from the baseline (usually the mean low-water mark) of a Coastal State. (UNCLOS Section 1 of Part II)

15. **Very serious marine casualty**:
    means a marine casualty involving the total loss of the ship or a death or severe damage to the environment.

Other definitions can be found in:

- The 'IMO Code for the Investigation of Marine Casualties and Incidents' which shall mean the Code for the investigation of Marine Casualties and Incidents annexed to resolution A.849(20) of the IMO Assembly of 27th of November 1997. + Resolution MSC.255(84) (adopted on 16th of May 2008) Adoption of the code of the international standards and recommended practices for a safety investigation into a marine casualty or marine incident (Casualty Investigation Code) + Resolution A.1075(28) adopted on 24th of February 2014
- The scope of the Accident Investigation Directive 2009/18/EC can be found in its article 2.

Other information can be found on:

- http://www.emsa.europa.eu/implementation-tasks/accident-investigation.html; or
- https://portal.emsa.europa.eu/emcip-public/#/dashboard

**Other expressions, as per EMCIP taxonomy**

1. **Accidental event** or **Accident event**:
   is an event that is assessed to be inappropriate and significant in the sequence of events that led to the marine casualty or incident.
2. **Casualty event**:
   Is an unwanted event in which there was some kind of energy release with impact on people and/or ship including its equipment and its cargo or environment. These events are classified in:
   - **Capsizing/Listing**:
     is a casualty where the ship no longer floats in the right-side-up mode due to negative initial stability (negative metacentric height), or transversal shift of the centre of gravity, or the impact of external forces.
     - **Capsizing**: when the ship is tipped over until disabled;
     - **Listing**: when the ship has a permanent heel or angle of loll.
   - **Collision**:
     a casualty caused by ships striking or being struck by another ship, regardless of whether the ships are underway, anchored or moored. This type of casualty event does not include ships striking underwater wrecks. The collision can be **with other ship** or **with multiple ships** or **ship not underway**.
   - **Contact**:
     a casualty caused by ships striking or being struck by an external object. The objects can be: **Floating object** (**cargo, ice, other or unknown**); **Fixed object**, but not the sea bottom; or **Flying object**.
   - **Damage to equipment**:
     damage to equipment, system or the ship not covered by any of the other casualty type.
   - **Grounding/stranding**:
     a moving navigating ship, either under command, under **Power**, or not under command, **Drift**(ing), striking the sea bottom, shore or underwater wrecks.
   - **Fire/explosion:**
     an uncontrolled ignition of flammable chemicals and other materials on board of a ship:
     - **Fire**: is the uncontrolled process of combustion characterised by heat or smoke or flame or any combination of these.
     - **Explosion**: is an uncontrolled release of energy which causes a pressure discontinuity or blast wave.
   - **Flooding/foundering**:
     is a casualty event when the ship is taking water on board.
     - **Foundering**: will be considered when the vessel has sunk. Foundering should only be regarded as the first casualty event if we do not know the details of the flooding which caused the vessel to founder. In the chain of events foundering can be the last casualty event in this case there is the need to add accidental events.

    - **Flooding**: refers to a casualty when a vessel takes water on board and can be:
        - **Progressive**: if the water flow is gradual.
        - **Massive**: if the water flow is extensive.
- **Hull failure**:
  a failure affecting the general structural strength of the ship.
- **Loss of control**:
  a total or temporary loss of the ability to operate or manoeuvre the ship, failure of electric power, or to contain on board cargo or other substances:
    - **Loss of electrical power**: is the loss of the electrical supply to the ship or facility;
    - **Loss of propulsion power**: is the loss of propulsion because of machinery failure;
    - **Loss of directional control**: is the loss of the ability to steer the ship;
    - **Loss of containment**: is an accidental spill or damage or loss of cargo or other substances carried on board a ship.
- **Missing**:
  a casualty to a ship whose fate is undetermined with no information having been received on the loss and whereabouts after a reasonable period of time.
- **Non-accidental events**:
  are intentional events as a result of illegal or hostile acts therefore they are not marine casualties or incidents. They are:
    - **Acts of war**: any act, against a ship or the people on board, by a State that would effectively terminate the normal international law of peacetime and activate the international law of war;
    - **Criminal acts**: any crime, including an act, omission, or possession under the laws of a State or local government, which poses a substantial threat to people on board of a ship or to property (e.g. terrorism, sabotage, piracy);
    - **Illegal discharge**: is an intentional discharge of polluting substances, oil or other noxious substances, from ships; and
    - **Other**: other intentional act that incur loss of or damage to a ship or environmental damage or harm to people on board.

  Non-accidental events are not considered as marine casualties or incidents and are not covered by the scope of the Accident Investigation Directive (2009/18/EC).

3. **Contributing factor**:
   is a condition that may have contributed to an accidental event or worsened its consequence (e.g., man/machine interaction, inadequate illumination).
4. **Occurrence with person(s)**:
   are grouped under **deviations**, which consist in the description of the event deviating from normality leading to the accident:
    - **Deviation due to electrical problems, explosion, fire - Not specified**
        - Electrical problem due to equipment failure - leading to indirect contact
        - Electrical problem - leading to direct contact
        - Explosion
        - Fire, flare up
        - Other Deviations not listed above
    - **Deviation by overflow, overturn, leak, flow, vaporisation, emission**
        - Solid state - overflowing, overturning
        - Liquid state - leaking, oozing, flowing, splashing, spraying
        - Gaseous state - vaporisation, aerosol formation, gas formation
        - Pulverulent material - smoke generation, dust/particles in suspension/emission of
        - Other Deviations not listed above

- **Breakage, bursting, splitting, slipping, fall, collapse of Material Agent**
  - Breakage of material - at joint, at seams
  - Breakage, bursting - causing splinters (wood, glass, metal, stone, plastic, others)
  - Slip, fall, collapse of Material Agent - from above (falling on the victim)
  - Slip, fall, collapse of Material Agent - from below (dragging the victim down)
  - Slip, fall, collapse of Material Agent - on the same level
  - Other deviations not listed above
- **Loss of control (total or partial) of machine, means of transport or handling equipment, handheld tool, object, animal**
  - Loss of control (total or partial) - of machine (including unwanted start-up) or of the material being worked by the machine
  - Loss of control (total or partial) - of means of transport or handling equipment, (motorised or not)
  - Loss of control (total or partial) - of hand-held tool (motorised or not) or of the material being worked by the tool
  - Loss of control (total or partial) - of object (being carried, moved, handled, etc.)
  - Loss of control (total or partial) - of animal
  - Other Deviations not listed above
- **Slipping - Stumbling and falling - Fall of persons**
  - Fall of person - to a lower level
  - Slipping - Stumbling and falling - Fall of person - on the same level
  - Fall overboard of person
  - Other deviations not listed above
- **Body movement without any physical stress (generally leading to an external injury)**
  - Walking on a sharp object
  - Kneeling on, sitting on, leaning against
  - Being caught or carried away, by something or by momentum
  - Uncoordinated movements, spurious or untimely actions
  - Other Deviations not listed above
- **Body movement under or with physical stress (generally leading to an internal injury)**
  - Lifting, carrying, standing up
  - Pushing, pulling
  - Putting down, bending down
  - Twisting, turning
  - Treading badly, twisting leg or ankle, slipping without falling
  - Other Deviations not listed above
- **Shock, fright, violence, aggression, threat, presence**
  - Shock, fright
  - Violence, aggression, threat - between company employees subjected to the employer's authority
  - Violence, aggression, threat - from people external to the company towards victims performing their duties
  - Aggression, jostle - by animal
  - Presence of the victim or of a third person in itself creating a danger for oneself and possibly others
  - Other Deviations not listed above
- **Other Deviations not listed above in this classification.**

5. **Location**:
   categories describing the location where the casualty or accident occurred are:
   - Outside Territorial sea it will be regarded as **open sea**.
   - If it is in waters up to 12 nautical miles from the baseline it is **coastal waters ≤ 12 nautical miles**.
   - If it is in the waters on the landward side of the baseline of the Territorial sea it is regarded as **internal waters** (**archipelago fairway, channel/river, port area**).
   - **Inland waters,** which includes any area of water defined by EU Member States and not categorized as 'sea'- e.g., canals, tidal and non-tidal rivers, lakes, and some estuarial waters (an arm of sea that extends inland to meet the mouth of a river).
   - **Repair yard** and **unknown** are the two other possible values.
6. **Occurrence with person(s) type**:
   means the mode in which only a person(s)on board was injured or died.

   Accidents not related to ship operations, illness, suicide and homicides are not covered by the scope of the Directive 2009/18/EC.
7. **Persons on board**:
   are categorised as follow:
   - Crew members / seafarers (any person who is employed or engaged or works in any capacity on board a ship);
   - Passengers; and
   - Others, for example persons working in harbours to load or unload ships.
8. **Safety recommendation**:
   is a recommendation derived from the analysis and conclusions of the investigation and is related to particular subject areas, such as legislation, training, maintenance, etc.
   Safety recommendations are addressed to those best placed to implement them, such as ship owners, maritime authorities, etc.

   Member States shall ensure that safety recommendations are duly taken into account by the addressees and, where appropriate, be given an adequate follow-up in accordance with Community and International law.
9. **Ship type:**

   Ships are catalogued in types according to the ship's main activity:
   - **Cargo ship**: is a commercial ship designed for the carriage of various types of cargo, goods or products and up to a maximum of 12 passengers.
   - **Fishing vessel**: is a vessel equipped or used commercially for catching fish or other living resources at sea.
   - **Passenger ship**: is a ship designed to transport more than 12 passengers.
   - **Service ship**: is a ship designed for special services, like a tug or a dredger.
   - **Other ship**: may be:
     - **Inland waterway vessel**: is a vessel intended solely or mainly for navigation on inland waterways.
     - **Recreational craft**: is a boat of any type, regardless of the means of propulsion, intended for sports or leisure purposes.
     - **Navy ship**: is a ship operating under the Navy or other military organization.
     - **Unknown ship type**: occurrence for which it was not possible to identify the vessel type.

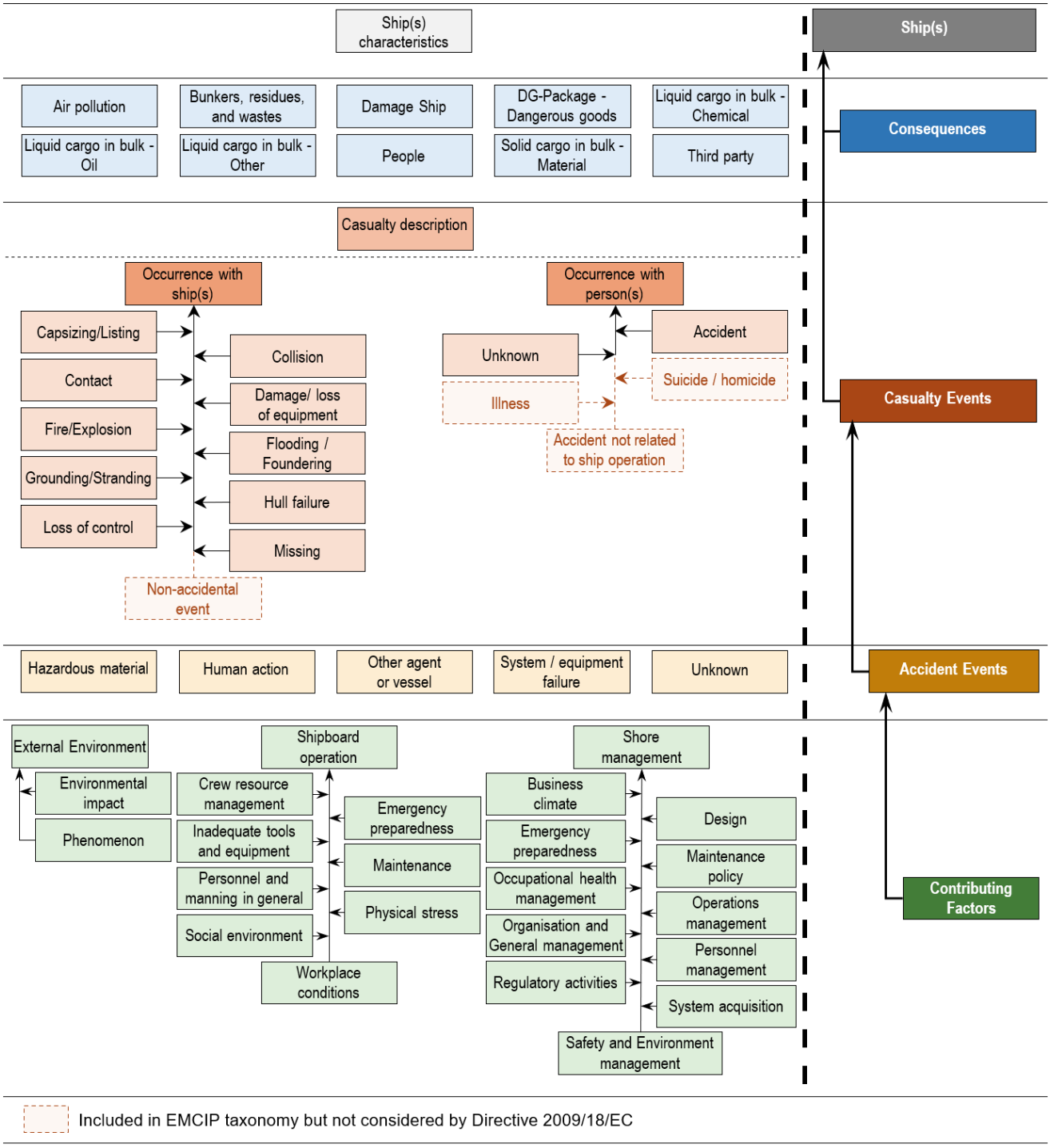
   Such vessels are considered within the scope of the Directive only when they are involved in an occurrence together with a ship which is covered by the Directive (e.g., a collision between a cargo ship and a recreational craft).

10. **Nature of a marine casualty or incident**:
    The nature of a marine casualty or incident is separated into two different categories:
    - **Occurrence with ship(s)**: when a ship, its equipment or cargo is affected by an accident; and
    - **Occupational accident**: where the accident affects only a person.
11. **Shore assistance**:
    because of a breakdown or immobilisation of the main engines or other event, the ships concerned might need shore assistance.
12. **Towage**:
    because of a breakdown or immobilisation of the main engines or other event, the ships concerned might need towage.
13. **Unfit to proceed**:
    means that the ship is in a condition, which does not correspond substantially with the applicable international conventions or national legislation, presenting a danger to the ship and the persons on board or an unreasonable threat of harm to the marine environment.
14. **Voyage segment**:
    determines the section of the voyage being undertaken at the time of the marine casualty or incident. It can be:
    - **Anchored or alongside**;
    - **Departure**;
    - **En route** (after the departure and before arrival, when she is underway at sea);
    - **Arrival**; or
    - **Unknown**.

# Appendix 2 EMCIP model

To harmonise the reporting in a meaningful and comprehensive way, a codification of the information resulting from marine casualties was defined. This codification provides also practical advice for a systematic investigation of marine casualties and incidents and allows the development of effective analysis and preventive action. It covers the different elements that connect the consequences of an accident to its root events.

EMCIP schematic model




Such model is not only implemented at European level, but also at international level through the IMO resolution A28/Res.1075.

To support this model, a specific taxonomy related to marine casualties and incidents, composed by 630 fields, has been developed in the EMCIP database to store the various information collected during the investigation.

The main elements of the EMCIP model are:

### Ship:

For each marine casualty and incident, it is necessary to add the information for as many ships as involved. Usually only one ship will be included, excepting in the case of collisions where at least two ships will be involved.

Information about Casualty Events and Consequences are required for each Ship.

### Consequences:

After a marine accident or incident some Consequences are expected. These Consequences are important not only for statistical reasons but also to determine the severity of the Occurrence. They are linked to each ship and are catalogued in 10 groups:

- Air pollution;
- Bunkers, residues and wastes;
- Damage Ship;
- DG-Package - Dangerous goods;
- Liquid cargo in bulk - Chemical;
- Liquid cargo in bulk - Oil;
- Liquid cargo in bulk - Others;
- People;
- Solid cargo in bulk - Material; and
- Third party.

For each group, there are different fields to include detailed data related to the Consequences.

### Casualty Events:

Casualty Events are the events representing the casualty itself.

Casualty Events are divided in two main groups, to distinguish between casualties with ships and occupational accidents:

- Occurrence with ship(s); and
- Occurrence with person(s).

The possible values for Casualty Events in a second level are only 10 for casualties with ships:

- Occurrence with ship(s) – Capsizing/Listing;
- Occurrence with ship(s) – Collision;
- Occurrence with ship(s) – Contact;
- Occurrence with ship(s) – Damage/loss of equipment;
- Occurrence with ship(s) – Fire/Explosion;
- Occurrence with ship(s) – Flooding/Foundering;
- Occurrence with ship(s) – Grounding/Stranding;
- Occurrence with ship(s) – Hull failure;
- Occurrence with ship(s) – Loss of control; and
- Occurrence with ship(s) – Missing.

The possible values for Casualty Events, in a second level, are only 2 for occupational accidents:

- Occurrence with person(s) – Accident; and
- Occurrence with person(s) – Unknown.

EMCIP taxonomy has other four second level options, but those options are not considered by the Directive 2009/18/EC.

EMCIP taxonomy includes third and fourth level options, not included in the schematic model for simplicity, to improve the definition of the Casualty Events.

### Accident Events

Accident Events are events not representing a casualty itself but having influence in a Casualty Event.

Accident Events are always related to a Casualty Event, and they should be considered in the context of the Casualty Event. Usually, Accident Events are unintended and unwanted.

There are 5 Accident Event Types:

- Hazardous material;
- Human action;
- Other agent or vessel;
- System/equipment failure; and
- Unknown.

Each Accident Event Type has specific taxonomy for its definition.

For the analysis of Accident Events two approaches are used in this document:

- Percentage of Accident Event Types; and
- Percentage of investigated Marine Casualties reporting at least once an Accident Event Type.

The percentage of Accident Event Types gives information about the influence of each Accident Event in the total amount of Accident Events. The procedure it is:

- In a sample extracted from EMCIP, for each Accident Event Type, the times that the Accident Event Type appears is counted. For the Accident Event Type number *i* a value $N_i$ is obtained.
- The total number of appearances of Accident Event Types in the sample extracted from EMCIP, T, is obtained as the sum of all the values Ni for all the Accident Event Types.
- The percentage of each Accident Event Type is then obtained dividing the correspondent value $N_i$ by *T*.
- The sum of all the percentages will be 100%.

The percentage of investigated Marine Casualties reporting at least once an Accident Event Type, gives information about the influence of each Accident Event Type in the investigated Marine Casualties, that means the percentage of investigated Marine Casualties influenced by each Accident Event Type. The procedure to obtain it is:

- In a sample extracted from EMCIP, for each Accident Event Type, the number of investigated Marine Casualties where the Accident Event Type appears at least once is counted. For the Accident Event Type number *i* a value $M_i$ is obtained.
- The percentage of each Accident Event Type is then obtained dividing the correspondent value *Mi* by the total number of investigated Marine Casualties in the sample extracted from EMCIP.
- The sum of all the percentages can be greater than 100% because each investigated Marine Casualty can be influenced by one or more Accident Event Type.

### Contributing Factors

Contributing Factors are the factors that help to cause the Accident Events.

Contributing Factors are always related to an Accident Event and are catalogued in three main types:

- External Environment;
- Shipboard Operation; and
- Shore Management.

The possible 21 values for Contributing Factors in a second level are:

- External Environment - Environmental impact;
- External Environment - Phenomenon;
- Shipboard Operation - Crew resource management;
- Shipboard Operation - Emergency preparedness;
- Shipboard Operation - Inadequate tools and equipment;
- Shipboard Operation - Maintenance;
- Shipboard Operation - Personnel and manning in general;
- Shipboard Operation - Physical stress;
- Shipboard Operation - Social environment;
- Shipboard Operation - Workplace conditions;
- Shore Management - Business climate;
- Shore Management - Design;
- Shore Management - Emergency preparedness;
- Shore Management - Maintenance policy;
- Shore Management - Occupational health management;
- Shore Management - Operations management;
- Shore Management - Organization and General management;
- Shore Management - Personnel management;
- Shore Management - Regulatory activities;
- Shore Management - System acquisition; and
- Shore Management - Safety and Environment management.

EMCIP taxonomy also includes third and fourth levels for Contributing Factors. The total possible Contributing Factors to choose are 185 (37 External Environment, 72 Shipboard Operation and 76 Shore management).

Such a great taxonomy increases the difficulty of the analysis. In this document the Contributing Factors categories are simplified by structuring them in only four categories:

- Human behaviour:
  - Shipboard operation: Crew resource management, Emergency preparedness, Maintenance, Personnel and manning in general
  - Shore management: Design and System acquisition
- Environment (internal or external):
  - External environment.
  - Shipboard operation: Physical stress, Social environment and Workplace conditions
  - Shore management: Business climate, Personnel management and Safety and Environment management
- Rules, procedures and training:
  - Shore management: Emergency preparedness, Maintenance policy, Occupational health management, Operations management, Organisation and General management and Regulatory activities
- Tools and equipment:
  - Shipboard operation: Inadequate tools and equipment

This new categorization of Contributing Factors facilitates the analysis.

### Safety Recommendations

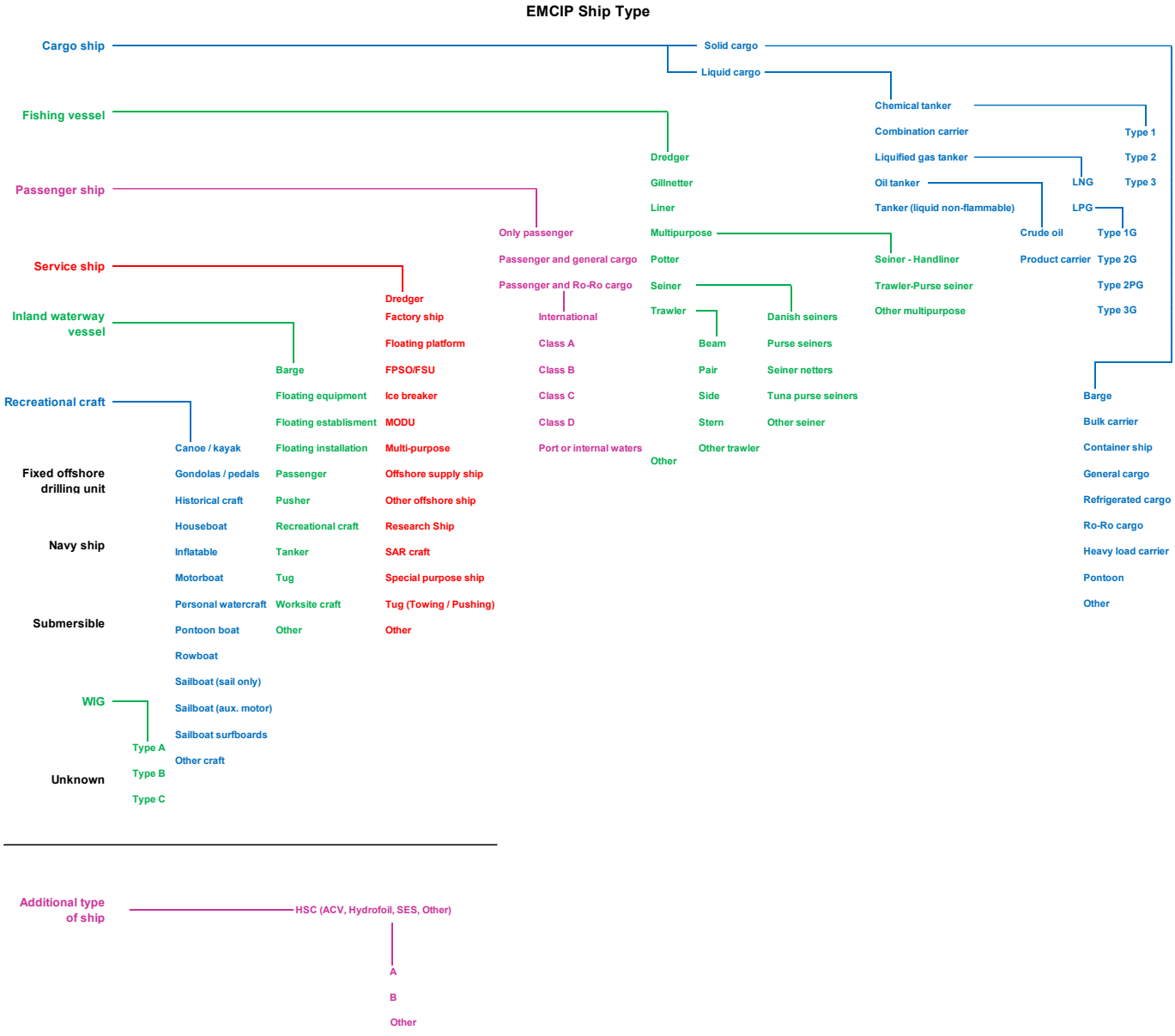
Issued by the investigative bodies, their objective is to ‘cut the links’ between the Contributing Factors, Accident Events and Casualty Events.

Safety Recommendations are related to the Marine Casualties and must be addressed to those that are best placed to implement them, as stablished in Directive 2009/18/EC.

EMCIP taxonomy includes Safety Recommendations, but they are not included in the schematic model for simplicity.

When safety issues have been properly identified during a safety investigation, and followed by relevant Safety Recommendations, a proper consideration by the addressee should prevent similar casualties.

# Appendix 3 EMCIP ship types



# Appendix 4 Methodology to determine EU 27 ship occurrence indicator

## Introduction

EU 27 ship occurrence indicator (OccID) is a ratio between the number of reported accidents or incidents for a given ship type and the corresponding EU 27 fleet size.

This indicator aims to provide information about the number of reported accidents and incidents per thousand ships in the fleet. As an example, if one year the indicator for a ship type is 100 it means than for every 1,000 ships of this type in the fleet, 100 had and accident or incident that year.

OccID is not intended to come up with a judgement whether one ship type is safer than other, as a 'safe system' cannot be simplistically defined by the lack of unwanted events.

## Methodology

For the ship type i and the year y, OccID is obtained applying the following simple mathematical formula:

$$OccID(i,y) = Integer\left(1000\frac{Number\ of\ accidents\ or\ incidents\ (i,y)}{Fleet\ size\ (i,y)}\right)$$

Data for marine occurrences (accidents or incidents) to determine the numerators of the above equation come from EMCIP, while the denominators are obtained using data from:

- MARINFO for cargo, passenger and service ships provided with IMO number. Ships are catalogued in types following the list of EMCIP ship types in Appendix 3.
- EU Fleet database[2] for fishing vessels. The tool is managed by DG MARE and provides detailed information on fishing vessels registered in the EU (only EU 27).

Further elements are considered:

- There is not full data available for other ships so, this ship type cannot be considered in the analysis.
- Fishing vessels fleets for EEA EFTA countries are not available in the EU Fleet database so, OccID only refer to EU 27 flagged ships, without considering EEA EFTA countries.
- For cargo, passenger, service, and other ships OccID, the analysis considers only the accidents and incidents reported in EMCIP involving ships provided with an IMO number to guarantee consistency with MARINFO.
- Only fishing vessels above 15 meters LOA (as per scope of the Directive 2009/18/EC) are considered for fishing vessel fleet.
- The analysis considers all the EMCIP occurrences matching the methodology without discriminating between occurrences with ships(s) and Occurrence with person(s).

[2] https://webgate.ec.europa.eu/fleet-europa/index_en

# Appendix 5 Methodology to determine fatalities indicator and injuries indicator per category of the person on board

## Introduction

Fatalities indicator and injuries indicator (FatID and InjID) are ratios between the number of fatalities or injuries reported for a given category of person on board and the estimated number of persons on that category in the fleet in Europe. To convert ratios in integers they are multiplied by one million.

These indicators aim to provide information about the number of reported fatalities and injuries per million persons of each category (crew member, passenger or other) on board. As an example, if one year this fatalities indicator in passenger ships is 5 for crew members, it means than for every million crew members on board passenger ships there were 5 crew member fatalities that year.

FatID and InjID are not intended to come up with a judgement whether a category of person on board is safer than other.

## Methodology

For the category of the person on board i and the year y, fatalities indicator (FatID) is obtained applying the following simple mathematical formula:

$$FatID(i,y) = Integer\left(1000000\frac{Number\ of\ fatalities\ (i,y)}{Estimated\ number\ of\ persons\ in\ the\ fleet\ (i,y)}\right)$$

For the category of the person on board I and the year y, injuries indicator (InjID) is obtained applying the following simple mathematical formula:

$$InjID(i,y) = Integer\left(1000000\frac{Number\ of\ injuries\ (i,y)}{Estimated\ number\ of\ persons\ in\ the\ fleet\ (i,y)}\right)$$

Data for the number of fatalities or injuries to determine the numerators of the above equation come from EMCIP, while the denominators are obtained using data from Eurostat with the following limitations:

- Every year EMSA publishes the seafarers' statistics in EU. These statistics are based in the STCW Information System and provide data only for seafarers with STCW certification. This is the source of information for the analysis so, excepting for the fishermen, only crew with STCW certification considered by the EU Member States (EU 27 and EEA EFTA States) is used for the analysis.
- Number of fishermen in EU are only estimations.
- Data for seafarers and passengers in 2021 was not published when this document was finished. Consequently, no data could be considered in the present document.
- It is not possible to determine the number of other kinds of person on board, so it is not considered in the analysis.

# Appendix 6 List of national investigative bodies in the EU

| Member State | Name of the national investigative body | Acronym | Website |
|---|---|---|---|
| Austria | Safety Investigation Authority of Austria | BAV/SUB | http://www.bmvit.gv.at/ |
| Belgium | Federal Bureau for the Investigation of Maritime Accidents | FEBIMA | https://mobilit.belgium.be/en/shipping/federal_bureau_investigation_maritime_accidents_febima |
| Bulgaria | Maritime Accident Investigation Unit | MTITC | http://www.mtitc.government.bg |
| Croatia | Air, Maritime and Railway Traffic Accidents Investigation Agency | AIN | www.ain.hr |
| Cyprus | Marine Accident and Incident Investigation Committee | MAIC | www.maic.gov.cy/mcw/dms/maic/maic.nsf/ |
| Czech Republic | Ministry of Transport, Czech Maritime Administration Navigation Department | MT_ND | http://www.mdcr.cz |
| Denmark | Danish Maritime Accident Investigation Board | DMAIB | http://www.dmaib.com |
| Estonia | Safety Investigation Bureau of Estonia | ESIB | www.ojk.ee |
| Finland | Safety Investigation Authority of Finland | SIA | http://www.onnettomuustutkinta.fi |
| France | French Marine Casualties Investigation Board | BEAmer | http://www.bea-mer.developpement-durable.gouv.fr/ |
| Germany | Federal Bureau of Maritime Casualty Investigation | BSU | http://www.bsu-bund.de |
| Greece | Hellenic Bureau for Marine Casualties Investigation | HBMCI | http://www.hbmci.gov.gr |
| Hungary | Transportation Safety Bureau of Hungary | TSB | http://www.kbsz.hu |
| Iceland | Icelandic Marine Accident Investigation Board | ITSB | www.rnsa.is |
| Ireland | Marine Casualty Investigation Board | MCIB | http://www.mcib.ie |
| Italy | General Directorate for Railway and Maritime Accident Investigation | DIGIFEMA | http://www.mit.gov.it |
| Latvia | Transport Accident and Incident Investigation Bureau | TAIIB | http://www.taiib.gov.lv |
| Lithuania | Transport Accident and Incident Investigation Division | TAITS | https://tm.lrv.lt/en/fields-of-activity/transport-accident-and-incident-investigations |
| Luxembourg | Administration of Technical Investigations | AET | http://www.mt.public.lu/transports/AET |
| Malta | Marine Safety Investigation Unit | MSIU | https://mtip.gov.mt/en/Pages/MSIU/Marine-Safety-Investigation-Unit.aspx |
| The Netherlands | Dutch Safety Board | DSB | www.safetyboard.nl |
| Norway | Norwegian Safety Investigation Authority | NSIA | http://www.nsia.no |
| Poland | State Marine Accident Investigation Commission | PKBWM/SMAIC | www.pkbwm.gov.pl |
| Portugal | Maritime Accident Investigation Office and Aeronautical Meteorology Authority | GAMA | www.gama.mm.gov.pt |
| Romania | Marine Accidents Investigation Department | MAID | http://www.mt.ro |
| Slovenia | Maritime Accident and Incident Investigation Services | MAIIS | https://www.gov.si/en/ |
| Spain | Standing Commission for Maritime Accident and Incident Investigation | CIAIM | https://www.mitma.gob.es/organos-colegiados/ciaim |
| Sweden | Swedish Accident Investigation Authority | SHK | http://www.havkom.se |

# ABOUT THE EUROPEAN MARITIME SAFETY AGENCY

The European Maritime Safety Agency is one of the European Union's decentralised agencies. Based in Lisbon, the Agency provides technical assistance and support to the European Commission and Member States in the development and implementation of EU legislation on maritime safety, pollution by ships and maritime security. It has also been given operational tasks in the field of oil pollution response, vessel monitoring and long-range identification and tracking of vessels

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