UEIM Transport Safety Investigation Center

MARINE SAFETY INVESTIGATION REPORT

VESSEL NAME	: PALLADA
IMO NO	: 8866931
FLAG OF THE VESSEL	: Cameron
PLACE OF ACCIDENT	: Port of Karadeniz Ereğli
DATE and TIME of ACCIDENT	: 19 November 2023 - 09:51 (GMT+3)
FATALITY/INJURY	: -/-
DAMAGE DEGREE:	: The vessel broke into two pieces and grounded
ENVIRONMENT POLLUTION	: None

Board Decision No: 17/D-05/2024	Date: 27/11/2024

The sole objective of this investigation is to make recommendations for the avoidance of similar casualties and incidents within the framework of the regulation by the Transport Safety Investigation Center.
This report shall neither be the product of a judicial or administrative investigation nor shall it bear the purpose of apportioning blame or liability.

LEGAL BASIS

This marine casualty has been investigated under the provisions of the "By-Law of Investigation of Marine Casualties and Incidents" enacted by its publication in the Official Journal No. 30961 on 27/11/2019.

Also, Resolution MSC.255(84) [Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Casualty Investigation Code)], as well as Resolution A.1075(28) (Guidelines to Assist Investigators in the Implementation of the Casualty Investigation Code), have also been taken into account for the procedures and principles of the investigation.

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DEFINITIONS and ABBREVIATIONS

GMT : Greenwich Mean Time
AIS : Automatic Identification System
VHF : Very High Frequency
ISM : Safe Management System (SMS)
IMO : International Maritime Organization
MT : Metric Tons
SOLAS : International Convention for the Safety of Life at Sea

SOURCE OF INFORMATION AND LIST OF REFERENCES

Port Pilotage Logs
PALLADA Vessel Logs
Records of The Ship Operator
Master and Crew

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SUMMARY

Image 1 Place of the Accident

Note: All times used in the report are local time. (GMT +3)

The vessel "PALLADA" arrived at the Port of Karadeniz Ereğli from the Port of Odessa, Ukraine, with ballast condition and anchored at the Port of Ereğli anchorage site on 08 November 2023, at 19:40. Against the possibility that the weather conditions getting worse, the port authority allowed her to anchor at anchorage site No. 4, located in front of Bozhane, on 13 November 2023 at 09:10.

On 19 November 2023, the vessel failed to endure the bad weather and sea conditions, and it was understood that the noise heard at 09:51 was caused by the breakage of the vessel, and the crew issued a distress call at around 10:00. Soon after, the vessel broke into two separate pieces, bow and stern, and drifted and grounded on the shore (Image 1). All 13 crew members aboard were safely rescued from the vessel.

On 21 November 2023, after the storm cease, the vessel was surrounded by sorbent oil absorbers to prevent any potential environmental pollution, and a total of 10,000 kg of oil, fuel, and bilge waste were removed from the vessel.

The marine safety investigation resulted in recommendations to the Chamber of Shipping and the Ship Manager.

1. SECTION - FACTUAL INFORMATION

1.1. Information on the Vessel

Flag	: Cameron
Call Sign	: TJMC692
IMO Number	: 8866931
Class Society	: VEGA REGISTER
Type	: Dry Cargo Carrier
Place and Year of Building	: Czechoslovakia / 1968
Gross Tonnage	: 2457
Length Over All	: 107.35 m
Beam	: 13 m
Main Engine and Its Power	: 2 X CKD Praha DIZ a.s. / Diesel 1030 kW
Hull Construction	: Steel

1.2. Information on Vessel Voyage

Port of Departure	: Odessa / Ukraine
Port of Arrival	: Karadeniz Ereğli / Türkiye
Cargo Details	: In Ballast
Number of Crew	: 13
Minimum Safe Manning	: 9
Type of Voyage and Restrictions	: Black Sea (no more than 20 nm[1] from the nearest coast all year round) - Mediterranean - Marmara - Sea of Azov

1.3. Information on Casualty

Date/Time of Accident	: 19 November 2023 – 09:51
Casualty Type (IMO)	: Very Serious Marine Casualty
Type of Casualty	: Breakage - Grounding
Location of Accident (Latitude-Longitude)	: 41°16.724' N - 031°25.17' E
Injured / Dead	: -/-
Damage	: The vessel broke and grounded.
Pollution	: Not reported

[1] Nm: Nautical Mile.

1.4. Information on Environment Conditions

Wind	: 10 Beaufort force from the South West
Sea Condition	: Storm
Visibility	: Poor
Weather Condition	: Close

1.5. The Vessel PALLADA

The vessel was built in 1968 under the designation VOLGO BALT 103 at the Zavody Tazkeho Strojarstva - Komarno shipyard in Slovakia. In 2005, she was designated ARAS 7, followed by CATRIN 2 in 2010 and finally PALLADA in 2015. Volgo-Balts are river-sea class dry bulk carriers designed to transport bulk cargo (coal, ore, grain, crushed stone, etc.) across the major inland waterways of Russia that have access to the sea. The vessel has four holds and is equipped with two main engines powered by diesel (Image 2).

The certifications and class documentation of the vessel PALLADA were valid on the date of the accident, and the survey period had not elapsed. The VEGA Register (VGRS)[2] Class Society issued the Safety Management System (SMS) and the International Ship Security Certificates, and they were verified annually. Figure 1 shows the Fire Control and Safety Plan of the vessel.

The two latest Port State Controls for the vessel PALLADA took place on 10 May 2023 in Samsun and on 28 August 2023 in Reni, Ukraine. Both inspections identified no shortcomings or flaws concerning structural damage.

Image 2 The vessel PALLADA

[2] VGRS: It is a local class society, though it is not a member of IACS.

The vessel is subject to meteorological and navigational restrictions as laid out in the International Loading Limit and Class Certificate. One of the navigational restrictions pertains to **"20 nautical miles offshore in the Black Sea,"** while meteorological restrictions specify **"a wave height of 3.5 meters."** The Cargo Carrier Radio Safety Certificate designates the navigational zone as A1+A2[3].

[3] **The navigational zones A1 and A2:** Global Maritime Distress and Safety System (GMDSS)
The navigational zones A1: within range of shore-based VHF DSC coast station (40 nautical miles)
The navigational zones A2: within range of shore-based MF DSC coast station (40 to 150 nautical miles)

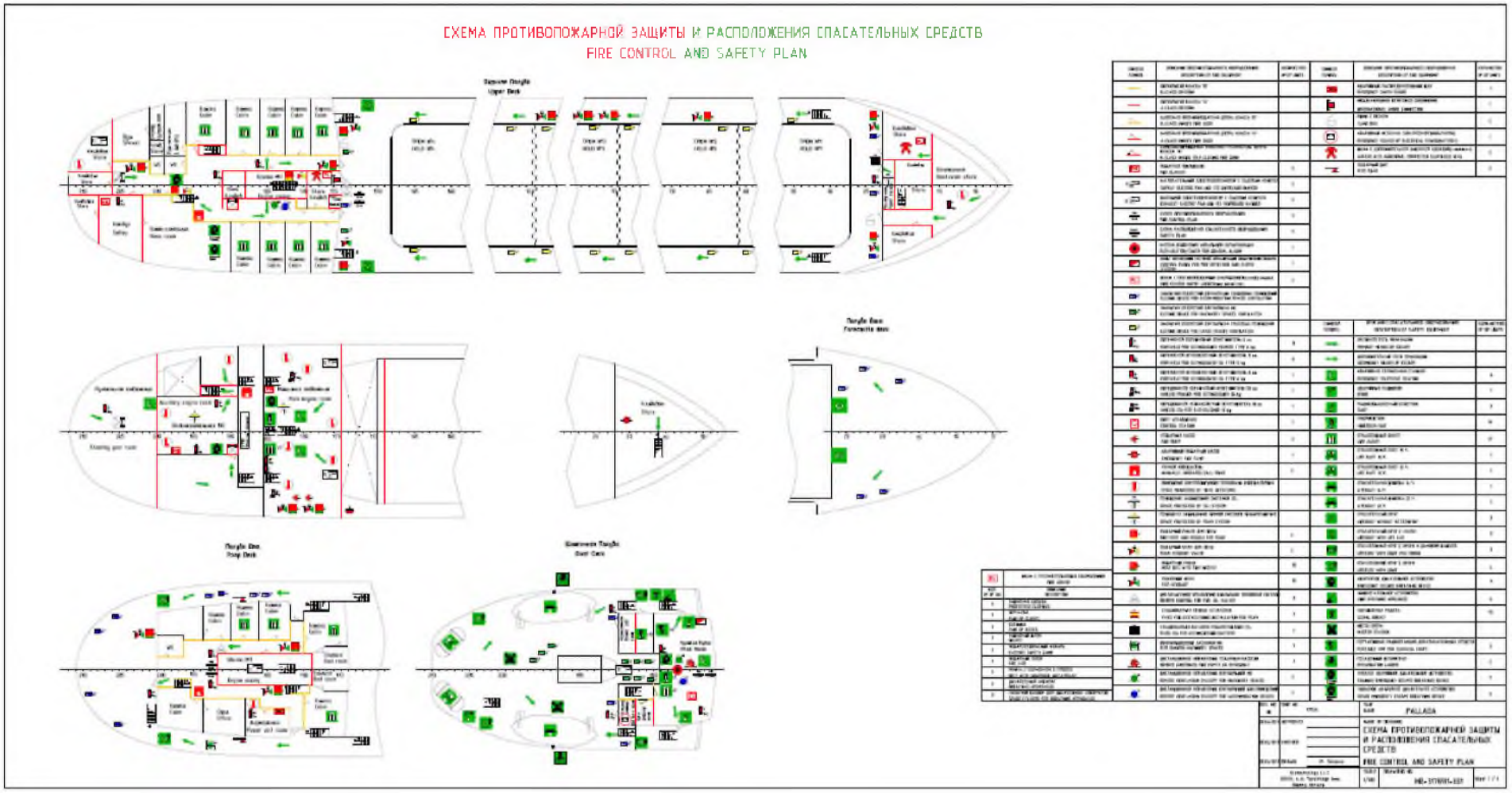

Figure 1 Fire and Safety Plan for PALLADA

1.6. Manning of PALLADA

PALLADA must be manned by nine (9) crew members in accordance with the Minimum Safe Manning Document issued under the International Convention for the Safety of Life at Sea (SOLAS 74) Rule V/14. On the day of the accident, there were thirteen (13) crew members onboard, including the master, and **the vessel was manned with an adequate number of qualified seafarers** in accordance with the Minimum Safe Manning Document. Also, neither a deck cadet nor the passengers were on board. The crew consists of ten (10) Ukrainian citizens, and three Azerbaijani nationals and the work language is Russian.

1.7. Key Crew on board PALLADA

1.7.1. Master

The master, a citizen of the Russian Federation, was a 65-year-old at the date of the accident and had joined the vessel 2.5 months ago. He was experienced as an Oceangoing Master for 12 years.

1.7.2. Chief Officer

The Chief Officer, a citizen of Ukraine, was 65 years old at the date of the accident and had been serving on that vessel for approximately 3 months. He had been working as a Chief Officer for 14 years.

1.7.3. Chief Engineer

The chief engineer was 54 years old at the date of the accident and had been serving in the same company for 2 years. He held a 4-year Chief Engineer's license.

1.8. Port of Karadeniz Ereğli

The coordinates of the port area of Karadeniz Ereğli are 41° 06' 57" N - 031° 17' 48" E to 41° 23' 30" N - 031° 37' 51" E.

The Port includes two (2) Bulk Cargo Berths, four (4) General Cargo Berths, one (1) Ro-Ro Berth and one (1) Train Ferry Berth (Figure 3). The water depths of the berths in the port range from 6.5 m to 20 m. The maximum vessel acceptance tonnage of the port is 200,000 DWT. The total length of the eight berths in the port is 1670 meters. A 1277-meter-long breakwater structure protects the New Port.

The water density can range from 1,010 kg/m^3 to 1,012 kg/m^3 depending on the temperature and salinity of the seawater and seasonal conditions. The measured temperature of the seawater at the time of the accident was 15 degrees Celsius. The port specifically accepts Cape Size

vessels[4] with high draught[5] by following the channel (Figure 2). There are occasional northerly bottom currents of 2-4 knots outside the port.

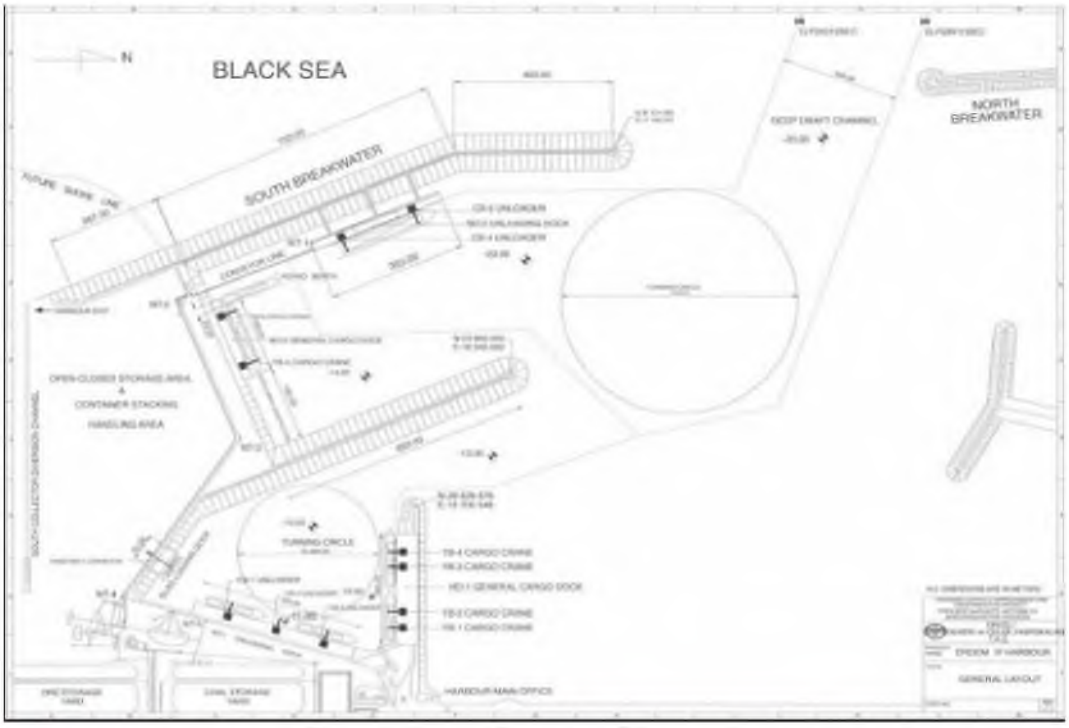

Figure 2 General Structure of Today's Port

Image 3 Today's Port Area of Karadeniz Ereğli

[4]Cape Size Vessels: These are the vessels that are too large to pass through the Suez Canal and Panama Canal. This category includes vessels up to 110,000 to 200,000 DWT. They have no cargo winches on them; they use cranes or loading and unloading systems at the port. They are mainly used to transport iron ore or coal and, to a lesser extent, grain, usually on long-distance routes.

[5]Draught: The distance the vessel remains under water or submerged.

1.8.1. South Breakwater of the Port of Karadeniz Ereğli

The South Breakwater of the New Port of ERDEMİR is 1417 m long, and the structure is protected by two rows of tetrapod[6]-coated blocks weighing 20 tonnes. The slope of the body of the structure is 1:4/3 on the offshore side and 1:3/2 on the roundhead side. The breakwater was designed and constructed at crest elevation + 6.0 m[7].

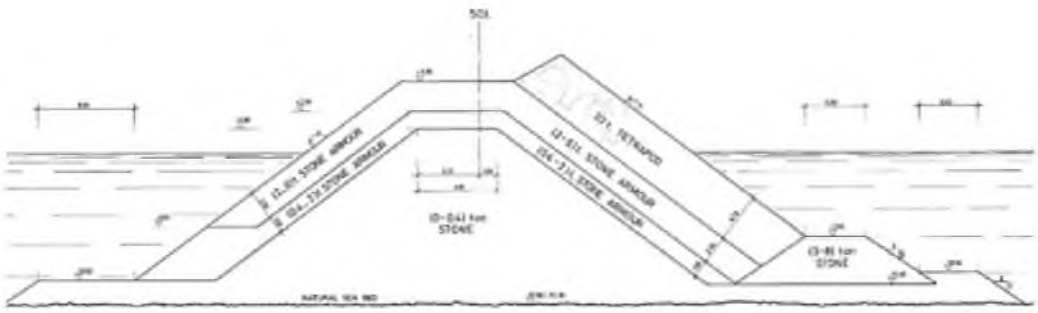

Figure 3 Breakwater Type Cross Section

1.8.1.1. Renovations to the South Breakwater of the Port of Karadeniz Ereğli

During the 2010 inspections, it was determined that the tetrapods were not in their original positions, as described in the project, due to shifts and collapses in the upper rows of the 20-tonne tetrapods, built as a protective layer in the above-water part of the breakwater structure at the South Breakwater of the New Port of Erdemir. Divers and specialised staff inspected all cross-sections, heel sections, underwater conditions, and above-water conditions of the structure during the field inspection. During the underwater inspections, cross-sections of the structure were prepared at a distance of 10 meters along the structure using a side scan sonar system, and the cross-sections were compared with the projects and evaluated. During the maintenance works, tetrapods that were broken and cracked due to displacement were identified, removed, and replaced with new tetrapods. All above-water tetrapods and locally underwater tetrapods were removed and replaced with new tetrapods in order to be able to remove and reinstall the tetrapods that were broken, cracked, and with their project layouts disrupted. The stabilisation of the structure was restored in the areas where maintenance works were carried out, and the structure was brought into a state in accordance with the approved projects.

[6] Tetrapod: An excerpt from the Report of the 8th Coastal Engineering Symposium describes a starfish-shaped concrete breakwater block that can weigh up to 120 tonnes and protects against strong waves for ports.

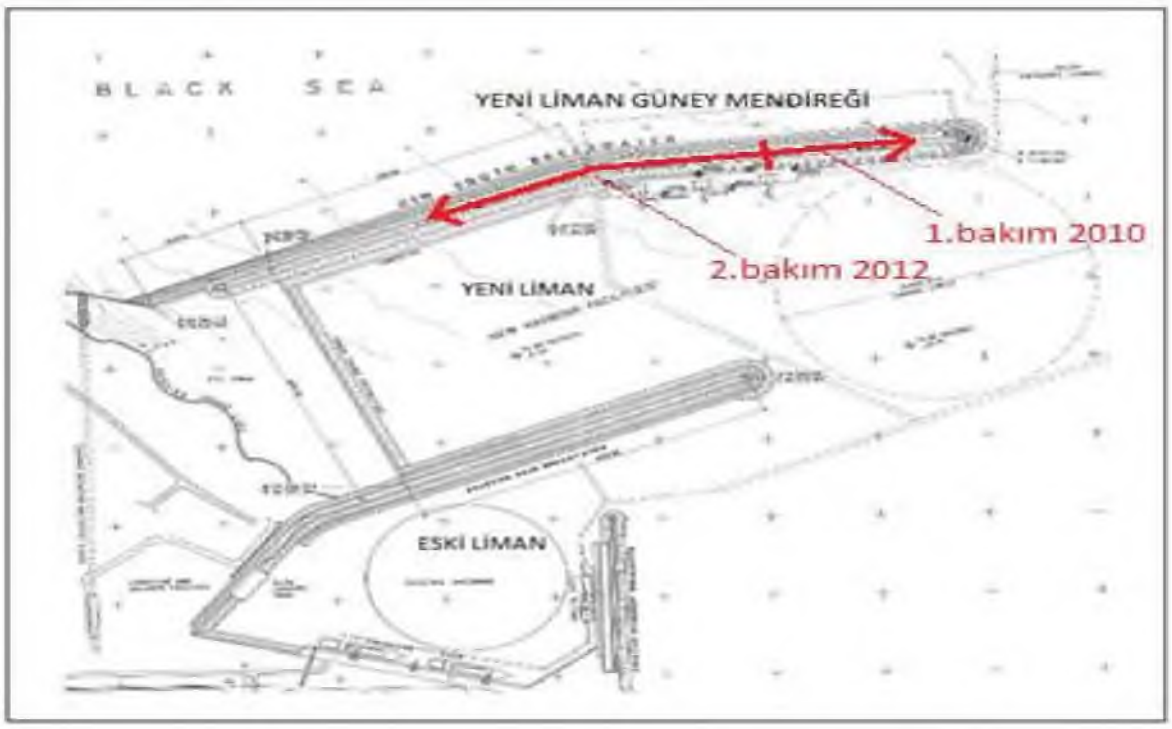

Figure 4 Port Layout and Maintenance Plan

1.8.2. North Breakwater of the Port of Karadeniz Ereğli

The North Breakwater and quay project of the Karadeniz Ereğli is a part of the "Modified Breakwater Types of Port of Ereğli" project, dated 23 November 1949, and approved by the "B.B. Directorate of Railways Construction", and can be found in Annex 1. The outer protective layer of the breakwater between Km:0+000 and Km:0+075 was constructed with natural blocks of the 5-10 tonne category and small concrete blocks removed from the temporary docks; the section extending from -0.50 m to -8.50 m of the outer protective layer between Km:0+075 and Km:0+200 was constructed with natural blocks of 5-10 tonnes and small concrete blocks removed from the docks; and the section extending from -0.50 m to +4.50 m was constructed with concrete blocks of 40 tonnes in the said project. The outer protective layer of the breakwater between Km:0+200- Km:0+795 meters was furnished with concrete blocks of 40 tons. The superstructure has an embankment structure of the crown wall.

The said breakwater was designed by allowing the wave to top over the breakwater at certain ratios since the formation of a quay on the main breakwater was not considered.

1.8.2.1. Renovations to the North Breakwater of the Port of Karadeniz Ereğli

During the construction of the northern breakwater, damages were caused to the main breakwater crown wall in 1968 and 2004 due to the sea movements in the region, and the inner

riprap stones[8] of the main breakwater were deformed due to the overtopping wave, and minor repairs were made.

Due to the persistence of wave overtopping problems, the main breakwater crown wall was damaged again and the interior layout ripraps were also deformed.

As a result of the investigations on wave overtopping and losses in the cross-section of the inner layout on the North Breakwater of the Port, repair works started on 15 December 2017. A 380 m crown wall was constructed, the main breakwater was repaired, 390 m of rubble mound fortifications were built, and the breakwater was repaired and renovated and completed on 30 November 2019.

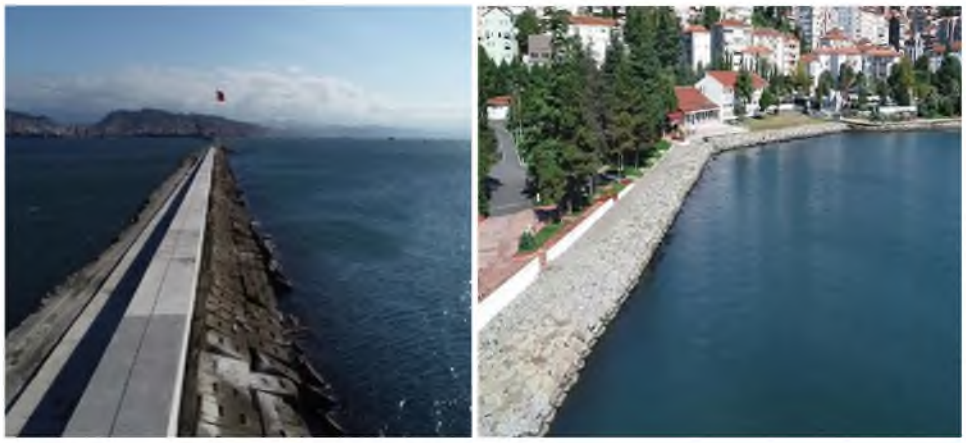

Image 4 Images of the North Breakwater after Renovation

1.9. Capacity and Pilotage Services of the Port of Karadeniz Ereğli

The Port of Erdemir renders pilotage, towage, and mooring services 24 hours a day. For these services, there are three tugboats (Total Pulling Power 126 tonnes), one mooring boat, and one pilot boat. The VHF communication channels are 12 and 16. Image 5 shows the port anchorage sites and pilotage location, and Table 1 indicates the capacities.

[8] Riprap: They are massive stone blocks used to quench the wave energy affecting the coastal structures.

Image 5 Anchorage Sites and Pilotage of the Port of Karadeniz Ereğli

VESSEL TYPE	PCS.	CAPACITY/TONNES
Bulk Carrier Winch	4	30-31
General Cargo Winch	5	15-25-40
Mobile Crane	1	40
Industrial Excavator	1	1.8 m3
Forklifts	9	3-10-16-20-32-42
Loader	5	0,4-3,4 m3
Crawler Excavator	5	0,8-1,3-1,5 m3
Tanker	1	7 m3
Tugboat	3	32, 32, 62 Tonne Bollard Pull

Table 1 Capacity and Pilotage of the Port of Karadeniz Ereğli

2. SECTION – NARRATIVE

The sequence and time of the incident that led to the marine casualty under investigation, as well as the where about of people depend on the eyewitness statements and interviews.

2.1. Voyage of the Vessel

The Cameroon-flagged vessel, PALLADA began sailing from the Port of Odessa, Ukraine, to the Port of Karadeniz Ereğli on 1 November 2023 under voyage no. 7/23 with ballast for loading salt in 3100 MT Big Bags[9] at the Port of Karadeniz Ereğli. She anchored at Anchorage Site No. 1 of the Port of Karadeniz Ereğli on 8 November 2023 at 19:40. The chart showing the route of the vessel between 1 November 2023 and 8 November 2023, the date of the accident, appears below.

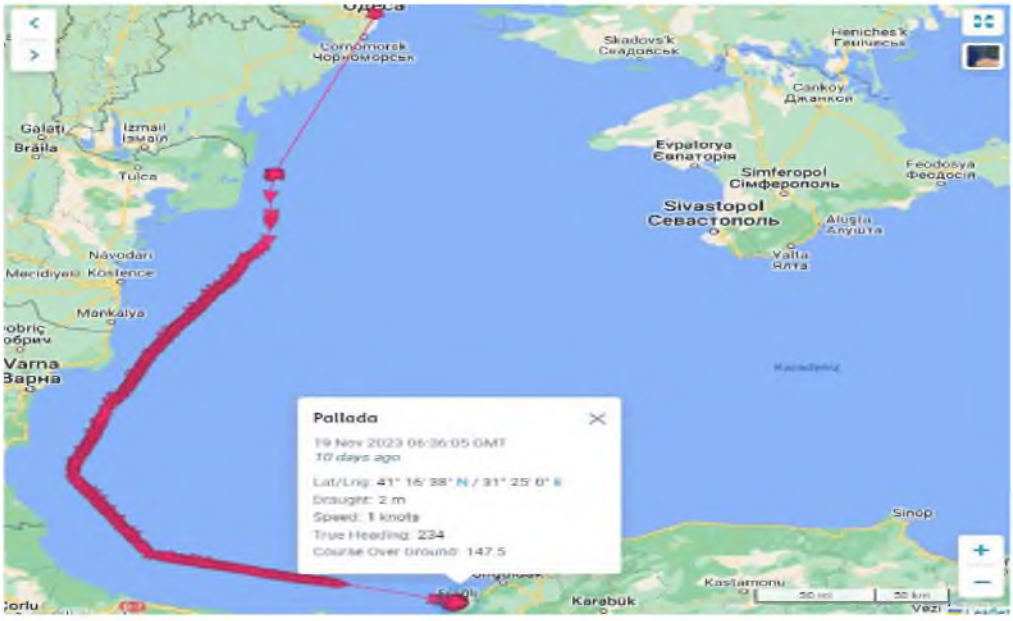

Image 6 Route Followed by PALLADA

2.2. Sequence of Events

As the sea and weather conditions in the region started to get worse, the vessel anchored from Anchorage Site No. 1, where she was anchored, to Anchorage Site No. 4 inside the breakwater on 13 November 2023 upon the permission of the Port Authority (Image 7).

[9] Big Bag: These are large sacks made of laminated or non-laminated fabrics for packaging, transportation, and storage of powder and granular products, allowing transportation between 200 kg and 2000 kg.

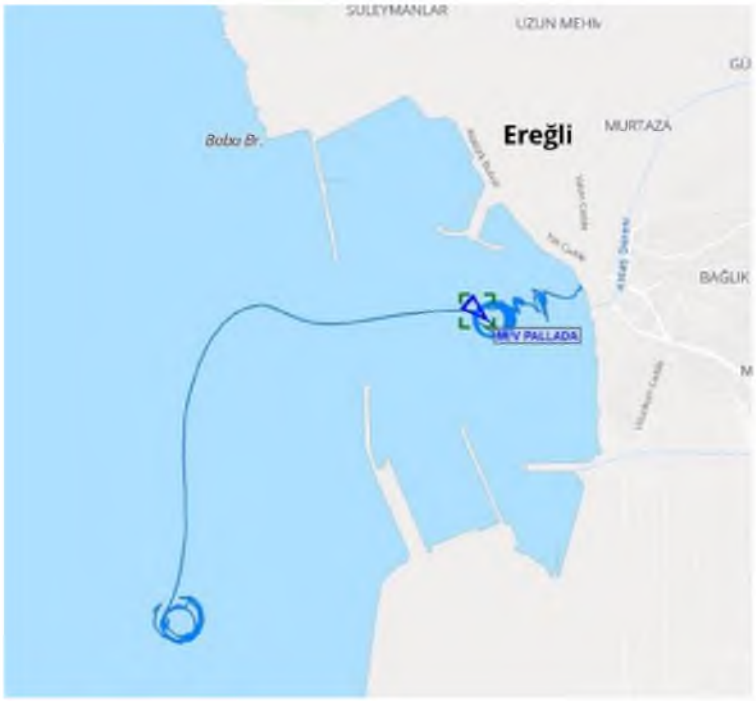

Image 7 Anchorage Sites for PALLADA

While the vessel PALLADA was on the starboard anchor in Anchorage Site No. 4 of the Port of Ereğli Bozhane, she was informed about the meteorological forecast that the weather and sea conditions getting worse as of 17 November 2023. Immediately after the last meteorological report received on 19 November 2023 at 08:30 on the date of the accident, sea and weather conditions worsened. Although the main engines and generator were operational, the vessel could not hold at anchor, and the anchor began to dredge. According to the Beaufort Scale[10], the wind speed increased to a full gale between 09:45 and 09:50. Subsequently, upon the breaking noise heard from the vessel, it was understood that the vessel broke at 09:51.

Image 8 Illustration of the Breakage of PALLADA

[10] Beaufort Scale: This is a scale that tries to determine the wind and sea conditions in navigation according to visual observations.

2.3. Search and Rescue Operations

The broken vessel drifted and leaned against the coastline in two separate pieces. At around 10:00, the vessel's crew asked for rescue help from the Port Authority and the pilotage organisation via VHF[11]. Meanwhile, the Turkish Search and Rescue Centre (AAKKM) received an EPIRB signal from the vessel PALLADA via the COSPAS-SARSAT[12] system at 10:11 on 19 November 2023 and notified Turkish Radio for a search. All 13 crew members on board were safely evacuated from the vessel with the cableway[13] system established by the local fire brigade and AFAD teams.

The vessel was encircled with a sorbent barrier against the possibility of environmental pollution on 21 November 2023 at 12:00, and pollutants (10,000 kg), including oil, fuel, and bilge wastes, were removed from the vessel at 15:00.

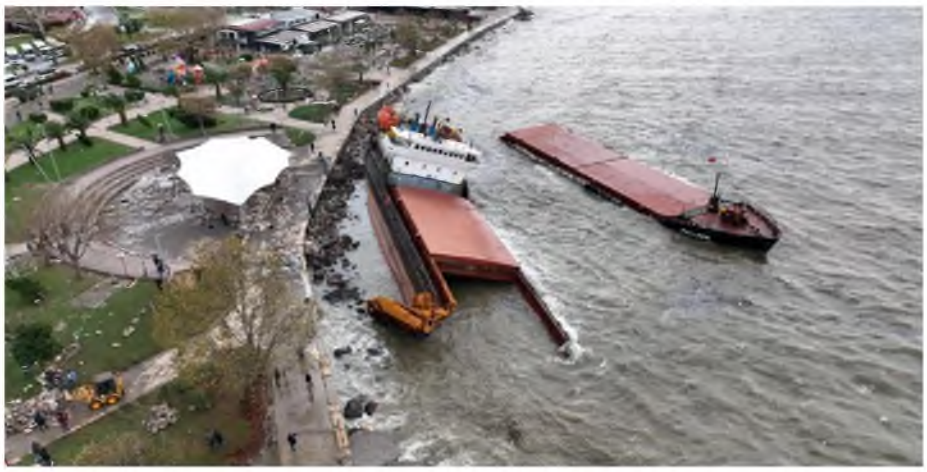

Image 9 Condition of Broken Parts of PALLADA

2.4. Characteristics of the North and South Breakwaters of Karadeniz Ereğli during the Storm

The outer protective layer of the north breakwater of Karadeniz Ereğli between Km:0+000 and Km:0+075 was constructed with natural blocks of the 5-10 tonne category and small concrete blocks removed from the temporary docks; the section extending from -0.50 m to -8.50 m (depth) of the outer protective layer between Km:0+075 and Km:0+200 was constructed with natural blocks of 5-10 tonnes and small concrete blocks removed from the docks; and the section extending from -0.50 m to +4.50 m (depth) was equipped with concrete blocks of 40

[11] VHF: These are radio devices that enable radio-telephone and digital selective call (DSC) communication using very high wave radio signals (VHF—Very High Frequency) on vessels.
[12] **COSPAS-SARSAT**: This is a satellite system designed to send alarms and the coordinates to assist search and rescue (SAR) activities by using spacecraft and ground facilities to locate the signals of distress beacons operating at 406 megahertz (MHz).
[13] Cableway: This is a system used to carry people with a basket hooked to a reel that moves on a strong rope stretched between two points.

tonnes. Finally, the outer protective layer of the breakwater between Km:0+200- Km:0+795 meters was also furnished with concrete blocks of 40 tons. **The said breakwater was designed by allowing the wave to top over the breakwater at certain ratios since the formation of a quay on the main breakwater was not considered.**

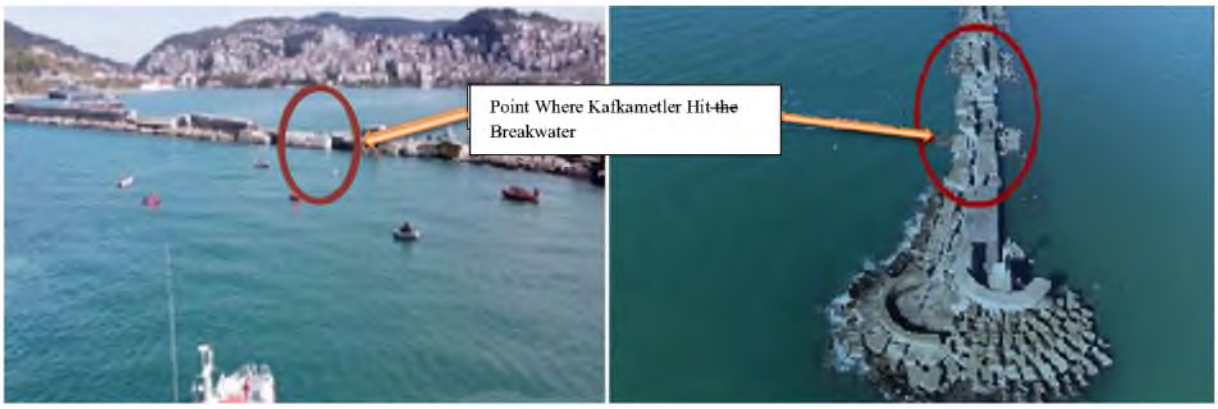

Image 10 Condition of the North Breakwater after Damage

However, the depth of the outer harbour of South Breakwater of Karadeniz Ereğli is -20 meters, and the length of the breakwater is 1417 meters in total. The outer protective layer of the breakwater, which was designed about 50 years after the northern breakwater, used 20-ton tetrapods for the body and 30-ton tetrapods for the roundhead. **One of the reasons behind it is the consideration of building a quay on the breakwater during the design phase, which made it necessary to restrict the amount of wave overtopping, and the project was designed accordingly.**

The south breakwater, on the other hand, showed the expected performance of the structure according to the design principles, and **no damage was caused in the harbour, except for incidents that could be eliminated with simple repairs.**

2.5. Conditions of Pilotage and Tug Services in Karadeniz Ereğli During the Storm

Pilotage and towage services are provided 24/7 at the Port of Karadeniz Ereğli. During this service, three 32-32-62 tugboats with a total bollard pull (BP) of 126 tonnes, a capacity of Fi-Fi[14], featuring escort and 360° Azimuth[15] propellers, are used.

[14] Fi-Fi: This is an external fire extinguishing system that is used for cooling and extinguishing with water cannons on tugboats.
[15] Azimuth Propeller with Nozzle: This is a kind of Z-type propulsion, integrating the function of pipe propellers and steering gears. The underwater part can be guided by a free rotation of 360 degrees. All-directional propulsion force is generated.

Image 11 Tugboat with Azimuth Propeller

The tugboat skipper and crew work one day on duty and one day off duty. The number of pilots is four, and three pilots work two days on duty and four days off duty. The chief pilotage is on duty from 07:30 to 17:30 on weekdays and works on call on weekends. According to the vessel type registration, the tugboats are offshore tugboats. They serve with four crew members, including the skipper, in accordance with the Minimum Seafarer Certification.

Although the vessel PALLADA was at anchor in the inner harbour of Bozhane during the accident, the vessel PALLADA started to drift by dredging anchor and asked for rescue help. The tugboats moored at the berth in the inner harbour of Ereğli received the calls but could not respond due to the storm.

Image 12 Meteorological Measurements of the Tugboat at the Time of Accident

3. SECTION– ASSESSMENTS

While assessing the marine casualty under investigation, the objective is to identify and determine the factors that caused the accident by considering the sequence of events and data gathered during the investigation, as well as to draw useful conclusions that lead to safety recommendations on root causes.

3.1. Anchor Dredging of the Vessel PALLADA

The vessel PALLADA started her voyage from the Port of Odessa, Ukraine, to the Port of Karadeniz Ereğli in ballast with the voyage No. 7/23 and anchored at the Anchorage Site No. 1 of the port on 08 November 2023 at 19:40. It was understood that while she was awaiting a port order to come alongside and load 3100 m/t of salt, the weather conditions would aggravate, and the Port Authority allowed the vessel to anchor at Anchorage Site No. 4 (BOZHANE) inside the breakwater on 13 November 2023 at 09:10 (Image 13).

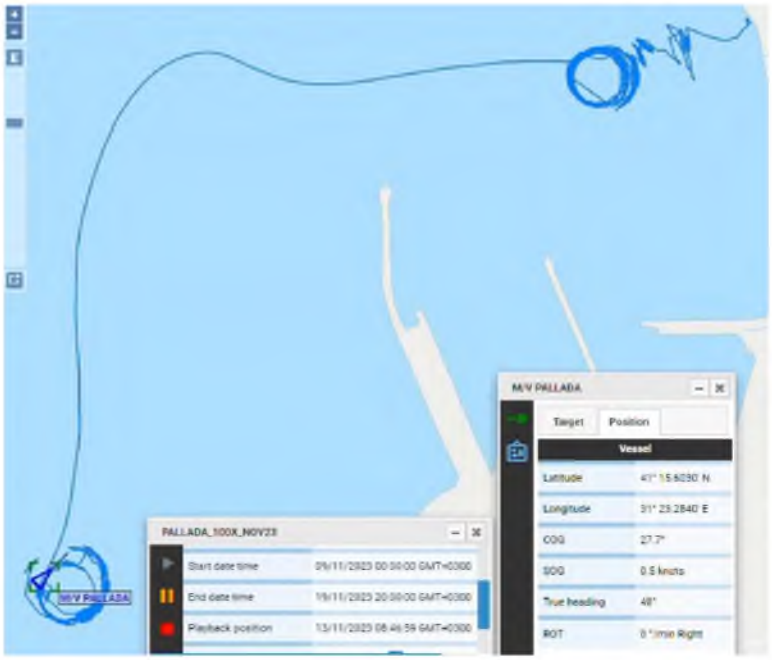

Image 13 First and Second Anchorage Site of PALLADA

PALLADA, which had been waiting on the starboard anchor in the anchorage site inside the harbour breakwater until the date of the accident, started to be exposed to the south and south-west wind and sea conditions that became effective from the first hours of 19 November. (Image 14)

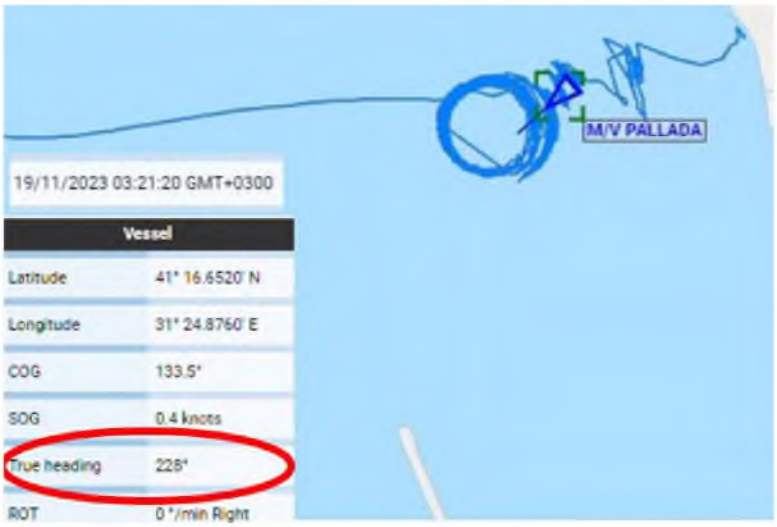

Image 14 Exposure of the Vessel PALLADA to High Seas and Gale

The AIS logs of the vessel indicated that the vessel, which was affected by the storm that aggravated, especially as of 08:00 on 19/11/2023, started to dredge her anchor and consequently moved in zigzags where it was stationed. (Image 15)

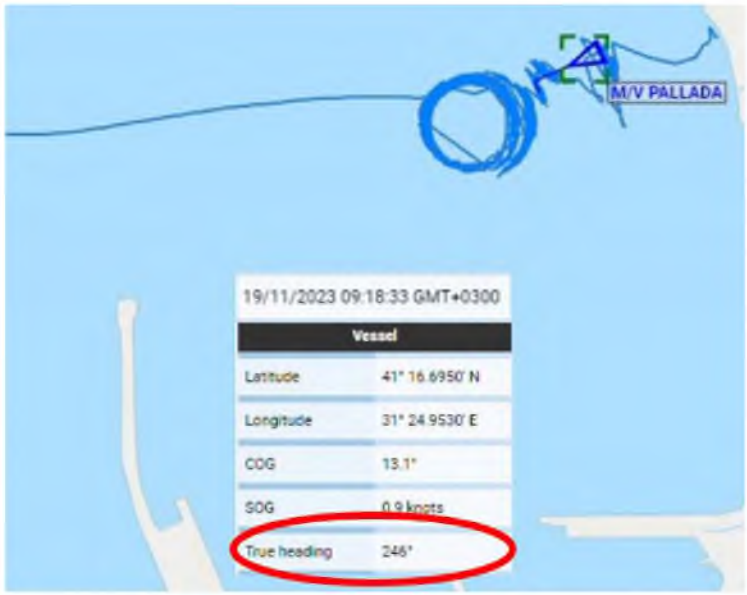

Image 15 Dredging Anchor of the Vessel PALLADA due to Storm

Due to the ongoing exposure to severe sea and weather conditions, the vessel PALLADA (Image 16) first broke into two pieces at its location and then grounded at around 10:16.

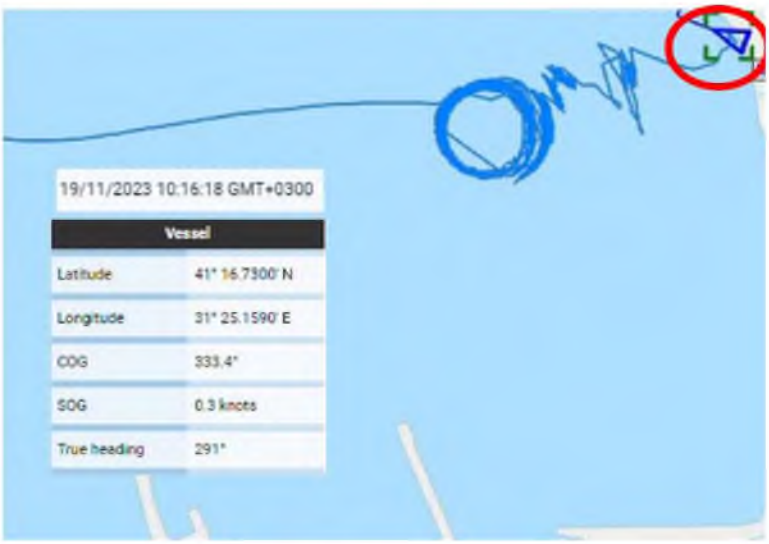

Image 16 Location Where the Vessel PALLADA Was Dragged Ashore

The crew of the vessel PALLADA reported in their statements that the weather and sea conditions became severe since the morning hours on the day of the accident, causing the vessel to oscillate heavily and that they were trying to hold on to the anchor by keeping the vessel's engine running against any unfavourable circumstances that might affect it.

The effect of the heavy oscillations, particularly of vessels at anchor, on the structural strength of the vessel is undeniable. It has been known that in similar cases, the vessels either break the anchor or, if they are unable to do so, damage the anchor windlass or strain the structural integrity of the vessel.

The vessel PALLADA is equipped with four cargo holds, and due to the structure of the holds of the vessel, it has large hatch covers, and therefore, large hatch apertures. Due to this structural feature, considering the metal fatigue caused by the advanced age of the vessel, it is inevitable that the hatch apertures will be subjected to major diagonal deformations and impact stresses under complex torsional moments in waves. Since the torsional strength of the vessel PALLADA should be measured at the structural design stage, the extent to which the structure of the vessel affected its breakage was not evaluated. However, it was evaluated that the breakage took place in the midship part of the vessel, where the stress was relatively higher than in the other parts of the vessel, and this was the main factor in the breakage of the vessel exposed to the waves caused by worst weather conditions.

3.2. Weather conditions

On 19 November 2023, the pressure value in the low-pressure centre that moved from Thrace towards the Central Black Sea dropped below 1000 hPa[16]. Consequently, the value of the horizontal pressure gradient from the low-pressure centre towards the periphery rose. Due to these effects, wind speeds in the low-pressure circulation at the accident location reached the storm force. However, the low centre at 500 hPa also strengthened in accordance with the pressure system at ground level, and the said frontal system was positioned over the Marmara Region with a centre value of 540 hPa, making the frontal system even stronger compared to the day before (Images 17 and 18).

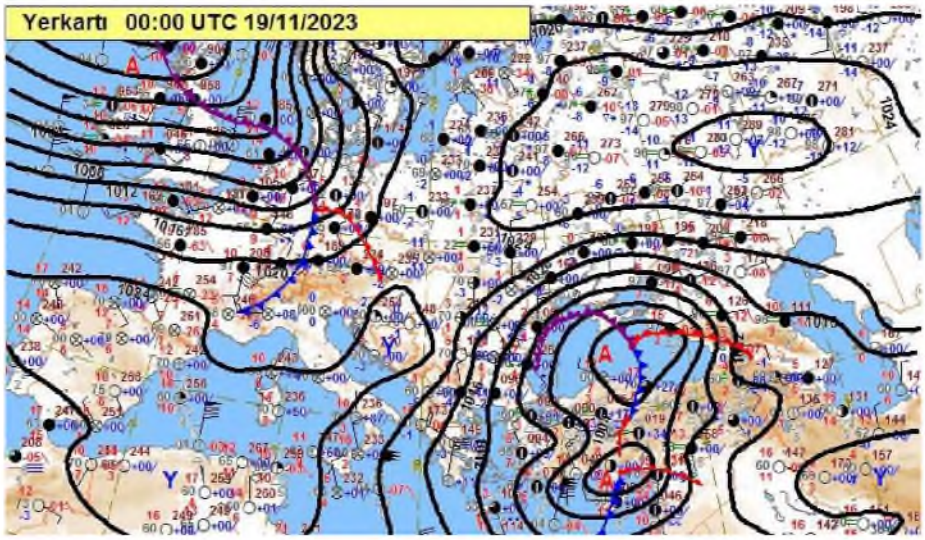

Image 17 Meteorological Observation Chart at Ground Level (19/11/2023, 00.00 UTC)

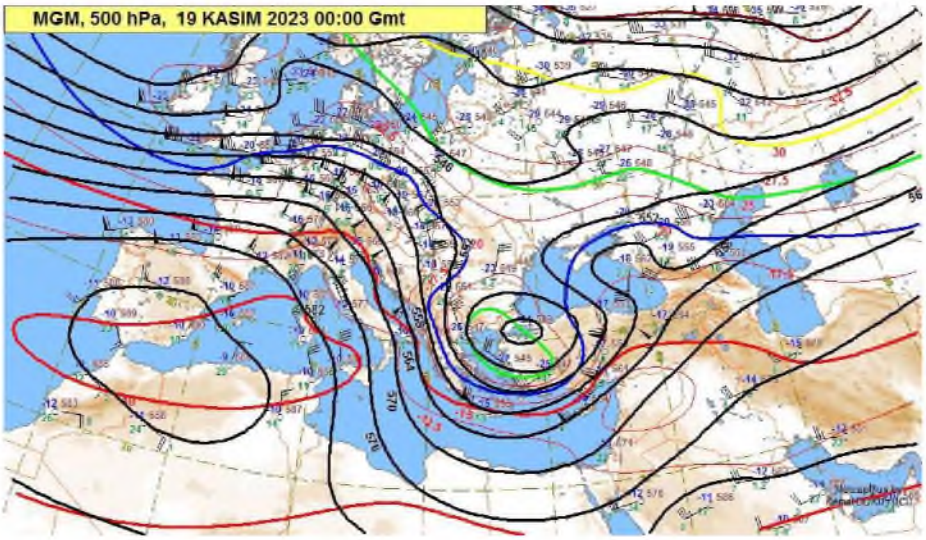

Image 18 Meteorological Observation Chart at 500 hPa Level (19.11.2023, 00.00 UTC)

[16] hPa: The air pressure at any height is the pressure exerted by the air column above that surface. This is equal to the air weight above that point. The air below that column has no effect on the pressure. At sea level, air pressure normally ranges from 1040 to 970 hPa.

Depending on the strengthening system, as indicated in the weekly weather forecast report produced the day before (18/11/2023) (Image 19) and in the marine forecast reports produced on 19/11/2023 at 00.00 UTC (Image 20), the winds intensified even more in the Western Black Sea, and the winds were predicted to be storm force.

T.C
ÇEVRE, ŞEHİRCİLİK VE İKLİM DEĞİŞİKLİĞİ BAKANLIĞI
METEOROLOJİ GENEL MÜDÜRLÜĞÜ

PERİYODU: Tarih - Saat	DENİZ TAHMİN RAPORU	YAYIN
Başlangıç:19.11.2023 00:00 TSİ		TARİHİ : 18.11.2023
Bitiş : 21.11.2023 23:59 TSİ		NOSU : 323

FIRTINA	Batı Karadeniz'de tam fırtına; Marmara ve Akdeniz'de kuvvetli fırtına; Doğu Karadeniz ve Güney Ege'de fırtına; Kuzey Ege'de fırtınamsı rüzgar bekleniyor.
KARADENİZ	Hava Durumu: Parçalı ve çok bulutlu, yer yer kuvvetli olmak üzere sağanak ve gök gürültülü sağanak yağışlı Rüzgar: Batı Karadeniz'de kuzey ve kuzeybatıdan, doğusu güneybatıdan 7 ila 9, yer yer 10; Doğu Karadeniz'de doğu ve kuzeydoğudan, sabah saatlerinden itibaren batı ve kuzeybatıdan 6 ila 8, öğle saatlerinden itibaren güneybatıdan 4 ila 6 kuvvetinde Dalga: 3,0 ila 4,0 m, bazı 4,0 ila 5,0 m Görüş: Orta, yağış anında zayıf.

Image 19 Sea Forecast Report

T.C.
ÇEVRE, ŞEHİRCİLİK VE İKLİM DEĞİŞİKLİĞİ BAKANLIĞI
METEOROLOJİ GENEL MÜDÜRLÜĞÜ

19.11.2023 - 25.11.2023 TARİHLERİ ARASI HAVA TAHMİNİ

GENEL HAVA DURUMU

Hava sıcaklıklarının ülkemiz genelinde yağışla birlikte azalacağı, iç ve batı bölgelerde mevsim normalleri altına düşeceği ancak Salı gününden itibaren tekrar artacağı tahmin edilmiyor.

19.11.2023 Pazar

Image 20 Weather Forecast Report

Meteorological information and data evaluated that the weather condition in Karadeniz Ereğli and offshore of the Western Black Sea Region on 19/11/2023 was overcast, with heavy and strong downpours and thunderstorms, winds from the north-northwest with a Beaufort force of 8-10 (storm), **a wave height of 4.0-6.0 m**, and poor visibility.

As found in the real-time meteorological radar images at the time of the accident, such a strong low-pressure system appeared to be more effective over the sea and near the coast until noon (conditions at 09.06 UTC and 12.30 UTC) (Image 21).

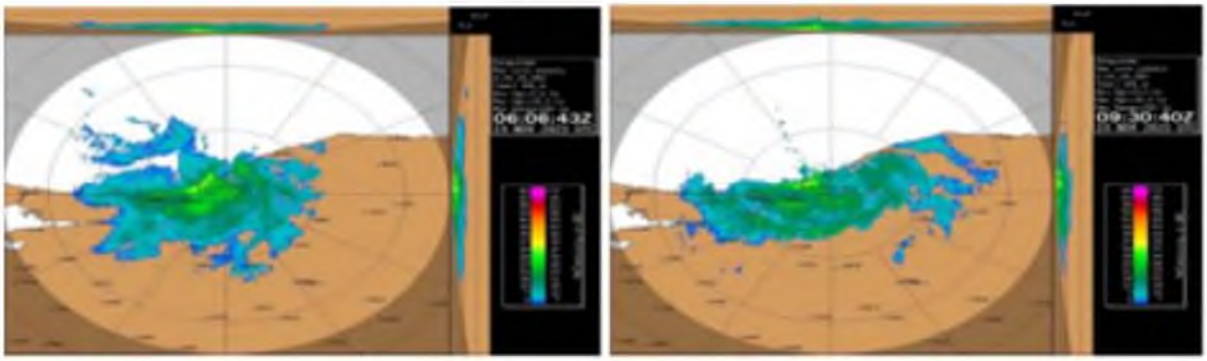

Image 21 Max Product of Radar image

The system was monitored since the moment it began to affect our country, and early meteorological warnings were issued two days in advance based on the meteorological analyses and forecasts (Image 22). The meteorological report published on 17 November 2023 at 14:40 forecasted that the wind in the Western Black Sea, where the accident took place in the Port of Ereğli, would blow from the north and northwest in the west starting from noon and from the south and southwest in the east after the evening hours as a gale with a force of 6 to 8 (50-75 km/h) on 18/11/2023 and as a storm with a force of 8 to 10 (75-105 km/h) on 19/11/2013.

T.C.
ÇEVRE, ŞEHİRCİLİK VE İKLİM DEĞİŞİKLİĞİ BAKANLIĞI
METEOROLOJİ GENEL MÜDÜRLÜĞÜ
ANALİZ VE TAHMİN MERKEZİ

Tarih : 17.11.2023	Saat : 14:40	Uyarı No : 0501

Uyarı Yapan Merkez	Meteoroloji Genel Müdürlüğü Analiz ve Tahmin Merkezi
Genel Başlık	Denizlerimizde(Batı Karadeniz, Marmara, Ege, Akdeniz) Fırtına Bekleniyor!
Beklenen Hadise	Fırtına
Hadisenin Şiddeti	Tam Fırtına
Beklendiği Yer	
	Batı Karadeniz'de rüzgarın, yarın (Cumartesi) öğle saatlerinden itibaren batısında kuzey ve kuzeybatıdan, akşam saatlerinden sonra doğusunda güney ve güneybatıdan 6 ila 8 kuvvetinde (50-75 km/saat) fırtına, Pazar günü (19.11.2023) 8 ila 10 kuvvetinde (75-105 km/saat) tam fırtına şeklinde esmesi tahmin edilmektedir. Pazartesi günü (20.11.2023) rüzgarın, bölgenin doğusunda batı ve kuzeybatı yönlerden 6 ila 8 kuvvetinde (50-75 km/saat) fırtına şeklinde esip akşam saatlerinden sonra etkisini kaybetmesi beklenmektedir.
Geçerlilik Periyodu	18.11.2023 08:00-20.11.2023 21:00

Image 22 Forecast Report Published by the General Directorate of Meteorology on 17 November 2023

The vessel PALLADA awaited at anchor with her engines running against the adverse impacts of weather and sea conditions. The vessel, which was affected by the heavy storm conditions, first dredged her anchor and then broke into two pieces.

When the accident was analysed holistically, it was clear that the north and south breakwaters that protected the berths inside the breakwaters of the Eregli Port against the effects of heavy weather and seas could not protect the offshores of Bozhane, where the vessel PALLADA was anchored, against the storm that blew from the west-southwest (Figure 5).

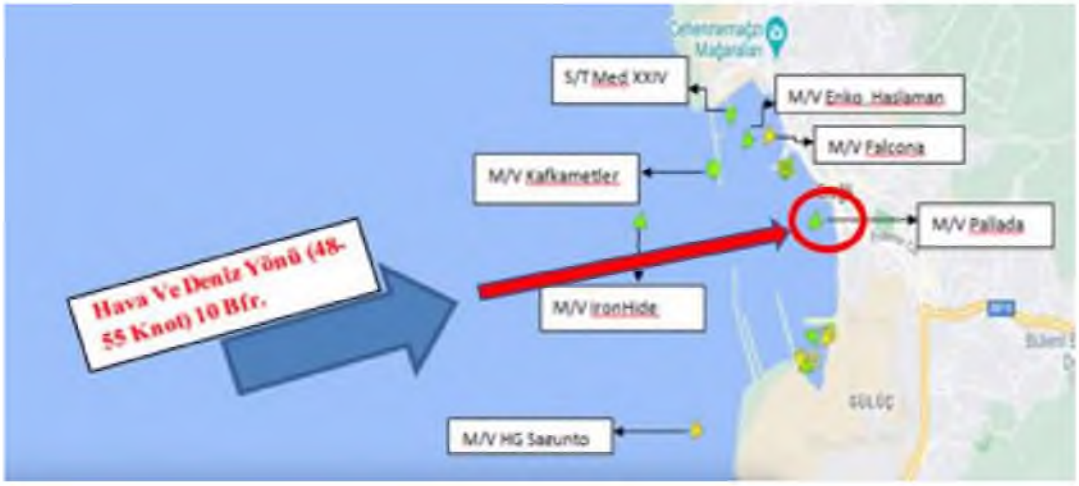

Figure 5 Location of the Vessel PALLADA Exposed to Adverse Weather Conditions Inside the Breakwater

Nevertheless, although the anchorage site inside the breakwater where the bridge crew of the vessel sheltered to protect the vessel from the approaching storm **saved the vessel from heavy weather conditions at first, the vessel began to be exposed to heavy weather and sea conditions as the storm shifted to the southwest. This** suggests that the bridge crew of PALLADA did not properly analyse the weather reports.

On the other hand, Table 2 displays the wind direction and speed recorded from the Karadeniz Ereğli station of the General Directorate of Meteorology over the years.

T.C.
ÇEVRE,ŞEHİRCİLİK VE İKLİM DEĞİŞİKLİĞİ BAKANLIĞI
Meteoroloji Genel Müdürlüğü

İstasyon Adı/No: KARADENİZ EREĞLİ/17611

Aylık Maksimum Rüzgar Yönü ve Hızı (m+sn)

Yıl/Ay	1	2	3	4	5	6	7	8	9	10	11	12
2014	SW 12.0	SSW 8.9	NNE 13.0	SW 11.6	NE 10.2	NNW 13.8	WSW 18.2	NNE 9.8	N 18.9	SW 11.4	SW 11.3	SSE 13.5
2015	SE 16.2	S 20.0	N 11.4	NNE 15.1	N 12.3	N 9.0	N 11.4	N 12.1	NNE 12.5	NNE 12.0	SW 11.8	SW 14.1
2016	SW 14.8	NNE 13.9	NNE 14.2	SSW 14.7	SSW 12.6	NNE 11.5	W 14.1	N 10.8	NNE 13.7	NE 10.5	WSW 12.5	SW 20.8
2017	SE 15.4	SSW 11.9	SSW 11.6	SSW 18.3	NE 13.1	W 9.5	SSW 16.1	NNE 12.4	WSW 11.9	S 10.4	WSW 14.5	WSW 11.9
2018	W 13.6	S 14.6	SE 11.8	WSW 8.9	N 10.4	S 12.8	SSE 11.3	NNE 13.7	NE 11.9	SSW 18.6	NNE 10.0	SSE 10.6
2019	SSW 14.8	SSE 11.0	N 14.6	W 8.9	SSE 12.5		N 6.8	NNE 11.0	NNE 44.3	ESE 19.9	SW 10.1	SSE 11.9
2020	NW 11.2	SSE 11.8	N 13.0	N 18.1	NNW 11.4	SSW 8.9	N 12.8	NNW 11.4	N 11.6	SSW 17.1	N 13.4	S 11.3
2021	NNE 39.4	SSE 45.0	SE 35.3	N 10.5	N 10.2	S 10.5	N 10.8	N 11.6	NNW 12.9	SSE 12.5	SE 15.3	SSE 13.7
2022	SSW 12.3	SSW 9.1	NNE 9.7	SSE 15.0	SSE 11.4	NNW 10.7	N 11.1	NNE 16.7	NNW 11.8	N 9.8	SSW 9.8	SE 11.4
2023	S 8.5	NNW 12.3	S 11.4	NW 8.5	N 9.8	N 9.4	SSW 16.3	N 8.5	N 16.2	N 10.2	SW 28.6	SW 13.5
2024	N 12.1	S 8.9	S 9.2	SSW 25.0	N 10.6	WNW 14.0	NNW 11.7	NW 28.8				

Table 2 Wind Direction and Force over the Years in Kdz. Ereğli

As the table clearly shows, the Karadeniz Ereğli Region is exposed to southwest winds at a force of 6 (10.8 m/s–13.8 m/s) and above 6 on the Beaufort Scale, especially in October, November, December, and January. On the date of the accident, the monthly average wind speed was recorded as 23.6 m/s, and this wind speed was classified as a storm (20.8-24.4) on the Beaufort Scale. This shows that the Port of Ereğli was exposed to a storm well above the seasonal norms in November when the accident took place.

3.3. Selection of Anchorage Site

When planning the berthing approach, the master should refer to charts and guidebooks on the suitability of the anchorage ground, traffic density and vessel movements, available oscillation area, holding ground, **protection from weather conditions,** wind, tide, and the length of time the vessel will remain at anchor.

If the "authorities" instruct the master to steer the vessel to a specific anchorage site, she/he should first assess special conditions, such as

- **the onset of severe weather conditions,**
- proximity to the coastline,
- traffic density,
- **heavy traffic,**
- exposure to air, water depth, and/or weak holding ground,

and determine whether it is safe to anchor in the prevailing conditions. When the prevailing sea and weather conditions adversely affect the safety of the vessel, the master must inform Vessel Traffic Services or the port authority that the anchorage site is unsuitable for anchoring, determine the most appropriate manoeuvre for the safety of the vessel, and act accordingly.

Every voyage plan must include a provision for anchoring. If this is not included at the beginning of the voyage, the voyage plan should be amended when anchoring becomes a prerequisite. **When a vessel begins to roll and/or surge heavily, it may be a decision that is long overdue.**

- The master should evaluate the anchoring plan in time.
- The master should decide on the time and place of anchoring, taking into account the safety of the vessel.
- The master should take into account abort parameters and contingency planning.
- All known chart and guidebook data on the ground, water depths, proximity to the shore, hazards, etc. should be utilised.

- He should use the information from the local agency, including specific anchorage sites/restrictions, numbers of vessels at anchor, traffic density and patterns, and other local navigational data.
- **He should review weather forecasts (including seasonal weather conditions, not just for the day).**
- He should take into account local currents and tidal currents.
- He should make sure that the bridge team is trained.

Given the direction of the approaching storm, the southern breakwater, and the northern breakwater in the port layout plan, it is very clear that heavy seas and weather conditions would adversely affect the vessel PALLADA. Indeed, parallel to the meteorological report, the vessel PALLADA, which easily maintained its position inside the breakwater preventing the heavy seas running from the north-northwest in the morning hours on 18/11/2023, began to be affected by the wind and seas in the evening hours when the wind began to shift[17]. As the weather conditions worsened after 08:00 on 19/11/2024, the vessel, which was exposed to gales and huge waves, first began to dredge the anchor and then broke into two pieces. The broken vessel pieces drifted ashore and grounded on the shore.

It is a critical decision to be made before the storm to navigate outside the breakwater with minimum impact of sea and weather conditions by keeping the engine working, also known as round turn (traverse) navigation, against the approaching storm, or to ensure the safety of the vessel by holding on to the anchor inside the breakwater. Considering **the clear restrictions on the navigation of the vessel that she can navigate at a maximum wave height of 3.5 meters**, it is clear that it was neither possible for her to navigate **outside the breakwater** nor was there much space for traversing inside the breakwater.

As such, it is considered that the vessel PALLADA has no other option but to come alongside at the berths under the protection of the northern breakwater and the southern breakwater in order to avoid any impact of the forecast storm, anchor on the southern breakwater side where the sea and weather conditions would have less impact on the vessel, or traverse with engine power on the southern breakwater side.

[17] To Shift: Change of Wind Direction

3.4. Anchoring Type

To maintain safe anchoring at the location of the vessel, it is of utmost importance that the anchor holds effectively. Therefore, it is necessary to calculate the correct length of the anchor chain to be slacked away[18] at the anchorage site. (Figure 6)

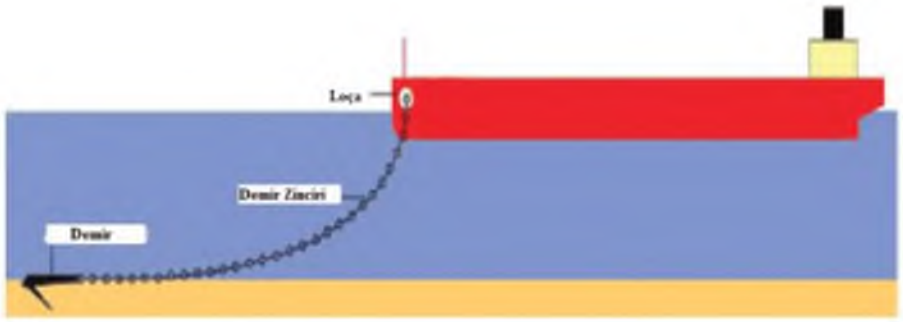

Figure 6 An Image of an Anchored Vessel

Upon realising that the weather conditions would aggravate, the vessel PALLADA, which was allowed to anchor inside the port breakwater, was anchored in front of Bozhane inside the breakwater on 13 November 2023, with the starboard anchor set in water at 1.5 shackles. However, since the morning hours of 19 November 2023, the vessel, which was exposed to strong winds and heavy seas, first dredged the anchor and dragged ashore, then broke, and immediately afterwards began to call for help.

According to the generally accepted formula for calculating the length of the anchor chain that is to be slacked away at the site where the vessels are anchored, the length of the anchor chain of the vessel PALLADA, which was anchored at a depth of 8 meters with its starboard anchor set in water at 1.5 shackles before the accident, to be slacked away was calculated as follows:

Number of Shackles: 25√D (D=Water depth in meters)
Number of Shackles: 25√D (D=8 meters/water depth)
Number of Shackles: 70,71÷27,5 Meters (Length of 1 shackle Anchor Chain)
Number of Shackles: Calculated as 2,57 Shackles.

Considering that the vessel PALLADA slacked away 1.5 shackles, it is understood that the vessel did not slack away the appropriate length of the anchor chain for safe anchoring under normal conditions. In fact, considering the fact that the vessel is ballasted and the impact of weather conditions on the anchorage site, she should have slacked away more for safe

[18] Slack: The length of the chain of a vessel anchored at sea.

anchoring. **However, it is considered that the anchor chain was slacked away less than it should have been since the vessel was anchored inside the breakwater.**

3.5. Vessel Condition and Restrictions

The Vessel Class is a regional class a local class society, though it is not a member of IACS[19]. The vessel with an invalid P&I insurance policy at the date of the accident was registered under the flag of Cameroon.

The certificates of the vessel **clearly restrict that she can navigate at a maximum distance of 20 nautical miles offshore in the Black Sea and in meteorological conditions with a maximum wave height of 3.5 meters. Besides, it is obvious that the vessel PALLADA, involved in the accident, could pose many dangers, especially metal fatigue in the vessel's hull and equipment, given her river-type design and her age of 55 years.**

Analysing the course of the vessel before the accident showed that the vessel was navigating at 31.51 nautical miles offshore on 7 November 2023 (Image 23). This suggests that the vessel PALLADA failed to comply with the navigational restrictions despite the prevailing harsh meteorological conditions.

Image 23 Nearest Distance of PALLADA to the Shore

3.6. Similar Accidents

The PALAU-flagged ARVIN[20]—one of the river-type vessels— was hit by a storm on 17 January 2021 while en route from the Port of Poti in Georgia to Bulgaria and broke and sank while trying to take shelter in the Port of Bartın. While a total of six crew members, including one Russian and five Ukrainian citizens, were rescued, the dead bodies of the master, chief engineer, and cook were found on the cliffs, and the missing three crew members could not be found.

[19] IACS: International Association of Class Societies.
[20] https://www.palaureg.com/wp-content/uploads/2021/03/ARVIN-MMC-Casualty-Investigation-Report.pdf

Image 24 Breakage Moment of the Vessel M/V ARVIN

4. SECTION- PRECAUTIONS AND CORRECTIVE ACTION TAKEN

Following the accident, the works carried out to prevent the recurrence of such an accident in the northern breakwater and to take corrective and remedial measures by identifying the existing damages are listed.

Image 25 Breakwater Repairs and Renovations

It was determined that the crown walls collapsed along a 255-meter-long roundhead of the North Breakwater at Karadeniz Ereğli North Breakwater, that the internal layout along the entire breakwater was scattered, that the energy facilities on the breakwater were damaged, and that the floors of the facilities were displaced. In accordance with the improvements and repairs to be made therein, the existing crown wall was removed, and a new crown was designed with a width of 15 meters, with an inner side at an elevation of +4 meters and the wall side at an elevation of +7.35 meters. The project is designed with a crest height of 7.35 meters, and a crest width of 11.30 meters and 43-ton antifer blocks will be used.

5. SECTION – CONCLUSIONS

5.1 Adverse weather-sea conditions played a causal role in the accident.

5.2 The vessel PALLADA failed to comply with the navigational and meteorological restrictions set forth in her Class Certificates during her voyage from the Port of Odesa, Ukraine, to the Port of Karadeniz Ereğli, Türkiye.

5.3 The vessel that anchored at Anchorage Site No. 1 of the Port of Karadeniz Ereğli on 08 November 2023, anchored at Anchorage Site No. 4 inside the breakwater on 13 November 2023 at 09:10 due to weather conditions with the permission of the Port Authority.

5.4 The bridge crew of PALLADA selected an inappropriate anchorage site considering the meteorological conditions.

5.5 The vessel broke into two pieces due to the worn-out river-type old hull structure (metal fatigue) under unfavourable weather-sea conditions and the presence of an unsuitable anchorage site.

5.6 The vessel PALLADA did not slack away the appropriate length of the anchor chain for safe anchoring in the anchorage site where she was anchored.

5.7 The weather forecast was published by the General Directorate of Meteorology on 17 November 2023 that there would be a storm with a force of 8 to 10 (75-105 km/h) on 19/11/2013, but PALLADA failed to take the necessary precautions against the approaching storm.

5.8 While the wind speed shifted to storm according to the Beaufort wind scale on 19 November 2023 between 09:45 and 09:50, the vessel, which was exposed to heavy sea and weather conditions, broke up at 09:51.

5.9 Following the accident, the vessel PALLADA called for help at 10:00, and the tugboats moored in the port were unable to respond due to heavy sea and weather conditions.

5.10 The broken vessel PALLADA was dragged by the impact of the sea and wind, drifted ashore in two separate pieces and grounded.

5.11 The north breakwater of the port of Ereğli was severely damaged in the storm, but the south breakwater was not significantly damaged.

5.12 The anchorage site No. 4 inside the breakwater of the port of Ereğli is vulnerable to the impacts of the winds blowing from the southwest and west and the seas.

6. SECTION – RECOMMENDATIONS

The following recommendations are made by considering the analysis and conclusions obtained from the safety investigation.

To the Ship Manager:

19/05-24 Developing and checking procedures for compliance by the vessel with the weather, sea, and navigational limitations laid down in the Class Certificate and the International Load Limit Certificate,

20/05-24 Establishing a procedure for deck officers and masters assigned in the fleet to follow up and evaluate meteorological reports and to take necessary precautions,

To İMEAK Chamber of Shipping:

21/05-24 Circulating the report to the members in order to minimise or avoid similar accidents,

To Mersin Chamber of Shipping:

22/05-24 Circulating the report to the members in order to minimise or avoid similar accidents.

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Annex 1 Beaufort Scale

BEAUFORT (BOFOR) RÜZGÂR ISKALASI

BOFOR	Rüzgârın Tanımı	Açık ve Düz Alanda 10 m. Yükseklikteki Tanımlanmış Rüzgâr Hız Sınırları				Rüzgârın Yaptığı Etki			Yaklaşık (takribi) Dalga Yüksekliği	
		Knot	m/sn	Km/h	mph	Karada	Denizde	Kıyıda	m	Ft
0	Sakin	1	0-0.2	1	1	Duman dikine yükselir.	Deniz çarşaf gibi düzdür.	Sakin.	-	-
1	Esinti	1-3	0.3-1.5	1-5	1-3	Rüzgârın yönü rüzgâr değil, dumanın sürüklenmesinden belli oluyor.	Çok küçük dalgacıklar, az belirgin ve köpüksüz (su üstünde balık pulu gibi buruşuk).	Balıkçı tekneleri hafif sallanır.	0.1	¼
2	Hafif Rüzgâr	4-6	1.6-3.3	6-11	4-7	Rüzgâr insan tenince hissedilir, yapraklar titreşir, rüzgâr gülü harekete geçer.	Küçük dalgacıklar kısa, fakat daha belirgindir. Dalga tepeleri düzgün görünüşlü, çatlamazlar.	Rüzgâr teknelerin yelkenlerini doldurur ve 1-2 knot hızla hareket ettirebilir.	0.2 (0.3)	½ (1)
3	Tatlı Rüzgâr	7-10	3.4-5.4	12-19	8-12	Rüzgâr yaprakları ve ince dalları devamlı hareket ettirir. Bayrakları hafif dalgalandırır.	Dalgacıklar birleşir, tepeleri camsı görünmeye başlar ve köpüklenir (köpükler dağılmış koyunlara benzer).	Yelkenliler yaklaşık 3-4 knots hızla ve yana yatarak hareket edebilirler.	0.6 (1)	2 (3)
4	Orta Rüzgâr	11-16	5.5-7.9	20-28	13-18	Rüzgâr toz ve kağıt parçacıklarını uçurur, küçük dalları hareket ettirir.	Küçük dalgalar genişlemeye başlar. Kırılan dalgaların köpükleri daha sık koyunlar gibidir.	Yelkenliler için en iyi rüzgâr; yelkenlerin tüm yelkenleri şişer ve iyice yana yatarlar.	1 (1.5)	3.5 (5)
5	Sert Rüzgâr	17-21	8.0-10.7	29-38	19-24	Yaprakları küçük ağaçlar sallanmaya başlar, iç sularda tepeli dalgacıklar oluşur.	Orta dalgalar daha belirgin bir şekilde gelişir (Koyun sürüsü yayılış). Hafif serpinti olasılığı vardır.	Yelkenliler yelkenlerini azaltırlar.	2 (2.5)	6 (8.5)
6	Kuvvetli Rüzgâr	22-27	10.8-13.8	39-49	25-31	Büyük dallar sallanır, telgraf tellerinde ıslık sesi işitilir, şemsiye taşımak güçleşir.	Büyük dalgalar oluşmaya başlar, dalga tepelerinin köpükleri etrafı daha fazla kaplar. Biraz serpinti olabilir.	Yelkenliler yelkenlerini kapatırlar. Avlanırken çok dikkat edilmelidir.	3 (4)	9.5 (13)
7	Fırtınamsı Rüzgâr	28-33	13.9-17.1	50-61	32-38	Bütün ağaçlar sallanır. Rüzgâra karşı yürümek güçleşir.	Deniz kabarmaya başlar. Kırılan dalgaların köpükleri rüzgâr yönü boyunca savrulur.	Yelkenliler limanda kalırlar. Denizde olanlar hareket edemezler, (fırça).	4 (5.5)	13.5 (19)
8	Fırtına	34-40	17.2-20.7	62-74	39-46	Rüzgâr filizleri kırar ve rüzgâra karşı yürümek genellikle çok zordur.	Uzun boylu, oldukça yüksek dalgalar, dalga tepelerinin kenarları rüzgâr tarafından kırılır, köpükler rüzgâr yönü boyunca savrulur.	Yakında olan tekneler limana çekilirler.	5.5 (7.5)	18 (25)
9	Kuvvetli Fırtına	41-47	20.8-24.4	75-88	47-54	Zayıf yapılı binalarda hasar meydana gelir. Bacalar yıkılır, kiremitler uçar.	Yüksek dalgalar; serpinti ve köpükler rüzgâr yönü boyunca de-ha yoğun bir hal oluşturur. Dalga tepeleri devrilmeye yıkılmaya ve yuvarlanmaya başlar. Serpinti görüş uzaklığını etkiler.	-	7 (10)	23 (32)
10	Tam Fırtına	48-55	24.5-28.4	89-102	55-63	Karada nadir olup, ağaçları kökünden söker, binalarda önemli zararlar yapabilir.	Uzun sarkıçlı çok yüksek dalgalar; büyük parçalar halindeki köpük ve serpintiler rüzgâr yönü boyunca çok yoğun bir şekilde savrulur. Deniz genellikle beyaz görünür, iyice yükselmeye ve kabar-maya başlar. Görüş uzaklığı azalır.	-	9 (12)	29 (41)
11	Çok Şiddetli Fırtına	56-63	28.5-32.6	103-117	64-72	Ender rastanır ve geniş çapta hasarlara neden olur.	Çok az görülen yüksek dalgalar; rüzgâr yönü boyunca oluşan köpük ve serpintiden denizin üstü beyaz görünür. Dalga tepelerinden her tarafa köpük puskurmektedir. Görüş uzaklığı azalmıştır (küçük ve orta büyüklükteki gemiler dalga arası arasından görülmeyebilir).	-	11.5 (16)	37 (52)
12	Harikeyn (Orkan)	64 ve daha fazla	32.7 ve daha fazla	118 ve daha fazla	73 ve daha fazla	-	Gökyüzü köpük ve serpinti ile kaplanmıştır. Deniz tamamen bembeyazdır. Görüş uzaklığı çok azalmıştır.	-	14 <	45<

1 Knot = 1.852 km/saat = 1 denizmili/saat(nm/h)
1 Knot = 0,514 metre/saniye(m/sec)
1 km/saat = 0277 metre/saniye =0,54 knot
1 metre/saniye = 3,6 km/saat = 1,945 knot

Annex 2 Modified Breakwater Types