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Ships' Routes to Polish Ports of the Gulf of Gdańsk

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ABSTRACT: The paper discusses ships' routes to Polish ports in the Gulf of Gdańsk determined on the basis of data obtained from the Baltic Ship Monitoring System by means of AIS coast stations and defined by the Baltic Sea Hydrographic Commission (BSHC). The measures to regulate maritime traffic implemented by the Polish maritime administration in order to reduce the identified risk of groundings and ship collisions are presented, as well as the author's opinion on their effectiveness.

1 INTRODUCTION

There are two large Polish sea ports on the coast of the Gulf of Gdańsk: Gdańsk and Gdynia. Their share (in thousands of tons and percentages) in the total amount of cargo handled in Polish seaports is presented in Table 1. Table 2 shows the number of seagoing vessels handled in these ports.

Table 1. Share of the ports in Gdańsk and Gdynia in the total amount of cargo handled in Polish seaports [21].

Year	Units	All Polish ports	Gdańsk	Gdynia	Gdańsk & Gdynia
2016	Thousands of tonnes	72926.2	31566.2	17751.1	49317.3
	%	100	43.3	24.3	67.6
2019	Thousands of tonnes	93864.4	45521.9	20547.7	66069.6
	%	100	48.5	21.9	70.4

Table 2. The number of seagoing vessels handled in the ports in Gdańsk and Gdynia [21].

Year	Units	All Polish ports	Gdańsk	Gdynia	Gdańsk & Gdynia
2016	Number	18928	3274	3956	7230
	%	100	17.3	20.9	38.2
2019	Number	20800	3927	4283	8210
	%	100	18.9	20.6	39.5

Port of Gdańsk is the only Polish port with deep water terminals for container ships (Deepwater Container Terminal - DCT), bulk carriers and tankers with maximum draft allowing to enter the Baltic Sea through the Danish Straits.

The main routes of ships equipped with Automatic Identification System (AIS) to the ports of Gdańsk and Gdynia in the Gulf of Gdańsk and in the waters directly adjacent to it are shown in Figure 1 [10, 18]. They intersect the route to the Russian ports of the Kaliningrad region in the Gulf of Gdańsk and the routes along the Polish coast to and from the ports in the eastern part of the Baltic Sea. It should be noted that over 50% of the cargo handled in the ports of Gdańsk and Gdynia (approximately 53% in 2019)

comes from or is destined for ports located west and north of the Gulf of Gdańsk [21]. For this reason and due to the depth limitations in the southern part of the Baltic Proper along the Polish coast, one of the most important tasks of the Polish maritime administration was determining a safe route for ships sailing to the analysed ports from western directions, mainly from the Danish Straits.

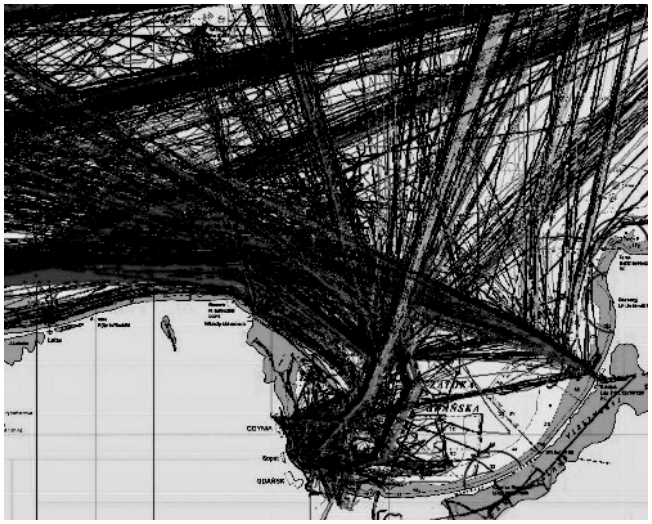

Figure 1. Routes of ships equipped with Automatic Identification System (AIS) to and from the ports of Gdańsk and Gdynia in the Gulf of Gdańsk and in the waters directly adjacent to it [10, 18].

2 DEPTHS AND ENVIRONMENTAL AND WEATHER CONDITIONS IN THE SOUTHERN PART OF THE BALTIC PROPER

2.1 *Depths and environmental conditions*

The south-western part of the Baltic Sea consists of the large shallow water area - Pomeranian Bay with the depths less than 30 m and offshore banks between the Island of Bornholm and western part of the Polish coast: Adlergrund (Rønne Bank) and Oder Bank with a minimum depth of 4.6 m. To the north, the Pomeranian Bay is separated from the Adlergrund with a minimum depth of 5.8 m by a narrow channel more than 20 m deep and 7 Nm wide. Further east, approximately 12 Nm north of the central Polish coast, the large offshore Słupska Bank (600 km2) is located. The bank is largely determined by the 20 m depth contour with a minimum depth of 8.2 m. A narrow channel more than 20 m deep and 5 Nm wide separates Słupska Bank from the coastal waters, which are scattered with irregular smaller shoals and numerous wrecks and stones [9, 11].

On the open German and Polish coastline a numerous nature reserves and land-sea protected areas are situated: Biosphere Reserve of South Eastern Rügen Island and Jasmund National Park on the German shore and Słowiński National Park (UNESCO 186.18 km² Man and the Biosphere (MAB) Reserve) and Woliński National Park on the Polish shore. Adlerground and Oder and Słupska Banks are also very important habitats for unique fauna and flora species. The ecological significance of these areas is recognized by several networks: Baltic Sea Protected Areas (BSPAs) established by Baltic Marine Environment Protection Commission, Ramsar introduced according to The Convention on Wetlands and Areas of Natura 2000 network. They represent an important habitat for non-commercial and commercial fish stocks, including freshwater fish species and a spawning and nursery ground for, for example, herring and different species of flatfish. More than one million seabirds winter in these areas, representing the most important wintering site in the whole Baltic Sea and the largest concentration of wintering seaducks in Europe. Described areas are further considered of global importance to the Slavonian grebe, the long-tailed duck, the velvet scoter and the Baltic race of the black guillemot. The unique importance of discussed areas for wintering waterbirds makes them one of the most sensitive areas to oil pollution in European waters. Even small oil spills could kill thousands of waterbirds. Scientific studies on the distribution of harbour porpoises indicate that during the early summer, which is the breading season for mammals, high concentrations of oil could potentially threaten an estimated 15% of this endemic population. A major oil spill would seriously harm local fishermen and would be a blow to the tourist industry as part of the main economic backbone in these areas [9, 12].

2.2 *Weather conditions*

There are no tides in the Baltic Sea, however, seasonal variations in the water level can exceed 1.5 m due to changes in atmospheric pressure and winds. There is a weak east-going surface current (average speed 0.2-0.5 kn) along the Polish coast disturbed by strong winds. Sea ice may form in January and February, mainly in coastal areas. The mean number of days with fog oscillates between 15 days per year in the area near Adlergrund and 56 days per year near Słupska Bank. Most frequently restricted visibility occurs in the winter. Predominant directions of wind are SW, W and NW. Storms, defined by the criteria that the mean wind speed is at least 17 m/s, occur for 2% of the time. They are most common from November to March. In November storms prevail for 9% of the time and strong winds (11-16 m/s) for 32% of the time. During the last 15 years, the wind speed has shown an increasing trend [9, 12].

Wave motion in the Southern Baltic is strongly related to wind and swell. Studies of sea waves in the Baltic Proper (i.e. BASYS or MAXWAVE project) have yielded in a unique set of time series of free-surface elevation records obtained by wave rider (WR) and directional wave rider (DWR) buoys, located at several points placed along the Baltic coastline including Polish areas [1, 14]. At Varnkevitz observation station near Adlergrund, the highest significant wave height was 2.0 m, whereas the significant wave height exceeding 1.0 m occurred 8% of the time and a wave height greater than 1.5 m occurred 2% of the time, respectively. The largest waves come from the NW and NNE directions. The greatest measured height of an individual wave was 2.7 m. For the area of Lubiatowo located in the central part of Polish coast, the biggest measured height of an individual wave was 7.6 m and the highest significant wave height was 4.0 m. The significant wave height exceeding 1.0 m occurred 29% of the time and greater

than 2.0 m - 6% of the time. The total set of 330 extreme waves has been observed among 19664 records. It has been found that the majority of the largest observed waves came from the W and NNE directions [9, 12]. Issued by the Hydrographic Office of the Polish Navy Sailing Directions, Volume Baltic Sea-Southern Part, informs that sea waves in an offshore area may achieve during the storms the height of 9 m [6]. According to information received from European Maritime Pilot Association – EMPA, research carried out for the tankers proves that such type of vessels of approximate size of 17,000 DWT and draught of 9 m will suffer a total reduction of under-keel clearance equal approximately to 5 m on a waves of height about 4.5 m and 10 s period.

3 SHIPS ROUTES TO THE POLISH PORTS IN THE GULF OF GDAŃSK

3.1 *Vessel traffic statistics*

There are three options for sailing from the Western Baltic and the Danish Straits to the ports in the Gulf of Gdańsk:

- Through the Bornholmsgat between the Island of Bornholm and the coast of Sweden;
- Between the Bornholm and shallow water area Słupska Bank; and
- Between Słupska Bank and Polish coast.

Bornholmsgat has no depths limitations. It is the main route for ships proceeding to and from the ports of the Eastern Baltic Sea and is characterized by a high volume of traffic. The passage between Bornholm Island and Słupska Bank extends the route to Gdańsk and Gdynia and will be hampered in the future by wind farms planned to be built in the water area north and northeast of Słupska Bank. The possibilities of passing south from Słupska Bank depend on the draft of the ship and the current hydro-meteorological conditions.

Through the area between the Bornholm Island and Polish coast approximately 16 000 ships equipped with AIS are passing on a yearly basis. The statistical profile of ships includes 67.9 % cargo ships, 16.3 % tankers and 4.5 % passenger ships. The main destinations of eastbound vessels in transit include the ports situated in the Gulf of Gdańsk (32%-38%), Klaipeda and Liepaja (20%-23%) and Russian ports in the Kaliningrad region (19%-20%). The crossing traffic operates to ports on the Bornholm Island and to the ports of Scandinavian countries (mainly ferry connections). Additionally, large fishing activities are in place in the area off Central Polish coast, which contributes to the traffic picture. Approximately 8500 vessels yearly trades between Western Baltic ports or entrances to the Baltic Sea and ports in the Gulf of Gdańsk, passing along central Polish coast. Some 20% of that traffic passes North of Słupska Bank and the rest of it uses the gateway south of Słupska Bank. Tankers represent 17% of all traffic in that area. Approximately 13% of the vessels have a draught of 7 metres or more and 8% a draft of 8 metres and more [9, 12].

More information, based on data received from the vessel monitoring system using the Baltic network of the AIS shore stations, on vessel traffic along the Polish coast and a comparison of the traffic density in waters north and south of Bornholm Island can be found in [16–18, 22].

3.2 *BSHC harmonized Plan for Hydrographic Surveys*

The main ships routes to the ports of the Gulf of Gdańsk are included in the Harmonized Re-survey Hydrographic Plan of the states - parties to the Convention on the Protection of the Marine Environment of the Baltic Sea Area (Helsinki Convention) of 1992. The Baltic states were obliged to introduce and maintain such a plan of systematic hydrographic surveys in the areas most frequently visited by ships and in ports by the Declaration on the Safety of Navigation and Emergency Capacity in the Baltic Sea Area of 10 September 2001, known as the Copenhagen Declaration of the Helsinki Commission - HELCOM Copenhagen Declaration. The development of the agreed survey scheme was entrusted to the hydrographic services of the Baltic states associated in the Baltic Sea Hydrographic Commission - BSHC. In 2002, the BSHC developed the first Harmonized Hydrographic Survey Plan, which included the usual shipping routes to the main Baltic ports. Due to the lack of tools for assessing the real ship traffic at that time, the routes were estimated. After the introduction of Automatic Identification System (AIS) devices in 2002 as mandatory equipment on commercial sea vessels, it became possible for coastal states to monitor the actual movement of ships in the Baltic, based on the receipt of ships' AIS messages via a network of coastal stations of this system. Moreover, in the period from the signing of the Copenhagen Declaration in 2001, the International Maritime Organisation (IMO) adopted, at the request of the Baltic states, many new and amended shipping route, technically suited to the image of actual vessel traffic obtained from the analysis of received AIS messages. Consequently, the BSHC introduced significant changes to the Harmonized Survey Plan in 2008, which was also modified in the following years. Currently, the surveyed waters are divided into 3 categories, including:

- Category I (CAT I) - primary survey area covering the main shipping lanes to seaports;
- Category II (CAT II) - additional areas that should be surveyed in order to ensure the safety of navigation; and
- Category III (CAT III) - other areas that should be surveyed for other reasons, e.g. protection of the marine environment.

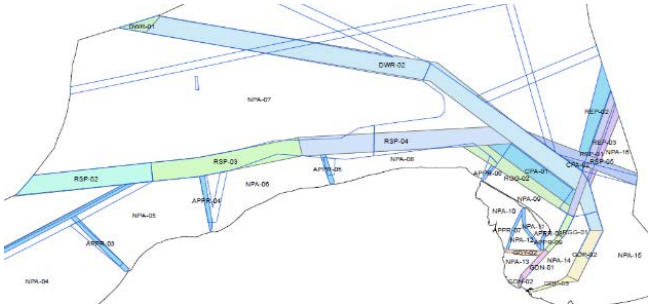

Figure 2. The main ships routes to the ports of the Gulf of Gdańsk inside the Polish maritime area included in the

current version of the Harmonized Plan for Hydrographic Surveys prepared by BSHC [23].

The main ships routes to the ports of the Gulf of Gdańsk inside the Polish maritime area included in the current version of the Harmonized Plan for Hydrographic Surveys prepared by BSHC are shown in Figure 2. The letter and colour markings of individual routes and their sections are related to their category and the current state of survey work.

These routes correspond to the shipping routes shown in Figure 3, determined on the basis of data from the AIS system [17,22].

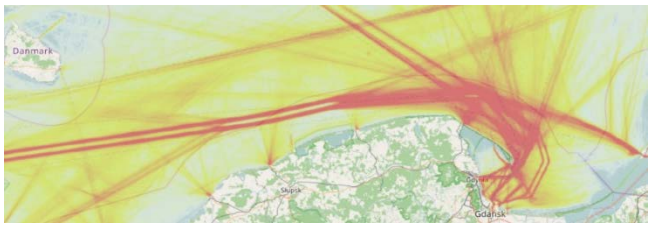

Figure 3. Routes of ships fitted with AIS in the southern part of the Baltic Proper [17,22].

3.3 *SRS, TSS and VTS in the Gulf of Gdańsk*

The Gulf of Gdańsk is not only a region of great importance for the national economy with respect to a number of branches, from ship and cargo handling in two largest Polish ports and shipbuilding industry to tourism and recreation, but also a very vulnerable ecosystem. Beginning from the Hel Peninsula and around gulf coastline up to the Vistula Split, following protected areas, including surrounding coastal waters, were established as Baltic Sea Protected Areas (HELCOM BSPA): Coastal National Park with a Puck Bay, Three Cities Landscape Park, Redłowo Clif Reserve and Vistula Split Landscape Park. The region of a special attention is the internal part of the Puck Bay, a unique site on the south Baltic coast of relatively warm, shallow sea water with little salinity, little water dynamic and communities of rare and endangered vegetable and animal species. It is a spawning ground and habitat for many endangered species, including harbour porpoise and, together with Vistula River Estuary, a major feeding and resting place for migratory birds and important wintering place for many birds that hatch on the North Baltic. For this reason, both these areas have also been recognized as bird protected area under Natura 2000 network [10].

With a view to enhance the safety of navigation and the protection of the marine environment in the waters of the Gulf of Gdańsk, a ships' routeing system within the Polish territorial and internal waters was established on 15 April 1980 in the form of two traffic separation schemes (TSS) for the approaches to the ports of Gdańsk and Gdynia, based on the general principles and the requirements of ships' routeing defined by IMO. It was introduced under Polish national legislation and announced in Polish Notices to Mariners No.12/1980 and No.15/1980, revised and amended with inshore traffic zones in 2003 (Polish Notices to Mariners: No.13/2003 and No.16/2003). Both TSSs guided all flow of ships to the Polish ports situated in the Gulf of Gdansk and have substantially contributed to simplify the patterns of traffic flow [10].

Furthermore, on 1 May 1986, a ship reporting system (SRS) "REPLINE HEL" was established within the Polish territorial waters, south of parallel 54°45′N, based on the IMO General Principles for Ship Reporting Systems and Ship Reporting Requirements, including Guidelines for Reporting Incidents Involving Dangerous Goods, Harmful Substances and/or Marine Pollutants, as adopted by IMO Resolution A.851(20). It was announced in Polish Notices to Mariners, the first time in No.17/1986), the second time in No.13/1987 [10].

On April 15, 1997 were established two vessel traffic services (VTS): "VTS Gdańsk" and "VTS Gdynia" served by Harbour Masters of these ports (announced in Polish Notices to Mariners No.14/1997). On 1 May 2003 they have been replaced by one Vessel Traffic Service (VTS) "Gulf of Gdańsk" (announced in Polish Notices to Mariners No.20/2003), acting as a coastal VTS and Maritime Assistance Service (MAS) operated according IMO Resolution A.857(20) and IMO Resolution A.950(23) respectively. The area of its responsibility covers the Polish waters of the Gulf of Gdańsk including both traffic separation schemes. Since that day the SRS "REPLINE HEL" has become a part of VTS reporting procedures (as amended by Polish Notices to Mariners No.16/2003) enhancing safety and efficiency of maritime traffic.

Establishment of the measures described above reduced significantly the risk of pollution caused by collisions and risk of grounding in the area and this had a positive impact on the entire Baltic Sea area. It should be emphasized that there was no major accident compromising the safety of navigation within the TSSs over the last 30 years. Recognizing the positive effects of the existing TSS, SRS and VTS on safety of navigation and protection of environment, Government of Poland decided in 2007 to submit information about them to IMO for approve by that Organization [10]. Maritime Safety Committee (MSC) approved them at its eighty-third session and announced its decision in three IMO circulars:

- COLREG.2/Circ.59. New and amended existing traffic separation schemes. Annex 2 "On the approaches to the Polish ports in the Gulf of Gdańsk" [2];
- SN.1/Circ. 263. Routeing measures other than traffic separation schemes. Annex "New Recommendation on navigation to the Polish ports through the Gulf of Gdańsk traffic area" [19]; and
- SN.1/Circ. 264. Mandatory ship reporting systems. Annex 2. Resolution MSC.249(83) (adopted on 8 October 2007) Adoption of the new mandatory ship reporting system "On the approaches to the Polish ports in the Gulf of Gdańsk" [20].

Traffic separation schemes on the approaches to the Polish ports in the Gulf of Gdańsk, boundary of the ship reporting system "GDANREP" (new name for "REPLINE HEL") and area of responsibility of the VTS "Gulf of Gdańsk" are shown in Figure 4 [10, 18].

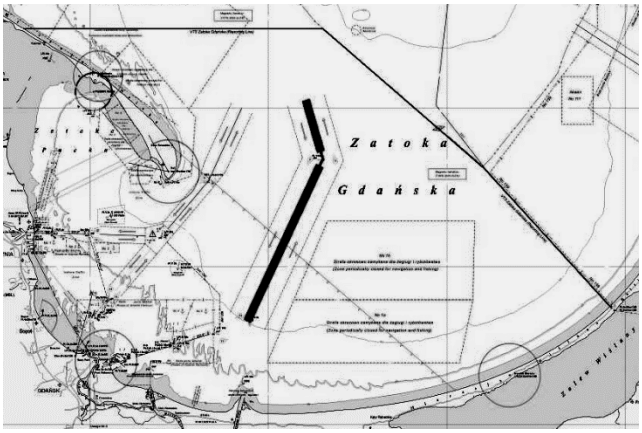

Figure 4. Traffic separation schemes on the approaches to the Polish ports in the Gulf of Gdańsk, boundary of the ship reporting system and area of responsibility of the VTS "Gulf of Gdańsk" [10, 18].

3.4 *Deep Water "D" route*

The increase in the transport of hazardous and environmentally harmful goods to the Polish ports in the Gulf of Gdańsk, especially after the opening in 1975 of the Northern Port in Gdańsk, accessible to ships with a draft of up to 15 m, was the reason why the Polish maritime administration decided to designate a deep water (DW) route bypassing shallow waters along the Polish coast and connecting Gdańsk with Danish Straits through Borngholmsgat. It was established 15 of May 1980 as the internally recommended route for following Polish vessels:

- oil tankers with a gross tonnage of 20,000 RT and above;
- gas carriers and chemical tankers with a gross tonnage of 1600 RT and more;
- ships with more than 2,500 tonnes of fuel (diesel and heating oil); and
- general cargo and bulk carriers with dangerous goods specified by the Polish Minister of Foreign Trade and Maritime Economy (Journal of Laws of 1961 No. 58 item 318) in category "0" in any quantity and in category "A" over 100 tons, classified in subclasses 1.1 and 1.2 and in classes 2, 3 and 7.

On February 3, 1982, the Intergovernmental Maritime Organization (IMCO) published a note of the Polish Government "Route for ships carrying cargo hazardous to the marine environment in the Gulf of Gdansk", requesting the establishment of a transit route for ships carrying cargos that are harmful to the environment in the Gulf of Gdańsk [7]. This route, connecting points with geographic coordinates [7]:

- 55°15.7'N; 016°06.0'E;
- 55°12.6'N; 018°25.5'E; and
- 54°42.7'N; 019°11.1'E,

was to be recommended for ships:

- tankers carrying crude oil of a gross tonnage of 20,000 RT or more;
- gas carriers with a gross tonnage of 1600 RT or more;
- ships with a gross tonnage of 1600 RT or more carrying liquid dangerous substances classified as classes A or B of Annex IV to the Helsinki Convention or Annex II to the MARPOL Convention of 1973.

The route was discussed at the 8th Session of the Helsinki Committee in 1982. At the request of Denmark and Sweden, the committee did not accept it. The formal reason for the objection of these two countries was proposed by Poland the method of connecting the "D" route with the "T" route off the Swedish coast. It was only agreed that the method of connecting these two routes should be carefully analysed. Informally, the reason for the objections of these countries was their refusal to shift to the north of Bornholm the traffic of ships that most threaten the environment in the event of their failure. Due to this position of the Helsinki Committee, the "D" route was not accepted by the IMCO. In later years, the position of connecting the proposed "D" route with the traffic separation scheme in Swedish waters was changed to a point with the coordinates: 55o21.5'N, 016o1.0'E, but the Helsinki Committee did not accept the amended proposal. So it was still functioned only as a route recommended for Polish ships, in accordance with the recommendation of May 15, 1980.

After the entry into force of the Polish Act of March 21, 1991 on the maritime areas of the Republic of Poland and maritime administration, the minister responsible for maritime economy did not introduce the "D" route in the Polish territorial sea in accordance with the requirements of this Act. Therefore, the route ceased to be shown as recommended for Polish ships carrying dangerous goods on charts published by the Polish Naval Hydrographic Office (BHMW) and described in the Sailing Directions published by this office. On September 18, 2002 during Extraordinary Meeting of the Baltic Sea Hydrographic Commission Poland submitted the deep-water "D" route situated entirely within Polish EEZ and territorial waters as a one of the major shipping routes scheduled for Harmonized Hydrographic Re-survey Plan of the Baltic Sea in accordance with IHO standards for hydrographic surveys S-44. The "D" route resurvey has been completed by the Hydrographic Office of the Polish Navy in 2005. The width of the surveyed area is 6 nautical miles in EEZ and 2 nautical miles in territorial waters. The lowest examined depth on the route was 23 m.

Attempts to introduce internationally, in agreement with Denmark and Sweden, the "D" route were resumed in 2005 at the forum of the Expert Working Group on Transit Routeing (EWG TRANSIT ROUETING) established at the 11th meeting of the Helsinki Commission in 2003. As a result of the discussion, the following information appeared in the document submitted by Baltic states without Russia to IMO in 2005 [8]:

"For ships bound for or leaving the Gulf of Gdańsk, Poland has advanced plans for a recommended deep-water route "D" in the Polish EEZ with a junction point to the deep-water route northeast of Bornholm. Also two traffic separation schemes are designed in the Gulf of Gdańsk. The deep-water route "D" will be further discussed regarding details with countries concerned. Poland intends to submit a proposal to NAV 52."

Several bilateral consultation meetings on this route, attended by representatives of the maritime administrations of Denmark, Germany, Poland and Sweden took place in 2005 and 2006 but no consensus was obtained due to the lack of consent of the maritime administrations of:

- Denmark and Sweden to introduce the "D" route as recommended for all ships carrying dangerous, noxious and polluting goods;
- Poland to introduce mentioned route only for ships with a draft not less than specified agreed value, in the discussed range of 8-12 meters.

Due to the impossibility of agreeing a common position, the meetings were suspended until 2012. In August 2012, Polish Ministry of Transport, Construction and Maritime Economy invited experts from Denmark and Sweden to discuss the question of establishing "D" route for ships with a draft not less than 12 meters. The meeting was held in Copenhagen in December 2012, but experts from Scandinavian countries did not respond to the Polish proposal, explaining that it required detailed analyses. Attempts to organize further meetings were not made.

3.5 *Route between Słupska Bank and Polish coast*

Regardless of the described attempts to introduce the DW "D" route, Poland has also taken steps to regulate on the international forum the rules for ships' traffic along the Polish coast.

The shallow and shifting shoals in the southern part of the Baltic Sea present a great risk of grounding for deeper draught ships and consequently pollution. This opinion confirmed accident with the bulk carrier „Conrad Oldendorff" which left Port of Gdańsk with a draught of 14.4 meters and grounded on June 28, 2006 on shallow water south of Bornholm Island. It demonstrated the necessity to introduce measures to prevent this pattern of accidents in the future. Such accident could have disastrous effects on the vulnerable nature of the whole Baltic Sea ecosystem. The study confirmed the common incidence of head-on close encounters in a confined space of navigable waters which could easily cause collisions and groundings. In view of the above and with the sole objective of:

- separating opposing streams of traffic to reduce the risk of head-on encounters;
- simplifying the patterns of traffic flow in converging areas;
- reducing the risk of groundings by providing safe passage and guidance to vessels navigating in areas with limited water depths; and
- organizing a safe traffic flow in the vicinity of environmentally sensitive areas,

Governments of Denmark, Germany and Poland decided to submit to IMO proposal to establish two traffic separation schemes: between shallow water areas Adlergrund and Pomeranian Bay in German waters (named TSS "Adlergrund") and between Słupska Bank and coastline in Polish waters (called TSS "Słupska Bank") [12]. The expected impact of the introduction of both TSSs on the safety of navigation was presented in Annex 1 to the German and Polish submission to IMO "Routeing of ships, ship reporting and related matters. Information about planned new routeing measures in the southern part of the Baltic Sea" containing the results of a statistical study undertaken by the Shipping Institute in Warnemünde an affiliate of the Department of Maritime Studies of the Wismar University of Technology, Business and Design [11]. IMO approved the proposal and announced its decision regarding TSS "Słupska Bank" in the circular COLREG.2/Circ.61 Annex 2 [3].

The real effects of introducing TSS "Słupska Bank" are shown in Figures 5 and 6. Figure 5 presents vessel traffic between Słupska Bank and the Polish coast before the introduction of TSS, Figure 6 - after its establishment. The top of each figure shows the ship's routes, the bottom - the traffic directions of ships passing through particular points of the control line drawn at right angles to the average direction of movement of most vessels.

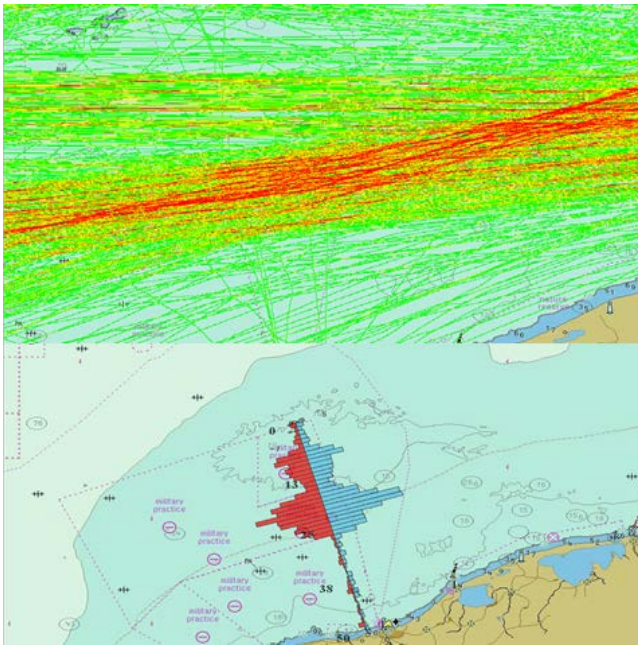

Figure 5. Ship traffic in the area between Słupska Bank and the Polish coast before the introduction of TSS [15].

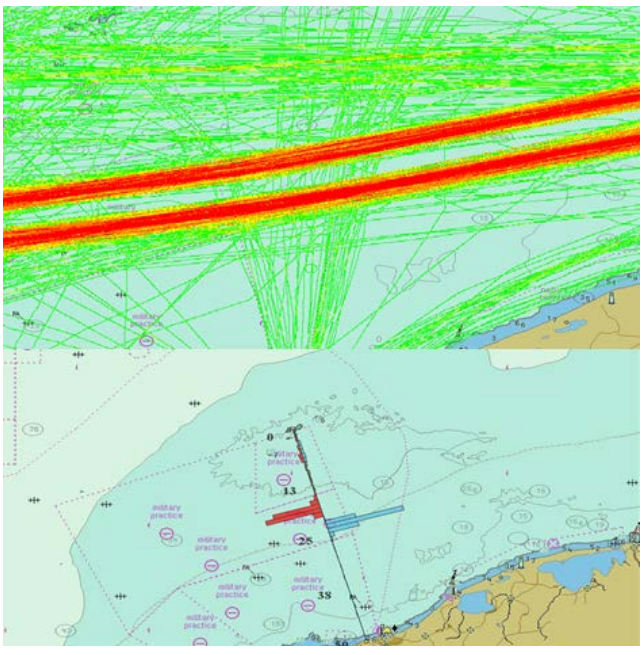

Figure 6. Ship traffic in the area between Słupska Bank and the Polish coast after the establishment of TSS [15].

As shown in Figures 5 and 6, introduction of traffic separation scheme “Słupska Bank” eliminates the potential risk coming from ships meeting each other on reciprocal or nearly reciprocal courses by streamlining the eastbound and westbound traffic as well as serves as an anti-grounding measure. Consequently, it enhances the safety of navigation in the area as well as reduces threat to the marine environment.

In order to enable the control and management of vessel traffic and to provide an information service for ships in the TSS “Słupska Bank” area, VTS with area of responsibility covering this TSS was established in 2010 and modernized in 2018, in both cases by a local legal act - an order of the Director of the Maritime Office in Słupsk. The revised rules of its operation were announced in Polish Notices to Mariners No. 06/2019.

On June 1, 2013, the bulk carrier “Twinkle Island”, carrying a cargo of coal from the port of Gdańsk, ran aground approximately 12 Nm east of the entrance to the analysed TSS. The accident was investigated by the Polish State Maritime Accident Investigation Commission, which published the results of its work in the Final Report 09/13 [5]. Report contained recommendation for the Polish maritime administration to intensify activities taken to designate a new safe route of TSS "Słupska Bank", conducting appropriate surveys and preparing documents in this matter for submission to the IMO [5]. Following this recommendations, Poland submitted to IMO a proposal for an appropriate modernization and expansion of TSS “Słupska Bank” towards the east in 2019 [13]. The proposal was accepted in 2020. Information about the amended TSS was published in the IMO Circular COLREG.2/Circ.75 [4]. The modified traffic separation scheme is presented in Figure 7 [13] and will become effective at 0000 UTC on June 1, 2021.

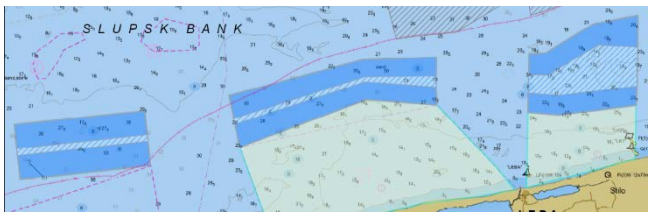

Figure 7. The modified TSS “Słupska Bank” [13].

4 CONCLUSIONS

Summing up the information presented in this paper, it should be stated that the traffic separation schemes and vessel reporting system introduced by IMO, as well as the establishment of the VTS service, ensure the proper level of safety of navigation and environmental protection in the Polish part of the Gulf of Gdańsk. In the case of TSS "Słupska Bank", due to the limited depths in its area, it may have a reservation regarding the lack of a recommendation on the maximum draft of ships that may use it. Its lack is due to the fact that the maritime administrations of Poland, Denmark and Sweden did not agree on a deep water route (“D” route) for ships sailing to/from Polish ports of the Gulf of Gdańsk between Bornholm Island and the coast of Sweden (through Brnholmsgat). Leaving the decision on this scope to ship captains creates a potential risk of grounding in stormy weather conditions of deep draft vessels. Doubts also raises the establishment of the VTS "Słupska Bank" operating inside the area of TSS introduced by IMO in the international waters and Polish territorial sea by local legal act (order of the director of the maritime office) only.

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