

# Risk Assessment While Maneuvering a Loaded Bulk Carrier in Close Proximity to a Vessel Performing Underwater Work

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**ABSTRACT:** This article focuses on issues related to risk assessment when maneuvering a loaded bulk carrier in close proximity to a vessel performing underwater work at the time. It is based on a detailed analysis of an incident that took place in the Gulf of Gdansk. The write-up explains real turns of events, conditions and factors that contributed to the incident, but also its consequences are explained. Some other aspects of this article focuses on, are the processes of examination of the direct causes of the incident and identification not compliance with regulations, requirements, or procedures that help to find out the human, technical, and organizational errors. The authors of this text indicate the safety guards that have failed, give the reasons for their failure and, where it was possible, point out the safety guards that should or must be established. The article does not take into account theoretical models for the described accidents, but only practical aspects, human errors and applicable local and international laws and regulations. Particular attention was devoted to the analysis of human errors made by officers maneuvering the surface vessel in the close vicinity of divers performing underwater works.

## 1 INTRODUCTION

A significant number of marine accidents and hazardous incidents occur every year due to the so-called human factor. According to the Annual Overview of Marine Casualties and Incidents for 2022 published by EMSA [1] (European Maritime Safety Agency), 2637 marine disasters and dangerous events were reported last year. The analysis of 2014-2021 shows that more than half (55%) of the recorded accidents occurred in the area of internal waters, with the domination of port areas, where 39.2% of incidents took place. The explanation for this can be among others: high density of different types of vessels in a relatively small area, limited maneuverability due to submergence, haste and fatigue of the crews.

Similar data are available on Electronic Quality Shipping Information System Equasis [3] and internal documentation collected by IGP&I International Group of P&I Clubs [4]. The above causes account for the highest percentage of all cases investigated by this commission. As presented in the Table 1, collisions are the major cause of marine accidents. From 2014 to 2021, no clear trend was stated. The number of collisions remained varied, depending on the considered time interval. The explanation for that can be the variety of causes of collisions. They are accidents that may happen alike on the open seas and in the gulfs, due to equipment failure or crew inattention, etc. Despite the introduction of more and more new safety regulations, the number of accidents has not decreased noticeably.

According to Polish State Commission for Maritime Accidents Investigation (SCMAI) [2], among 63 investigated cases of maritime incidents, 18 resulted from a lack of caution in maneuvering, and 13 were caused by the lack of proper alertness and attention of the crew. The SCMAI is an independent organization, which carries out safety investigations based on research of vessel accidents that took place in Polish waters. This institution is obliged to inspect each and every 'severe' or 'very severe' marine accident. Marine accident should be considered as an occurrence or several consecutive occurrences linked directly to the ship's operations, resulting in:

- any loss of life,
- major serious injury to a person loss of a person onboard the ship,
- draught, loss of the ship in another way,
- damage to the ship seriously affecting its structure,
- maneuverability or operability so that an in-depth repair is required,
- ship's grounding, or any ship's hull contact with the sea bottom,
- an impact of the ship into a subsea obstacle,
- laying-up or collision of the vessel,
- fire, explosion,
- an impact into a building,
- facility of installation,
- cargo dislocation,
- damages due to unfavorable weather conditions,
- damages by ice,
- crack of the hull or suspected damage to the hull,
- damage by the ship to a port's infrastructure, or to facilities providing access to ports, harbors, installations or offshore structures causing a serious risk to safety of the ships, other ships or persons,
- damage to the natural environment or posing a risk thereof.

Table 2 includes numbers of marine accidents reported in Polish internal waters or territorial sea in the period from 2016 to 2021. Those data are based on Statistical Yearbook of Maritime Economy (Edition 2020 and 2022) [2, 16].

Table 2. Number of marine accidents reported in Polish internal waters or territorial sea in period 2016-2021.

Specification	2016	2017	2018	2019	2020	2021
Number of notifications	90	114	110	144	109	142
Investigations not started, investigations renounced or another reason	61	83	44	71	59	79
Investigations started of which	29	31	66	73	50	63
Investigations completed of which resulted from	16	21	53	49	37	54
renounced investigations	15	19	53	49	37	54

Source: Statistical Yearbook of Maritime Economy (Edition 2020 and 2022). Data collected by the State Maritime Accident Investigation Commission (SCMAI) based on [2] and [16].

The aim of the authors of this article is to present in details the risk assessment when maneuvering a large ship in close proximity to a small diving boat performing underwater operations. Similar incidents are observed quite often around the world, including Poland. The further part of the study, focuses on a particular accident that took place in the Gulf of Gdansk at the end of January 2023. One of the authors

– Grzegorz Rutkowski was appointed by the P&I Club in London as the main investigator of this incident. This article does not consider theoretical models of the described accident, but only practical aspects, human errors and applicable local and international regulations. The article shows step-by-step, the real turn of events, analyzes the legitimacy of the ship commanders' decisions and points out all causes of this accident and its possible variants. Particular attention was devoted to the analysis of human errors made by officers maneuvering the surface vessel in the close vicinity of divers performing underwater works. Moreover, it mentions every non-compliance with regulations, requirements and procedures.

## 2 METHODOLOGY

The authors analyzed the internal data collected by Polish State Commission on Maritime Accident Investigation [2], Electronic Quality Shipping Information System Equasis [3], IGP&I International Group of P&I Clubs [4] and Maritime Office in Gdynia [5]. They scrutinized the scientific literature (e.g. [9-17]) and online-based data related to homogenous marine accidents from the Polish Maritime Administration [5-7] and national and European statistical offices [1,2,4].

It is crucial to mention that not all hazardous situations with the participation of the vessels are reported. Minor marine incidents are usually concealed to avoid legal, administrative and financial consequences. Those reported ones, are not always dedicated to a detailed analysis of the effects and causes of the events. To give an example, Polish Maritime Chamber adjudicates cases on marine accidents only at the request of the parties concerned or a maritime administration. For this reason, "marine accidents and incidents" or even less "severe accidents", including those with the participation of underwater diver intervention, are not necessarily disclosed or they are less frequently presented. However, they represent a remarkable group in the events recorded by the SCMAI.

Another important piece of information about SCMAI is the fact that it is not engaged in maritime incidents related exclusively to vessels of the Naval Forces, Border Guard or Police, unpowered or small-scale wooden vessels; ships for exclusive state service or used by the state for non-commercial purposes, 15 meters long fishing boats, leisure yachts—except for very serious accidents; or accidents at offshore drilling units. In accordance with Art. 40(1). There are two main principles of SCMAI - the reports of this organization cannot constitute evidence in criminal proceedings and they do not establish fault or responsibility for causing the accident. The only goal of reports of SCMAI is to examine background of a certain accident to prevent and avoid similar cases in the future.

Table 1. Causes of marine accidents according to the analysis of the European Maritime Safety Agency EMSA.

	2014	2015	2016	2017	2018	2019	2020	2021	Total
Collision	548	483	548	497	494	556	354	435	3915
Loss of control - drive power supply	321	315	394	447	500	597	562	546	3682
Contact	303	332	276	346	323	336	319	335	2570
Damage/loss of equipment	237	318	314	286	313	317	326	300	2411
Grounding - hull unsealing	223	221	191	191	191	183	168	189	1557
Fire/ explosion	125	139	104	109	108	111	111	129	936
Utility of control- change of direction	64	74	72	79	66	88	91	122	656
Grounding- others	72	62	60	72	73	55	52	48	494
Flooding/flooding and submersion	72	74	47	63	45	49	52	46	448
Loss of control - loss of tightness	63	50	55	45	56	42	55	57	423
Loss of control - electrical power supply	60	41	39	44	51	53	41	56	385
Listing/capsizing	17	18	8	18	20	19	8	7	115
Hull damage	7	16	22	5	6	2	3	9	70
Loss of control- others	1	1	11	3	6	0	1	0	23
Others	0	0	1	1	1	1	0	0	4
Total	2113	2144	2142	2206	2253	2409	2143	2279	17689

Source: EMSA [1] Annual Overview of Marine Casualties and Incidents 2022. Access date: 06.03.2023

According to EMSA (based on [16]), 19418 vessel accidents were reported in Europe from the year 2014 to year 2019. Despite this, the investigation was provided only in 833 cases. The data collected by the EMSA, the same as those from SCMAI, have their methodological limitations - their publication contains statistics on maritime incidents which involve ships whose flag state is an EU Member country, incidents that take place in the territorial or internal waters of EU member states, and finally, events that are related to the substantial interests of those nations.

In addition, to obtain detailed information about the Gulf of Gdansk and to get a practical view of the issues of maneuvering a vessel with a large number of units operating in this relatively small area, the authors interviewed the staff of the VTS Gulf of Gdansk Station, located at the Harbor Master's Office in Gdynia. The meeting was organized by the Student Special Interest Group of Underwater Research SeaQuest, in the VTS Station facility. It was possible thanks to hospitality of the authorities of this institution. Owing to this, the authors were able to improve their understanding of numerous aspects of maneuvering from the practical side and confront their point of view with the opinions of the experts.

This article does not reveal the real names of the ships and people engaged in the accident due to the protection of personal data. For the reason mentioned above, the vessel not complying with traffic regulations will be called SHIP 1, the boat performing underwater work will be named DIVER 2, and the third vessel involved in the event will be given the name SHIP 3.

The SHIP 1 is a typical Capsized bulk carrier with the following parameters: 88,397 gross tons, length over all (LAO) 288 m, width (B) 45 m, air draft (H) 56 m, draft (T) 15 m. The DIVER 2 is a small boat with length over all (LAO) 15 m, width (B) 4 m, air draft (H) 7 m, draft (T) 0,7 m. The SHIP 3 is a standard tanker characterized by the following dimensions: 57,144 gross tons, length over all (LAO) 282 m, width (B) 42 m, air draft (H) 58 m, draft (T) 15 m. The author - Grzegorz Rutkowski, acting on the request of Morska Agencja Gdynia, as Gard (North America) Inc. P & I Club Underwriters Correspondent, participated in the investigation process related to the

dangerous actions taken by the SHIP 1 observed at Gdansk Anchorage No. 4 on January 28th, 2023 in close proximity to DIVER 2 diving boat and fully loaded SHIP 3 restricted in her ability to maneuver, due to broken anchor chain on port anchor.

### 3 THE COURSE OF THE INCIDENT

SHIP 1 arrived in the Gulf of Gdansk on January 28th, 2023 on the early morning at about 07:10 LT. This vessel was loaded with 130,600 metric tons of Australian Thermal Coal in her to be discharged in the ports of Gdansk [6] and Gdynia [7]. Fifteen minutes after arrival, SHIP 1 called Gdansk Port Control on CH-14 VHF and was informed by Harbor Master that her berth (Ore Pier in Gdansk North Port) had been occupied by another vessel and she was requested to proceed to SE part of anchorage No.4. To be more detailed, the SHIP 1 received clear instructions from the VTS Gulf of Gdansk Duty Officer to drop anchor in the South-Western part of anchorage No. 4 and not to come closer than required minimum distance of 6 cables ( $\approx 1100$  m) to a DIVER 2 diving boat which at that time, was performing underwater operations near SHIP 3. The Master of SHIP 1 confirmed several times that he would follow those VTS commands. However, he ignored the order which resulted in exposing the divers working underwater to great danger. At 09:00 LT SHIP 1 passed in between two other vessels maintaining 6 cables ( $\approx 1100$  m) distance. A few minutes later, the vessel decided to drop the anchors in the North part of Anchorage No.4. which was equal to breaking the order of Gdansk Port Control.

In such circumstances, the Duty Officer of Gdansk Port Control called SHIP 1 to ask about her present actions. The Vessel reported, that the anchor was just dropped and the anchoring operation would be complete in about 10 minutes. The Port Control responded and informed the SHIP 1 that she was already less than 5 cables from SHIP 3 and dangerously close to DIVER 2 diving boat. SHIP 1 was instructed by Harbor Master to heave up the anchor and shift the vessel to the South or to the East of Anchorage area No. 4. SHIP 1 was to drop the anchor

in the South-Western part of anchorage No. 4 and not come closer than the requested minimum of 6 cables ( $\approx 1100$  m) to a DIVER 2 diving boat performing underwater work in close proximity to SHIP 3. SHIP3 was fully loaded at a draft of approximately 15 meters and therefore she had restricted ability to maneuver within anchorage No. 4 with available water of 17 m to 19 m depths.

DIVER 2 diving boat was performing underwater operations at that time. Two divers were searching underwater for the broken anchor chain of SHIP 3 and because of that, the DIVER 2 diving boat had also restricted maneuverability. SHIP 1 and SHIP 3 under keel clearance (UKC) oscillated from a minimum of 2 m to a maximum of 4 m considering good weather conditions.

At 09:15 LT SHIP 1 started heaving up anchor in order to move to SW part of Anchorage No. 4. SHIP 1 then moved from the initial anchorage position and at 11:12 LT dropped the anchor in SW part of Anchorage No. 4. Just after heaving up the anchor in the primary anchoring position, the Master of the SHIP 1 continue maneuvering the vessel the way that she was only 3 cables ( $\approx 550$  m) away from the boat DIVER 2 providing direct services to divers. According to Harbor Master's opinion, this action created a serious threat to persons working underwater.

Figures 1 to 4 show the data obtained from the system SWIZB (Navigation Safety Information Exchange System) of VTS Gulf of Gdansk. The analysis of those data shows that SHIP 1 approached the DIVER 2 diving boat at a distance closer than the minimum required (see Fig. 2), generating a high risk for divers performing underwater operations. It is important to remember, that these distances are measured from the point where the antenna is attached on SHIP 1 and DIVER 2. Taking into account the length, width and draft of SHIP 1 (LOA=288 m; B=45 m, T=15 m) and also the size of DIVER 2 diving boat (LOA=15 m, B=4 m), it can be noticed that the real distance the vessels passed each other was even less than 3 cables (on Fig. 2 it is 0,24 Nm which gives only about 450 meters minus ship's real contour).

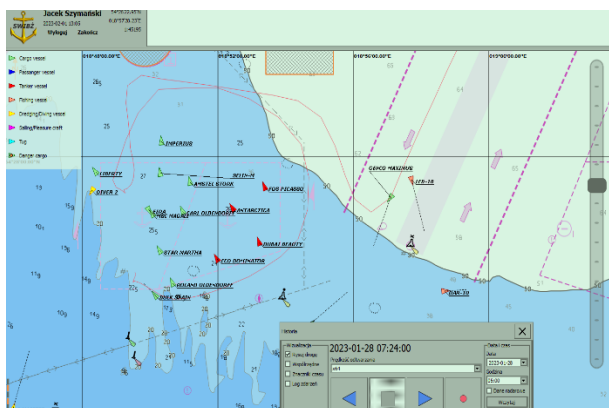


Figure 1. SHIP 1 dangerous activity observed at Gdansk Anchorage No. 4. Source: VTS Gdansk [5].



Figure 2. Distance between SHIP 1 and DIVER 2 diving boat = 0,24 NM = 449 m. Source: VTS Gdansk [5].



Figure 3. Distance between SHIP 1 and SHIP 3 = 0,35 NM = 647 m. Source: VTS Gdansk [5].

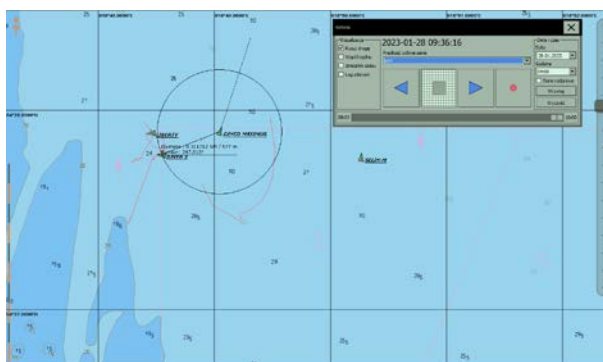


Figure 4. Distance between SHIP 1 and SHIP 3 = 0,31 NM = 577 m. Source: VTS Gdansk [5].

Due to the facts and irregularities described above, the Gdansk Harbor Master decided to talk to the master of SHIP 1 in order to obtain his explanations about what had happened and to start the process of the possible an administrative penalty on him, for not complying with maritime law rules in Polish territorial waters.

In Journal of Laws 2022.457 (Maritime Areas of the Republic of Poland and Maritime Administration) in Article 56 (Deeds subject to a financial penalty) [17] there is a statement that: 'Anyone who stops or anchors a ship outside the place intended for this purpose or drives a ship outside the fairways or does not maintain the course indicated by the competent authority, does not comply with the orders set out in Art. 52, etc. shall be subject to a financial penalty up to the amount not exceeding twenty times the average monthly remuneration in the national economy for the preceding year, announced by the President of the Central Statistical Office.' In case presented in this

article, the administrative penalty could be approximately EUR 25,000.

After clarifying all disputes, the Harbor Master presented his accusation to the Master of SHIP 1 regarding his improper and unsafe activity recorded at Anchorage No. 4 of January 28, 2023. The objections raised by the Harbor Master concerned two main points:

The first one was concerned with the method of approaching anchorage No. 4 by SHIP 1, as the vessel was ignoring the instructions received from the Duty Officer of the VTS Gulf of Gdansk. It resulted dropping the anchor in the Northern part of Anchorage No 4 in the close vicinity (about 5 cables  $\approx$  900 m) 0,5 Nm from other vessels, including a DIVER 2 diving boat performing at that time underwater operations. Earlier, the SHIP 1 had received clear instructions from the VTS Gulf of Gdansk Duty Officer to drop anchor in the south-western part of anchorage No. 4 and not to come closer than a minimum required distance of 6 cables (0,6 Nm  $\approx$  1100 m) to a DIVER 2. SHIP 1 confirmed several times that she would follow this VTS orders, but in fact, the Master of SHIP 1 ignored this order and dropped the anchor in a different place, exposing the divers working underwater to serious danger. Master of the SHIP 1 did not post any objections to the place where he had been ordered to proceed for anchoring. The master of the SHIP 1 was unable to reasonably explain his maneuvers at the Anchorage without informing VTS. However, he showed great remorse and humility and also apologized for his reprehensible behavior, which could have endangered other vessels in the vicinity, especially DIVER 2 diving boat and its divers.

The second point was related to the issue of dangerous maneuvers performed by SHIP 1 when she was heaving up the anchor and later was moving forward to the North-West, passing very close to the DIVER 2 diving boat with two divers working underwater. According to the data received from VTS Gulf of Gdansk, that time the SHIP 1 approached the diving boat DIVER 2 at a distance of about 2,4 cables (0,24 Nm  $\approx$  449 m). They did not follow the instruction received from the VTS duty officer which was to keep a minimum 6 cables distance ( $\approx$ 1100 m). The Port Control officers had the impression that the management of SHIP 1 did not understand the given instructions or did not intend to follow them, breaking the regulations of the maritime administration.

In this case, the Master SHIP 1 was also unable to reasonably explain his maneuvers at the Anchorage neglecting VTS guidelines and good sea practice. He again apologized for his behavior and promised that in the future he would be more careful and always follow the orders of the VTS operators.

The Harbor Master accepted the apology. The matter was only ended with a verbal warning, as the diving company (the owner of DIVER 2 boat) and the Master of SHIP 3 have not lodged any official claim; nobody was injured and nothing got damaged. Taking into consideration the lack of any damage reported and the full cooperation of the Master of SHIP 1 in objective clarification of the incident that occurred, the Gdansk Harbor Master's Office has

decided not to initiate administrative proceedings in the subject matter.

#### 4 RECOMMENDATION

To avoid the situation described in this article, the crew should always be familiar with voyage plan, port pilotage, VTS systems, navigational charts and publications, navigational warnings and all other information regarding ship's route system, next port of call, available anchorages, local rules and regulations as well any other information needed for safe navigation. In this case, the ship's crew did not obtain in advance information that their position in the harbor was occupied by another vessel. The possibility of such an eventuality when planning ship's voyage should be taken into account.

A well-prepared passage plan is particularly important for ships as large as SHIP 1 and SHIP 3. Such vessel is constrained by their size and draft which limits their maneuverability. The risk of difficult situations increases when vessels are in a relatively small area with a lot of navigational hazards. Another important issue are good communication and risk assessment.

On the one hand, the ship's captain, did the right thing when he did not follow blindly the order given by the VTS Gulf of Gdansk Duty Officer. The captain was aware of the depth in the area which was not sufficient for dropping the anchor. On the other hand, he made several crucial mistakes that led to the described accident.

The first mistake the master made was confirmed the order, but did not perform it. VTS service would have certainly taken every notice into account if the master had reported them. Had the anchorage not been suitable for this bulk carrier, the operators would have indicated another, safe place to drop anchor. If the captain's concerns had been wrong, his doubts would have been allayed. However, by acknowledging the order without any complaints, the VTS watch remained unaware of his problems and the master was left alone with his doubts.

Irresponsible act of the captain was the fact that he carried out maneuvers on his own, without following previously formulated orders. Proved to be another irresponsible behavior there is always a lot of traffic in the Gulf of Gdansk area which causes navigation to be more difficult. In such conditions, the VTS staff plays a significant role in monitoring ships' actions and coordinating their operations in order to prevent hazardous situation. The wide knowledge and experience of the operators of this service supported by high- tech equipment ensure undisturbed and safe vessel traffic.

Even though, when a ship begins to act on its own and does not comply with COLREGS and given orders, it creates a serious threat to other vessels. One of serious dangers is the occurrence of the so-called chain reaction, i.e., when maneuvering vessel does not follow orders, causes unpredictable actions of other vessels to avoid collision. This type of situation is a challenge for VTS Duty Officers. The SHIP 1, by its

actions, posed a hazard to the working divers and vessels engaged in those operations. It could have led to even more serious consequences. To give an example, the incident could have ended up dramatically if the weather conditions had got worse. It would have resulted in difficulties in maneuvering and/or conducting surveillance. For this reason, the distance between the SHIP1, DIVER 2 boat and SHIP 3 at critical moment could have decreased and reached less than 3 cables. Such a turn of events would have resulted in a collision between the vessels and injury to the divers.

Another aspect in which The Master of SHIP 1 failed was the fact that he did not take into account his limited knowledge of the Gulf of Gdansk area, so he judged the situation wrongly.

Fortunately, in the mentioned case there were no casualties among humans and none of the vessels was damaged. The incident did not result in any pollution to the environment either. Similar events should be analyzed in order to increase the safety of navigation and provide protection to marine environment.

## 5 FINAL CONCLUSION

The main reason for the accident was human error. This incident could have been avoided if only the guidelines received from the Duty Officer of the VTS Gulf of Gdansk service had been followed by Master of SHIP 1 and proper visual observation had been carried out at the same time. Proper look-out must be maintained, especially during passage in traffic separation schemes.

During this incident, several rules from COLREGs were broken, including:

Rule 5 (Look-out): *Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.*

Rule 8 (Action to avoid collision): *Any action to avoid collision shall be taken in accordance with the Rules of this Part and shall, if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship. In this case, it was extremely important to conduct proper look-out and proper radio communication with Duty Officer of VTS Gulf of Gdansk in order to confirm that our intentions are in line with the guidelines of the VTS service operator.*

The first point concerned by the Harbor Master was the method of approaching anchorage. The master ignored the instructions received from the Duty Officer of the VTS Gulf of Gdansk and, as a result, dropped the anchor in the close vicinity (about 5 cables) of other vessels, including a DIVER 2 diving boat, which performed underwater operations at that time. Before, the vessel received instructions from the Duty Officer VTS Gulf of Gdansk to drop anchor in different position and not to come closer than a minimum required distance of 6 cables to a diving boat performing underwater work, the vessel confirmed several times that she would comply with this VTS order. In fact, the Master ignored this

command and dropped the anchor in a different place, exposing the divers working underwater to great danger.

The second point, raised by the Harbor Master was the issue of dangerous maneuvers performed when the vessel was heaving up the anchor and then, proceeding forward, passing very close to the diving boat with divers underwater. According to the data from VTS Gulf of Gdansk, the ship approached the diving boat at a distance of about 2,5 cables ( $\approx 450$  m), and according to the instructions received from the VTS Duty Officer, it was supposed to keep a minimum 6 cables distance ( $\approx 1100$  m).

In both cases the Master of SHIP 1 did not notify the Duty Officer of the Harbor Master's Office about any doubts related to the place where he was ordered to drop anchor and anchored elsewhere without the officer's consent. At the time of anchoring, the SHIP 1 was closer to the unit conducting underwater operations than recommended by the port officer (minimum distance 6 cables). In addition, after heaving up the anchor, SHIP 1 set a North-West course, as a result of which the vessel passed only 2,5 cables from the DIVER 2 boat, all this happened in spite of having information about underwater operations conducted by both the DIVER 2 boat and SHIP 3.

In both cases, the Master SHIP 1 was unable to reasonably explain his maneuvers at the anchorage contrary to VTS guidelines and good sea practice. He apologized for his behavior and promised that in the future he would be more careful and always follow the instructions of the VTS operators.

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