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**CATALOG OF NON-MILITARY RISKS
OCCURRING IN MARINE AREAS, WITH
SPECIAL CONSIDERATION FOR THREATS
GENERATED BY NATURAL CONDITIONS**

SUMMARY

The study indicates that not only the state of an armed conflict which may pose a significant threat to people, and the natural environment, but also non-military events occurring during peace, even during the daily functioning of the state and its citizens. The considered problem is aimed at developing a catalogue of forecasted non-military threats, taking into account the development of already defined threats generated by the forces of nature. In addition, the paper specifies the determinants of the occurring natural hazards, and indicates the areas of particular sensitivity, i.e. the progressive threats, and the resulting risks.

Keywords:

Security, non-military threats, risk catalogue, natural threats

INTRDUCTION

Shipping is the engine of the world economy. Almost 90% of trade takes place via the sea. There are over 90,000,000 sea-going vessels in sea areas, carrying various types of goods, passengers, and those carrying out offshore works. Therefore, ensuring safety in sea areas is a priority for all sea users. Any disturbances in the functioning of a complex system may lead to the occurrence of various types of negative effects, including threats on a global, and / or local scale. In view of the above, it seems fundamental for ensuring safety in sea areas to define the threats, and the resulting risks.

It should be emphasized, that the security of maritime areas should be considered in a broad aspect of threats: military and non-military (civil). Generally speaking, international maritime safety is a matter for all beneficiaries

of the sea and oceans, it is the safety of life and property, protection of the marine environment against the adverse effects of human activity, and the actions of nature itself, the effects of which we are often unable to predict. Due to the international nature of maritime safety, when building the rules of maritime safety, one must take into account the already existing situation, face the phenomena that have arisen, and implement the defined concepts, and procedures implemented through the binding formal and legal regulations, and good "maritime" practices. They are implemented in such a way that they secure the conducted activity in the most optimal way, and are consistent with the changing reality. The above formulations can be considered as nothing new, but in the era of sudden and abnormal changes taking place on our globe, including those related to the influence of the power of nature, they must be considered in a wide and long-term spectrum of consequences, affecting both safety, and security: shipping, people working on sea-going vessels, and avoiding degradation of the natural environment.

The issues to be considered will be in the aspect of non-military threats, including maritime safety, understood as:

- safety of life and health of people (working in sea areas, staying on sea-going vessels as a passenger, and crew member, as well as people who could feel the effects of events that arise as a result of activities conducted in sea areas);
- protection of the natural environment (against environmental degradation during the exploitation of offshore deposits, ships, and the development of marine areas);
- avoiding damage to property, i.e., inter alia, maritime units, their equipment, cargo, maritime, and port infrastructure.

The main purpose of the study is, on the basis of defined natural hazards, to identify sensitive areas of special sensitivity that arise as a result of the influence of the power of the forces of nature. In order to achieve the assumed goal, it is reasonable to develop a catalogue of forecast risks of non-military threats in the maritime environment, with particular emphasis on threats generated by the forces of nature. In order to achieve the main goal, it is advisable to decompose it into the following specific goals, the chronological implementation of which is ensured by the content of individual work point

- determining the global situation in terms of occurrences in sea areas and on the collected data, making:
- identification of threats considered on a global scale for the safety of shipping, the marine environment, and people, as a function of time,

- indication of contemporary threats and risks, and potential natural hazards, the power of which may generate potential risks for the safety of navigation, people, and the natural environment,
- indication of sensitive areas, the so-called bottlenecks, for which it is justified to develop scenarios.

The main research problem is to identify the areas of special sensitivity (areas critical for the safety of navigation, people, the natural environment, and property of significant value), i.e. events / situations / phenomena that may constitute on the increase in threats to the activities carried out in sea areas, and thus requiring appropriate preparation of scenarios of conduct in case of their occurrence.

The basic research method used to achieve the aim of the article is the analysis of source materials, mainly reports prepared by leading classification societies, such as: Det Norske Veritas, Lloyd's Register, insurance companies, in particular Allianz, and scientific articles prepared by leaders of risk analysis, and conducting risk assessments in the marine environment. However, for the purpose of risk assessment, it will be the HAZID (Hazard Identification), and HAZOP methods, consisting in the identification of hazards, and using the method of analysis conducted by an expert (in this case the author of the study).

The research technique used is participatory observation, consisting in the author's participation in numerous activities for the identification of threats, and improvement of safety, primarily while working on sea units in the on-board department, and participation in rescue, and rescue exercises on sea units, and as an observer on behalf of the shipowner. The study will be presented in a descriptive, tabular, and graphic form, and the information will be supported by analyses and available data.

The intended final result of the conducted research will be the conclusions formulated in the summary, regarding the complexity of the process of developing the risk assessment of hazards generated by natural conditions.

The layout of the study reflects the adopted assumptions and research goals. The text consists of an introductory part, substantive chapters corresponding to the scope of the specific objectives set out above, and a final part, which summarizes and indicates the directions of further research in this area. From the conducted research, conclusions can also be drawn regarding solutions implemented as part of effective risk management, and reduction of adverse events based on a proper risk assessment.

DETERMINATION OF THE GLOBAL SITUATION OF NON-MILITARY EVENTS OCCURRING IN MARINE AREAS

The purpose of this chapter of the study is to define the global situation in terms of the existing threats, and the resulting risks for the safety of navigation, the marine environment, and people. This will allow to identify the threats, and the resulting risks for humans, the natural environment, and marine units in the further part of the work.

The analysis undertaken should begin with considering the problem within a complex system, shaped by: international legal regulations, and those established at the local level, mutual interactions of sea users affecting each other directly, or indirectly, the marine environment, the ship and its cargo, external factors, including non-technical ones, as well as internal factors, including: the human aspect. The correctness of the system is supported by the naval forces, whose operational, and allied tasks, are carried out not only during military threats, but also in peaceful situations, by carrying out control, auxiliary, operational, preventive tasks, and a number of others, depending on the needs, using their resources and resources. These elements are also related to each other with various types of defined external partners, having an impact on the functioning of the system as a whole, and the maintenance of the level of safety in emergency situations, as well as during everyday activities in sea areas, Fig. no 1.

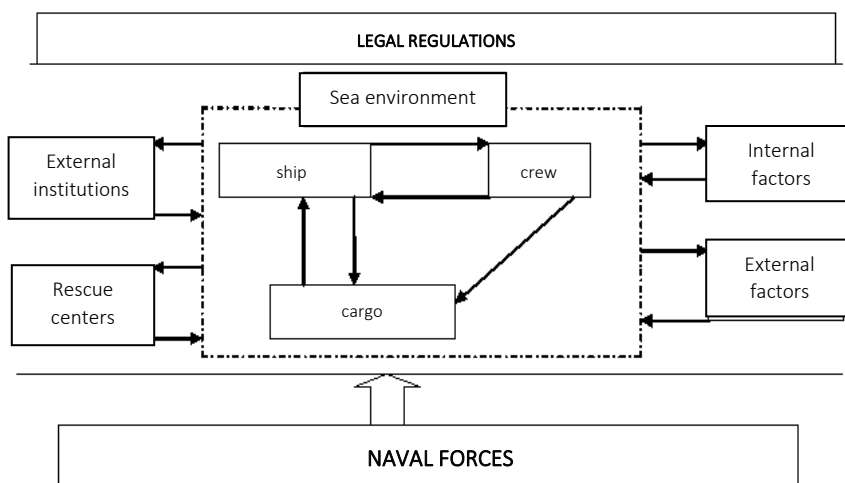


Fig.1. Mutual interaction of system components in sea areas.

Source: own research

In order to ensure the functioning of this complex process, and preparation for action during the occurrence of a hazard, it is necessary to classify the hazards, identify the risks they may generate together with the risk assessment. In addition, the identification of both defined, and potential threats in a complex research process aimed at identifying areas of special sensitivity, i.e. critical points, the occurrence of which may pose a significant risk to the broadly understood safety in sea areas. It is the first step in effective risk management, it allows to categorize all risks. Failure to identify threats results in the inability to detect the occurrence of a risk, and thus to prepare to act in the event of its occurrence. The diagram in Figure 2 shows the mutual relations, and dependencies in an effective risk assessment and management process. It shows that the next steps are integral, and compatible with the previous one, and that it is a system of closed dependencies and connections, the purpose of which is to keep the risk at an acceptable level. The scheme announced by the author aims to draw attention to the fact that the identification of threats and risks is the first, but extremely important step in the systemic approach to threats, regardless of the type, degree, location, or source of the threat.

Within the meaning of the subject of the study, the priority is to identify threats that require appropriate classification, taking into account the impact on the safety of people, both working on sea-going units, and those living on the shoreline, and the natural environment, as well as generating losses in property. This is an essential step in the materialization of risk, which is the responsibility of every organization, and institution operating in maritime areas.

The first group of threats, the occurrence of which constitutes a significant risk of a state of threat to humans, the natural environment, and property operating in sea areas, are threats generated by natural conditions. They are related, inter alia, to: the direction and strength of the wind, the state of the sea, the intensity of precipitation, visibility, undersea earthquakes, rising water levels, temperature of water and air, and other parameters, phenomena resulting from their accumulation, or as a result of their impact on marine environment.

In the last 10 years, there has been a noticeable increase in abnormal and unpredictable hydrometeorological phenomena related to, inter alia, weather parameters, and their impact on air circulation, caused by the changing climate, and the associated global warming. The current situation generates hurricane winds, as well as other, such as changes in water levels, melting ice, and the descent of icebergs in the North Atlantic in an unprecedented amount so far. The situation poses a threat to the entire ecosystem, to the exploited marine units, as

well as to the people working on them, and the coastal zone. These phenomena will be discussed in more detail later in this work.

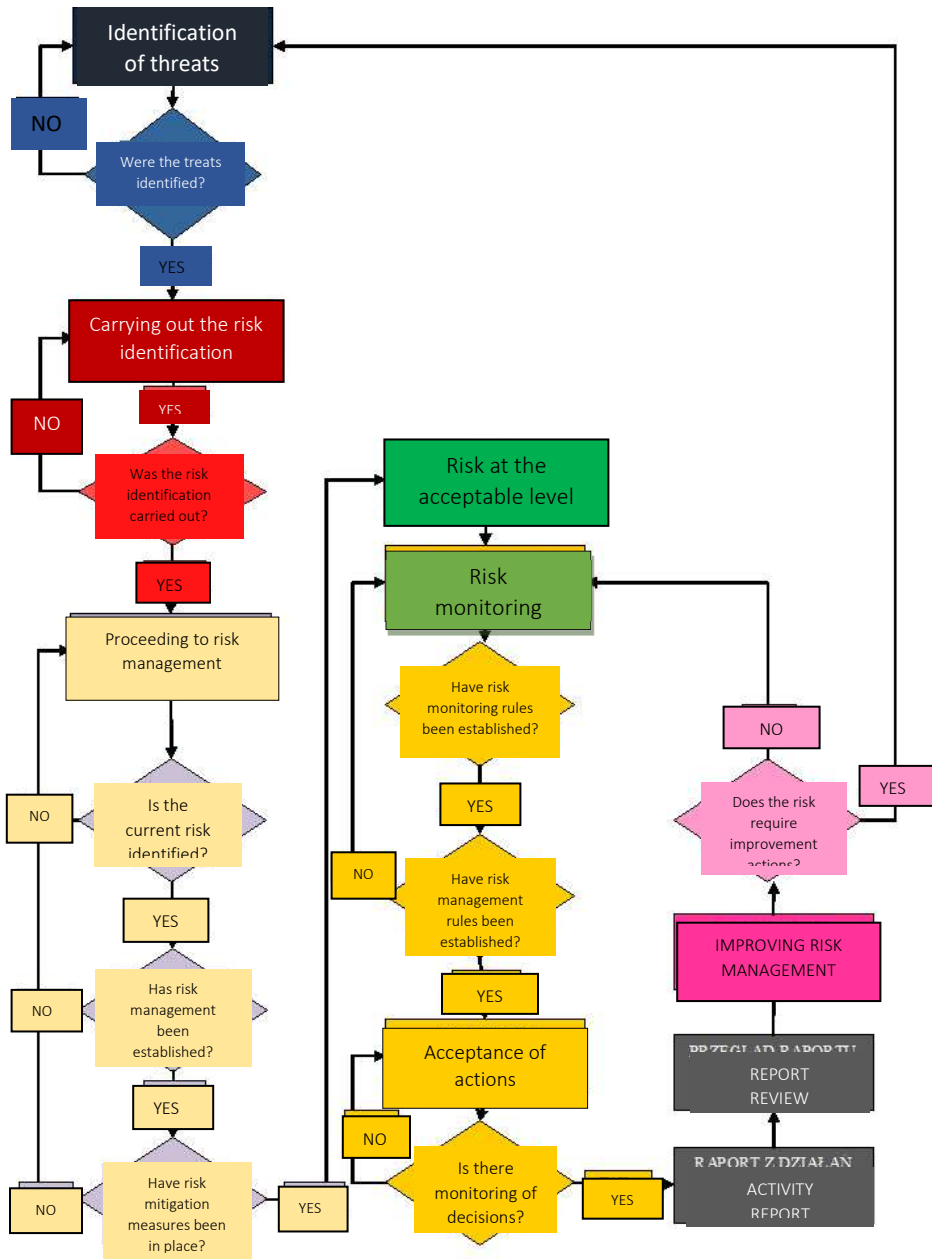


Fig.2. Mutual relationships and dependencies in an effective risk assessment process.

Source: own research, based on [4]

Another contemporary threat has been the problem of pollution of the marine environment by the operation of sea-going vessels, and in connection with the activities carried out in sea areas, both in terms of spatial development, and extraction of raw materials under the seabed, and the emission of harmful substances into the atmosphere, invariably for years. Illegal fishing or fish farms, which introduce pollution, also pose a threat to the ecosystem.

Alarming signals also concern accidents involving maritime units, including tankers, and the sinking of ships themselves. Taking into account fuel and petroleum substances, or in loading, harmful goods located on ships that have crashed, sank and were not tankers. However, in the case of the forfeiture of tankers, according to the data of the International Tanker Owners Pollution Federation Limited (ITOPF), a downward trend in oil spills caused by tanker failures continues.

The potential risk of various threats to the natural environment, including its pollution and degradation, and to the safety of ship routes, is the development of sea areas by wind farms. The potential of sea areas is huge in terms of its use and the acquisition of various resources, raw materials, and spatial development of sea areas, therefore it should be assumed that the interference with "nature" will continue. There is even talk of putting out wind farms installed on land, and shifting energy production to sea areas. Northern Europe is a world leader in wind energy production. Every year, not only the number of installed turbines grows, but also the efficiency and effectiveness of offshore wind technologies. The map in Figure 3 shows the distribution of wind farms in maritime areas in 2019 and 2018.

According to the data published by the Polish Offshore Wind Energy Society at the Conference in October 2019, it was reported that out of 106 offshore wind farms located in Europe²⁰ produce of energy of 20,381 MW by 4,811 wind turbines. The leaders in this area are Great Britain and Germany, followed by Belgium, the Netherlands, and Denmark.

Conducting activities related to crude oil and natural gas in offshore areas carries the risk of serious hazards, accidents, accidents, dangerous situations, and other events. The fact is that the threat generated by spilled crude

²⁰ Wind energy currently accounts for 14% of electricity in the EU (up from 12% in 2017), 16.7 GW of future projects have reached their final investment decision. Europe installed 11.7 GW (10.1 GW in the EU) with gross capacity in 2018, 33% less than in 2017. With a total net installed capacity of 189 GW [<https://windeurope.org/about-wind/statistics/european/wind-energy-in-europe-in-2018>].

oil in maritime areas may pose a threat to the life and health of people, not only at the installation, but also as a result of contact with the contaminated natural environment and its degradation for many years. Moreover, the threats that took place in the offshore production fields show that they had a negative impact on the regional and global economy, and shaped the exploration and production activities, as well as the prices of crude oil on local and world markets.

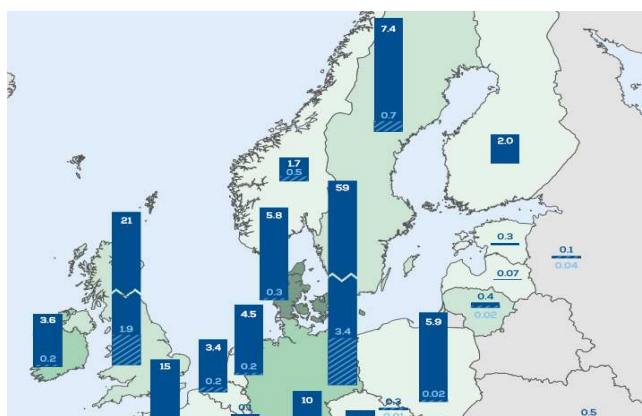


Fig. 3. Map of Europe with the location of the individual energy capacity produced by individual countries. The hatched areas relate to the power of energy generated in 2018 and 2019.

Source: [2,4]

Past events on the offshore fields, in particular the tragedy on the Piper Alpha in the North Sea in 1986, and the events of April 10, 2010 in the Gulf of Mexico, initiated an international debate to regulate exploration, and production of crude oil and natural gas in sea areas. In particular, attention has been focused on preventive actions consisting in: securing the conduct of works in marine exploitation fields, immediate, and above all, proper conduct in the event of a threat and increasing the awareness of threats among the society and entities conducting activity. An important aspect of the analysis of the current safety situation in the offshore industry is the fact that the operated installations, both underwater, and above-water, are already 25-30 years old, and even more, thus approaching the original planned operation periods. Therefore, the aging fleet requires appropriate risk management in order to reduce the number of accidents (including at work), and to introduce appropriate safeguards. According to data published by Loyds Intelligence List, installations built 20

years ago or more in North Europe constitute 68%, Latin America – 70%, North America – 71%, Africa – 75%. In North America, 30% of offshore installations and submarine pipelines are 30 years old, or older. This requires the introduction of regulations, and mechanisms for proper monitoring of the situation, broadly understood protective measures, and appropriate response to an event.

The map in Figure 4 shows the number of offshore rigs distributed throughout the world

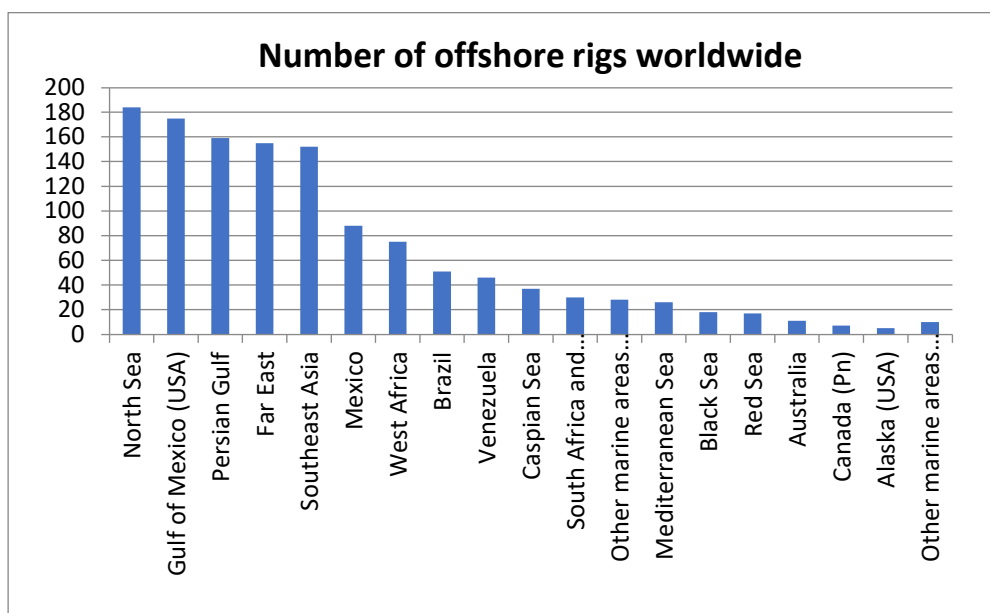


Fig. 4. Number of offshore rigs.
Source: own research, o[8]

Another threats to the safety of navigation, and the risk of environmental degradation and the safety of crews working on sea units, is the transport of goods along the Northern Route. This is already evidenced by the data on accidents that took place in this virgin area (Table 3 in the next chapter). The Northern Road is opened for the transport of goods due to the changing climate – its warming and melting ice. In addition to threats, it opens up new possibilities for the transport of cargo by sea. In the summer season, the northern route becomes clear, and allows, for example, for shortening the route of ships sailing from China to Europe. This means that the road from Shanghai to Rotterdam via the Suez Canal is 10557 Nautical miles, and 8046 via the North Route. This is

a 24% reduction in distance. Such data at the present time, where cheaper transport solutions are sought, seems a tempting proposition. However, one should bear in mind the environmental consequences of the activity undertaken.

The threat to people and the natural environment is also generated by the technological progress itself in building larger vessels with significant cargo capacity, but also capable of taking several thousand passengers on board²¹. Another danger is replacing the ship's crew with integrated systems, modern devices, and innovative technologies. However, according to the data, man and equipment failure on board, which may also result from improper handling, are responsible for dangerous events on board. The risk of a navigational accident should be considered possible due to the devices used, which may fail. The limited number of the crew, and the increase in the capacity of sea-going vessels make it much more difficult to carry out a quick and effective rescue operation directly on board the ship by the crew, but also by rescue services, and their capabilities. It poses a risk of prolonging the rescue operation, and as a result, exposing people to loss of health, or life, both for the injured, and the rescuers. An example of a successful rescue operation is the 7-hour-long evacuation by air of passengers of the Norwegian Gate Away off the coast of Norway. Examples of such a situation are fires, in particular on the (ultra-large container ship) container ships Maersk Honam in March 2018. The causes of total ship losses, significant damage, and accidents are not only on the side of system failures, or crew errors, but also result from incorrectly, or undeclared cargo, lack of rescue measures, and adequate management of the resulting situation.

Another threat are events related to the operation of ships, breakdowns, errors, or the influence of external and internal factors, or a sequence of

²¹ In 50 years, container ships increased their size by 1500% from 1,530 TEU in 1968 (m / v Encounter Bay) to 21,413 TEU in 2017 (OOCL Honkong Kong. (Fig. 5) in the field of sustainable development for the improvement of safety. Understood as retrofitting, or using other equipment with extinguishing, rescue and rescue means. Moreover, the forces and resources of rescue services stationed in land-based centers are not able to carry out a quick rescue operation, even with the use of all equipment and support of other countries. The aspect will be discussed in more detail in the last chapter of the work on the areas of special sensitivity in the complex system of ensuring broadly understood security, and emergency response. Although the trend in the number of events is declining, now we should not look at the number of units but cargo capacity. Examples of total losses of ships of the largest units the following can be given: Car carrier Sincerity Ace (fire in the North Pacific Ocean on 31/12/2018, the rider Grande America sank as a result of a fire on 03/12/2019, the container ship Yantian Express suffered significant losses in a fire in January 2019, the fire also broke out at APL Vancouver in Vietnam.

unfavorable events. Risks caused by a number of navigational factors are characterized below. They differ depending on the body of water, type of ship, and crew, as well as the combination of all factors, the occurrence of which has an impact on the occurrence of a state of emergency, a potentially dangerous situation, a number of risks, as well as a series of adverse events that may generate an emergency situation. These are primarily threats related to:

- navigation in stormy conditions, related to the "seaworthiness" of the ship, as well as the type of cargo carried, and its loading condition.
- Parameters of hydrometeorological conditions. Weather conditions may carry various threats, which, especially in the situation of high sea state and strong wind, may lead to a number of navigational hazards: loss of ship stability, excessive acceleration, bow, or stern hitting the wave (slamming phenomenon), deck flooding, rolling resonance, excessive structural stresses, and ship hull overloads.
- The occurrence of external factors on the safety of the gull, such as: water parameters, systems of position accuracy, parameters of hydrometeor conditions, other objects moving in the water, traffic intensity, parameters, vessel traffic management systems.
- Occurrence of internal factors, related to the characteristics and operation of the ship: type of ship with its steering and propulsion equipment, type of cargo, equipment with navigation and machinery, implementation of the safety management system on the ship, competences and qualifications of the crew for the occupied positions, pilot, project managers, including Operating factors: inspections, maintenance, service, rules.
- Human factor impact: both on board the ship, and onshore operators and on other ships, rules of communication and information exchange
- Interpretation, or non-compliance with the provisions of legal regulations, both at the international, and local levels
- Inadequate management of the ship, understood as a violation of the regulations specified by the International Conventions and Codes, including the ISM Code, the provisions of which will be discussed further in this study.

The threats are also connected with the introduction of unmanned units, or with a reduced manning. This may result, in particular, at an early stage of such solutions:

- Failure of transmission systems,
- Disruptions in data transmission,
- Human error,
- Interference of unauthorized persons in the functioning of the system,

- Fatigue of the crew in a situation of a limited number,
- The need to develop scenarios of conduct in the event of an incident.

The above analyses are confirmed by the fact, that the total losses of ships over 10 years are presented in the data in Table 1.

Table 1. Summary table, the number of sinkings of ships with a tonnage above 100 GT. in 2018, 2017, 2016, and in the years 2009-2018.

Region	2018	2017	2016	2009-2018
Southeast China, Indonesia, Philippines,	12	30	23	234
East part of Mediterranean, and Black Sea	6	17	12	153
British Islands, North Sea, English Channel, and Bay of Biscay	4	8	7	77
Arabian Peninsula along with the access roads to the areas located there	2	6	2	58
Japan, Korea, and North China	3	6	11	117
Bay of Bengal	2	2	3	28
Baltic Sea		2	0	
Northern Russia and Barents Sea	1	1	2	26

Source : own research based on [3,9].

The events that generate hydrometeorological conditions, which at the present time are changeable, unpredictable, and violent, force changes to the routes of ships' passage. However, not all ships manage to safely hide in port or sail to safer waters. In addition, pressure from the operator, or cargo manager causes pressure on the captain and the crew, to leave the port in all conditions, or accelerate the reloading work (it is primarily related to the crew's fatigue and thus loss of concentration and attention) may lead to mistakes and accidents. Giving in to pressure and making wrong decisions by the captain may prove fatal, as was the case with the tragedy of the El Faro ship.

The largest risk groups occurring in the maritime economy sector, and in maritime areas in 2018 include threats related to:

- catastrophes generated by the forces of nature (34%);

- risks related to cyber threats, including crimes in the network, interference in the operation of IT systems, interference in data sets, compensation and charges related to criminal cyber-attacks, they come second with the share (32%) of incidents;
- risks related to market volatility (28%) also caused by supply chain disruptions (28%);
- threats related to the size of disasters and insufficient forces and resources of rescue centers, which require the deployment of additional forces, including naval forces, in an emergency situation.

The catalog of threats include considered on a global scale of a non-military nature in the field of maritime safety, the occurrence of which may constitute a real and potential risk for people, the natural environment, and generate material losses in the maritime infrastructure. All events: generated by the forces of nature, ecological, are presented in Table 2.

Table 2 Catalog of non-military threats in maritime areas.

Category of threats	Subcategory	Impact on:		
		people	Natural environment	property
Natural threats	Events connected with the weather	✓		
	Events related to navigation on the North-Night Route		✓	
	Descent of the icebergs	✓	✓	✓
Pollution of the natural environment (degradation)	Pollution from naval vessels	✓	✓	
	Development of spatial development in sea areas		✓	
	Conducting activities related to crude oil and natural gas		✓	
Increase in ship size	Difficulties in conducting rescue operations	✓		
	Oil spills from damaged fuel and cargo tanks		✓	
	Not meet the requirements with the size of the vessels and firefighting installations	✓		

	(means), evacuation system ect.			
	Increase of cargo damage (container vessels)			✓
Threats related to the operation of sea units	Events generated by the so-called Human factor	✓	✓	✓
	Events resulting from a failure on an operating unit, or another	✓	✓	✓
	Events related to the impact of external factors (hydrometeorological conditions)	✓	✓	✓

Source: own research

The above catalog can be extended to include threats related to cybercrime, political tensions, and the introduction of unmanned vehicles into operation.

Due to the conducted scientific research, and the subject of the study, attention will be focused on the analysis of events generated by natural conditions, the impact of which has an impact on the safety of navigation, and the life and health of people working in sea areas, as well as the impact of the power of the sea on infrastructure, ships, and with transported load.

THREATS GENERATED BY THE FORCES OF NATURE-OCCURRING PHENOMENON

This chapter of the study will allow to get acquainted with the global situation in terms of the existing threats generated by natural forces. In connection with the above, an answer will be given to the question: What is the contemporary global situation in terms of natural phenomena, and how does it change as a function of time?

Over the last decade, there has been a noticeable increased frequency, violence, and intensity of phenomena related to weather parameters, and phenomena generated by the power of nature. The changing climate associated with global warming generates weather conditions of considerable intensity and variability. In 2017, there was an increased number of catastrophic weather conditions. In particular: Hurricanes Harvey, Irma, and Maria (HIM), which hit

the Caribbean Sea, the US East Coast and Florida; typhoons in Southeast Asia: Damrey and Hato caused nearly 30 shipwrecks. During the typhoon Dimeria 6 ships sank off the coast of Vietnam, and more than 63,000 recreational yachts were destroyed, or completely lost during the raging Irma and Haveria. The events resulted in the closure of ports, disturbances in passenger ship schedules, shortages in cargo deliveries, and an increase in fuel prices. While the ports were repairing the losses, another haunted them, destroying their work.

On the other hand, 2018, and according to the data from the first half of 2019, should be considered the year of unprecedentedly variable levels of waters, especially inland waters. For example, in 2018 in European waters, low water levels were recorded in the Rena and Elba rivers, disrupting the supply chain by sea, and rising prices, in particular, of petrochemicals and raw materials for industry. The solution to the problem was to reduce the loading condition of the ships. However, this was not always successful, and the ships ran aground. There were also problems with shipping routes across the Mississippi River, this time caused by both low, and sometimes high water. In January the ship Anglo Alexandria ran aground. In March, according to the data of the US Army Corps of Engineers, nearly 80 ships waited at the river entrance for the waters to settle, the high level of which remained above the months typical for intense rainfall (December – May). It should be emphasized, that it is an area of high priority importance for the transport of cargo, which is transported by 175 million tons of various types of goods. In addition, high water level increases the risk of flooding port areas, damage to port infrastructure, as well as the occurrence of an increased risk of collisions between ships and fixed objects, which may consequently pose a threat to the health, and life of people working on shipping routes. Moreover, it may contribute to a greater disruption in the supply chain caused by changes in cargo delivery schedules.

Such a state of affairs will cause that crisis centres will have to ask for support from other services, including the resources at the disposal of the maritime forces.

However, according to the World Meteorological Organization, 2019 ends a decade of exceptional global heat, receding ice, and record high levels. The released WMO statement on the state of the global climate reports, that the average global temperature in 2019 (January to October) was about 1.1 degrees Celsius above the pre-industrial period. [7] Moreover, carbon dioxide concentrations in the atmosphere reached a record 407.8 parts per million in 2018, which continued to rise in 2019. Global averages for 2019 will not be

available until the end of 2020, this is worrying phenomenon because the ocean acts as a buffer by absorbing heat and carbon dioxide, paying a high price. This means that seawater is 26 percent more acidic than it was at the beginning of the industrial age. Hence, among other things, marine ecosystems are being degraded. Another fact is that the sea level rise has accelerated since the start of satellite measurements in 1993, is accelerating due to the melting of the Greenland and Antarctic ice sheets. The daily minimum for Arctic sea ice coverage in September 2019 was the second lowest in satellite records, with another record size recorded in October. Antarctica report record low ice coverage in some months in 2019. According to the report prepared by the International Ice Patrol, 2019 was a record year in terms of descending icebergs that crossed the 48N. It is even called the Ice Year, and was the 10th year in the history. Descending icebergs, including those crossing the above-mentioned parallel, are shown in the diagram in Figure 5.

2019 is considered to be the second / third hottest year in the history since the beginning of the measurements. The last decade has been warmer than the previous one. In 2016, the extremely strong El Niño phenomenon was recorded, which was currently the warmest year, and contributed to the recognition of the 2009-2019 decade as the warmest so far. Most of the land area has been warmer than the average of recent years, including South America, Europe, Africa, Asia, and Oceania. The US state in Alaska was also exceptionally warm. In contrast, much of North America was colder than the last average. There has also been an increase in global mean sea level due to melting ice caps in Greenland and Antarctica. In October 2019, the main global sea level reached the highest value since the beginning of the satellite readings record (January 1993).

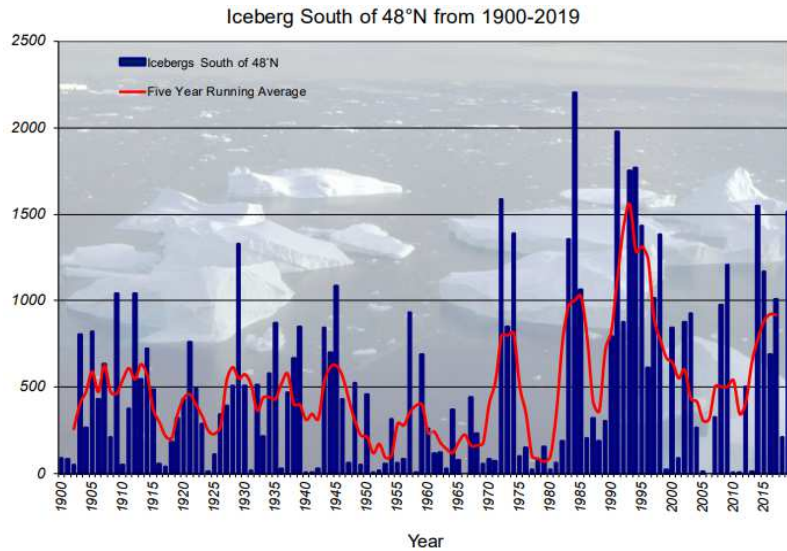


Figure 5. Number of ice icebergs passing the 48 N parallel.

Source:[1].

More than 90% of the surplus energy accumulated in the climate system as a result of the increased concentration of greenhouse gases goes to the ocean. In 2019, the heat content of the ocean at the top 700 m (in the series beginning in the 1950s), and at the top 2,000 m (in the series starting in 2005) was at a record, or near record level, with the average for the year exceeded the current record highs set in 2018. Satellite-based sea surface temperature sampling can be used to monitor sea heat waves. So far in 2019, the ocean has experienced an average of about 1.5 months of unusually warm temperatures. More oceans had a sea heatwave classified as "Strong" (38%) than "Moderate" (28%). In the Northeast Pacific, large areas have reached the "Strength" sea wave category.

Due to the phenomena, high amounts of rainfall were recorded in 2019 over the central United States, Northern Canada, Northern Russia, and South-West Asia. 12-month rainfall averaged for the contiguous United States from July 2018 to June 2019 (962 mm) was the highest ever. In turn, the beginning and end of the Indian monsoon was delayed, which resulted in a large rainfall deficit in June, but an excess of rainfall in the following months. In January, very humid conditions hit parts of South America. Floods occurred in northern Argentina, Uruguay, and southern Brazil, resulting in losses in Argentina and Uruguay estimated at \$ 2.5 billion. Many drought-affected parts of East Africa were severely affected in October and early November.

Tropical cyclones are noteworthy as they were slightly above average. There were 66 tropical cyclones recorded in the northern hemisphere, compared

to an average for this time of year 56, although the accumulated cyclone energy (ACE) was only 2% higher than the average. In the southern hemisphere, also in the analysed period 2018/2019, the amount was above average, with 27 cyclones.

One of the most intense tropical cyclones this year was Dorian, which landed with an intensity of Category 5 in the Bahamas on September 1, 2019, raging over 24 hours, destroying whatever it found in its path. Earlier, on August 26-28, 2019, it reached the Caribbean islands. It was the strongest cyclone since the cyclones "Irma" and "Maria" in 2017. The strongest cyclone, of the strongest known, on the east coast of Africa was the tropical cyclone "Idai", which landed in Mozambique on March 15, 2019, causing many casualties and widespread destruction. Typhoon Hagibis landed west of Tokyo on October 12, causing severe flooding.

The changing climate will generate variability and suddenness of the hydrometeorological changes taking place. The report of the Intergovernmental Panel on Climate Change (IPCC) predicts that in the period from 2081 to 2100, the temperature may be 0.3 to 4.8 degrees higher than in the period 1986-2005. Moreover, the World Meteorological Organization (WMO) confirms, that 2018 was the fourth warmest year in the history of atmospheric measurements, and the preceding years 2015 - 2017 are next in the ranking. The increase in temperature and energy in the atmosphere causes an increase in the amount of heat in the oceans, which results in an increase in sea level, and ocean acidification, as well as an increase in the intensity of related atmospheric processes and phenomena (e.g. hurricanes, tornadoes, storms, etc.), or a reduction in the ice surface (land-ice, mountain glaciers, or floating ice). Thermal changes, as well as the recorded sums, and types of precipitation, including the decrease in the share of snowfall in the total rainfall, and the related thickness together with the duration of the snow cover, play a decisive role in the area's water balance, significantly modifying the hydrological cycle.

It should also be noted, that in recent years abnormal waves in the North Sea above 20 m have been recorded. According to the data of the Institute of Meteorology and Water Management (IMGW), the number of storm days in the Baltic Sea area has increased along with the wave height of up to 10 m³.

IDENTIFICATION OF THREATS AND RISKS GENERATED BY NATURAL WORKS – NEURALGIC AREAS

Over the last 10 years, there has been a noticeable increase in the frequency, violence, and intensity of weather phenomena. In connection with the above, the potential risks will require the use of additional forces, and resources, taking into account rescue services intended for this purpose, but also with the use of support forces, including the potential of the land forces and the navy. Without additional support, future problems may worsen, and give rise to various forms of crisis both locally, and internationally.

The nature of the occurring weather phenomena, in particular stormy and hurricane winds, opened an international debate on early warning, and thus preparation for the advent of the element and methods of securing sea vessels. Understood as seeking refuge in waters, from raging elements, or in harbors (although they may not always turn out to be safe places).

The current state of affairs indicates the legitimacy of developing risk scenarios related to the possibility of introducing:

- effective warning and strengthening awareness of the phenomena that are taking place, in particular for the population reducing the coastline, and working in sea areas,
- design, operated, and organizational solutions for maritime units,
- protection against damage to maritime and port infrastructure,
- ensuring the supply chain through better organization of routes and means of transport, or preparation of alternative delivery routes.

The changing climate forces the consideration of a new approach to integrated security solutions. Deliveries to other ports should be considered, and the transport of goods should be secured by road, or places of refuge should be designated for waiting for improvement of conditions. In this state of affairs, the transport of cargo by sea should be considered not only in the context of orders, but the possibility of their delivery to the designated area, and on time, ensuring the security of the supply chain.

"Contemporary" threats must be analysed by ship operators, in order not to generate economic losses, but also to prepare security solutions for newly built ships.

Although the trend in the number of events is declining, nowadays the number of units should not be considered but cargo capacity. Examples of total

ship losses of the largest units include the following Sincerity Ace Car Rally (North Pacific Ocean fire on 31/12/2018, Grande America rifle sunk as a result of fire on 03/12/2019), Yantian Express container rally sustained significant losses as a result of fire in January 2019, a fire also broke out at APL Vancouver in Vietnam. The above examples show that something needs to be done to improve the detection, and extinguishing systems of large vessels in order to ensure sufficient operational efficiency. Events also causes an increase in insurance costs due to the increasing risk of events threatening people, the environment and property.

However, the possibilities offered by nature at the present time should be considered, and analysed to ensure the highest level of safety for the ship's passage through these virgin lands, in such a way as not to degrade them and contaminate them. It is disturbing that the number of accidents increases by almost 30% with the increase in the number of naval units moving along the Arctic Silk Road. Between 2008 and 2018, 522 events were recorded in Arctic waters. They were caused by extremely difficult natural conditions, breakdowns, or damage to machinery, which accounted for 47% of all accidents. Table 3 shows the types and number of events that took place in 2018.

Table 3. Events that took place in Arctic waters (Northern Trail) in 2018

Type of event	amount
Damage to machine devices and their failures	24
Shoal entrance	8
Fires and explosions	6
Ship collisions	2
Port collisions	1
Sinking	1

Source: own research on the basis of Lloyd's List Intelligence Casualty Statistic. Safety and shipping review 2019.

Reported events for ships with a capacity of 100 GT and above were 46. Table 4 shows the events that took place on the northern route.

Table 4. The number of events in 2009-2018 on the northern route.

Events	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Machine damage	14	16	12	13	20	27	45	32	46	24
Shoal entrance	14	9	9	8	10	14	6	11	9	8
Collisions	4	10	4	4	2	-	3	2	4	2
Fire / explosion	2	6	6	1	4	2	4	1	3	6
Hull damage	6	2	2	1	2	1	1	2	2	-
Sinking	2	-	3	1	1	2	-	1	-1	
Incomprehension	4	4	2	6	5	5	6	4	6	4
Total number	48	51	39	37	50	55	70	55	71	46

Source: own research on the basis of Lloyd's List Intelligence Casualty Statistic. Safety and shipping review 2019.

CONCLUSIONS

The analysis of the collected data allowed for the development of synthetic conclusions, which one included and developed here. The research goal set was achieved in the author's appreciation, and showed the broad spectrum of identifying threats, and determining the catalog of risks based on them. Areas of special sensitivity have been indicated, which are extremely susceptible and dependent on the power of nature.

Generalizing each aspect of the activities conducted in the maritime areas, it is burdened with the risk of occurrence of hazardous events and threats at each stage. Therefore, at the beginning of the work, the author indicated the risk management process, which was aimed at making people aware of the scope of activities and a proactive approach to the issues.

Safety of human life and health, protection of the natural environment, and avoidance of property losses due to the impact of threats and risks at an

unacceptable level is a priority for all organizations and sea users. In the course of scientific research, it was determined that:

1. Identification of threats and generated potential risks, which may occur in the peaceful conditions of the functioning of the state, is a multidimensional chain of actions. It begins with an analysis of the current situation and trends, in order to develop a given position. The links connecting subsequent modules of the complex chain of analysis have become available reports prepared by control, supervisory, and expert institutions in a given field.
2. The analysis of the complete spectrum of threats identification, and the development of a catalog of risks required considering it both internationally, and nationally. This multi-segment sequence of actions is influenced by factors of an internal and external nature.
3. The catalog of risks is opened by sudden conditions of high intensity and changeability generated by the forces of nature, which, due to their parameters, generate a number of risks to the safety of the gull, the functioning of sea ports, and the supply chain.
4. At the present time, there is a noticeable increase in the intensity of the occurring phenomena related to global warming, which generates an increased risk of events in sea areas related both to the operation of sea-going vessels, and the natural environment itself.
5. Due to the available data, and facts determined by international institutions, it is possible to define contemporary risks and potential threats, and thus designate areas of special sensitivity, which are a critical point in ensuring broadly understood safety in maritime areas, taking into account also economic aspects.
6. Accordingly, the tests and analyses performed are summarized in Table 5.

Table 5. Natural threats with the definition of subcategories, detrminants, contemporary threats, as well as potential, and areas of special sensitivity.

Threat category	Natural threats		
Main threat determinant	Climate change related to global warming, which poses a threat to human, the environment, and shipping safety		
Subcategory	Events related with weather determinants	Events on the Northern Route	The descent of the Icebergs to the N. Atlantic
	Collisions		
	Ship damage (structure, equipment, installations, devices, etc.)		
	Machine failures of steering drive systems		

Catalog of non-military risks occurring in marine areas, with special consideration...

Contemporary risk	Failures of navigation devices
	Power supply
	Cargo damage
	Shoal entrance
	Load shift / load damage
	Power outages, or complete failure
	Failures of machinery and navigation devices, mainly related to the harsh climate (temperature, humidity)
	Rising water levels
	Breaching and destroying arctic areas
	Accidents involving people
Potential risk	Failure to deliver cargo on time
	Interruptions in access to goods
	Destruction / spoilage of goods
	Increasing transportation costs
	Additional means of transport are required
	Increase in insurance costs
	Increase in ship operating costs
	Exposure of the ship to risk of passage through hazardous areas related to political crisis / tensions
	Losses in vessels, and cargo related to the suddenness of the occurring phenomena, and the inability to predict them due to the changeability of phenomena
	Increase in costs for building new infrastructure required as an alternative delivery route
	Economical crisis
	Dying off of unique regions and negative impact on human functioning on the globe
	Increase in the accident rate, and thus the risk of loss of health and life for people working in maritime units and in the coastal zone.
An area of special sensitivity	<p style="text-align: center;">Introducing measures to reduce environmental degradation</p> <p style="text-align: center;">Timely delivery</p> <p style="text-align: center;">Protection of human health and life</p>

Source: own research

Identifying areas of particular sensitivity is a starting point for further analyses and development of risk scenarios. Maybe these are not new concepts, but the deduction carried out confirms their topicality, and priority for taking effective actions at every organizational level, in the international dimension by all sea users.

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KATALOG RYZYK NIEMILITARNYCH WYSTĘPUJĄCYCH NA OBSZARACH MORSKICH ZE SZCZEGÓLNYM UWZGLĘDNIENIEM ZAGROŻEŃ GENEROWANYCH PRZEZ WARUNKI NATURALNE

ABSTRACT

W opracowaniu wskazano, że nie tylko, stan konfliktu zbrojnego, może stanowić znaczące niebezpieczeństwo dla ludzi i środowiska naturalnego, ale także zdarzenia mające charakter niemilitarny występujące podczas pokoju, wręcz podczas codziennego funkcjonowania państwa i jego obywateli. Rozpatrywana problematyka ma na celu opracowanie katalogu ryzyk prognozowanych zagrożeń niemilitarnych z uwzględnieniem rozwoju już zdefiniowanych zagrożeń generowanych przez siły natury. Ponadto w pracy określono determinanty

występujących zagrożeń naturalnych oraz wskazano obszary szczególnej wrażliwości, czyli postępujące zagrożenia i wynikające z nich ryzyka.

Słowa kluczowe:

Bezpieczeństwo, zagrożenia niemilitarne, katalog zagrożeń, naturalne zagrożenia

