DMAIB
DANISH MARITIME ACCIDENT INVESTIGATION BOARD

HENDRIKA JACOBA

Marine accident report on fall between quay and ship

29 MAY 2022

MARINE ACCIDENT REPORT ON FALL BETWEEN QUAY AND SHIP ON HENDRIKA JACOBA ON 29 MAY 2022

published by

DMAIB
Danish Maritime Accident Investigation Board
Batterivej 9
DK-4220 Korsoer
Denmark

The report is issued on 14 September 2022.

Photo: HENDRIKA JACOBA berthed in Thyboron.
Source: DMAIB

The investigations are carried out separately from the criminal investigation, without having used legal evidence procedures and with no other basic aim than learning about accidents with the purpose of gaining and promoting an understanding of safety. Consequently, any use of this report for other purposes may lead to erroneous or misleading interpretations.

Content

Introduction

Start of the investigation

On 29 May 2022 at 1737, the Danish Maritime Accident Investigation Board (DMAIB) was informed by the Danish Maritime Authority about an occupational accident in Thyboron Port, Denmark. A crewmember from the United Kingdom registered fishing vessel HENDRIKA JACOBA was found missing during the ship's port stay. Recordings from the port's CCTV showed that a person had fallen into the water while attempting to board HENDRIKA JACOBA early in the morning at 0315. Later the same day at 2110, DMAIB received information that the missing crewmember had been recovered from the water near the ship and was pronounced dead.

Due to the accident's serious consequences, DMAIB immediately launched an investigation to clarify the circumstances of the crewmember's fall between quay and ship. Two investigators were deployed to the scene of the accident on 30 May 2022 to carry out an onboard investigation.

Narrative

RECONSTRUCTION OF COURSE OF EVENTS

This section presents the course of events as it was experienced by the involved persons. The course of events is based on witness statements from crewmembers on HENDRIKA JACOBA, information from port personnel, search and rescue reports, police reports and AIS information.

The course of events covers the period from HENDRIKA JACOBA arrived in Thyboron Port in the evening of 27 May 2022 until the deckhand was pronounced dead in the evening of 30 May 2022.

Times are stated in local time (UTC+2).

Background

HENDRIKA JACOBA (Figure 1 and Appendix) was a United Kingdom registered fishing ship built in 2020. The ship operated from various ports in Northern Europe depending on the fishing season. In May 2022, the ship operated from Thyboron Port and carried out fishing in the North Atlantic Ocean within the Norwegian EEZ. The ship was rigged with twin rig trawl and had monkfish, plaice and cod as target species.

The crew consisted of three Dutch fishermen, one of whom was the owner of the ship, and two Filipino deckhands.

Figure 1: HENDRIKA JACOBA.
Source: DMAIB

Course of events

In the early morning of 23 May 2022, HENDRIKA JACOBA departed Thyboron Port heading for a fishing ground 160 nm northwest of Thyboron. After 3.5 days of fishing, the fishing operation was stopped and the ship headed for port at 0200 on 27 May 2022.

At 2055 the same day, HENDRIKA JACOBA arrived in Thyboron and unloaded the catch at the fish landing. Two hours later, when the unloading was completed, the ship approached the berth they had been assigned. At this point, the owner had left the ship and was ready to take the mooring ropes on the berth, when HENDRIKA JACOBA arrived at 2309. As soon as the ship was made fast, the Dutch crew packed their belongings into the owner's car. At 2335, they drove to the Netherlands for the weekend and intended to return early Monday morning.

The Filipino deckhands remained on board during the weekend. On Saturday morning, they started cleaning the entire ship, finishing late in the afternoon. In the evening, they had planned to socialise with a group of friends on one of the other fishing ships in the port, MIKKEL-LOUISE. Around 1830, four of their friends from other fishing ships came on board HENDRIKA JACOBA. Three of the visiting persons left the ship shortly after along with one of HENDRIKA JACOBA's deckhands (Deckhand A). They went to the supermarket to buy some alcoholic beverages and headed for the fishing vessel MIKKEL-LOUISE. The other deckhand (Deckhand B) remained onboard to have dinner with one of the visitors. Deckhand B and the visitor left HENDRIKA JACOBA at 2110, and joined the group on MIKKEL-LOUISE. When Deckhand B arrived on MIKKEL-LOUISE, he could see that Deckhand A was in high spirits and noticeably affected by alcohol.

On MIKKEL-LOUISE, they socialised the entire night and some of them consumed large quantities of alcohol. Around 0100 or 0200, Deckhand A and two others decided to leave MIKKEL-LOUISE to find a bar ashore. Deckhand B decided to stay overnight on MIKKEL-LOUISE.

The next morning on 29 May 2022, the Deckhand B was awoken by one of the persons who had gone to the bar the previous night. He said that Deckhand A had left the bar alone and wanted to make sure that he had returned to the ship safely. He could not find him and reckoned that Deckhand A might be sleeping on MIKKEL-LOUISE, as the door was locked on HENDRIKA JACOBA, and nobody answered. Deckhand B accompanied him back to HENDRIKA JACOBA, and they searched the ship, but Deckhand A was nowhere to be found. By the door opening in the ship's side they found a blood stain on the deck. Deckhand B was puzzled by the blood, because it was not there the night before.

They went back to MIKKEL-LOUISE and talked about the missing deckhand to some of the others, who had participated in the social event the night before. None of them knew his whereabouts, and they started to look for him in the port area, on the other ships and in the nearby town.

As the hours went by, the concern grew among the searching persons, and they asked the skipper on the fishing vessel berthed next to HENDRIKA JACOBA to contact the harbour personnel and ask, if they were able to trace Deckhand A's whereabouts on CCTV. The time was now 1315.

The harbour personnel looked through the recordings. 30 minutes later, the harbour personnel called the emergency services, as they observed a person falling into the water while attempting to board HENDRIKA JACOBA at 0315. Shortly after, the fire department and the police arrived at the scene of the accident.

A search was initiated in the outer harbour basin by boat and a rescue swimmer, who searched in the sea surface. The rescue personnel assessed that the likelihood of finding the deckhand alive was low, because more than 10 hours had passed since he fell into the sea. They searched for two hours with no result. Due to a strong current in the harbour basin, the rescue personnel thought that the deckhand had been carried out into the ocean, and the search and rescue operation was aborted at 1600.

The skipper on the ship berthed next to HENDRIKA JACOBA phoned HENDRIKA JACOBA's owner and informed him of the situation. The owner immediately drove for Thyboron, where he expected to arrive late in the evening.

The missing deckhand's friends found it difficult to accept that the he had not been found. In the course of the evening, they got the idea of dragging a grapnel over the sea bottom between the quay and the berthed ships. In the fourth attempt, which was carried out by Deckhand B, the grapnel caught on to something heavy in the water. Deckhand B started to heave up the grapnel, and the body of Deckhand A surfaced.

Rescue services were immediately called, and they came to the site to recover the body. The owner of HENDRIKA JACOBA arrived at the ship before the body was transported to the hospital and confirmed the identity of Deckhand A. He was officially pronounced dead at 0000 on 30 May 2022 at Regional Hospital West Jutland.

Investigation

SCOPE AND METHOD DESCRIPTION

From the sequence of events, it could be determined that the deckhand fell into the water during an attempt to board the ship. The accident occurred while the deckhand was off duty and on his way back to the ship after a night ashore.

The investigation focussed on establishing the following:

- How did the deckhand fall between the quay and ship?
- Which factors influenced the deckhand's fall between quay and ship?

To answer these questions DMAIB examined CCTV recordings, the means of access to the ship, the environmental factors influencing the ship's position at quay, risk assessments, alcohol policy, and the deckhand's physiology, training and clothing.

Observations of fall overboard on CCTV recordings

The port's CCTV cameras covered the quay where HENDRIKA JACOBA was berthed and recorded the deckhand's movements on the quay prior to and during his fall into the water.

In the following, DMAIB's observations from the CCTV recordings are described. The figures below do not contain images of the CCTV recordings of the accident. Instead, the events are visualised by a CCTV screenshot of HENDRIKA JACOBA immediately before the deckhand arrived on the quay. Thus, the deckhand does not figure in the images below.

03:10:06
The deckhand comes around the corner to the street leading to the quay where HENDRIKA JACOBA is berthed. No other persons can be seen on the quay. As the deckhand passes a workshop on the corner of the street, he stumbles and falls to the ground. One minute later, he gets up and continues to move unsteadily in the direction of HENDRIKA JACOBA (Figure 2).

Figure 2: Deckhand falls outside workshop on his way to HENDRIKA JACOBA.
Source: Thyboron Port / DMAIB

03:13.32

The deckhand arrives at HENDRIKA JACOBA and pauses for a moment. He then walks to a bollard located near a door opening in HENDRIKA JACOBA's port side and stands on the right side of the bollard. He then seems to change his mind and goes left of the bollard (Figure 3).

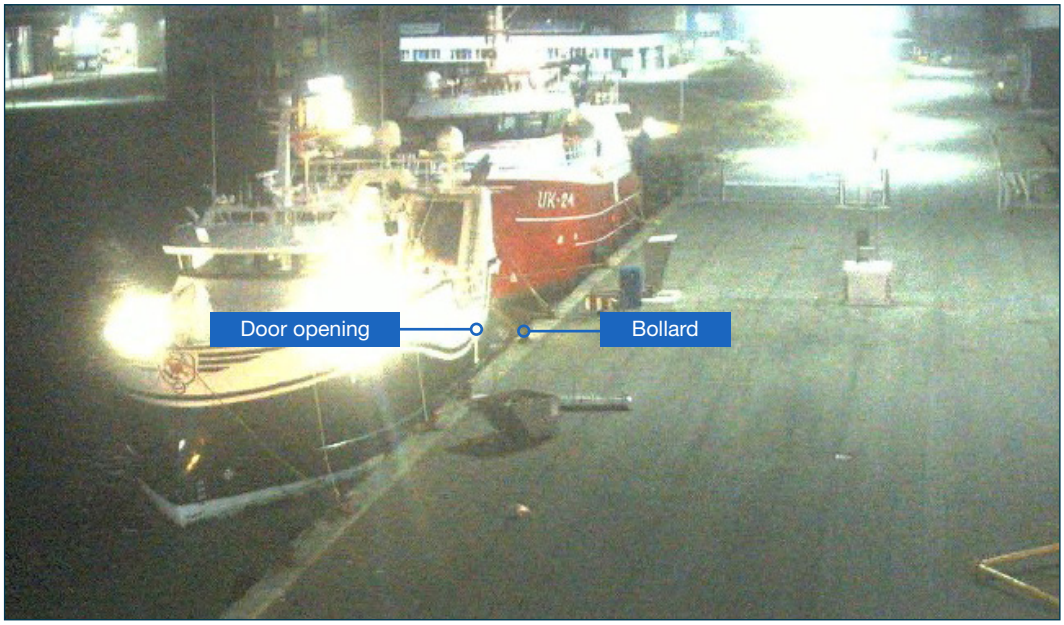

Figure 3: Deckhand pauses at the bollard on the quay at the opening to HENDRIKA JACOBA.
Source: Thyboron Port / DMAIB

03:03:14:51

The deckhand steps on a tyre fender fastened to the bollard and grabs onto a mooring line going from the bollard to the weather deck on HENDRIKA JACOBA (Figure 4).

Figure 4: Deckhand grabs on to mooring line, step on the tyre fender and leans upper-body into door opening. Source: DMAIB

03:15:01
The deckhand leans the upper part of his body forward into the door opening with his head first. He then starts to take a step, extending one foot towards the door opening. While taking a step onto the ship, the deckhand loses his balance, falls between the tyre fender and the ship and disappears.

Access ways

When berthed port side alongside, the crew commonly used three access ways (Figure 5):

- A door opening in the ship side accessing the main deck.
- Steps built into the ship side with a door to the weather deck.
- Guard rails at the weather deck.

On the starboard side, there were no door in the ship side.

The access ways were used depending on the level of the quay in relation to the ship. If the quay was high compared to the ship, the crew preferred to climb and step over the guardrails. If the quay was low, the door in the ship side was normally used. The steps integrated in the ship side were used in both situations. The choice of access way also depended on the distance between the quay and ship, which was determined by the fenders' size and location in relation to the ship.

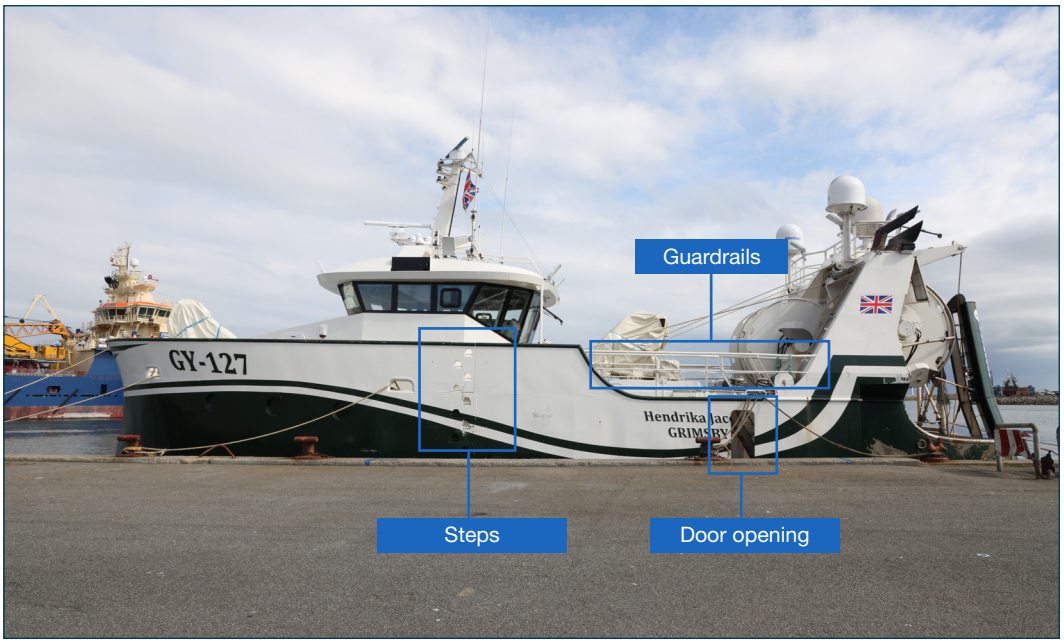

Figure 5: Access ways on HENDRIKA JACOBA's port side.
Source: DMAIB

Observations from CCTV recordings from 27-28 May 2022 showed that the crewmembers used the door opening when boarding or leaving the ship. When other persons visited the ship on 28 May 2022, they also chose to access the ship via the door opening. This indicated that the opening was found most convenient to use, although some visitors visibly had more difficulty than others accessing the ship.

During the investigation on the ship, crewmembers demonstrated how to access the ship by the door opening to the main deck, which was located beneath quay level. The crew stepped on a tyre fender located close by the door opening and held on to a mooring rope fastened on the weather deck while stepping down onto the ship. During DMAIB's examination on the ship, the tyre fender was located slightly fore of the door opening. This made it necessary for the crewmembers to stand on a sloping part of the fender, when stepping down on the ship (Figure 6).

Figure 6: Crew member demonstrates how to access HENDRIKA JACOBA via door opening.
Source: DMAIB

The crew also demonstrated how to pass from ship to quay via the steps integrated in the ship' side. The steps were not aligned with a tyre fender, and it was necessary to straddle the gap between the ship and the quay. Due to the crewmembers' difference in height, this was not a feasible accessway for all crewmembers (Figure 7).

Figure 7: Crew member demonstrates how to leave HENDRIKA JACOBA via the steps.
Source: DMAIB

On CCTV recordings, a gangway can be seen lying on the quay in front of the ship. The gangway belonged to one of the workshops located in the port and had no relation to HENDRIKA JACOBA. The ship did not have a gangway on board, and the ship did not use other gangways during port stays, because the three access ways on the ship were considered acceptable.

According to "Code of Safe Working Practice for the Construction and Use of Fishing Vessels of 15 m Length Overall to less than 24 m Registered Length"[1] issued by the United Kingdom's Maritime and Coastguard Agency, *"A gangway with a net underneath, accommodation ladder or other suitable means, providing an appropriate and safe means of boarding and leaving the vessel shall be available"*. This means that a gangway was an option and not a requirement, as long as other measures were in place.

In "Provisions of Safe Means of Access to Fishing and Other Small Vessels in Ports"[2] issued by the United Kingdom's Maritime and Coastguard Agency, stepping directly from quay to ship was considered a safe means of access, if appropriate safety measures are taken, i.e. that the ship was securely moored so that the gap between quay and ship was minimal. The Provisions also stated that the seafarers played a part in minimising the risk to themselves, e.g. by avoiding alcohol.

1 Merchant Shipping Notice MSN 1872 Amndt 1 (F). The Code of Safe Working Practice for the Construction and Use of Fishing Vessels of 15m Length Overall to less than 24m Registered Length. Issued November 2018 by Vessel Stand-ards Branch, Maritime and Coastguard Agency.

2 Marine Guidance Note MGN 591 (M+F). Provision of Safe Means of Access to Fishing and Other Small Vessels in Ports. Issued August 2018 by Fishing and Code Vessels Safety Branch, Maritime and Coastguard Agency.

Ship's position at quay

Quay layout

On 27 May 2022, HENDRIKA JACOBA was assigned to Tanker Quay (in Danish: Tankskibskaj). Tanker Quay was a multi-purpose quay designed to accommodate various types of ships, such as offshore vessels, fishing ships and small cruise ships.

The bollards on the quay were fitted with tyre fenders of varying sizes fitted on the quay wall (Figure 8). The crew perceived the quay to be suitable, due to the number and width of fenders hanging on the quay wall. The fenders protecting HENDRIKA JACOBA from the quay wall had a width of 70 cm. Also, a fender could be used to close the gap between the door opening in the port ship side and the quay.

The quay wall had integrated ladders (Figure 8). At HENDRIKA JACOBA's berth, two ladders were fitted: one by the aft and one forward. Tyre fenders blocked the view and access from where the deckhand fell in the water to the integrated ladders (Figure 9).

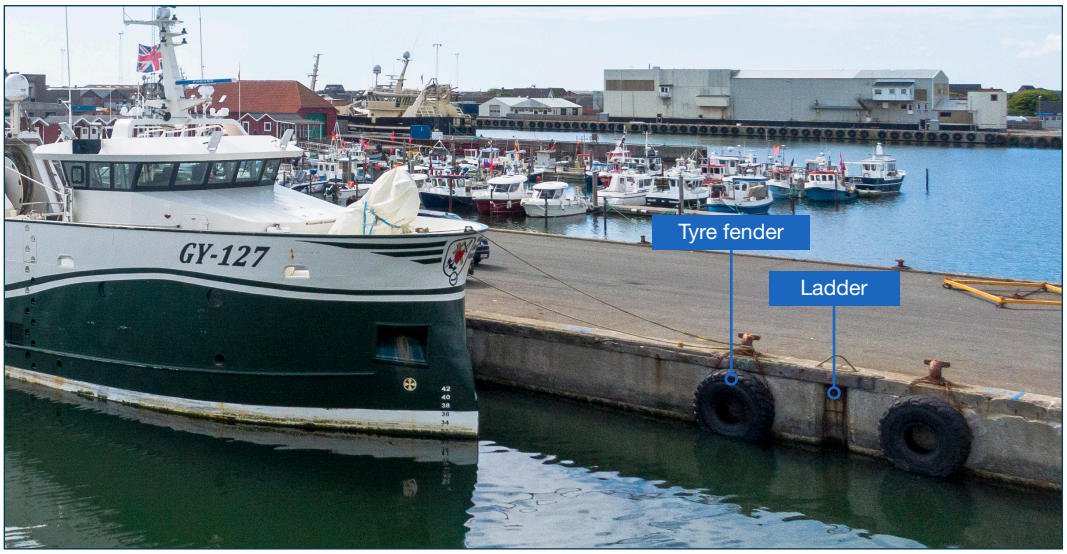

Figure 8: Tyre fenders and integrated ladders on Tanker Quay.
Source: DMAIB

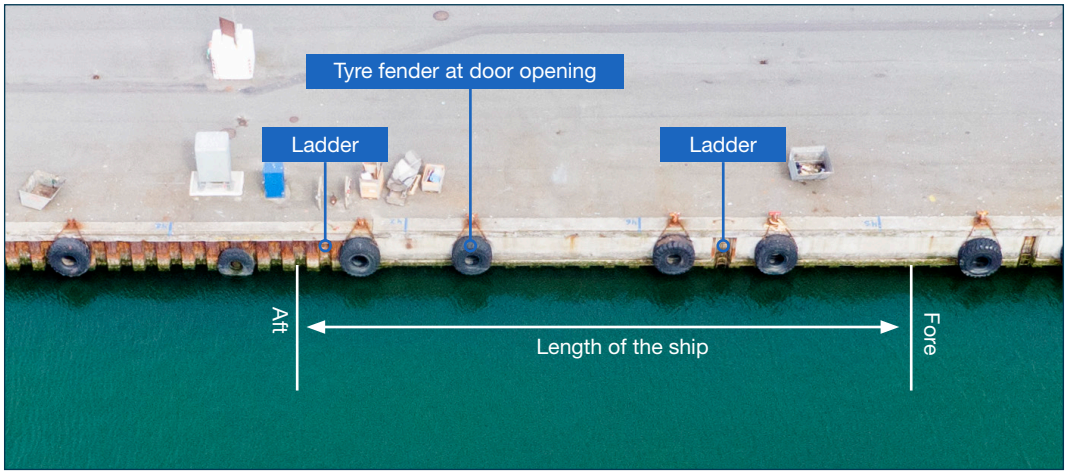

Figure 9: Location of ladders in relation to tyre fender by the door opening on HENDRIKA JACOBA.
Source: DMAIB

Environmental factors in Thyboron Port

Thyboron Port is located on the West Coast of Jutland, Denmark. The port entrance faces east in Thyboron Channel, sheltered from the North Sea (Figure 10). During northwesterly winds, waves and swell from the North Sea create residual wave patterns in the port area, especially in the outer basin which lay directly at the port entrance. Furthermore, northwesterly winds make the sea level in the port rise.

Figure 10: Thyboron Port.
Source: SafeSeaNet Ecosystem GUI / DMAIB

According to the Danish Harbour Pilot (in Danish: Den Danske Havnelods), the difference between mean high tide and mean low tide is approximately 0.5 m. Northwesterly winds often resulted in high water up to 1.5 m. In the time span from HENDRIKA JACOBA came alongside to the deckhand fell between quay and ship, the sea level varied between -12 cm and +49 cm.

On 27 May 2022, HENDRIKA JACOBA arrived at Tanker Quay and was all fast at 2315, two hours after low tide. The wind was northwesterly (314°) and had gale force with a speed of 18 m/s. On CCTV recordings, an instream of water to the port was visible and waves and swells caused movements of the moored ships in the outer basin. The sea level at the time of berthing was +36 cm.

On 29 May 2022 at 0315, when the deckhand attempted to board HENDRIKA JACOBA, it was high tide, and the sea level was measured to +18 cm. The wind was still northwesterly (328°), but had decreased to a fresh breeze of 8.9 m/s. On CCTV recordings, the sea surface was observed to be calm with a slight swell, resulting in vessel motions.

During DMAIB's investigation on the ship, measurements were taken to determine the distance between ship and quay on 30 May 2022 at 1730, one hour after high tide. At this time the sea level were measured to +10 cm, and the wind had decreased to a gentle breeze from a northerly direction, and the sea in the outer basin was calm.

Distance between quay and ship

HENDRIKA JACOBA was moored with six mooring lines, three fore and three aft. It was not deemed necessary by the crew to adjust the mooring lines during the port stay. The crew considered the variation in sea level of approximately 0.5 m during tide to have little influence on the ship's position alongside.

When the sea level decreased during the weekend, the mooring lines slackened, allowing the ship to shift in off-quay, fore and aft direction. On CCTV recordings it can be observed that the ship was moved by waves and swell, especially with the aft-part moving off-quay resulting in a gap between quay and ship. DMAIB measured the horizontal distance between the quay wall and the door opening in HENDRIKA JACOBA's ship side to vary between 90-130 cm (Figure 11).

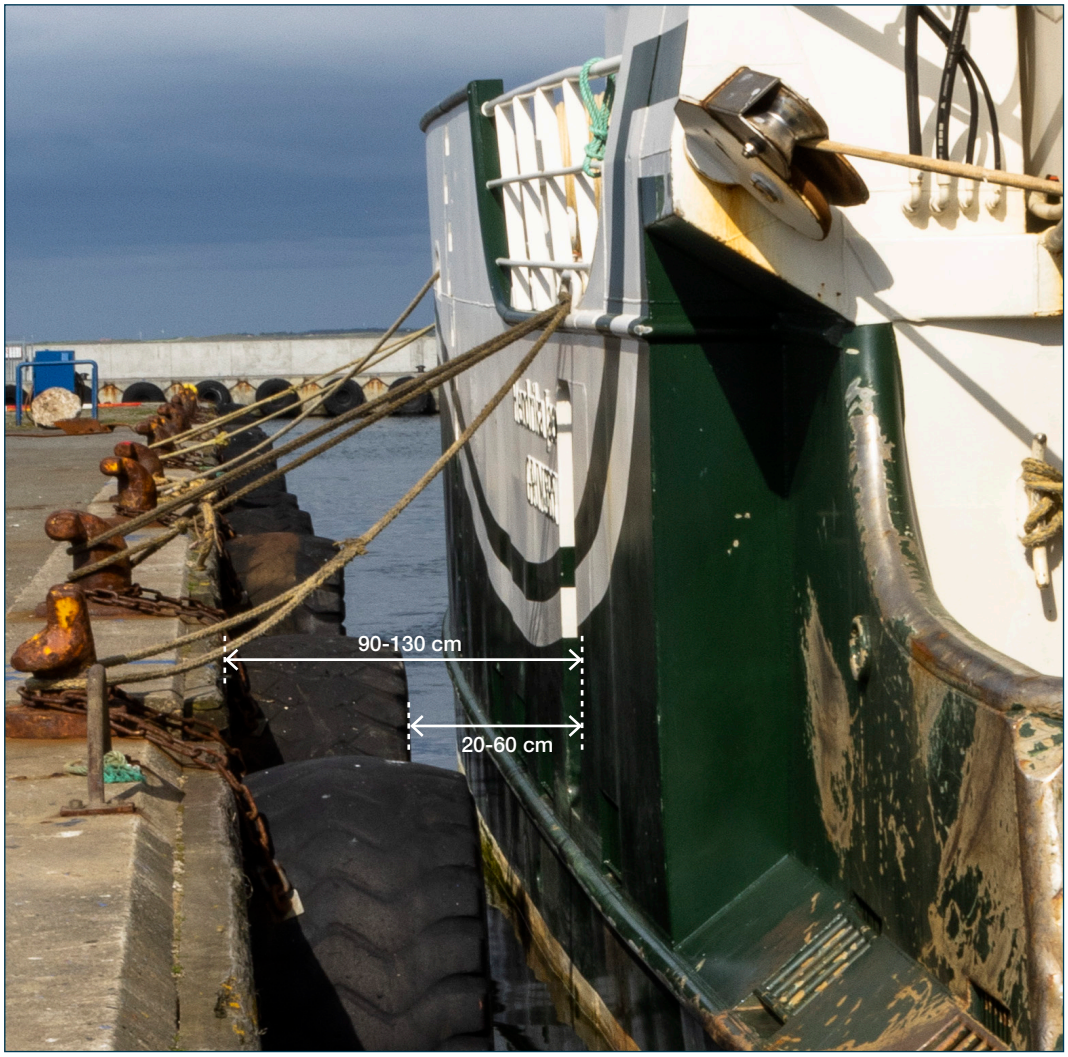

Figure 11: Distance between quay and ship.
Source: DMAIB

From the stepping point on the tyre fender to the middle of the door opening the distance was 55 cm (Figure 12), and the stepping point was 82 cm higher than the door opening (Figure 13). The distance from the sloping part of the tyre, where the crewmembers set off when stepping from fender to ship, varied between 100-115 cm on the day of investigation (Figure 14).

At the time of the accident, the sea level was 8 cm higher than at the time the measurements were made. This meant that the gap was a few centimetres shorter at the time of the accident.

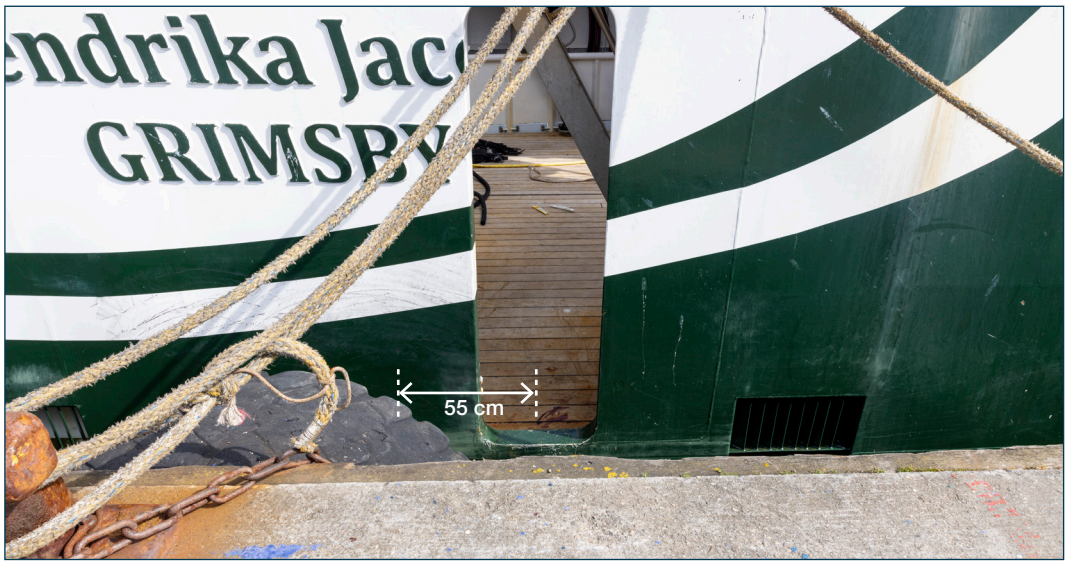

Figure 12: Horizontal offset between stepping point on tyre fender and door opening. 30 May 2022 at 1730. Source: DMAIB

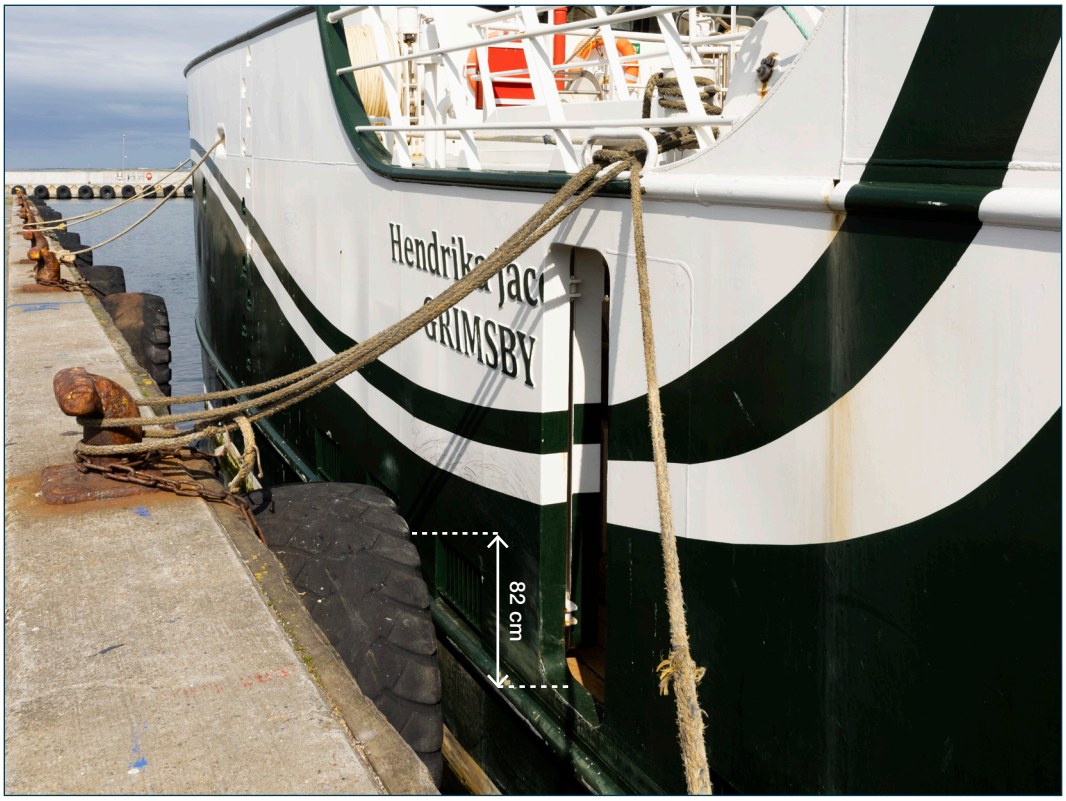

Figure 13: Difference in height between stepping point on tyre fender and door opening. 30 May 2022 at 1730. Source: DMAIB

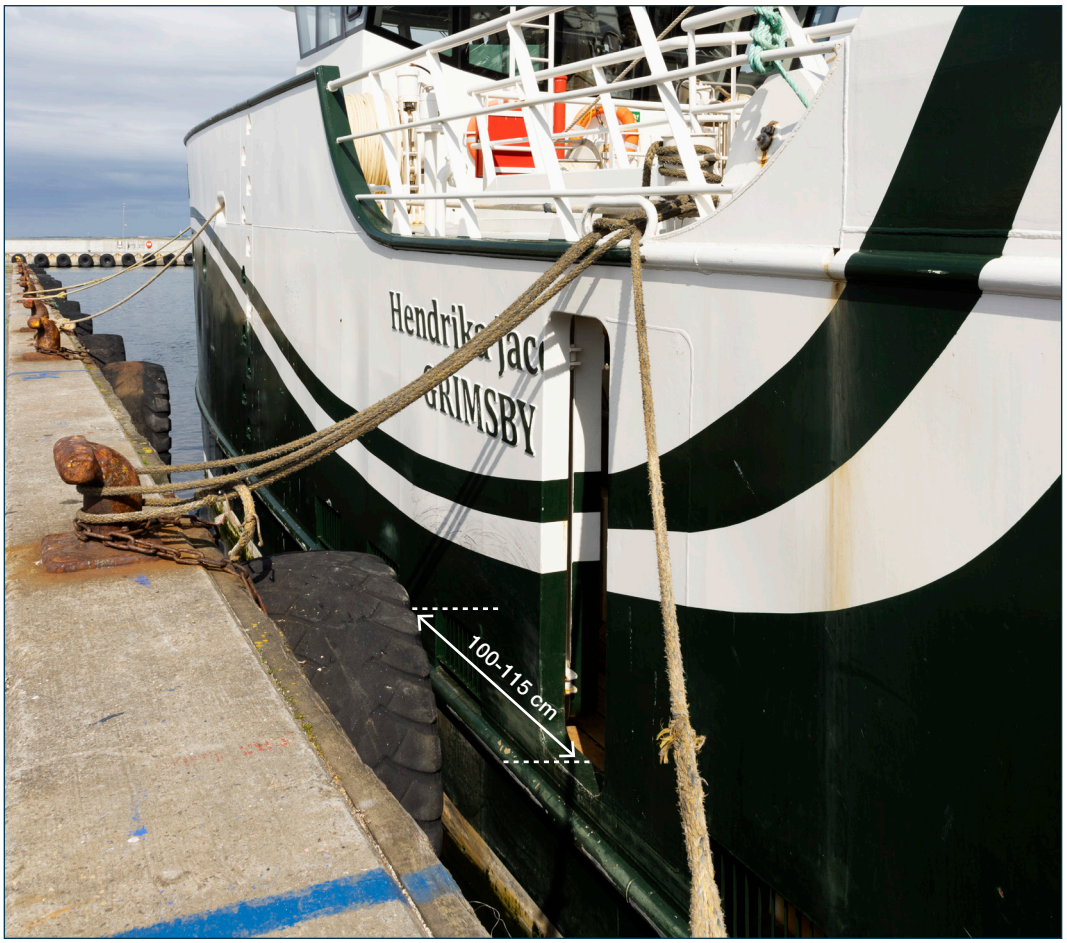

Figure 14: Actual distance to straddle when stepping from tyre fender to door opening. 30 May 2022 at 1730. Source: DMAIB.

Risk assessment

"Provisions of Safe Means of Access to Fishing and Other Small Vessels in Ports" stated that the person responsible for providing a safe means of access should carry out a risk assessment to identify potential hazards and implement appropriate safety precautions to mitigate the risk to an acceptable level.

On HENDRIKA JACOBA, a risk assessment for boarding and leaving had been prepared by the owner in September 2020 and was valid at the time of the accident.

The risk assessment was made from of template downloaded at www.safetyfolder.co.uk which was a free online service offered to the UK fishing industry to improve safety management. On this website the ship could register and access risk assessment templates for different types of activities, e.g. boarding and leaving. The templates were blank, and the ship crew were meant to fill in hazards, control measures, identified risks and risk levels for work processes found relevant by the crew. A button in the form stating *"Add example data for Boarding and Leaving"* was available in the online template. When pressing the button, text examples in the work process and hazard columns could be added.

HENDRIKA JACOBA's risk assessment contained these sample texts and the rest of the columns were filled out by hand. The predefined text comprised items such as work with dinghy and using a gangway, neither of which were on board or used on HENDRIKA JACOBA and therefore not relevant to the investigation. Other items in the sample text such as "*Crossing other vessels"* and *"Quayside"* were found relevant.

For actions undertaken on quayside the sample text stated the following hazards:

- Falling into the water leading to hypothermia or drowning.
- Slippery deck/surfaces leading to falls.
- Obstructions leading to falls.
- Unprotected openings leading to falls.

No additional hazards were added by the crew.

The controls already in place to mitigate these hazards were filled in by the crew by hand: *"We always try to moor as close as possible to the quay. When possible, have entrance alongside quay ladder or other easy step-up point."*

Furthermore, the following significant risk was identified:
"Due to changing tide level or wind direction, the place of the ship may change."

As the controls and identified risk related to the hazard of falling into the water, they indicated that the crew's main concern with quayside operation was falling between ship and quay during boarding or leaving the ship. The risk level column was not filled in and therefore the perception of severity and likelihood was not documented.

The deckhand's training, physiology and clothing

Training and experience

The deceased deckhand had served on fishing vessels for more than 10 years and held a certificate as Rating Forming Part of a Navigational Watch (STCW/IV). In 2020, he had completed a one-day training course in Safety Awareness for experienced fishermen, which included Accident Prevention and Risk Assessment.

The deckhand was assigned on HENDRIKA JACOBA on a six-month contract, and it was his second contract on this ship. Based on the deckhand's seagoing experience and having served on HENDRIKA JACOBA for more than six months, the deckhand was familiar with conduct on fishing vessels in general and was familiar with the means of access on HENDRIKA JACOBA.

Physiology

The deckhand was 51 years old and held a Medical Certificate stating that he was fit to work and that his hearing, sight and psychological test were all satisfactory with no restriction to fitness. The Medical Certificate was issued in June 2021. Witness statements confirm that the deckhand seemed to be in good physical shape with no physical limitations in the daily work. The deckhand had a height of 162 cm.

At the post-mortem it was observed that deckhand had two deep lacerations on his forehead: one above the left eyebrow and one by the hair line on the left part of the scalp. There was no visual indication of bone fracture in relation to the cuts and no other visual signs of injuries on his body. The death certificate stated that the presumed cause of death was asphyxia caused by drowning.

It has not been possible to determine how the deckhand had suffered the lacerations in the forehead. During the investigation, blood marks were found by the workshop ashore where the deckhand fell prior to the boarding attempt. In this area, the blood marks were characterised by a spray of small stains. On HENDRIKA JACOBA, one large blood mark was found on the deck in the door opening. Due to the stain characteristics, DMAIB finds it plausible that the large blood mark on the ship indicated that the deckhand's face was already blood-covered, when he hit his head against the deck during the fall between ship and quay. Consequently, DMAIB finds it plausible that the deckhand had suffered one or more blows to his head before his attempt to board the HENDRIKA JACOBA.

On the CCTV recording, it was observed that the deckhand moved unsteadily prior to and during the attempt to board HENDRIKA JACOBA. It has not been possible to determine the exact cause of the deckhand's unsteady movements. Witness statements indicate that the deckhand had been taking alcohol throughout the evening and night, and he seemed affected by the intake. No blood alcohol analysis was carried out post-mortem by the authorities and the blood alcohol content at the time of the accident remains unknown. The unsteady movements could be caused by both alcohol or a blow to the head from the fall at the workshop. Both alcohol intoxication and concussion to the brain can lead to impaired vision, dizziness and balance problems.

Clothing

When the deckhand's body was recovered, he was found wearing dark jogging pants, a dark T-shirt, socks and no footwear. Witness statements said that the deckhand had been wearing slide sandals during the evening. Slide sandals sit loose on the foot and do not provide much support or foot grip. The deckhand's clothing did not protect him from cold exposure from the sea or provide buoyancy.

Alcohol policy

There was no formalised alcohol policy in written statements, posters or signs on HENDRIKA JACOBA. The owner had expressed to the crew verbally that he did not approve of the use of alcohol or drugs on HENDRIKA JACOBA.

In practise, it was accepted that the crew took one or two units of alcohol, when the fishing was concluded, and the ship was returning to port, except for the person on watch. There were diverging opinions whether or not the crew was allowed to drink alcohol in their spare time during port stays. These opinions varied from no alcohol intake being allowed to an understanding that it was accepted to go ashore and have a drink.

The Filipino deckhands were employed by a crewing agency, who facilitated a six-month contract with HENDRIKA JACOBA. In the contract with the crewing agency, the deckhands had signed the following obligation:

"During seafarer's contract on board, he at all times will not use alcohol or drugs (…) The use of alcohol and drugs will be considered as a violation of the employment agreement and all the related expenses will be covered by the seafarer".

In practise, crewmembers on other ships employed by the same crewing company regularly socialised, when they had lay-overs in the same port. The socialising during weekends often involved alcohol consumption as a means of unwinding during the long-term contracts.

Analysis

Analysis of causal factors

Fall between quay and ship

The deckhand fell in the water as he was standing on a tyre fender secured to the quay wall and was about to step through the door opening in the ship's port side. Though the deckhand held on to a mooring rope, when he extended one foot towards the ship, he lost his balance and fell into the water and drowned.

Access to the ship

HENDRIKA JACOBA's crew perceived the berthing conditions at Tanker Quay in Thyboron Port to be good, because the large fenders protected the ship from the quay, and the difference in sea level during tide was fairly small.

The crew used three different ways of access, which provided different options for accessing the ship depending on the difference in height between the ship and quay. Common for the access ways was that they required stepping directly from quay to ship. This is an accepted means of access by the authorities, provided that the gap between ship and quay is kept minimal. Thereby it was recognised in the provisions that gaps are not unacceptable per se.

In Thyboron, the large tyre fenders created a gap between the ship and quay of 70 cm. When the ship berthed, the crew strove to align the door opening on the main deck with one of the fenders, so that the fender could close the gap between quay and the door opening.

To the crew's experience and knowledge, the sea level in Thyboron rarely varied more than 0.5 metres. In the crew's perception, this variation did not significantly affect the ship's position alongside, and mooring lines were not tightened or slackened during the port stays in Thyboron. However, when the ship was berthed on 27 May 2022, the sea level was increased due to a northwesterly gale. As the wind went down during the next day, the sea level decreased, causing the mooring lines to slacken. At the time of the accident, the sea level was 18 cm lower than on the time of berthing. Consequently, the ship shifted, resulting in a gap between ship and fender. The fender and ship door opening also became offset, so the fender no longer closed the gap between the quay.

During the investigation, the off-quay distance varied between 20-60 cm, but due to the offset and the height difference between fender and doorstep, the distance from the stepping point on the tyre fender to the door opening varied between 100-115 cm. At the time of the accident, the sea level was 8 cm higher than during the investigation, and swell could be observed on the CCTV. The distance to overcome during the time of accident was thus a few centimetres less than 100-115 cm, but the ship was lying more unsteadily along the quay.

On the day before the accident, the sea level was down to -12 cm, resulting in a greater distance between quay and ship than at the time of the accident. During this day, the deckhands stepped between quay and ship several times. Furthermore, different persons visited the ship throughout that day and accessed the ship by stepping from the fender to the door opening. This indicates that the gap was perceived to be within acceptable limits.

Physiology

When the gap between fender and ship increased, persons boarding the ship had to compensate with their physiological ability to bridge the gap. Due to the height difference between fender and ship, the fender being offset and the gap, the persons had to make a combined forward, sideways and downward movement to reach the doorstep from the tyre fender.

From CCTV and the reconstruction, it was determined that the technique used by the persons boarding the ship was to stand on a sloping part of the tyre fender to get as close to the door as possible, before stepping down on the ship. A mooring line hanging above the door opening was used as an aid when the persons leaned over while straddling over the gap and moving down onto the ship. The shift in the body's centre of gravity during the step down made it impossible to halt the boarding, once the step was taken. If the ability to bridge the gap fell short, the person would fall into the water.

The ability to bridge the gap between fender and ship comprised of following parameters: physique, balance, flexibility, climbing technique, coordination skill, judgement of distances and timing. These parameters could be challenged or fall short due to a variety of conditions, such as health issues, limitations of work wear, lack of experience, cognitive distractions or simply the limbs being too short for the distances to be overcome.

At the time of the accident, the deckhand's ability was most likely challenged by a combination of factors:

- *Height:* The deckhand had to straddle a distance 2/3 of his own height. The further into extreme positions the locomotor apparatus is stretched, the harder it becomes to maintain balance control.
- *Footwear:* The deckhand most likely wore slide sandals when attempting to board the ship. The sole on this type of footwear rarely provides traction against slippery surfaces. Slide sandals are not secured to the foot at the heel and provide little support for the foot. Balancing on the tyre fender's sloping rubber surface while stepping onto the ship might have been challenged by the sandal slipping or the foot twisting in the sandal.
- *Alcohol:* Alcohol intoxication might have impaired the deckhand's motor function and coordination, cognitive functions including judgement of distance, and balance control. From the CCTV it is evident that the deckhand walked unsteadily prior to the boarding attempt, but the level of intoxication could not be verified.
- *Head trauma:* Injuries on the deckhand's forehead indicated that he had suffered a blow to his head prior to the boarding attempt. Head trauma can lead to dizziness and impaired vision due to concussion to the brain. Furthermore, blood running from the forehead to his eyes might hamper his vision.

Drowning

When the deckhand attempted to board HENDRIKA JACOBA, no persons were on board the ship and there were no persons in the vicinity. Nobody noticed that he was missing until next morning, five hours after he fell into the water, and it was not until 10 hours later that his friends realised, he had fallen into the water.

When falling into the water, the deckhand had little or no possibility of saving himself. During the fall, he hit his head hard against the deck at the door opening, which likely caused confusion or unconsciousness. Depending on the alcohol level in his blood at the time of the accident, he would be more susceptible to cold chock and hypothermia. If he were able to overcome this, the combination of the quay layout and the ship's position rendered him no possibility of coming out of the water. The door opening in the ship side and the quay side were too high up, and the ladders in the quay wall were out of sight and reach.

Conclusion

Cause of the accident

The deckhand on HENDRIKA JACOBA fell between quay and ship during an attempt to board the ship after a night of socialising. Due to changes in sea level, the ship had shifted slightly. This caused a gap to develop between a fender tyre, which was used as a means of access during boarding, and the ship. This made it necessary for the deckhand to bridge a distance of approximately 100 cm. While he had succeeded with this during the day, his ability to bridge the gap was most likely impaired by a combination of alcohol intoxication, head trauma and the type of footwear at the time of the accident. As the ability to board the ship fell short, the deckhand fell into the water and had no possibility of saving himself.

Stepping directly from quay to ship is a generally accepted means of access on fishing ships and other smaller ships as long as the distance between quay and ship is kept to a minimum. This also means that a gap between quay and ship is recognised as unavoidable to some extent, and this is commonly compensated for by the crewmember's physiological ability to bridge the gap.

In Thyboron, the tyre fenders were perceived as an asset by the crew, as they kept the ship well away from the quay. However, this also introduced a minimum distance between quay and ship of 70 cm, making it necessary to use the fender as a means of access by aligning the door opening and the fender. While the tyre fender bridged the gap between ship and quay when aligned with the opening, the tyre fender became a hazard when the ship shifted and the door opening was no longer aligned with the fender. The distance that the deckhand had to straddle was longer, and the deckhand had to stand on a sloping part of the tyre to reach the ship.

The access way was not regarded as problematic prior to the accident by neither crewmembers nor visitors who all used the tyre fender and door opening as a convenient means of access. This illustrates the normality for the persons on fishing ships to compensate for shortcomings of the means of access with their own physiological capabilities, which in turn entails variying degrees of risk of falling.

Appendix

SHIP'S DATA

Name:	HENDRIKA JACOBA, GY 127
Ship type:	Fishing vessel, stern trawl/fly-shoot
Nationality:	United Kingdom
Port of registry:	Grimsby
Call sign:	MIHQ9
IMO number:	9877389
Year built:	2020
Shipyard/shipyard number:	Casco- & Sectiebouw Rotterdam
Classification Society:	Bureau Veritas
Length overall:	24.90 m
Breadth overall:	8.50 m
Maximum draught:	3.12 m
Gross tonnage:	233
Propulsion power:	749 kW
Hull material:	Steel
Hull type:	Single hull

VOYAGE DATA

Port of departure:	Thyboron, Denmark
Port of arrival:	Thyboron, Denmark
Voyage type:	National
Information about the cargo:	No cargo
Manning:	None
Number of passengers:	None

WEATHER

Wind – direction and speed:	8.9 m/s - Northwest
Current:	Unknown
Wave height:	0-0.5 m
Visibility:	Good
Weather conditions:	Clear
Light/dark:	Dark

INFORMATION ABOUT THE ACCIDENT

Type of marine casualty:	Occupational accident
IMO Classification:	Very serious
Date and time:	29 May 2022, 0315 LT
Location:	Thyboron Port
Position:	56°42.07 N - 008°13.38 E
Ship operation:	Alongside, in port
Place on board:	Over the side
Human factors:	Yes
Consequences:	One crew member perished.

ASSISTANCE FROM AUTHORITIES ON LAND AND EMERGENCY SERVICES

Parties involved:	Thyboron Rescue Station, Thyboron Fire Department, Danish Police
Resources Used:	FRB 16
Speed of response:	8 minutes
Actions taken:	Search for the deckhand
Results achieved:	The deceased crewmember was recovered from the sea.

RELEVANT CREW MEMBERS

Deceased deckhand (A):	51 years old. Had 19 years' experience at sea and had served on HENDRIKA JACOBA since June 2021.
Deckhand (B):	38 years old. Had served on HENDRIKA JACOBA since November 2021.
Owner:	59 years old. 45 years at sea in total. Owner of HENDRIKA JACOBA since new-built. Served as relief skipper on the ship.