



Maritime accidents affect the environment

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Abstract

This paper highlights the effects of transport accidents on the environment, specifically those occurring in maritime transportation. International trading and shipping are important for several reasons. International trade and shipping facilitate the movement of goods and services between countries, contributing to economic growth and development. It allows countries to access resources, products, and markets they might not have domestically, thus expanding their economic potential. Not all countries possess the same resources or expertise. International trade enables countries to specialise in producing goods and services where they have a comparative advantage, leading to more efficient resource allocation and increased productivity. International trade provides consumers access to various goods and services at different prices. This enhances consumer choice and allows people to enjoy products that may not be available or affordable domestically. International trade fosters competition among businesses, driving them to innovate, improve quality, and reduce costs to stay competitive in the global marketplace. This benefits consumers through better products and lower prices. Export-oriented industries create jobs as they expand to meet global demand. These jobs often have higher wages due to the specialised skills required.

International trade generates foreign exchange earnings for a country, which can be used to pay for imports, service foreign debt, and invest in other countries. A positive balance of payments is crucial for a stable economy. Trade exposes people to different cultures by exchanging goods, services, and ideas. This fosters greater understanding and co-operation among nations. Dependence on a single industry or market can be risky. International trade allows countries to diversify economies and reduce vulnerability to economic shocks. Shipping and transportation networks required for international trade often lead to improvements in infrastructure, including ports, roads, railways, and communication systems. These improvements benefit not only trade but also local communities. Trade can facilitate the transfer of technology, know-how, and best practices between countries. This helps less developed countries to catch up and develop more quickly. While shipping contributes to global carbon emissions, it also promotes energy-efficient practices through demand for cleaner and more sustainable transport options. In summary, international trading and shipping are essential drivers of economic growth, job creation, innovation, and cultural exchange, fostering co-operation and stability between nations while promoting efficient resource utilisation and diversification. The author performed a detailed statistical analysis based on the accident database. It explains the impacts on the environment and some remedies for it.

Keywords: environmental effect, waterborne accident, waterborne transport

1. Introduction

The environment and transportation are two crucial and paradoxical facets of our world. The movement of people and goods depends very highly on transportation activities, which is also an important factor in social and economic development. Transportation-related activities, however, have significant environmental effects, such as habitat destruction and air and water pollution. Transportation also contributes to climate change (Mako *et al.*, 2021).

The environmental effects that transportation causes can have very damaging effects on both humans and the natural environment. For example, while greenhouse gas emissions lead to global climate change and cause more frequent and severe weather events like heat waves, an increase in Arctic temperatures, sea level rise, and other damaging effects, air pollution can result in respiratory issues, health problems, and neurological diseases. Unluckily, the ecosystem and biodiversity are being parallel destroyed.

In order to balance the advantages of transportation with preserving the natural environment and thus make transportation sustainable, several solutions have emerged. These include a variety of tactics, such as promoting environmentally friendly modes of transportation like maritime transport (Jugović, Debelić, Brdar, 2011).

We can better understand the environmental effects of transportation activities and work to develop more sustainable and environmentally responsible transportation practices by examining the relationship between transportation and the environment. This study offers solutions and analysis, keeping in mind what Berry said: “The earth is what we all have in common.” (Wendell Berry, 2018)

The idea of the transportation system acting as the growth engine is common. It is regarded as the foundation of the economic and social progress of the 20th century and serves as a conduit for people to interact with one another and access resources (Debelić, Vilke, Milanović, 2016). However, it also significantly destroys the environment and the upheaval of communities, which are frequently distributed inequitably. The structure of national economies has changed due to the simplicity with which materials and goods can be transported within and between countries, enabling connectivity on a global scale (Gudmundsson *et al.*, 2015).

The relationship between living and non-living things and their surroundings is known as their environment. The environment should be viewed as the setting for life in this sense. Remembering that people are an integral part of the environment is important. The United Nations World Charter for Nature emphasises humanity’s connection to nature (United Nations, 1982).



This paper offers a brief overview of the basic concepts used in the study of maritime accident effects, overviews accident types and offers some general solutions to the problems.



Figure 1: Birds-eye View Photo of Freight Containers

(Source: <https://www.wallpaperflare.com/birds-eye-view-photo-of-freight-containers-aerial-shot-building-wallpaper-gydai>)

2. What is maritime transportation?

Maritime transportation is transporting goods, people, raw materials, and semi-finished products using ships, especially on seas. This branch of transport is required to offer not only transportation-related services but also other related and wider logistical services in a more effective manner (Song, Panayides, 2015). Maritime logistics is a term that frequently refers to the maritime transport system, which is deeply interlinked with the entire logistics flow (Dvorak et al., 2020). The main benefit of maritime logistics is that it consistently achieves high operational effectiveness and customer service.



Figure 2: Container ship,

(Source: EUROSTAT, 2023)

2.1 What are accidents?

Maritime transportation accidents occur while transporting goods or people by ships, boats, or watercraft. Causes may include human error, defective equipment, and unfavourable weather. Examples include fires, explosions, capsizing, sinking or grounding, resulting in fatalities, injuries and environmental harm (Li, Ren, Yang, 2023). International organisations like the International Maritime Organization have established rules and standards to ensure safety, including crew training, certification, and adherence to operational and safety standards.



2.2 Types of accidents

As mentioned, accidents are unexpected events that can occur during a commercial trip and can happen in many ways. According to the European Maritime Safety Agency (EMSA), a casualty occurs when one of the following conditions is met:

- “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;
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.” (EMSA 2022, EMSA 2023)

The following figures show how the number of maritime accidents has diminished over the previous decade (Figure 3), their ratio to total number of accidents (Figure 4) and their time series if any tendencies could be defined (Figure 5):

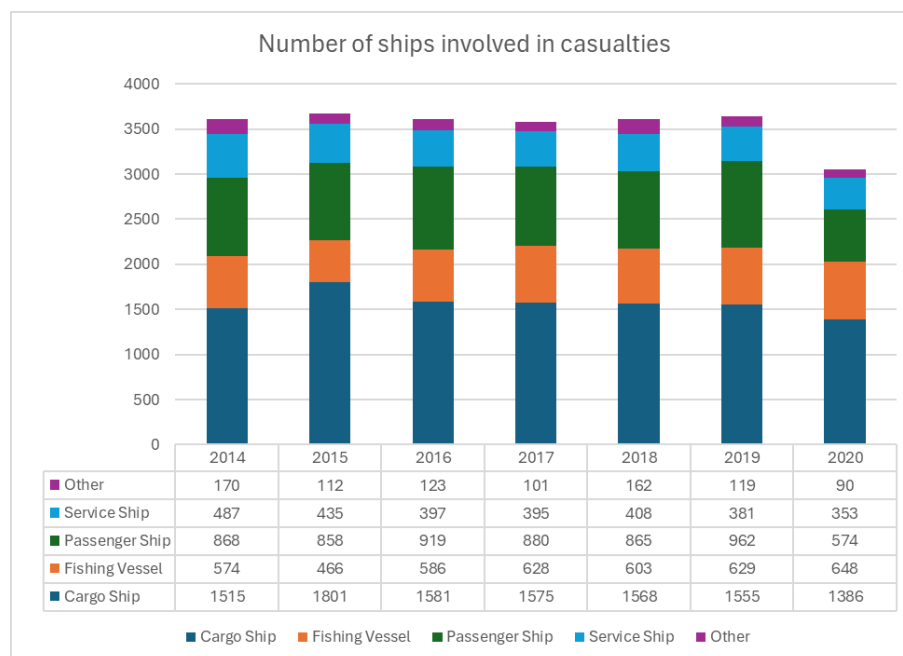


Figure 3 Numer of ships involved in accidents with casualties
(Source: Bilogistik, 2019, Sepehri et al. 2022, EMSA, 2022, EMSA 2023)

Figure 3 offers a more comprehensive perspective that cargo ships are the ones that suffer the most casualties. The information in the table above pertains to each type of ship's annual fatalities for 2014-2020. The author is aware that the number of accidents alone cannot describe the risk of shipping, although performance or distance-based comparison of different waterborne transport is impossible due to the lack of a coherent and transparent database.

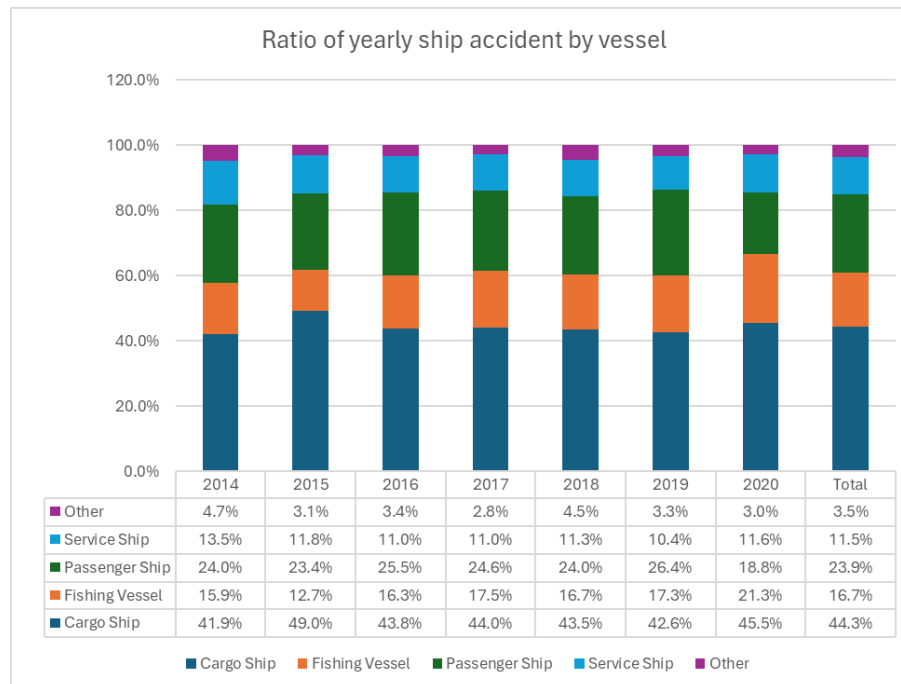


Figure 4 Ratio of ships involved in accidents with casualties
(Source: own calculation based on Bilogistik, 2019, Sepehri et al. 2022, EMSA, 2022, EMSA 2023)

It can be seen in Figure 4 and Figure 5 that the accident share of passenger ships significantly dropped, most probably due to the COVID-SARS-19 pandemic. The cargo ship and service ship ratio is nearly constant over time. Meanwhile, the role of fishing vessels is increasing, most probably due to increasing fishing activity.

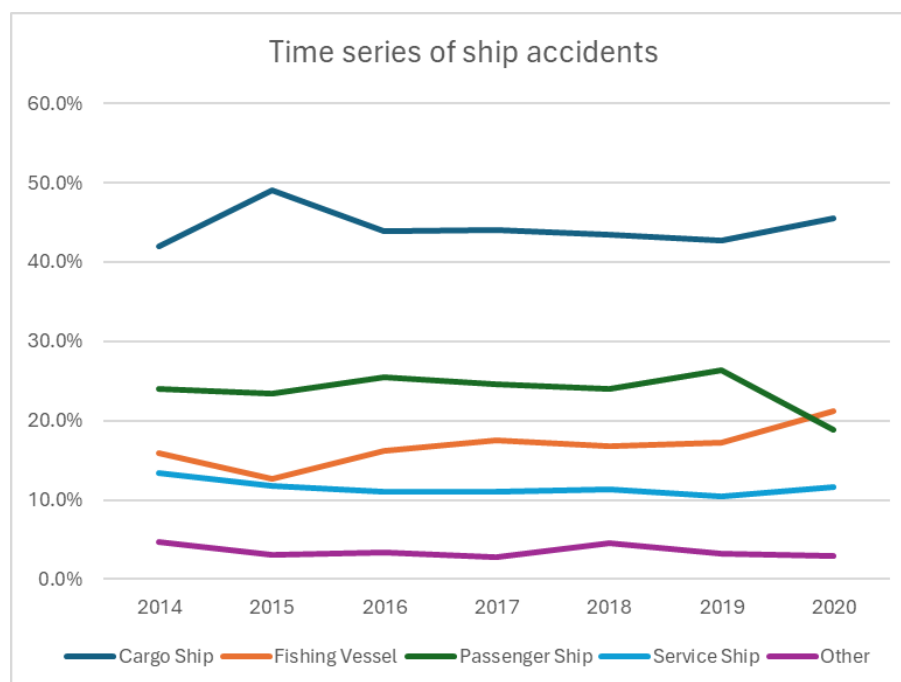


Figure 5 Time series of ships involved in accidents with casualties
(Source: own calculation based on Bilogistik, 2019, Sepehri et al. 2022, EMSA, 2022, EMSA 2023)

The average number of accidents and standard deviation of each type were calculated in this table to indicate how much variability there is in the data:

Table 1 Descriptive statistical analysis of maritime accidents 2014-2020

	Average	Standard Deviation	ST/AVG
Cargo Ship	1569	123	7.8%
Fishing Vessel	591	61	10.3%
Passenger Ship	847	126	14.9%
Service Ship	408	43	10.5%
Other	125	30	24.0%
Total	3539	218	6.2%

(Source: own calculation based on Bilogistik, 2019, Sepehri et al. 2022, EMSA, 2022, EMSA 2023)

Based on Table 1, it can be stated that although the number of other types of accidents is very low, they vary a lot over time. Meanwhile, the largest number of accidents can be connected to cargo ships, deviation of accidents are low.

2.3 Effects of Accidents on the Environment

There are some significant and frequently long-lasting effects that maritime mishaps can have on the environment:

1. Oil spills from ships can seriously harm the environment because the oil can cover large areas of the ocean and shorelines, causing the death of marine life and, thus, ecosystem disruption. Oil can stay in the ocean for a very long time, which makes spills have long-lasting effects on the environment.

In the figure below, there is a representation of what an oil spill causes to the marine environment. Figure 6 was chosen because oil spills have the most detrimental environmental effects.

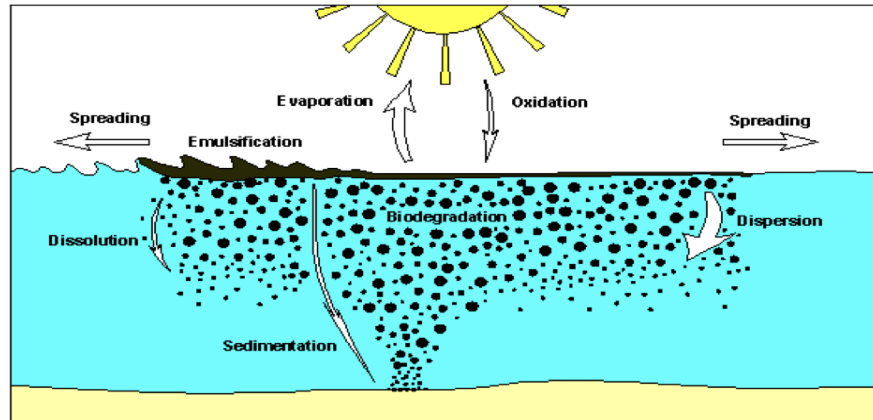


Figure 6: Fate of oil spilt in the marine environment (Weathering Process),
(Source: Kozanhan, 2019: .9)

The weathering process describes the physical and chemical changes caused by exposure to air, sunlight, water, and other natural elements. It is a process that occurs when oil leaks into the marine environment. This process can impact the outcome of the oil spill in several ways.

2. Chemical Spills: Depending on the quantity of chemicals released, ship spills can seriously harm the environment. Chemical spills can harm humans, animals, and marine life while contaminating the soil, water, and air.
3. Habitat Destroying Accidents: Maritime mishaps like collisions or groundings can physically destroy coral reefs, seagrass beds, and other crucial marine habitats. It may take years or even decades for these ecosystems to recover.
4. Noise pollution: Marine life, such as whales, dolphins, and other marine mammals, can be disturbed by ship noise, which may interfere with their ability to communicate and navigate.



5. Non-native species can be found in ballast water discharged by ships. These species compete with native species and cause ecosystem disruption.
6. Climate Change: The emission of greenhouse gases like carbon dioxide and methane during maritime transport contributes to climate change. These emissions may contribute to ocean acidification, damaging ecosystems and marine life. This, in turn, causes harm to human society.

2.4 Minimising the impact

Several approaches can be used to lessen the environmental harm caused by maritime accidents. The best strategy is prevention through effective safety measures, crew training, and safety protocols. A successful emergency response strategy incorporating containment booms and skimmers can be extremely important. Tougher environmental regulations, like prohibitions on ballast water discharge and requirements for low-emission fuel, can aid in minimising the impact of maritime transportation. Innovative technologies can be used to reduce greenhouse gas emissions and halt the spread of invasive species, such as alternative fuels and ballast water treatment. International co-operation is essential to address the global nature of maritime transport and its effects on the environment, including the development of global laws and standards and co-operation between nations and organisations. In the wake of an accident, restoration is crucial. Examples include removing trash, repairing damaged ecosystems, and aiding affected communities.

3. Conclusion

Environmental impacts of maritime transportation can be significant and widespread. Maritime transportation's main environmental effects include introducing invasive species, habitat destruction, and air and water pollution. The main source of air pollution from maritime transportation is the emission of greenhouse gases like carbon dioxide and other pollutants like sulfur and nitrogen oxides, which can negatively impact human health and the environment.

Untreated ballast water discharge, oil spills, and the release of other chemicals and waste materials into the ocean are just a few of the many sources that can lead to water pollution. These contaminants can harm marine life, destroy habitats, and contaminate human food sources. Significant environmental effects of maritime transportation include the destruction of habitat. While the movement of ships can introduce non-native species into new environments, which can have detrimental effects on local ecosystems, the construction of ports, dredging, and waste disposal are all activities that can harm coastal and marine ecosystems. In conclusion, there is a need for ongoing efforts to reduce the negative effects that maritime transportation has on the environment. The shipping industry and regulatory bodies must collaborate to develop and implement measures to reduce air and water pollution, prevent oil spills and other types of pollution, and minimise habitat destruction and the introduction of invasive species. To ensure that the environmental impacts of maritime transport are minimised while still meeting the rising demand for international trade and commerce, co-operation between governments, industry, and other stakeholders will be necessary. Additionally, digitalisation is essential to improving the sustainability of maritime transportation. The maritime sector is becoming more cost-effective, efficient, and environmentally friendly thanks to integrating new technologies and digital platforms.

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