DUTCH
SAFETY BOARD

Capsizing and sinking of fishing vessels

Lessons learned from the occurrences involving the UK-165 Lummetje and the UK-171 Spes Salutis

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The Hague, June 2021

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The Dutch Safety Board

When accidents or disasters happen, the Dutch Safety Board investigates how it was possible for these to occur, with the aim of learning lessons for the future and, ultimately, improving safety in the Netherlands. The Safety Board is independent and is free to decide which incidents to investigate. In particular, it focuses on situations in which people's personal safety is dependent on third parties, such as the government or companies. In certain cases the Board is under an obligation to carry out an investigation. Its investigations do not address issues of blame or liability.

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SUMMARY

On 28 November 2019, the trawler UK-165 Lummetje capsized and sank in coastal waters near Texel. The occurrence cost the lives of the two crew members on board. On 9 December 2020, the UK-171 Spes Salutis also capsized. As a result of these two occurrences, the Dutch Safety Board launched an investigation.

Events leading up to the capsizing and sinking of the UK-165
In the early morning of 28 November 2019, the UK-165 was fishing for shrimp. The vessel was sailing on a northerly heading in coastal waters near Texel. At least one of the two nets became entangled in the wreck of the steamer Ruth.

The entanglement of the UK-165 with the wreck did not result immediately in the capsizing of the trawler. In accordance with fixed procedures, measures were taken on board. Firstly, the port outrigger boom was raised slightly, and the port gear was lifted up to the boom. The aim was to prevent the portside fishing net becoming entangled in the propeller. This resulted in what is known as an asymmetric loading condition. The investigation revealed that this condition dangerously compromised the stability of the vessel, leaving practically no further margin to compensate for any unexpected heeling moment. Eventually, the sudden breaking free of the starboard gear followed by the starboard outrigger boom swinging upwards generated the fatal heeling moment.

The investigation also revealed that the position of the wreck of the Ruth was not accurately recorded on the chart. The Safety Board has investigated whether the incorrect position marking of the wreck of the Ruth on the chart was a relevant factor in the occurrence. This proved not to be the case.

Events leading up to the capsizing and sinking of the UK-171
In the morning of 9 December 2020, the starboard fishing net of the trawler UK-171 Spes Salutis jolted suddenly. The crew decided to cut power to the propeller and to pay out the nets. During attempts to retrieve both nets, the trawl wire on the starboard fishing gear shot over the afterdeck, and the starboard outrigger boom suddenly swung upwards. Eventually, the crew was forced to cut through the starboard trawl wire. The starboard outrigger boom then returned to a horizontal position.

The port gear was then retrieved from the seabed. This led to the same type of asymmetric loading condition as on the UK-165. Here, too, the investigation revealed a dangerous compromising of the stability of the vessel, eradicating all margins for compensating for any subsequent unexpected heeling moment. The heeling moment that proved fatal for the UK-171 was caused by the weight of both the starboard and port gear. Both sets of gear were suspended from the port side outrigger boom, while there was no further weight at all, on the starboard boom.

Asymmetric loading conditions

Both the UK-165 and the UK-171 were faced with undesirable events affecting one of the sets of gear, prior to capsizing. Nonetheless, these events were not the direct cause of the capsizing. On the UK-171, the jolting of the gear was not the direct cause of the capsize. The swinging upwards of the starboard outrigger boom on the UK-171 was also not immediately fatal for the vessel.

Besides that both vessels were carrying additional fishing gear that was not allowed to be on board. It also emerged that given these occurrences, even if this specific equipment had not been present on board, both vessels would have capsized anyway.

This insight provided the Safety Board with grounds to further investigate the influence of asymmetric loading conditions on the stability of beam trawlers. The investigation was carried out on three beam trawlers with a length of less than 24 metres: the UK-165, the UK-171 and the TX-21. In almost all asymmetric loading conditions investigated, the stability no longer satisfies the requirements applicable for this situation.

Legislation fails to ensure that these loading conditions are taken into account in the certification process for seagoing trawlers. As a consequence, it is unknown how seriously the stability is compromised in asymmetric loading conditions.

Potential for response

The competences necessary to enable crews to recognize and prevent dangerous asymmetric loading conditions are not a fixed element of the curriculum taught in fishery training programmes. Moreover, legislation and regulations fail to guarantee that crew members on board are fully aware of the risks of asymmetric loading conditions on the vessel they are sailing on. This has a negative impact on their ability to recognize and prevent dangerous asymmetric loading conditions.

Conclusions

The Safety Board concludes that in the case of asymmetric loading conditions, stability can be rapidly and dangerously compromised. The risk of asymmetric loading conditions occurring is real, and can lead to very serious and potentially fatal occurrences.

The Board also concludes that the failure to include stability under asymmetric loading conditions in the design and certification processes, in stability books and in fishery training programmes contributes to the fact that the risks occurring in the event of asymmetric loading conditions on beam trawlers with a length of less than 24 metres remain unrecognized.

Interim warning

The Dutch Safety Board considered it irresponsible to wait until the publication of the report to publish the conclusion that the stability of vessels can rapidly become dangerously compromised in the event of asymmetric loading conditions. For that reason, on 8 April 2021, the Safety Board published an interim warning. In this warning, crews of beam trawlers were notified of the rapid and dangerous compromising of stability in the event of asymmetric loading conditions. The Board addressed the warning to sector organizations in the fishery sector, sending copies to the Minister of

Infrastructure and Water Management and the Minister of Agriculture, Nature and Food Safety.

CONSIDERATION

Sea fishing is a centuries-old profession. Not only does it provide fishermen and their families with a livelihood, but it is also a deep-rooted tradition in close-knit communities such as Urk, Katwijk and Arnemuiden. The fishing industry is still developing within that tradition, for example in terms of fishing methods, equipment and vessel design.

Beam trawling has become a popular fishing method since the nineteen sixties. Within this form of fishery, a trawler drags a dragnet (the bag net) over the seabed, that is attached to a metal tube (the outrigger boom) on both sides of the vessel. For decades, this has proven a very effective method for catching sole, plaice and shrimp. Beam trawling has gradually developed and practices have improved. Trawlers have been converted and equipped with other rigging and safety facilities, and indeed the design of the trawlers themselves has evolved. These innovations continue to this day. At present, the Dutch fishing fleet includes around 280 active trawlers, of different designs. Many of these vessels are active on a daily basis, among others in Dutch coastal waters.

The capsizing and sinking of the Urk-based beam trawlers UK-165 Lummetje (in November 2019) and the UK-171 Spes Salutis (in December 2020) provided conclusive proof that beam trawling is not without risk. The two crew members of the UK-165 lost their lives, and the three-man crew of the UK-171 were scarcely able to be rescued. These serious occurrences deeply affected the surviving relatives and the entire community of Urk.

Day in, day out, trawler crews must determine whether and how they can safely sail and fish with their vessels. In addition to a thorough knowledge of the specific characteristics of their vessel, this requires experience of weather conditions and sea conditions, and an understanding of the risks. Fishermen gain these insights through knowledge, training and experience. Investigations into occurrences involving trawlers can reveal new risks.

The investigation into the occurrences involving the UK-165 and the UK-171 has revealed that asymmetric loading conditions on beam trawlers with a length of less than 24 metres can rapidly and dangerously compromise the stability of the vessels. An asymmetric loading condition can for example occur if fishing gear is suspended from the outrigger boom on one side of the vessel, but not on the other side. In that situation, the ship no longer floats upright in the water, but adopts a permanent list. Even a small further increase in the angle of list - for example as a result of wind, waves and weight displacements on board - can result in the rapid capsizing and sinking of the vessel. These circumstances occur regularly and as such represent a real risk. It became clear that the same level of risk applied to the TX-21 Pieter van Aris, another vessel investigated by the Safety Board. The TX-21 is a modern trawler of a commonly built type.

The fact that under asymmetric loading conditions stability decreases is in itself not new. However, the fact that stability can be compromised so rapidly that it leads to a real risk of capsizing surprised both the Safety Board and external experts.

The rapid and dangerous compromising of stability was until now barely known or recognized, if at all. Until now, no attention was focused on this aspect either in ship design, certification, training or practice. Traditionally, vessel stability has been considered from the point of view of symmetric loading conditions.

The Safety Board considered the newly identified safety risk to be so serious that in advance of the publication of the full investigation report, it decided to address an interim warning to the fishery sector, on 8 April 2021. The most important aim of this interim warning was to inform the crews of similar trawlers to the UK-165 and UK-171 as quickly as possible of this risk, to allow them to take appropriate action.

The sector responded to the interim warning. Not only the trawler crews but also other parties involved in sea fishing in the Netherlands were duly informed. In addition, the sector aims to start coming up with structural solutions for the risk. The response from the sector to this warning is a first step towards reducing the acute safety risk of capsizing and sinking as a consequence of asymmetric loading conditions.

Both in the long and short term, this warning must be heeded. For the long term, preventive measures are essential. These could include the systematic analysis and calculation of asymmetric loading conditions for trawlers to assess stability risks. To date, despite being a statutory assessment criterion, such analyses and calculations have not been carried out. All three of the trawlers investigated by the Safety Board revealed the same phenomenon: as soon as the gear or outrigger booms are affected by an event on board, leading to an asymmetric loading condition, the stability no longer satisfies the standards for symmetric loading conditions. The occurrence of a risk of this kind is not taken into account in the design or certification of trawlers. This means that further knowledge will have to be developed regarding the stability of trawlers, including those with a length of more than 24 metres. This new knowledge will have to be taken into account in ship design for future generations of beam trawlers and when making changes to the existing fleet.

In the short term, people must remain alert to the safety risk. Risk management must also be given a permanent place both in practice and in fishery training programmes, as quickly as possible. By investing in this way in improving awareness of the risk in daily practice, it is possible right now to make a start on reducing the risk of a repetition of serious and fatal occurrences.

RECOMMENDATIONS

The investigation focuses on the occurrences involving the UK-165 and the UK-171. Both vessels were beam trawlers with a length of less than 24 metres. To chart out the safety risk for trawlers of capsizing and sinking as a result of dangerous asymmetric loading conditions and with a view to achieving safety improvements, it is recommended that a more broad-based investigation be carried out within the entire sector. That investigation should focus on all trawlers - both those with a length of less than and more than 24 metres.

The Dutch Safety Board issues the following recommendations.

To the Minister of Infrastructure and Water Management:

1. Recognize that asymmetric loading conditions occur regularly on beam trawlers and that the stability of these vessels can be considerably less favourable than in symmetric loading conditions. On that basis, calculate and analyse the stability in asymmetric loading conditions as part of the legal certification process.
2. Ensure full compliance with the statutory obligations to include in the stability book loading conditions that have an unfavourable influence on vessel stability, and provide specific relevant instructions. Do this by also including asymmetric loading conditions in the stability book. Involve the fishery sector in drawing up these specific relevant instructions.
3. Investigate the scale of the safety risk of the capsizing and sinking of trawlers as a result of dangerous asymmetric loading conditions within the entire Dutch trawler fleet. Include all fishing vessels in this investigation, irrespective of their length. Take measures to counter this safety risk.

To the Fishery Sector Council Foundation (Stichting Sectorraad Visserij):

4. Ensure that crews of beam trawlers with a length of less than 24 metres receive structural information on the risk of dangerous instability in the event of asymmetric loading conditions. Assist the Minister of Infrastructure and Water Management in drawing up specific relevant instructions which must be included in the stability book in the event of loading conditions with an unfavourable influence on vessel stability.

The competences necessary to enable crew members to recognize and prevent dangerous asymmetric loading conditions are not a fixed element of fishery training programmes. To improve the potential for response by (future) skippers, the Safety Board issued the following recommendation:

To the Foundation for Cooperation on Vocational Education, Training and Labour Market (Samenwerkingsorganisatie Beroepsonderwijs Bedrijfsleven) and Industry and the Fishery Sector Council Foundation:

5. Ensure that within fishery training programmes, attention is focused explicitly on the safety risk of asymmetric loading conditions and how to respond in practice to manage this risk. Include this in the teaching material, for example.

In addition to improving the potential for response by skippers, it is equally important that safety gains be achieved through improvements in vessel design. For that reason, parties within the maritime manufacturing industry must also be involved in preventing the safety risk of asymmetric loading conditions on fishing vessels. These parties include shipyards, shipbuilders and ship designers. In the Netherlands, all these parties can be reached via the sector organization Netherlands Maritime Technology.

To Netherlands Maritime Technology:

6. Ensure that parties in the maritime manufacturing industry are informed of the safety risk of dangerous instability in the event of asymmetric loading conditions. Arrive at a situation in which these parties contribute to preventing this safety risk by including the principle of maintaining stability in asymmetric loading conditions in the design, construction and conversion of fishing vessels, and fishing equipment.

J.R.V.A. Dijsselbloem
Chairman Dutch Safety Board

C.A.J.F. Verheij
Secretary Director

1 INTRODUCTION

1.1 One report, two occurrences

On 28 November 2019, the trawler UK-165 Lummetje was lost in coastal waters near Texel. The two crew members on board lost their lives in the occurrence.

In response to this occurrence, the Dutch Safety Board launched an investigation. During the investigation, another occurrence took place, involving a trawler. In December 2020, the UK-171 Spes Salutis capsized and sank to the north of Schiermonnikoog. All persons on board were rescued. It rapidly became clear that there was a realistic possibility that similar underlying causes and factors led to both occurrences. At the moment of the occurrence involving the UK-171, it had already emerged from the investigation into the occurrence with the UK-165 that the UK-165 first capsized before the ship sank. For that reason, the Safety Board decided to combine the two investigations.

Appendix A contains the accounting for the investigation. This discusses in greater detail such issues as background, demarcation, the investigation approach and methods, cooperation and quality assurance.

1.2 The occurrences

1.2.1 UK-165 Lummetje

In the early morning of Thursday 28 November 2019, beam trawler UK-165 Lummetje was fishing for shrimp. The vessel was sailing on a northerly heading in coastal waters near Texel. At least one of the two nets became caught on what later emerged to be a wreck on the seabed. Shortly afterwards, the vessel disappeared from the radar and the vessel ceased transmitting AIS signals[1].

The alarm was sounded at the Coastguard when the automatic emergency satellite beacon (EPIRB[2]) on the vessel started transmitting emergency signals. A large-scale Search and Rescue operation (SAR operation) was immediately organized, involving both waterborne and airborne equipment. The fishing boat WR-181 Elisabeth, which at the moment of the first emergency signal was located nearby, sailed to the immediate vicinity of the last-known position of the UK-165. The WR-181 reached the location approximately ten minutes after the first emergency signal and fifteen minutes after the disappearance

1 The *Automatic Identification System* (AIS) on board ships automatically transmits information at regular intervals via a radio transmitter, including the position, speed and vessel data relating to the journey in question.
2 EPIRB: Emergency Position Indicating Radio Beacon (emergency radio beacon on board ships).

of the radar signal, but found nothing at the location. During the SAR operation, an empty self-inflating life raft was discovered from the air. The EPIRB was also found floating in the sea.

Later in the morning of the occurrence, the wreck was discovered on the seabed by a minesweeper of the Royal Netherlands Navy, 600 metres to the north-northeast of the vessel's last-known position. Divers of the Royal Netherlands Navy found and retrieved the bodies of both crew members, in the wheelhouse, three days after the accident.

1.2.2 UK-171 Spes Salutis
On 9 December 2020, at around 06.52 hours, something went wrong with the starboard fishing net of the beam trawler UK-171 Spes Salutis. At the time, the vessel was sailing on a westerly heading, approximately 10 nautical miles north of the Rottumerplaat. The vessel was beam trawling at the time.

The starboard fishing net jolted suddenly, at which point the crew decided to shut off power to the propellor and to pay out the nets. During attempts to retrieve both nets, the trawl wire of the starboard fishing gear shot over the afterdeck, and the starboard outrigger boom swung suddenly upwards. Eventually, the crew were forced to cut through the starboard trawl wire. When the port gear was subsequently hauled in, the trawler capsized. After the skipper had been helped out of the wheelhouse, the three-man crew climbed onto the keel. One of the crew members was able to notify the home front via a mobile telephone. When the trawler sank, the crew members were able to swim to, activate and climb into the life rafts. Shortly afterwards they were rescued by the fishing boat TH-10 Dirkje.

1.2.3 Classification
Both accidents have been classified as very serious accidents as defined in the Casualty Investigation Code of the International Maritime Organization (IMO) and Directive 2009/18/EC of the European Parliament and Council. This entails an obligation to investigate the accidents. Because the accidents occurred on Dutch vessels, the investigation was carried out by the Dutch Safety Board.

1.2.4 Purpose of the investigation
The purpose of this investigation is to answer the following investigation questions:

1. What are the direct and indirect causes of the capsizing and sinking of the trawlers?
2. What lessons can be learned from the investigation into these occurrences?

1.3 Reading this document

The report is structured as follows. Chapter 2 reconstructs the loss of the UK-165 Lummetje. Chapter 3 describes the sinking and capsizing of the UK-171 Spes Salutis. Chapters 2 and 3 also provide background information and where necessary refer to appendices to the report. Chapter 4 identifies and analyses the underlying causes and factors. The conclusions appear in chapter 5, followed by recommendations in chapter 6.

2 THE FATAL OCCURRENCE INVOLVING THE UK-165

This chapter discusses the fatal occurrence involving the UK-165 Lummetje. It describes the course of events based on the knowledge that the vessel eventually sank. It emerged from the investigation that the UK-165 in fact first capsized. The capsizing is further discussed in section 4.1.

2.1 Direct cause

The occurrence involving the UK-165 took place on 28 November 2019 at around 05.42 hours[3] (Dutch time). It was dark, with a strong west-southwesterly wind force of 5 to 6 Beaufort. In the run-up to the occurrence, the beam trawler UK-165, with its bow pointed roughly in a northerly direction, was following a north-northeasterly course over the ground[4] approximately 4 nautical miles[5] to the west of Texel. At this point, the current was flowing at a rate of 1.2 knots in a north-northeasterly direction (030°). The investigation revealed that the waves were running in the same direction as the wind and the current. Witness statements revealed that there was considerable swell. The trawler disappeared from the radar at the location shown in Figure 1.

Figure 1: Section of sea chart showing the position in which the UK-165 disappeared from the radar. (Source: Hydrographic chart 1801.10)

3 Times are local times = UTC+1.
4 The course followed by the vessel in relation to the ground/seabed.
5 Nautical mile = 1852 metres.

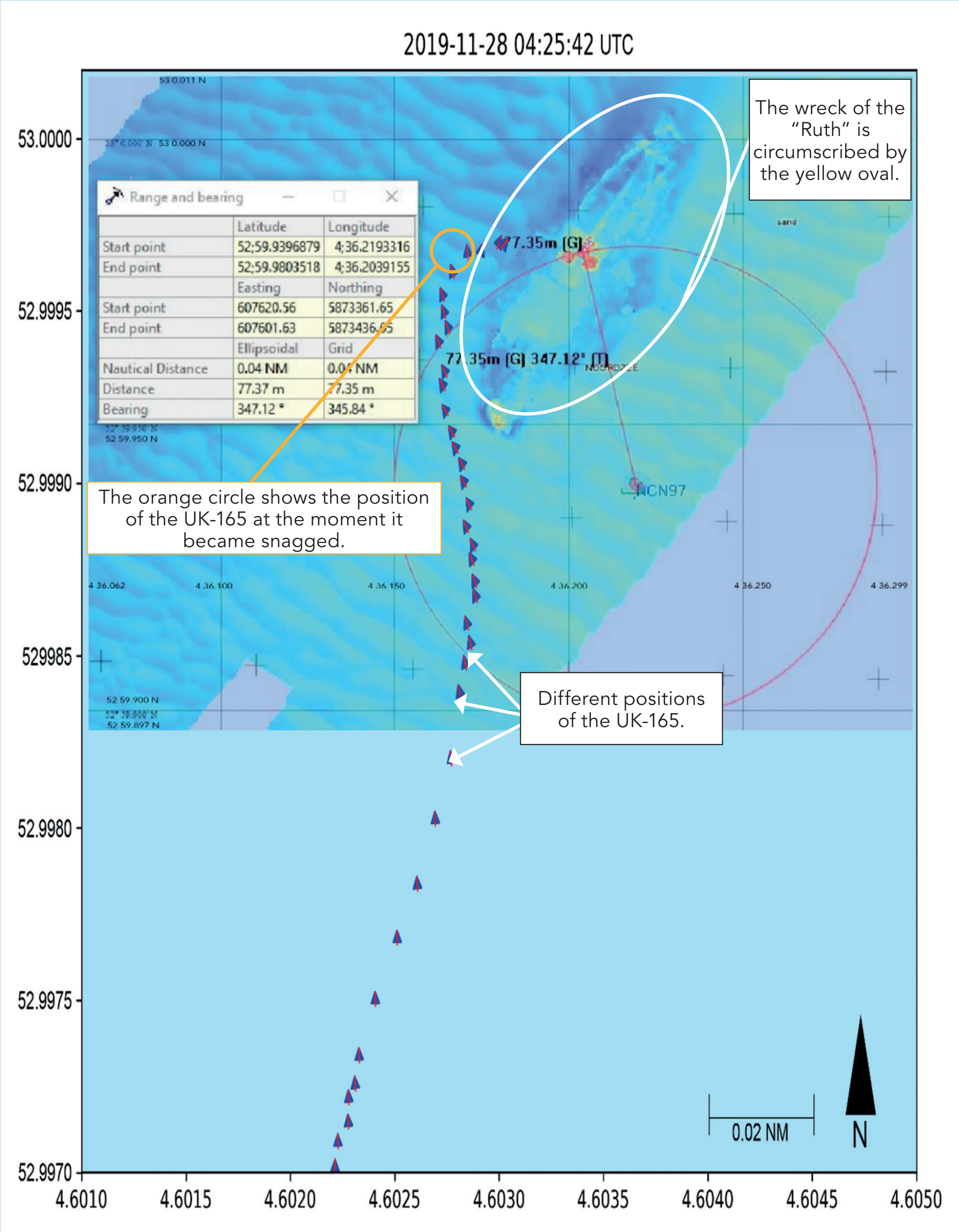


Figure 2: Track of the UK-165 up to the moment of becoming snagged. (Source: RWS and Dutch Safety Board)

The UK-165 was fishing for shrimp, and as such the vessel was equipped for beam trawling. Two nets, suspended from a steel pipe or beam with trawl heads (beam trawls) are dragged over the seabed, one on each side of the vessel, on a long trawl wire. Figure 2 shows part of the course sailed by the UK-165 in the last 20 minutes before the emergency signal was received. This track shows the course over the ground followed by the ship. The track is marked in the figure on a reproduction of the seabed charted out by Rijkswaterstaat (RWS) shortly following the accident. Each marked position shows the applicable compass course at that moment.

Figure 2 shows that initially, the UK-165 was headed directly towards the position of a wreck on the seabed. The wreck in question is that of the Swedish steamer Ruth (see block). A survey carried out shortly after the occurrence by RWS revealed that the charted position[6] of the Ruth, marked in Figure 2 by the centre point of the large red drawn circle and bearing the text 'NCN97' was in fact around 77 metres too far to the south-southeast[7].

6 The charted position of the wreck is the point at which a wreck protrudes furthest above the seabed.
7 The incorrect position of the wreck of the Ruth and its influence on the occurrence is discussed further in section 2.4.

UK-165 Lummetje

The trawler was built in 1986 as a fishing boat for the IJsselmeer. The boat was later converted for sea fishing. As a seagoing fishing boat, the UK-165 was equipped both for otter trawling and beam trawling[8]. For otter trawling, the equipment of the 19.50-metre-long and 5.30-metre-wide fishing vessel includes a net reel on the stern part. For beam trawling, the beam trawls and nets could be suspended on the outrigger booms on both sides. A further explanation with names, the route and function of the wires, blocks and slip construction as present on the UK-165 appears in Appendix C to this report.

Ruth

The Ruth was sunk on 9 May 1942 by English aircraft. The steel ship was more than 104 metres long and more than 14 metres wide. Figure 2 clearly shows the wreck on the seabed, with the remains of the bow in the bottom left and the stern part in the top right. The shallowest points of the wreck are shown in yellow and red, and protrude above the seabed. These points are located in the fore part and in the centre, at the position of the engine and steam boilers. Between the steam engine and stern part is a pale coloured straight line. This marks the propeller shaft of the Ruth.

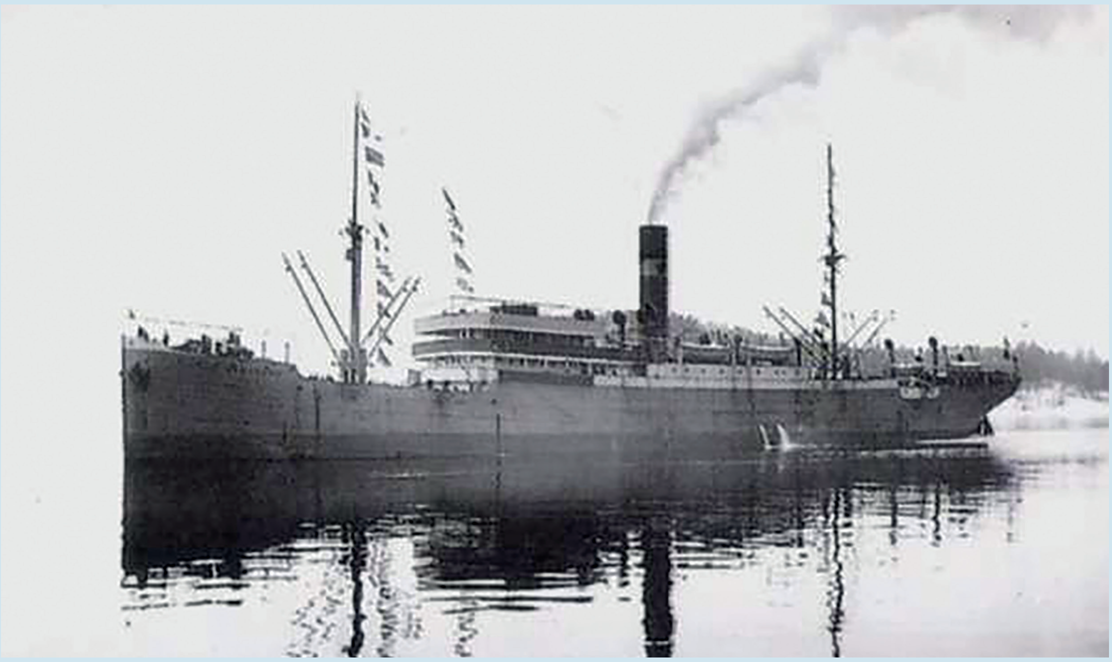


Figure 3: Streamer Ruth.

As it approached the wreck, the UK-165 started to shift its heading to port. The AIS[9] data on which Figure 2 is based show that current and wind conditions meant that a compass course alteration of approximately 45 degrees resulted in only a relatively small change

8 For more information about fishery types, visit https://vistikhetmaar.nl/.

9 The *Automatic Identification System* (AIS) on board ships automatically transmits information at regular intervals via a radio transmitter, including the position, speed and vessel data relating to the journey in question.

in the course over the ground of between 15 and 20 degrees. The altered compass course did not take the UK-165 far enough away from the wreck of the Ruth.

The course alteration to port raises the suspicion that at the last moment, the crew attempted to prevent the nets becoming snagged on the wreck. Current and wind conditions meant that the manoeuvre was not fast enough. At the same time, with its nets under water, the ship was unable to turn further to port, so as to avoid the wreck of the Ruth more rapidly. In this situation, the starboard trawl wire would have come too close to or even run up against or below the stern part (see Figure 4). The port gear is not drawn in on Figure 4, but was extended.

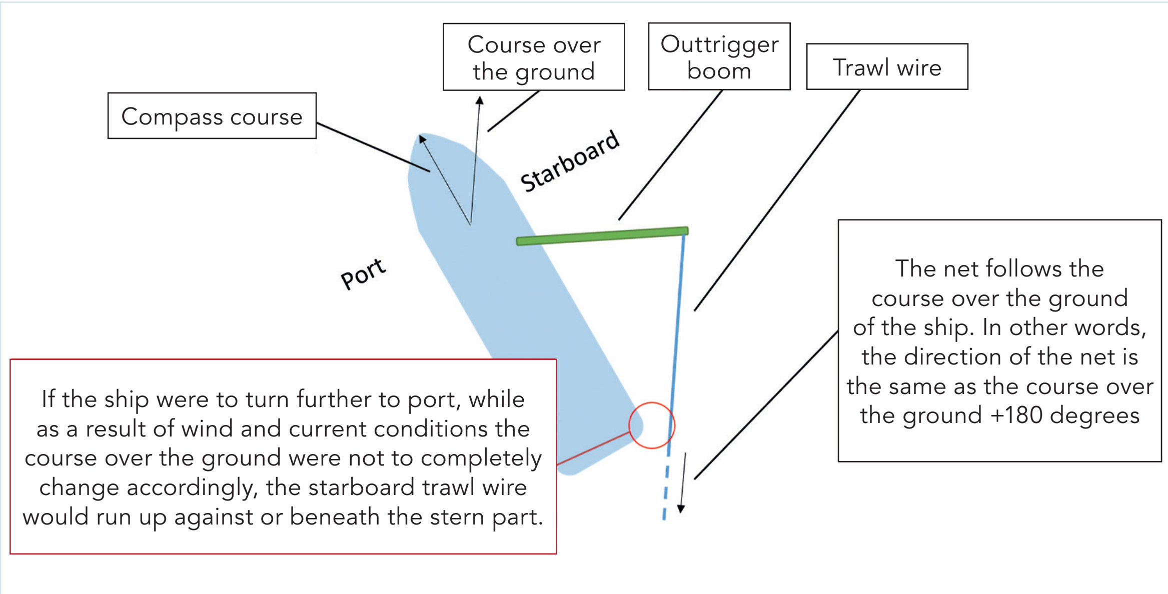


Figure 4: Starboard trawl wire close to the stern part. (Source: Dutch Safety Board)

The AIS data show a very abrupt change in both compass course and course over the ground, when the nets, that were suspended approximately 50 to 60 metres behind the ship, reached the position of the bow of the Ruth. The position of the UK-165 at this moment (05.25:29 hours) is marked in Figure 2 with a small orange circle. At that point, partially propelled by current and wind, the vessel was travelling at a speed of 3.8 knots over the ground.

After becoming snagged on the bow of the Ruth, the UK-165 turned sharply to starboard. The AIS data show that the position roughly maintained a northeasterly direction in respect of the bow of the wreck of the Ruth. This took place zigzagging backwards and forwards over a distance of approximately 35 metres, at a separation of on average between 60 and 65 metres from the bow of the Ruth. More than fifteen minutes later, at 05.41:29 hours, the AIS signal was lost.

It can be concluded from these data that after becoming snagged with the wreck, with the starboard gear fixed on the seabed, the UK-165 remained attached by the trawl wire. At the end of the day, the key determining factors for the position of the UK-165 were wind and current.

2.2 Investigative findings

To describe the further course of events, it is necessary to first here specify the relevant findings from the investigation.[10]

- The UK-165 was found 600 metres north-northeast of the wreck of the Ruth, on the seabed.
- The port fishing gear was intact. The port outrigger boom had been set at an angle of 45 degrees, and the port gear had been hauled in to the tip of the port outrigger boom. The cod end of the fishing net had been lifted to above the afterdeck. It can therefore be concluded that after becoming snagged, the crew had been working to haul in the port net to prevent the net or the trawl wire coming into contact with the propeller, while manoeuvring. The investigation revealed that this was standard procedure on board, whenever the gear became snagged with an obstacle on the seabed.
- The double sheared starboard trawl wire was intact. This wire travelled from the winch below the wheelhouse via the stern part and the guide pulley behind the mast to the quadrant block suspended from a small davit on the fore part. From there the trawl wire travelled via the trawl block past the rear mast and backwards away from the ship towards the wreck of the Ruth. This is shown on the underwater image in Figure 5. More than 60 metres behind the ship, the trawl wire travelled via the underwater block back to the ship, past the rear mast and through the trawl block back to the davit, to which the quadrant block was also attached. At that point, the trawl wire was connected to the davit via a shackle.

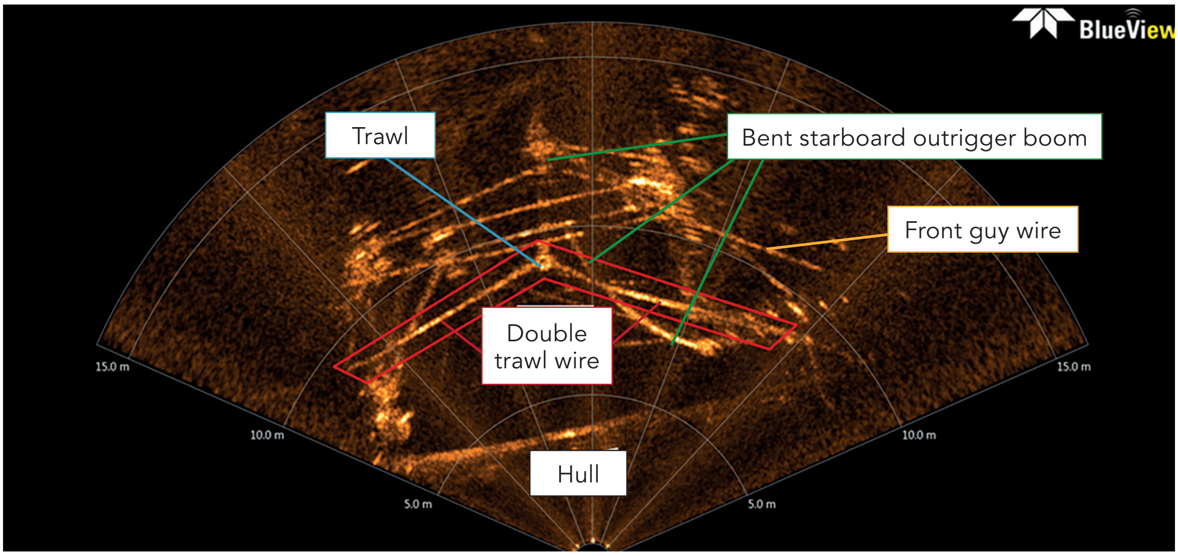


Figure 5: Underwater image wreck UK-165. (Source: Rijkswaterstaat)

10 A further explanation with names, route and function of the wires, blocks and slip construction as present on the UK-165 appears in Appendix C to this report.

- Three chains were attached to the starboard underwater block. Two of these chains were connected on the other side to the trawl heads of the starboard beam trawl. The pipe (or beam) which should have been in place between the two trawl heads was missing. The majority of the fishing net and the bobbin wire were missing.
- Both heavy steel trawl heads on the starboard gear were discovered to be displaced. This is clear evidence that the trawl heads had been subjected to considerable forces.

Beam trawl

The beam trawl is a steel pipe reinforced in the centre, with two heavy steel trawl heads, one on each side (see Figure 6). These trawl heads are slid over the end of the pipe. The tensioning of the net between the two trawl heads prevents them from sliding off the end of the pipe. One or more bobbin wires are also attached between the trawl heads.

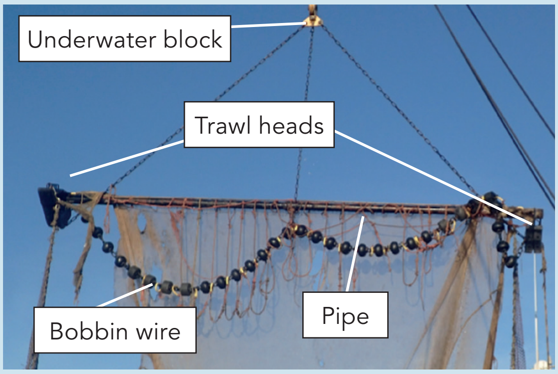


Figure 6: Beam trawl with net. (Source: Vist ik het maar)

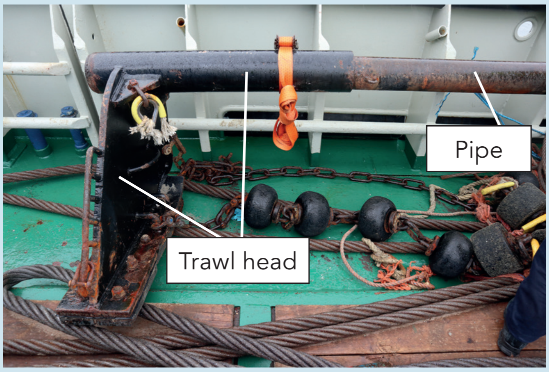


Figure 7: Trawl head and pipe of the port beam trawl of the UK-165. (Source: Dutch Safety Board)

On board the UK-165, as shown in Figure 6, the catch nets were attached to the underwater block through which the trawl wire was passed, with three chains. Figure 7 shows one of the trawl heads of the portside beam trawl of the UK-165, once it has been raised above water, during the recovery.

- The starboard outrigger boom was bent towards the mast.
- The fixed section between the mast and the tip of the outrigger boom was wrapped around the mast, where it became trapped behind the remains of a small platform. The part leading to the tip of the outrigger boom was taut, while the other part hung slack.
- The starboard trawl block was suspended approximately one metre below the tip of the starboard outrigger boom. The slip construction was open or had failed, which meant that the trawl block could hang in this position.
- The boom wire on the starboard trawl block passed through the tip of the starboard outrigger boom to the top block on the mast, and due to the weight of the trawl block was under tension.The boom wire was trapped near the mast, in the bracket attaching the fixed part to the boom wire. This bracket was itself trapped between

the remains of the small platform on the mast. Part of the boom wire hung slack. This was the part which ran from the winch beneath the wheelhouse, via the lower block to the mast and via the block on the lower lifting beam from the slip patent to the upper block in the mast (Figure 8).

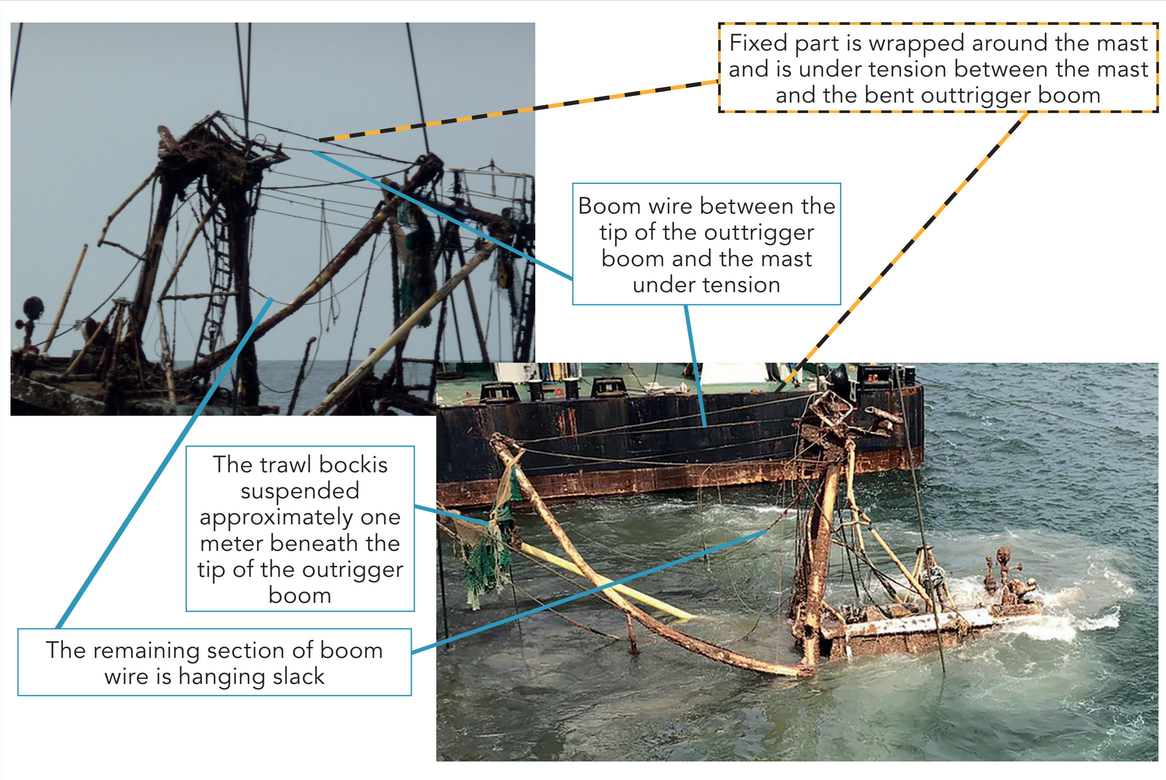


Figure 8: Photographs of recovery with explanatory notes. (Source photograph top left: Dutch Safety Board. Source photograph bottom right: Multraship Towage & Salvage).

- The rear guy wire of the starboard outrigger boom was broken, with badly frayed break.
- The starboard trawl wire on the winch below the wheelhouse was severely tangled. This effect occurs when the winch is paying out, while the wire on the winch is not running out quickly enough, if at all. In other words, if there is no or too little tension on the wire.
- The support on the starboard mast, against which the outrigger boom rests when raised to the vertical position, had broken off. Figure 9 clearly shows that at this point the mast is dented, and there are clear tears in the metal. This is an indication that the boom smashed into the support with considerable force.

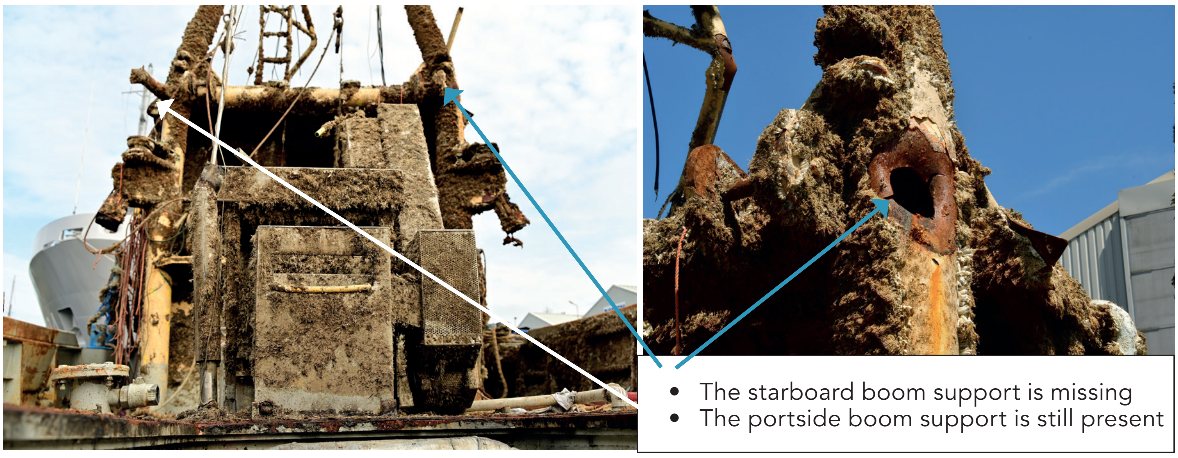


Figure 9: Missing boom support. (Source: Dutch Safety Board)

- The winch control for the starboard trawl wire was switched to paying out at full speed.
- The propulsion was set to full speed ahead.
- The rudder was set to full starboard.
- The net reel, part of the equipment for otter board fishing, was in the mounting brackets intended for that purpose, on the afterdeck. A spare net for shrimp fishery was wrapped around the net reel.
- The seal on the limiter for the main engine was intact and there were no traces of unlawful changes to the fuel supply to the main engine.

2.3 Course of events

It was determined that the starboard outrigger boom collided with the fixed part around the mast and together with the boom wire, became lodged at that point. From there, on the basis of the other findings, it was possible to reason back to the moment of snagging:

Swinging upwards of the boom
The fact that the fixed part became wrapped around the mast can only be explained by the sudden swinging upwards of the starboard outrigger boom, at high speed. The discovery that the support of the starboard outrigger boom had broken off the mast and the denting and tearing of the mast at the point where the support had been mounted corroborated this conclusion.

Interviews with crew members of other fishing boats, including boats equipped with the same type of slip construction at the end of the outrigger boom revealed that in the given circumstances, there are only two possible reasonable causes for the rapid upward movement of the outrigger boom:

1. The sudden breaking free of the slip construction at a point in time when there is tension on the trawl block and the boom wire, applied by the trawl wire. In that situation, the outrigger boom will swing upwards, and the trawl block and boom wire will run out many metres of wire. After all, the upward movement of the outrigger

boom creates a great deal of leeway in the boom wire, which passes several times backwards and forwards between the outrigger boom and the mast. In this situation, the boom wire ends up hanging in a series of slack loops between the mast and outrigger boom. The tension on the trawl wire will then once again cause the boom wire to be pulled taut, resulting in the running out of the trawl block.

2. The sudden breaking clear of the fishing gear from the obstacle on the seabed. It has been determined that the fixed part of the starboard outrigger boom became trapped behind the mast, after it had swung around the mast. The taut section of the fixed part between the mast and outrigger boom in this situation pulls on the lever used to release the slip construction.[11] The bottom side of this lever, which is normally kept under tension by the boom wire running backwards and forwards between mast and boom, is then unable to prevent the opening of the construction. After all, as the outrigger boom swings upwards, the boom wire is no longer under tension. As a result, the slip construction is released, and the trawl block on the boom wire falls from the tip of the boom.

It was determined that the boom wire was also trapped behind the mast. For that reason, the trawl block would only be able to tighten the leeway created in the boom wire as a result of the swinging up the outrigger boom, between the tip of the boom and the mast, so that it could only fall a limited distance from the tip of the boom.

The position of the trawl block following the occurrence was the determining factor in identifying why the starboard outrigger boom had swung upwards. In the final situation, the trawl block was suspended approximately one metre below the tip of the boom and had not run out. The cause described in point 1 was therefore impossible, so that the cause described in point 2 is the only possible remaining cause. Figure 10 shows how this occurred.

This cause for the sudden upwards movement of the outrigger boom also explains why, following capsizing, the UK-165 was no longer snagged with the Ruth. Because the gear had suddenly broken free, the UK-165 was carried approximately 600 metres by the current, before the vessel finally ended up on the seabed.

11 See appendix C.2, slip construction.

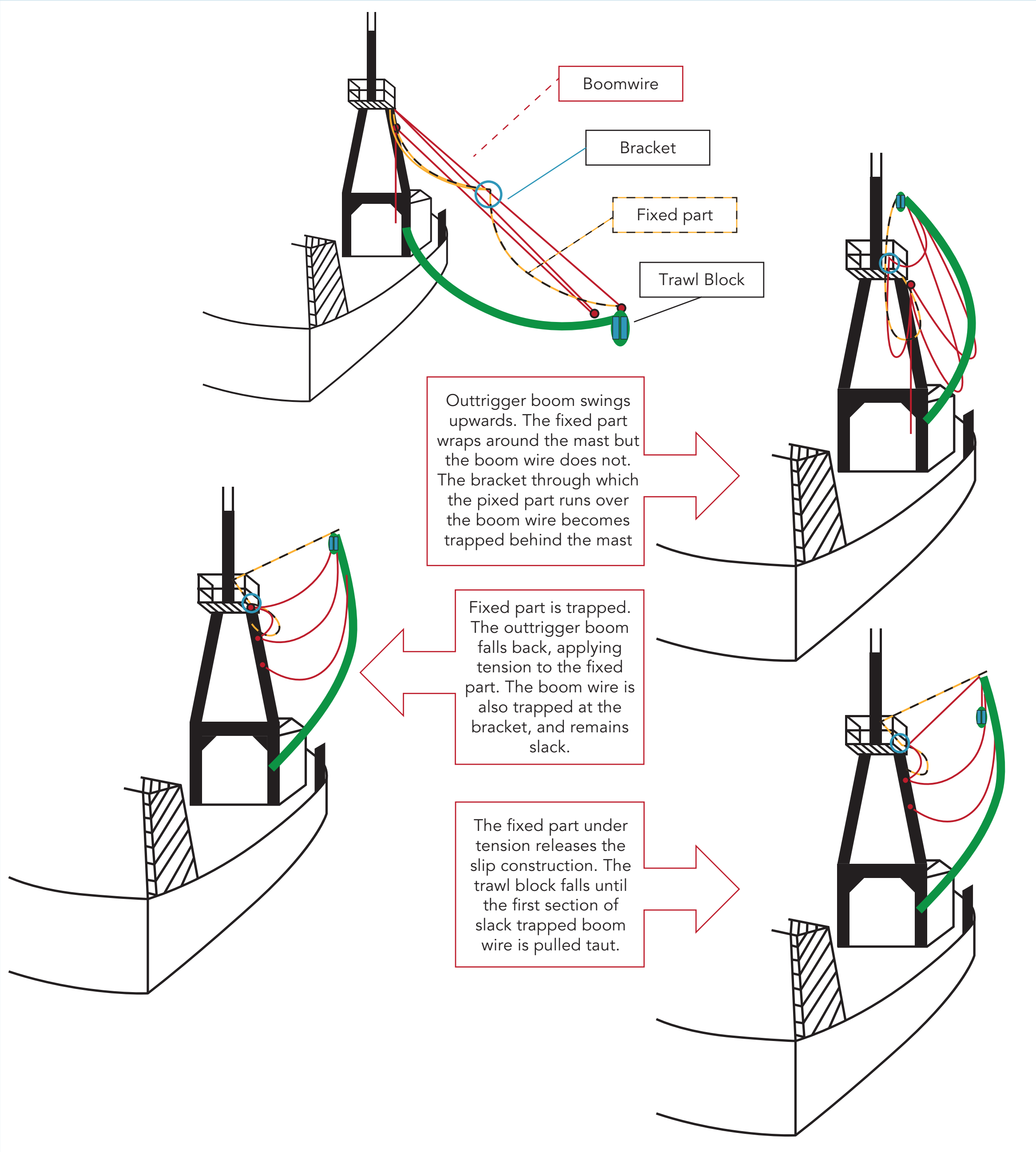


Figure 10: Swinging up of the boom and release of the slip construction. (Source: Dutch Safety Board)

Sudden breaking free of the starboard fishing gear from the wreck of the Ruth
Based on the above, in this section, it is possible to reconstruct what must have happened to the starboard fishing gear under water. The only parts of the starboard fishing gear that were recovered were the underwater block and the trawl heads attached to the block with chains. These were located approximately 60 metres behind the stern part of the UK-165, and were still connected to the fishing boat by the trawl wire that ran through the underwater block. The conclusion must be that the trawl heads slipped off the pipe of the beam trawl. This is only possible if the pipe (the beam) between the trawl heads becomes bent. This is an indication of the enormous force that occurred when the UK-165 became snagged.

During the period while the crew on board was working to retrieve the port fishing gear, the vessel was swinging on the entangled trawl wire. The vessel was practically athwartships to the waves, causing it to roll. The trawl wire came under further tension, in jolts, causing the trawl heads to slide further and further from the beam pipe and causing the net to tear further from the beam trawl. Eventually, during one such jolting movement, the trawl heads shot off the bent beam pipe, suddenly releasing all tension from the trawl wire. This caused the outrigger boom to swing suddenly upwards.

Bending of the boom

After the boom swung upwards, the tension on the starboard trawl wire was released. In other words, following the breaking free of the trawl wire, severe tension on the wire could no longer have been the cause of the bending of the starboard outrigger boom. The boom must therefore have been bent before the wire broke free.

Because huge forces must have been involved in the bending of the starboard outrigger boom, without being able to draw a conclusion with absolute certainty, it seems apparent that the bending took place when the gear became snagged. As described earlier in this report, and as further illustrated in Figure 11, the trawl wire travelled at an angle past the rear of the stern part. The outrigger boom was bent in the same way that a bow is bent during archery. In this situation, it is entirely possible that the boom was bent with the tip of the boom bending towards the mast, rather than towards the water.

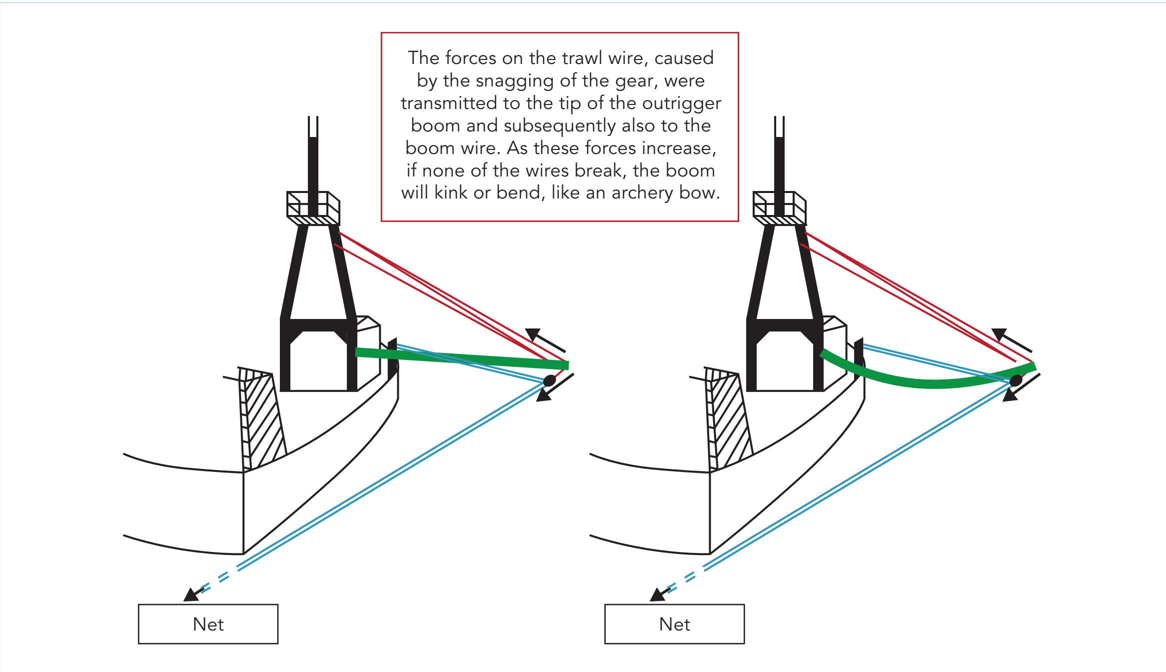


Figure 11: Bending of the outrigger boom. (Source: Dutch Safety Board)

Breaking of the rear guy wire

At a certain point between the snagging with the wreck of the Ruth and the capsizing of the fishing boat, the rear guy wire of the starboard outrigger boom also broke. It cannot be determined on the basis of the findings precisely when this happened.

Starboard trawl wire entangled on the winch

The crew attempted to pay out the trawl wire as quickly as possible, at a moment when there was insufficient or no tension on the wire. This is demonstrated by the position of the operating handle on the winch for the starboard trawl wire and the fact that the wire was wrapped around the starboard trawl wire winch in a tangle. The moment at which this took place cannot be determined with any certainty. It is, however, likely that this must have been a desperate attempt made at the moment when the fishing boat was capsizing. This was the only moment in the series of events at which there was no further tension on the trawl wire. After all, shortly before this took place, the trawl wire had broken free.

Based on the above description in this chapter, the course of events of the occurrence involving the UK-165 can be reproduced in the following chronological order of events:

05.25	UK-165 was heading for the wreck of the Ruth.
	Starboard beam trawl gear became snagged on the wreck of the Ruth.
	Starboard outrigger boom became bended, beam pipe of the starboard beam trawl became kinked.
	UK-165 did not capsize but turned sharply to starboard.
	The UK-165 started to roll athwartships of the waves.
	The crew set the port outrigger boom to an angle of 45 degrees and raised the port gear above water.
	The trawl heads of the starboard beam trawl broke free from the beam pipe suddenly releasing the tension on the starboard trawl wire.
	The starboard outrigger boom suddenly swung upwards.
05.41	The AIS signal from the UK-165 was lost. The ship sank.

2.4 Sea chart

The investigation into the sinking of the UK-165 revealed that the position of the wreck of the Ruth was not marked correctly on the chart. The shallowest point of the wreck was located approximately 70 metres further to the north-northwest than shown on the chart. The Safety Board has investigated whether the incorrect position marking of the wreck of the Ruth on the chart was a relevant factor in the accident.

The fact is that according to its certificates, the UK-165 had on board a paper sea chart to be used as a navigation aid.[12] During the investigation, a paper sea chart with number 1801.10 from the 1800 series was found in the wheelhouse of the UK-165. This chart series was issued by the Hydrographic Service of the Royal Netherlands Navy.

12 There was also an electronic chart on board. It has not been determined whether this was updated, whether and how this was used, or whether the wreck position in the electronic chart was correctly recorded and to what scale it was set.

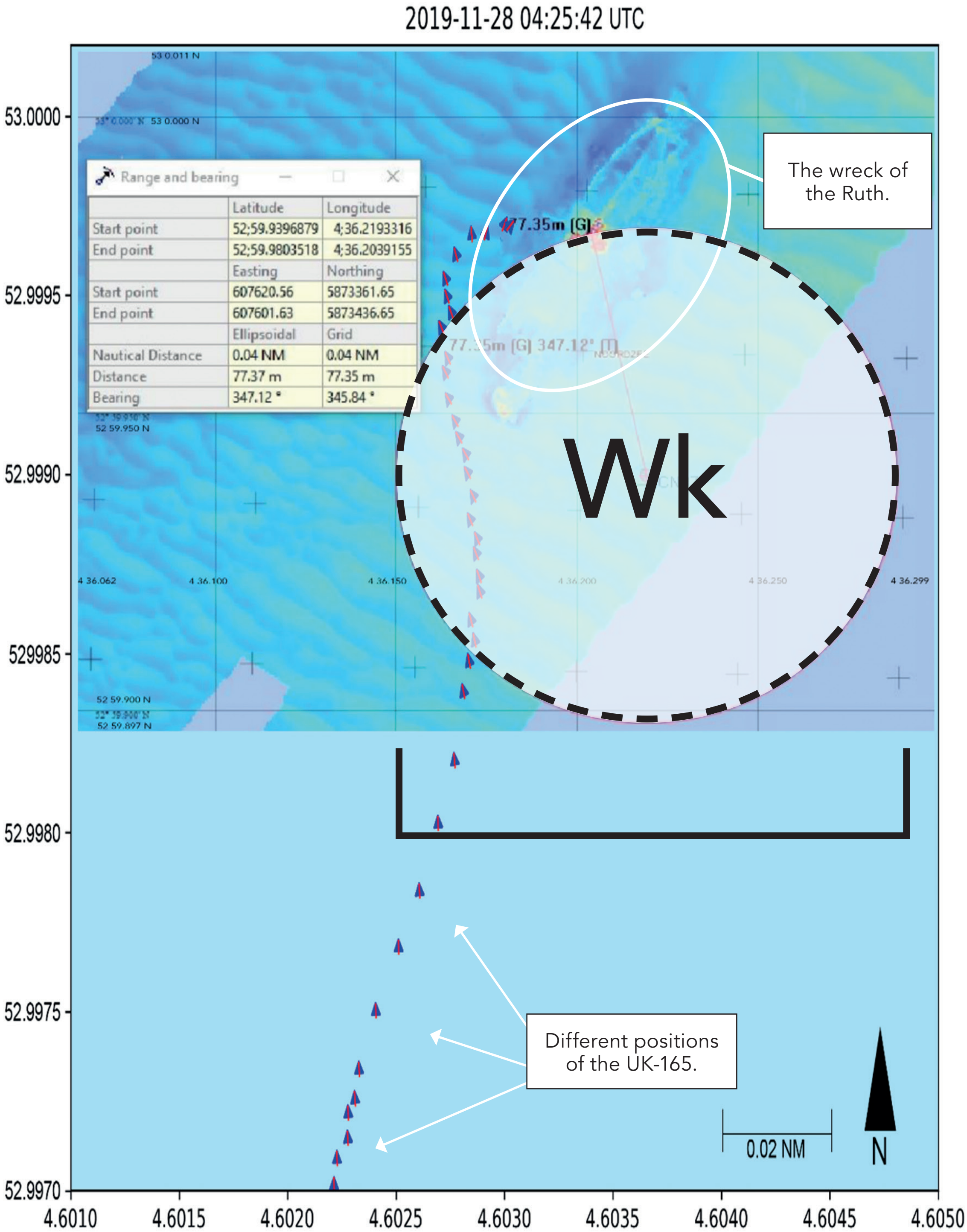


Figure 12: Track of the UK-165 up to the moment of becoming snagged. The wreck symbol on the paper sea chart is projected. (Source: RWS and Dutch Safety Board)

A wreck is marked on a paper chart with a symbol. The symbol covers part of the chart. According to the scale of the chart, it is possible to determine how large the area of the covered section of the chart is, in reality.

The wreck symbol of the Ruth would cover a circular area with a radius of 75 metres, to within a few metres' accuracy. The circle projected in Figure 12 shows that the wreck symbol on the chart did not overlap the entire wreck of the Ruth. However, it did overlap the part of the Ruth to which the UK-165 was heading and on which the fish net of the UK-165 became snagged.

The incorrect position of the wreck of the Ruth on the sea chart had no influence on the course of events of the occurrence involving the UK-165.

In response to the incorrectly recorded position of the wreck of the Ruth on the chart, the Hydrographic Service undertook an internal investigation. More information about this investigation, its findings and the measures taken, appear in Appendix D.

2.5 Search and Rescue (SAR) operation[13]

Three days following the capsizing and sinking of the UK-165, both deceased crew members were discovered in the wheelhouse and the galley of the UK-165, by divers of the Royal Netherlands Navy. This is evidence that neither was able to escape the ship on time, when it capsized.

The SAR operation organized by the Coastguard Centre with waterborne and airborne units on and above the water would not have been able to save the lives of the crew members. Nonetheless, the Netherlands Coastguard evaluated the SAR operation. In this evaluation, input from the fishery sector was heard.

On 28 November 2019 at 05.44 hours, an automatically generated message was received at the Coastguard Centre in Den Helder, that a signal had been received from the EPIRB[14] on board the UK-165 Lummetje. The message reproduced the position of the trawler at that moment. While tracing this position on the AIS equipment at the Coastguard centre, the signal from the UK-165 disappeared from the screen. Between 05.44 and 05.47 hours, attempts were made at the Coastguard centre via multiple channels to establish contact with the UK-165, but without success.

The WR-181 Elisabeth was sailing in the immediate vicinity of the last-known position of the UK-165. This fishing boat was immediately requested by the Coastguard to take a look at the last-known position of the UK-165. The skipper of the WR-181, who had seen the UK-165 shortly before the alarm was sounded, even at that moment no longer had visual contact with the UK-165. At the Coastguard centre this immediately led to the suspicion that the UK-165 had sunk and that the crew members were either trapped in the ship or could be in the water.

13 Source: Incident evaluation Sinking of the Trawler Lummetje - UK165 - Trimension commissioned by the Coastguard.
14 EPIRB: Emergency Position Indicating Radio Beacon (emergency radio beacon on board ships).

At 06.00 hours, a first maritime emergency call was transmitted with the request: "All ships are requested to keep a sharp lookout". Fishing boats sailing in the area responded to this request. What followed was an impressive search operation, whereby four airborne units and eighteen ships were involved. These included thirteen fishing boats.

Waterborne units deployed:
Lifeboat Joke Dijkstra (KNRM)
Lifeboat Beursplein 5 (KNRM)
HNLMS Makkum (Royal Netherlands Navy)
Guardian (Coastguard)
Visarend (Coastguard)
Fishing boats: WR-181, TX-21, WR-213, HK-81, TX-34, WR-40, TX-33, WR-27, WR-244, WR-212, WR-18, WR-108, WR-123.

Ingezette vliegende eenheden:
Rescue 01 (Coastguard aircraft)
Rescue 06, Rescue 08, Rescue 10 (SAR helicopters)

The Coastguard asked the naval vessel HNLMS Makkum, which was sailing nearby, whether it had divers on board. This was the case, and preparations were immediately started to deploy the divers. HNLMS Makkum generated sonar images of the area, in the hours that followed. At 08.56 hours, the wreck of the UK-165 was localized. Due to sea conditions, the navy divers were unable to dive at that moment. They did undertake dives during the subsequent days, but always under difficult circumstances.

The SAR operation proved difficult. The weather conditions and sea conditions at the time were a clear contributing factor. At organizational and operational level too, the SAR operation proved dissatisfactory to the participants in the SAR operation, which among others led to emotional responses.

The evaluation reveals that the Netherlands Coastguard learned several relevant lessons:
1. An Action Plan for the SAR operation was drawn up but was not discussed sufficiently with the various parties, during the operation.
2. Due to the absence of a trained and experienced On Scene Coordinator on board the Guardian, the search operation at sea did not run smoothly. As a result, the initiative lay above all with the fishing boats participating in the search operation. In particular the skipper of the TX-21 Pieter van Aris played an important role.
3. Communication was not restricted specifically to a VHF channel reserved for that purpose, but also took place via telephone. As a result, not everyone had access to the same information.

The SAR operation organized by the Coastguard Centre with waterborne and airborne units on and above the water would not have been able to save the lives of the crew members. For that reason, the Safety Board did not assess the evaluation and did not investigate to what extent measures were taken by the Coastguard.

3 CAPSIZING AND SINKING OF THE UK-171

Figure 13: UK-171 Spes Salutis. (Source: Rorifocus.nl)

3.1 Events leading up to the capsizing

The UK-171 Spes Salutis capsized on 9 December 2020 at around 09.44 hours.[15] At that time, the UK-171 was located approximately 10 nautical miles above the Rottumerplaat. The wind was blowing in a southerly direction at force 3 Beaufort. Sea current at the location was running at 0.4 metres per second in a west-northwesterly direction (300 °). Following its capsizing, the UK-171 sank. The wreck was eventually discovered at 53° 41.181 N 006° 20.995 E, shown in Figure 14. This was 111 metres to the west of the position from which the last AIS signal from the UK-171 was received.

15 Local time = UTC+1.

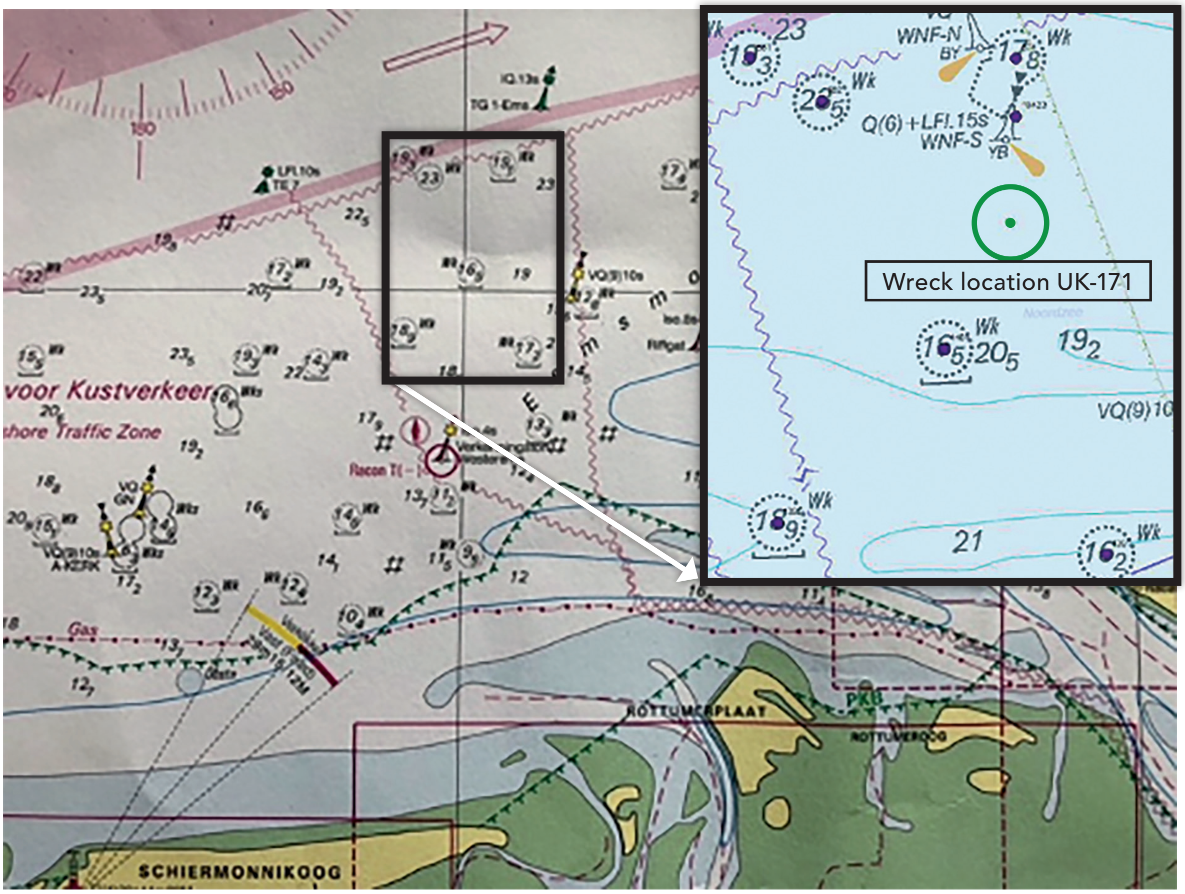


Figure 14: Section of sea chart showing the position of the wreck of the UK-171. (Source: Rijkswaterstaat)

UK-171 Spes Salutis

The UK-171 was built in 1963 as a fishing boat for sea fishing. The UK-171 was equipped for both beam trawl fishery and twin rig fishery.[16] Unlike on the UK-165, the wheelhouse of the UK-171 was located in the stern part. As a result, the route taken by the wires was slightly different than on the UK-165. Nonetheless, the description of the beam trawl gear in Appendix C is still sufficient for the UK-171. One difference between the UK-165 and the UK-171 was that the UK-171 was not equipped with slip constructions in the tip of the booms. Another difference between the two trawlers was that the UK-171 was fitted with an access door to the outside, in the wheelhouse, on both the port and starboard side. The UK-165 had a single door, at the back.

On the day of the occurrence, the UK-171 was fishing for shrimp. The beam trawl gear was suspended from the two outrigger booms on the vessel, one of the starboard side and one on the port side. During the fishing operation, the nets were dragged behind the vessel, over the seabed. At the start of the occurrence, the nets were positioned approximately 50 metres behind the UK-171.

16 The twin rig method involves towing two horizontally attached trawl nets, behind the vessel.

While fishing, the deputy skipper felt the starboard net jolt. He responded immediately by reducing engine power and switching from autopilot[17] to manual control. The deputy skipper turned the rudder to midships and continued to sail slowly ahead. He then activated the alarm on the bridge to call the skipper and deckhand on deck. After the situation was explained to the skipper following his arrival in the wheelhouse, the skipper took over the navigation. The deputy skipper went on deck. The deckhand was already present on deck.

The outrigger booms, which were set horizontally (fishing position), were raised by the skipper to an angle of approximately 50 degrees, in order to haul in the trawl wires. The skipper then slowly hauled in both the starboard fishing net and the port fishing net. During the process of hauling in the nets, the starboard trawl wire suddenly swung across the stern part. The outrigger boom folded up to an almost vertical position. The starboard trawl wire was pulled taut over the wheelhouse to port.

In order to return the boat to a position between the nets (with the starboard net on the starboard side and the portside net on the portside), the skipper attempted to sail the stern part underneath the starboard trawl wire. This manoeuvre was unsuccessful, and instead the boat made a hard turn to port. The starboard outrigger boom did not descend, but instead remained pointing straight upwards.

To create a stable situation, the skipper attempted to lower the starboard outrigger boom. Because the initial attempts were unsuccessful, he first paid out both trawl wires so that the fishing gear remained resting on the seabed. As a result there was no weight of the fishing gear on the outrigger booms. In order to achieve a stable situation, the skipper also raised the portside outrigger boom to an almost vertical position. The propeller was shut down and the boat slowed down to stationary. In other words, it was no longer pulling on the trawl wires.

When it became clear that it would not be possible to haul the starboard fishing gear on board, the crew decided to cut the starboard trawl wire. This is shown in Figure 15. The intention was that the trawl wire would be pulled out of the underwater block using the winch, in the direction of the green arrows. They would leave behind the fishing net, the beam trawl and the underwater block on the seabed. As a result, the majority of the trawl wire would be brought on board and preserved. In addition, the crew expected that the starboard outrigger boom would then descend, of its own accord. However, this did not happen. At this point the crew used a winch to lower the starboard outrigger boom into a horizontal position.

17 Autopilot is a system that enables a vessel to automatically follow a preset heading.

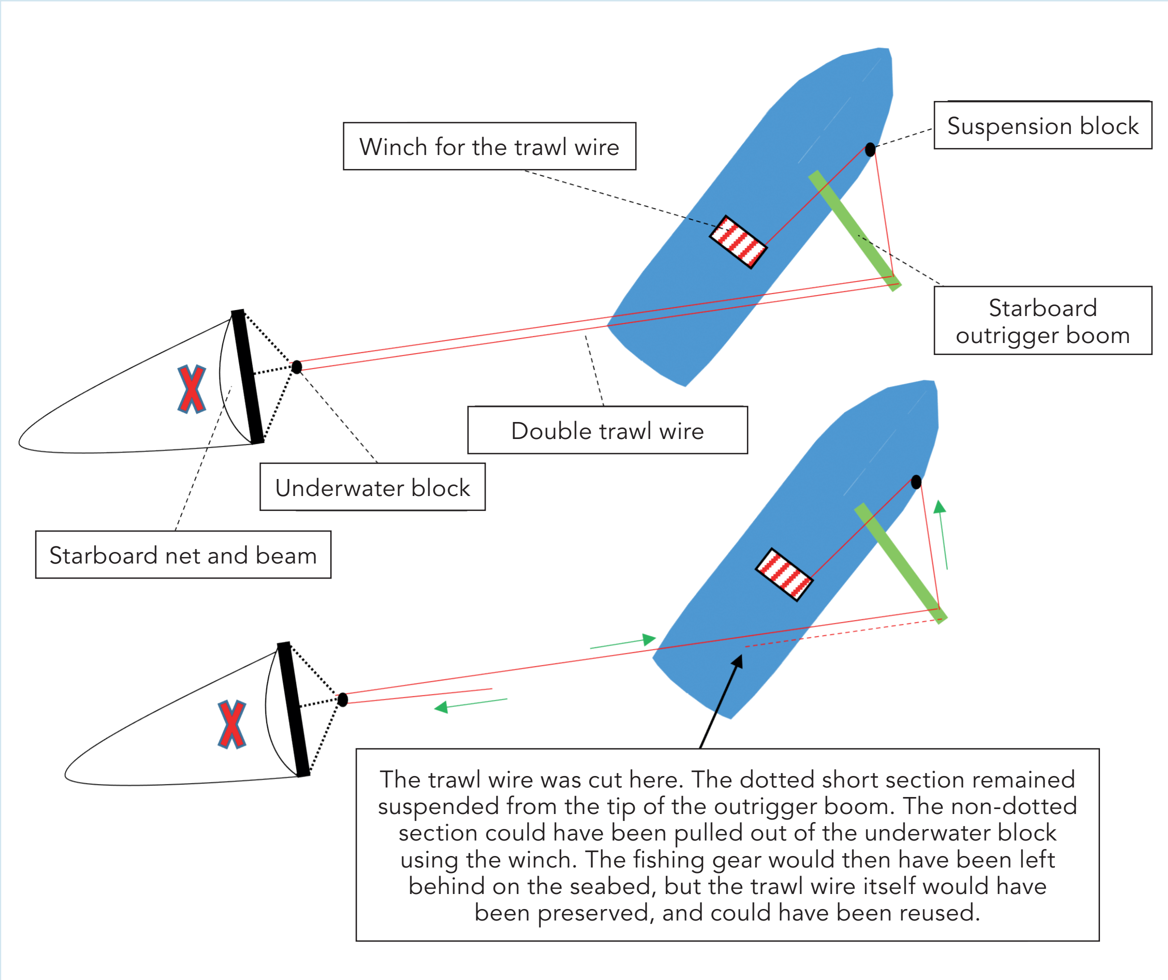


Figure 15: The cutting of the starboard trawl wire on the UK-171. (Source: Dutch Safety Board)

On the UK-171, the trawl wires were double run, as shown for the starboard side in diagrammatic form, in Figure 15. From the winch below the wheelhouse, the wire travelled via the suspension block to the tip of the outrigger boom, and from there to the underwater block, that was attached to the beam trawl and fishing net with a series of chains. The trawl wire then ran back to the tip of the outrigger boom, through the underwater block. At that point, the trawl wire was attached to the tip of the boom with a shackle.

The port outrigger boom was then once again set to an angle of 50 degrees, on board. The skipper then started hauling in the starboard trawl wire. He intended to pull the trawl wire through the underwater block on the starboard fishing gear back on board. During the hauling in of the starboard trawl wire, however, the wire became pulled taut underneath the fishing boat. In response, the skipper paid out the starboard trawl wire and started hauling in the portside trawl wire. When the underwater block from the port fishing gear came clear of the surface of the water, the skipper halted the hauling in operation. To bring the net closer to the vessel, the skipper intended to lift the port outrigger boom higher. At that moment, the fishing boat capsized over the portside.

To be able to determine as precisely as possible the course of events of the occurrence, further investigations were carried out to determine why it was not possible to haul in the starboard trawl wire, after it had been cut by the crew. The sonar image of the wreck appearing in Figure 16 provides an initial indication as to why it proved impossible to haul in the trawl wire.

In Figure 16, the contour of the hull of the wreck is shown in light blue. Both sets of fishing gear were found close together on the port side of the wreck. In the red-marked area, we also see the starboard trawl wire. This runs from the starboard bow of the vessel to the tip of the starboard outrigger boom and then appears to run under the wreck towards the two sets of gear. The starboard outrigger boom is marked within the green area. The dark-blue area surrounds the port trawl wire.

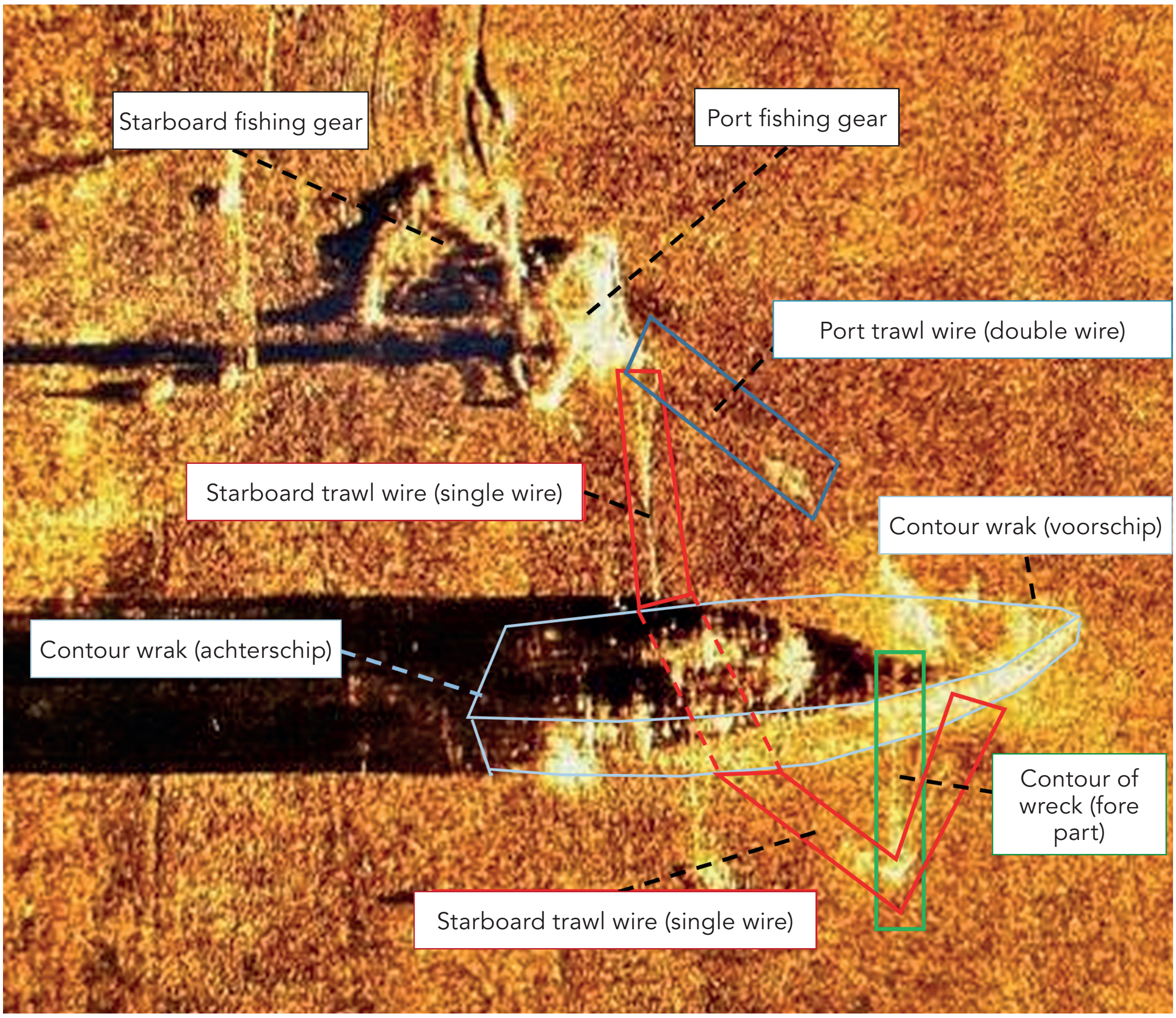


Figure 16: Sonar image of the wreck of the UK-171 on the seabed. (Source: Rijkswaterstaat)

The sonar image in Figure 16 appears to show the port and starboard fishing gear entangled together. If the starboard trawl wire had become trapped in this entanglement, that would explain why the starboard trawl wire could not be pulled through the underwater block.

This scenario was confirmed by underwater video recordings made by divers of the salvage company. These recordings show that a single part of the starboard trawl wire does actually run beneath the vessel. Figure 17 shows a number of screen shots from the video recordings. These recordings show that the starboard trawl wire is wrapped around the portside trawl wire.

This information also clarifies why during the hauling in of the port fishing gear, the starboard fishing gear was also raised. At a certain moment, the weight of both sets of fishing gear was suspended from the portside outrigger boom.

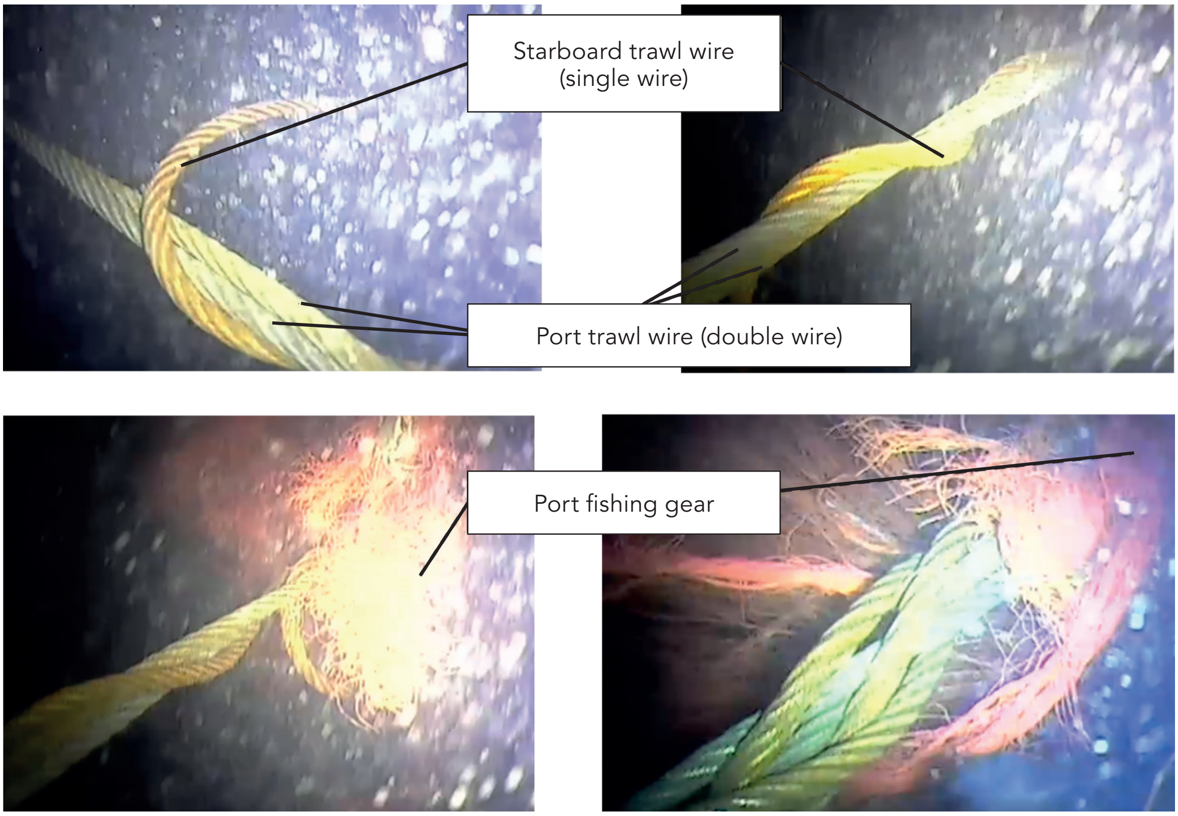


Figure 17: Starboard and port trawl wires UK-171 entangled. (Source: Multraship Towage & Salvage)

In the remainder of the investigation into the course of events, an attempt was made to determine how the two sets of gear were able to become entangled. The investigation included a study of the AIS data from the vessel, which made it possible in addition to the route followed, to also determine the compass course at each moment of that route as well as the direction in which the vessel was actually moving (course over the ground) and the speed through the water of the vessel.

These data were combined with the data from the underwater survey that was carried out by Rijkswaterstaat in the week following the occurrence. The aim of that survey was to determine whether the starboard fishing net had indeed become snagged behind an object on the seabed and what that object may have been. This resulted in the image in Figure 18.

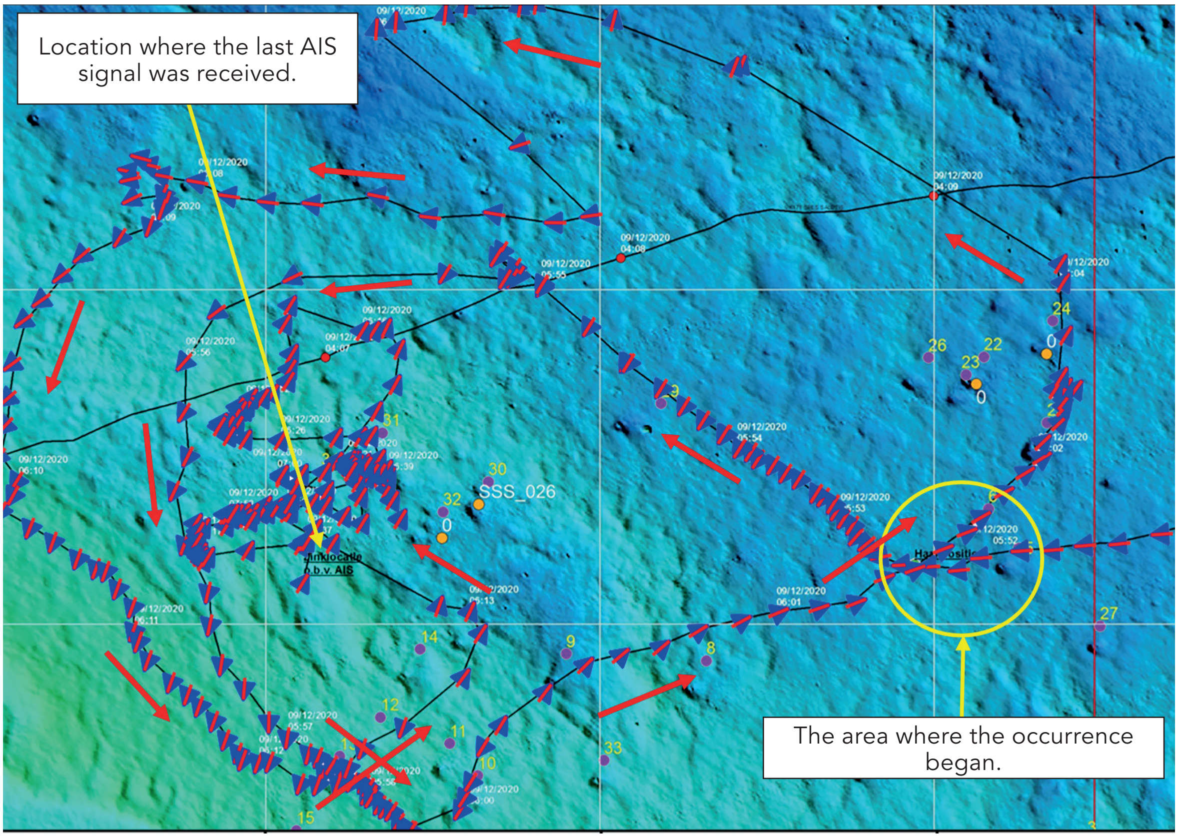


Figure 18: AIS data projected on an image of the seabed. The red arrows show the route of the UK-171. (Source: Rijkswaterstaat)

The AIS data shows that while fishing, the vessel maintained a fixed heading and fixed speed for a lengthy period of time. In the area marked in Figure 18 with a yellow circle, that period of fixed heading and speed ends abruptly. Thereafter there was no comparable period. This leads to the conclusion that the occurrence started in the area marked by the yellow circle. It was in this area that the deputy skipper felt the starboard fishing net jolt.

There are two rocks of sufficient format to be recorded in the underwater survey in the area marked by the yellow circle, but it is not possible to say with certainty that these rocks were actually involved in the occurrence. Moreover, no damage was observed to the nets, after they were recovered. There were no large rocks or other heavy objects in the nets. It was not possible to determine what caused the jolting of the starboard fishing gear.

In the statements by the crew, there is no clear timeline relating to the subsequent events. As a result, it was not possible to determine precisely where and when the events described by the crew took place. There are multiple possible scenarios which could explain why both sets of fishing gear became entangled, and there is too little information to determine with certainty which scenario is the only one to describe the course of events surrounding the entanglement.

3.2 Events following the capsizing

The deputy skipper and deckhand climbed onto the side of the vessel and were able to help the skipper escape from the wheelhouse, via the starboard door. The deputy skipper and deckhand were wearing self-inflating lifejackets. When the vessel turned completely upside down, the three crew members climbed onto the keel.
With the still operative mobile telephone that was in the possession of the deputy skipper, he called the German coastguard, but the call went to voicemail. He then called the home front who in turn notified the Dutch Coastguard. They then swam to the life rafts, released the lines that were still holding the rafts on place on the UK-171 and climbed aboard. After about ten minutes, they were rescued by the fishing boat TH-10 Dirkje.

course also possible to sound the alarm via telephone, but on the water, a standard mobile telephone does not always have reception. This depends among others on the provider. The emergency number for the Dutch Coastguard is 0900 0111. If it is not possible to make telephone contact with this number for technical reasons, the Dutch Coastguard can also be contacted via 112. The national Dutch 112 emergency control room immediately passes on any requests for assistance from within the area of responsibility of the Dutch Coastguard to the Coastguard Centre in Den Helder.

Based on the above description in this chapter, the course of events of the occurrence involving the UK-171 can be reproduced in the following chronological order of events:

06.52 While fishing, the starboard fishing gear suddenly jolted. The power to the propeller was shut down.

The skipper took over navigation in the wheelhouse. The two other crew members went on deck.

The crew attempted to raise both sets of fishing gear above the water.

The starboard trawl wire suddenly pulled taut over the wheelhouse, towards the port. The starboard outrigger boom swung upwards.

Attempts to manoeuvre the vessel between the trawl wires failed.

The starboard trawl wire was cut and the starboard outrigger boom was returned to a horizontal position.

The portside outrigger boom was set at an angle of approximately 50°.

The crew attempted to haul in part of the cut starboard trawl wire. This was unsuccessful. The trawl wire was trapped taut beneath the vessel, having become entangled with the port fishing gear.

The starboard trawl wire was paid out and the port fishing gear raised.

The starboard fishing gear was also suspended from the port outrigger boom, because the two sets of gear had become entangled.

09.44 The UK-171 capsized and the AIS signal from the UK-171 was lost.

4 STABILITY AND ASYMMETRIC LOADING CONDITIONS

With regard to the occurrence involving the UK-171, it was determined that the boat first capsized and then sank. For the UK-165, this could not be determined on the basis of the course of events. Based on an investigation into the stability of the UK-165, it was eventually possible to determine that the boat first capsized before it sank. This is described in section 4.1.1. The stability of the UK-171 during the occurrence is further elaborated in section 4.1.2.

The remainder of this chapter deals in further detail with asymmetric loading conditions on board beam trawlers with a length of less than 24 metres. It appears that prior to sinking, both the UK-165 and the UK-171 were subject to an asymmetric loading condition. On both vessels, at that moment, the weight of the port fishing gear was suspended on the portside outrigger boom, with no weight on the starboard boom.

4.1 Stability[18] of the UK-165 and UK-171 during the occurrences

4.1.1 Stability of the UK-165

The course of events as described in chapter 2 provides no conclusion as to why the UK-165 eventually sank. The information available did make it possible to approximately determine the nature of the situation on board at the moment of sinking. This was important because that information, backed up by stability calculations, made it possible to ascertain why the UK-165 sank. The situation on board was as follows:

- The vessel was sailing athwart of the waves;
- The hauled in port fishing gear was suspended on the extended port outrigger boom above the water;
- The port outrigger boom was set at an angle of approximately 45 degrees;
- After first having swung up against the mast in an almost vertical position, the starboard outrigger boom was also at an angle of approximately 45 degrees;

18 Ship stability is the degree to which a ship is able to re-right itself after it has become unbalanced. Appendix D.1. contains a simplified explanation of stability.

- The beam trawl and the fishing net were no longer suspended from the starboard outrigger boom. Only the trawl heads were still connected to the vessel. The trawl heads were discovered on the seabed, more than 60 metres behind the wreck of the UK-165. Because the water depth at the site of the scene could not have been more than 20 metres (chart depth plus tide), the trawl heads must have been resting on the seabed shortly before and during the sinking. As a consequence, the weight of the trawl heads was not suspended from the boom.

The stability calculations revealed the following: the sudden loss of the starboard net, accompanied by an abrupt loss of tension on the trawl wire resulted in a *heeling moment*[19]. This was accompanied by a sudden lateral displacement of the centre of gravity of the vessel, caused by the sudden folding upwards of the boom. This heeling moment caused the vessel to roll so far towards the port side along the longitudinal axis of the vessel that the deck was forced far under water. This was partly due to the fact that there was already an asymmetric loading condition, caused by the port fishing gear suspended from the port outrigger boom. The *stability arm* became negative, as a consequence of which there was no further *righting torque* to keep the vessel upright. In other words, the breaking clear of the fishing gear and sudden upward folding of the boom capsized the vessel immediately to port.

4.1.2 Stability of the UK-171

The course of events as described in chapter 3 provides no explanation as to why the UK-171 eventually capsized. It was possible to approximately determine the situation on board at the moment that the vessel capsized. This was important because that information, backed up by the stability calculations, made it possible to ascertain why the UK-171 capsized. The situation was as follows:

- The port fishing and the starboard fishing gear was suspended from the extended port outrigger boom, under water. The trawl block of the port fishing gear was just below the surface of the water;
- The portside outrigger boom was set at an angle of approximately 50 degrees;
- The starboard outrigger boom was in a horizontal position;
- The weight of the starboard fishing gear was no longer suspended from the starboard boom. Although the fishing gear was still connected to the starboard boom, there was sufficient slack in the line to mean that these weights did not act on the starboard boom;
- The entire starboard fishing gear was entangled with the port fishing net;
- Two nets with cables from the twinrig gear were present on board, rolled up around the net reel on the stern part.

The stability calculations revealed the following: at the moment that both sets of fishing gear were suspended together on the port boom, the UK-171 must have capsized directly to port. In this situation, the vessel was already somewhat heeled to port, with a negative stability arm and hence a heeling torque.

19 Force acting on the vessel causing it to heel over.

At the moment when only the port fishing gear was suspended from the port boom, the vessel was already heeled over. Even at that moment, the stability was reduced. When the starboard fishing gear was also lifted clear of the seabed, the vessel capsized so quickly that no further intervention was possible.

4.1.3 Non-permitted equipment for the fishery

The net reel on the stern part of both vessels was part of the equipment for otter board fishery. In the stability book for the UK-165 approved by the Human Environment and Transport Inspectorate (ILT), the requirement is listed that this net reel had to be removed from on board while fishing with beam trawls. With regards to the UK-171, the net reel was permitted to remain on board while fishing with beam trawls, but that the nets had to be removed from on board.

It became clear during the salvage that the net reel was still on board the UK-165. On the UK-171, it became clear that the nets on the reel had not been removed. The calculations showed that the stability of both vessels was reduced, as a consequence. Moreover, the calculations also revealed that the UK-165 would have capsized even if the net reel had not been on board. The UK-171 would also have capsized if the nets on the net reel had been left on shore.

Both the UK-165 and the UK-171 capsized before they sank. Both trawlers experienced a heeling moment that caused them to capsize.

For the UK-165, this happened at a moment when the stability had already been reduced because the port fishing gear was suspended from the port boom, with no (counter) weight suspended from the starboard boom. As a result, the vessel found itself in an asymmetric loading condition.

On the UK-171, the heeling moment was caused by the fact that the weight of both the starboard fishing gear and the port fishing gear were suspended from the port boom. There was no weight on the starboard boom. As a consequence, at any angle of list, the stability was negative. The fishing boat was already listing because in the first instance, only the weight of the port fishing gear was suspended from the port boom. For that reason, the UK-171 capsized immediately. There was no margin to respond on time.

The stability calculations revealed that the presence of additional fishing gear that was not allowed to be on board reduced the stability of both vessels. It also emerged that given these occurrences, even if this specific equipment had not been present on board, both vessels would have capsized anyway.

4.2 Asymmetric loading conditions

In the investigation into the course of events of the capsizing of the UK-165 and the UK-171, a series of stability calculations were carried out. As well as being able to determine the course of events, these calculations also led to a further observation. In the investigated cases, it became clear that the stability no longer satisfied the requirements imposed on the vessel in a so-called symmetric loading condition. For that reason, a number of additional situations were calculated that involved an asymmetric loading condition.

> The term symmetric loading condition refers to the condition in which vessels are not listing, and are therefore in principle floating upright, in the water. An asymmetric loading condition arises, for example, if there is more weight on one side of the vessel, than on the other. In that situation, the vessel is not floating upright, but with a permanent list.

Together with the outcomes of the calculations, the calculated situations appear in Appendix E.2.1. In combination with the various settings of the outrigger booms, various asymmetric conditions were simulated and calculated.

The findings were the same for all the investigated situations: in all cases, the stability was poorer than the minimum requirements laid down in legislation and regulations for symmetric situations. In other words, in each asymmetric loading condition, the vessel was endangered.

During the investigation, many (former) skippers of fishing boats were consulted. It emerged from these interviews that while fishing with beam trawls, it is common for the fishing gear to become caught on objects on the seabed. This can lead to a trawl wire breaking, or having to be cut. Another possible consequence is that the outrigger boom suddenly swings up against the mast. It is also common to find heavy rocks or other objects in the nets or for the nets to become filled with heavy sand. In this type of fishery, there is a real risk of the occurrence of asymmetric loading conditions. The occurrences involving the UK-165 and the UK-171 clearly show that these loading conditions can result in capsizing and sinking, with all the resultant risks for the crew.

Judgements by the Dutch Maritime Court[20] show that these risks have been recognized since the late nineteen eighties.

20 The Dutch Maritime Court (*Raad voor de Scheepvaart*) was a Dutch body that investigated accidents involving shipping. The Court also functioned as a disciplinary court, responsible for legal judgements. The Dutch Maritime Court was disbanded on 1 July 2010. A new body, the Maritime Disciplinary Court of the Netherlands (*Tuchtcollege voor de Scheepvaart*) took over the disciplinary tasks from the Dutch Maritime Court from 1 January 2010 onwards. The investigative tasks were transferred to the Dutch Safety Board. (Source: Dutch Maritime Court, via: https://web.archive.org/web/20131009233238/http://www.raadvoordescheepvaart.nl/index.php?menu=1&id=1).

A number of relevant accidents dealt with by the Dutch Maritime Court
In the period between 1985 and 1998, at least nine small fishing boats were lost. Two fishermen lost their lives. A number of the accidents dealt with during this period by the Court:

- On 16 August 1995, both of the fishing nets of the WR-15 Pieter Cornelis became filled with sand. To rinse the fishing nets clean, both outrigger booms were set to an angle of between 35 and 45 degrees, and both sets of fishing gear were hauled in as far as possible. In this process, the starboard boom bent double and the weight of the starboard fishing gear was applied to the bulwark. The port fishing gear was suspended from the still extended port boom. This resulted in an asymmetric loading condition and a negative stability. The portside winch refused to pay out, whereupon the WR-15 capsized.[21]
- On 6 November 1997, the two nets of the OD-52 Jet became filled, probably with sand. The crew was no longer able to raise the nets on board. They planned to run both nets aground in shallow water, where they hoped to be able to dive, to open the cod ends of the nets. At a certain moment, while sailing, one of the two nets ran aground sooner than the other, resulting in an asymmetric loading condition, causing the fishing boat to capsize immediately.[22]
- On 4 June 1998, the shrimp boat WR-22 Barend Jan ran aground, with both sets of gear. While attempting to free itself 'it has been concluded with certainty that an unbalanced weight distribution arose, and the fishing boat was overturned to starboard'.[23]

During the certification process for every fishing boat, stability calculations must be made and assessed. The law[24] describes precisely for which loading conditions the calculations must be carried out.

1. *Departure from port with destination the fishing grounds, fully equipped, with full bunkers and freshwater tanks and with ice or salt in the fish hold;*
2. *Departure to fishing grounds with a quantity of fuel and freshwater equivalent to 50 percent of the available capacity of the tanks and a quantity of cargo in the fish hold, which may be viewed as normal for this fishing method;*
3. *Return to port with a residue of fuel and freshwater equivalent to 10 percent of the available capacity of the tanks in question and otherwise laden as indicated in 2.;*
4. *Return to port with a residue of fuel and freshwater equivalent to 10 percent of the available capacity of the tanks in question. The fish hold contains a cargo equal to 20 percent of the cargo in the fish hold as intended in 2. For vessels equipped with a machine for the production of ice, it may be assumed that of the volume of freshwater intended for ice production, a greater residue remains on board; and*

21 https://zoek.officielebekendmakingen.nl/stcrt-1996-83-URS75.html
22 https://zoek.officielebekendmakingen.nl/stcrt-1999-38-URS190.html
23 Notification to the Deep Sea Fishing Industry 12/1989 – Stability.
24 Notification to the Deep Sea Fishing Industry 12/1989 – Stability.

5. *5. any other loading condition that occurs regularly and that results in considerably less favourable outcomes than the loading conditions as intended in 1. through to 4.*

When it came to approving the stability calculations for the UK-165 and the UK-171, only those situations in points 1 through to 4 were submitted and assessed. These situations related only to a 'symmetric loading'. In other words, situations in which the setting of the outrigger boom and the positions of the beam trawl gear are identical on the port and starboard sides. These are not situations in which for example the gear is missing or is resting on the seabed on one side, while the other gear is suspended from the boom. Consultation with the Human Environment and Transport Inspectorate (ILT) revealed that the inspection of stability calculations on fishing boats with beam trawl gear assume only symmetric loading conditions.

Legislation and regulations

The legislation and regulations for the fishing industry are laid down at international, European and national level. Within this legislative framework, a distinction is made between fishing boats with a length of up to 24 metres and boats with a length of more than 24 metres. The applicability of the regulations also depends on the year of construction of a vessel. In the Netherlands, the ILT is responsible for ensuring compliance with legislation and regulations for fishing vessels.

The Ships Act (*Schepenwet*) specifies requirements on the seaworthiness of vessels and obligations on the captain. The Fishing Vessels Decree (*Vissersvaartuigenbesluit*) 1989 is a further elaboration of the Ships Act containing specific safety requirements for fishing vessels with a length of up to 24 metres. The regulations in this Decree for construction and equipping only apply for vessels predating 1989, if practically implementable and reasonable[25], as judged by the head of the Shipping Inspectorate.[26] Against that background, for example, the UK-165 was not obliged to satisfy the requirement of being able to exit from the wheelhouse via a door on the starboard and a door on the port side. This regulation only became part of legislation after 1989. The UK-171 was also built before 1989, but was equipped with outer doors on both the port and starboard side of the wheelhouse.

If the fishing vessel satisfies these regulations, a Certificate of Seaworthiness is issued.[27] Vessels with a length of more than 24 metres are subject to the Fishing Vessels Decree 2002.

The legislation in the Fishing Vessels Decree is supplemented by Notifications to the Deep Sea Fishing Industry (BadZ). Relevant to this investigation were notifications BadZ 12/1989 - Stability and BadZ 02/1989 - Safety Measures for Beam Trawl Fishery. In these Notifications, the stability requirements for fishing vessels are specified. They also contain the safety measures that must be taken for vessels involved in beam trawling. For vessels longer than 24 metres, these additional regulations are contained in what are known as ministerial orders.

The findings relating to the stability in the asymmetric condition that arose during these occurrences are worrying, specifically because the stability in fact satisfied the standards in the symmetric loading conditions. The asymmetric conditions that can occur on board are not considered by the ILT in evaluating the loading conditions. For that reason, asymmetric conditions are not a subject of the certification process and, on the basis of the stability book, there is no obligation on board to understand stability in these asymmetric conditions. This means that the law offers space for interpretation of the term ‘loading condition’.

25 Fishing Vessels Decree Article 361(3).
26 The Shipping Inspectorate is today part of the Human Environment and Transport Inspectorate (ILT).
27 Fishing Vessels Decree Article 22(1).

The investigation into the course of events, however, shows that the risk of asymmetric loading conditions on the UK-165 and the UK-171 was considerable. The occurrences investigated by the Dutch Maritime Court reinforce the suspicion that on fishing vessels with a length of less than 24 metres, the substantial loss of stability due to the occurrence of an asymmetric loading condition is a commonly occurring risk.

As part of this analysis, therefore – over and above the investigation into the direct course of events – the stability in various asymmetric loading conditions has been considered in greater detail.[28] In this analysis, calculations were carried out for three different beam trawlers with a length of less than 24 metres. In addition to the UK-165 and the UK-171[29], the third vessel was the TX-21 Pieter van Aris.[30] The TX-21 was chosen because it is a modern fishing boat of a design relatively common on the North Sea. This method resulted in a clear picture of the stability in asymmetric loading conditions of beam trawlers of comparable dimensions.

Figure 19 shows the various situations investigated, with an indication for each vessel of whether, in the asymmetric loading condition, it still satisfied the statutory standards applicable for the specified loading conditions. In the case of each calculation, the settings of the outrigger booms and the positions of the shrimp gear are altered, such that the vessel was (fictitiously) placed in a new balance situation.

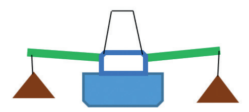
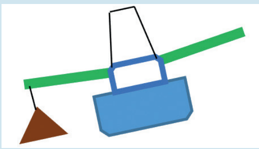
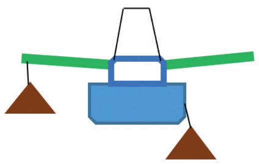
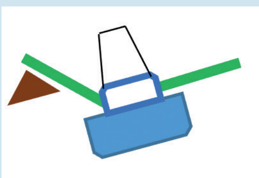
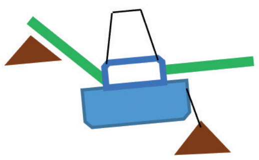
In addition, all calculations were as far as possible made with the principles outlined in Figure 19. Any deviations are listed per calculation in Appendix E:

28 A simplified explanation of stability appears in Appendix E. This appendix also contains more detailed results of all the stability calculations carried out, including the so-called stability curves.

29 After the calculations had been made, the outrigger booms of the UK-171 each turned out to be one metre longer. Appendix E.4.3 shows that as a result the stability was compromised even further, but this fact had no influence on the outcome of the investigation.

30 With the permission of the owner.

Asymmetric loading conditions		
	Crew	2 persons, 175 kg (selected on the basis of compulsory minimum crewing numbers on the UK-165)
	Supplies such as food	250 kg (estimated)
	Catch	1000 kg (selected)
	Ballast tanks (fore peak /after peak)	Empty (assumed)
	Spare net in storage area in fore part	160 kg (determined)

No.	Situation diagram	Description	Satisfies standards for symmetric loading conditions		
			UK-165	UK-171	TX-21
1		• Symmetric loading condition	Yes	Yes	Yes
2		• Both booms horizontal; • Port gear raised to block • Starboard fishing gear missing	No	No	No
3		• Both outrigger booms horizontal; • Port gear raised to block • Starboard fishing gear raised to gangway using slip constructions and suspended there clear of seabed	No	No	No
4		• Port boom at 45° setting • Port gear raised to block • Starboard boom horizontal • Starboard fishing gear missing	No	No	No
5		• Port boom at 45° setting • Port gear raised to block • Starboard boom horizontal • Starboard fishing gear raised to gangway using slip constructions and suspended there clear of seabed	No	No	No

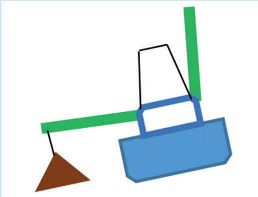
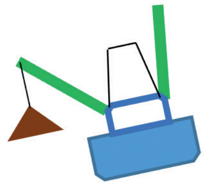
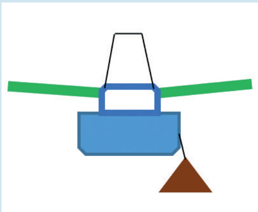
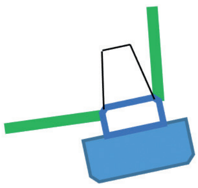
Asymmetric loading conditions					
6		• Port boom horizontal • Port gear raised to block • Starboard boom vertical • Starboard fishing gear missing	No	No	No
7		• Port boom at 45° setting • Port gear raised to block • Starboard boom vertical • Starboard fishing gear missing	No	No	No
8		• Both outrigger booms horizontal • Port gear missing • Starboard fishing gear raised to gangway using slip constructions and suspended there clear of seabed	No	Yes	No
9		• Port boom horizontal • Starboard boom vertical • Both sets of gear missing	Yes	No	No

Figure 19: Various asymmetric loading conditions UK-165, UK-171 and TX-21. (Source: Dutch Safety Board)

The investigation revealed that on three investigated vessels, with the exception of situation 8 on the UK-171 and situation 9 on the UK-165, stability no longer satisfied the standard for symmetric loading conditions, as soon as the gear and/or outrigger booms on board were affected in a way that caused an asymmetric loading condition.

This is worrying, specifically because situations arise on board with considerable regularity that can easily result in such an asymmetric loading condition. Examples include nets becoming filled with sand, heavy rocks in the net and the snagging of the gear on a wreck or other obstacle.

Nonetheless, these asymmetric conditions are not assessed during the certification process for the fishing vessels, and to date no reason has arisen to have these asymmetric conditions calculated, for example during the design phase for new vessels. Asymmetric conditions are indeed not part of the stability books that have to be produced for the purposes of certification.[31]

31 Stability books must be approved by the ILT.

Stability in asymmetric loading conditions was investigated on three beam trawlers with a length of less than 24 metres. It became clear that on all three vessels, the stability no longer satisfies the standards for symmetric loading conditions, as soon as the gear and/or outrigger booms on board are affected in such a way that an asymmetric loading condition occurs. At the same time, it is observed that situations of this kind occur with some regularity.

Legislation fails to ensure that these conditions are included in the certification process, and also fails to ensure that they are considered in the stability book that must be present on board every fishing boat. There is also no means of ensuring that in the vessel's design phase, asymmetric loading conditions are taken into account, in terms of stability.

4.3 Potential for response

To prevent vessels ending up in unfavourable or even dangerous situations in terms of stability, crew members must know how to respond in a variety of (unintended) situations. There must be sufficient potential for response on board to be able to prevent very serious occurrences such as those involving the UK-165 and the UK-171.

Training

One method of mitigating the danger of compromised stability in various situations is including knowledge of this aspect in the training provided. At the very least, improved awareness and guidelines according to which measures can be taken on board would offer crew members a potential for response in making choices in sudden dangerous situations as a result of asymmetric loading.

In response to the findings of this investigation, the Safety Board consulted with each of the Dutch training institutes for sea fishing. What emerged was that the basic principles of stability are a compulsory component of fishery training programmes. Attention is also paid during the training programmes to what happens when heavy objects are moved on board.

Nonetheless, it is important that the theory on these issues be clear and simply related to all practical situations that may occur on board, without having to consider the relevant complex calculations. Besides the fact that in such emergency situations there is no time to make the necessary calculations, for a proportion of trainee skippers, an understanding of the potential dangers of asymmetric loading conditions can only be communicated on the basis of a clear link between theory and practice.

To be permitted to sail as a skipper on a fishing vessel of up to 24 metres, the skipper must at least have obtained the SW6 certificate[32]. In the Dutch education system, this training is considered equivalent to an MBO level 2 course (basic vocational education). At this level, students are practically oriented, and are not required to deal with any major theoretical challenges. As a rule, more complex stability calculations are reserved for students of MBO level 3 (SW5) and higher.

However, the specific problem of the stability in asymmetric conditions that can occur on board is not a compulsory part of the curriculum. The level of attention focused on this subject depends on the individual school, and the personal knowledge and experience of the teaching staff. One subject that is often discussed is the urgent actions that have to be taken on board without delay in order to prevent a vessel capsizing, as an immediate consequence of the snagging of the fishing gear. During these classes, asymmetric loading conditions are barely discussed, if at all.

Stability book

Article 69 of the Fishing Vessels Decree specifies:

"Sufficiently accurate and reliable data regarding the stability of the vessel must be provided to the captain, to allow him to be able to rapidly and simply assess the stability of the vessel, under a variety of operating conditions. If necessary, the data must include specific instructions for the captain warning him of operating conditions that can have an unfavourable influence on the stability or trim of the vessel. The stability data must be presented to the Head of the Shipping Inspectorate, for approval."

The above mentioned stability book is used to comply with this obligation. It was already concluded in section 4.2 that unfavourable asymmetric loading conditions[33] are not included in the stability book. For this reason, the stability book contains no specific instructions that warn of asymmetric loading conditions with an unfavourable influence on stability. Here, too, the asymmetric loading conditions that can occur on board are not taken into account by the ILT in assessing the loading conditions.

Slip construction

It is generally known and represents a lesson learned from previous accidents, that the pulling free of a fishing net snagged on the seabed is an enterprise that can compromise stability, if carried out 'over the tip of the boom'.

32 Article 28g of the Seafarers Decree (*Besluit Zeevarenden*).

33 In the Fishing Vessels Decree, the term 'operating condition' is used. In the Notifications to the Deep Sea Fishing Industry no. 13, referred to in the Decree for further elaboration, these operating conditions are designated as 'loading conditions'.

Pulling a net free 'over the tip of the boom' means that a winch is used to pull on the trawl wire while the trawl block remains suspended at the tip of the boom. The force applied by the winch to the trawl wire is then applied to the ship, via the tip of the boom. Because the tip of the boom is located so far from the point of rotation of the vessel, it generates a considerable heeling moment. As a consequence, the gear and the winch are strong enough to pull the vessel over (capsize the vessel) if the net remains snagged on the seabed. For this reason, pulling snagged nets free via the tip of the boom is prohibited in law, as laid down in the Notification to the Deep Sea Fishing Industry no. 2-1989 (*safety measures beam trawling*).[34]

The law also requires the presence of a so-called slip construction[35] on vessels built after 1969. Using this construction, the crew can lower the trawl block from the tip of the boom to a suspension block near the bulwark. The force from the trawl wire is then transferred to the vessel via the suspension block. In this situation, the block is far closer to the rotation point of the vessel. As a result, in an attempt to pull the net free, the maximum heeling moment that can occur can remain far lower.

On the UK-165, as the situation arose, it was standard practice to first haul in the non-snagged net, and to raise the boom far enough to be able to reach the net. This meant that the rear end of the fishing net (cod end) could be brought on board. In Figure 19, this is situation 5. It is clear that in this situation – in other words with the slip block in use and the weight of the net suspended from the slip block – the stability of all three vessels is compromised. In addition, in this situation, the force needed to pull the net free is not yet taken into account. Situation 3 in Figure 19, in which both booms are positioned horizontally, is also unsafe.

34 Notifications to the Deep Sea Fishing Industry no. 2-1989, Article 2(3).
35

Fishing boats with a length of less than 24 metres, involved in beam trawling, can become dangerously unstable too easily, in the event of asymmetric loading conditions.

The competences necessary to enable crews to recognize and prevent dangerous asymmetric loading conditions are not a fixed element of the curriculum taught in fishery training programmes. Moreover, legislation and regulations fail to guarantee that crew members on board are fully aware of the risks of asymmetric loading conditions on the vessel they are sailing on.

These factors restrict the potential for the crew to respond if such conditions do occur on board. In addition, these factors have a negative impact on the prevention of dangerous asymmetric loading conditions. This increases the risk that crew members unconsciously compromise the stability of their vessel through incompetence, even if the safety systems on board are deployed. This can for example be the case in the event of the use of the slip construction for the trawl block at the tip of the boom.

5 CONCLUSIONS

The UK-165 Lummetje and the UK-171 Spes Salutis capsized prior to sinking. Both trawlers experienced a heeling moment that caused them to capsize. The two crew members of the UK-165 lost their lives. They were unable to escape from the wheelhouse on time. The three crew members of the UK-171 did succeed in saving themselves and each other. They were rescued on time.

Both the UK-165 and the UK-171 faced an unintended occurrence affecting one of the sets of gear. Nonetheless, this occurrence itself was not the direct cause of the capsizing. The snagging of the UK-165 on the wreck of the Ruth did not result immediately in the capsizing of the trawler. In the case of the UK-171, the jolting of the gear was not the direct cause of the capsizing. The swinging upwards of the starboard outrigger boom on the UK-171 was also not immediately fatal for the vessel.

On the UK-165, following the snagging of the gear, in accordance with fixed procedures, measures were taken on board. Firstly, the port outrigger boom was raised slightly and the port fishing gear was lifted up to the boom, to prevent the port fishing net becoming entangled in the propeller. This resulted in an asymmetric loading condition. The investigation revealed that this condition dangerously compromised the stability of the vessel, leaving practically no further margin to compensate for any unexpected heeling moment. Eventually, the sudden breaking free of the starboard gear generated the fatal heeling moment.

On board the UK-171, after a series of actions, the decision was eventually taken to leave the starboard fishing gear behind on the seabed. After the trawl wire had been cut, and the starboard outrigger boom was returned to the horizontal position, the port gear was retrieved from the seabed. This led to the same type of asymmetric loading condition as on the UK-165. Here, too, the investigation revealed a dangerous compromising of the stability of the vessel, eradicating all margins for compensating for any subsequent unexpected heeling moment. The heeling moment that proved fatal for the UK-171 was caused by the weight of both the starboard and port gear. Both sets of gear were suspended from the port side outrigger boom, while simultaneously there was no further weight at all, on the starboard outrigger boom.

On board both vessels, equipment was found that was intended for otter board fishery and which, as outlined in the stability books on board, should not have been on board during beam trawl fishing. On the UK-165, the equipment in question was the net reel on the stern part. On the UK-171, it included the nets on the net reel. The stability calculations revealed that the presence of this equipment on both vessels reduced their stability. It also emerged that given these occurrences, even if this specific equipment had not been present on board, both vessels would have capsized anyway.

The above findings provided the Safety Board with grounds to further investigate the influence of asymmetric loading conditions on the stability of beam trawlers. The investigation was carried out on three beam trawlers with a length of less than 24 metres: the UK-165, the UK-171 and the TX-21. In almost all asymmetric loading conditions investigated, the stability no longer satisfies the requirements laid down in legislation and regulations.

Legislation fails to ensure that these loading conditions are taken into account in the certification process for seagoing trawlers. As a consequence, it is unknown how seriously the stability is compromised in asymmetric loading conditions. This investigation revealed that:

1. In beam trawl fishery there is a real risk of an asymmetric loading condition;
2. On three beam trawlers with a length of less than 24 metres, the stability was rapidly and dangerously compromised.

The competences necessary to enable crews to recognize and prevent dangerous asymmetric loading conditions are not a fixed element of the curriculum taught in fishery training programmes. Moreover, legislation and regulations fail to guarantee that crew members on board are fully aware of the risks of asymmetric loading conditions on the vessel they are sailing on.

Knowledge of the risks of instability in the event of asymmetric loading conditions is not guaranteed. If that knowledge is not present, it restricts the potential for the crew to respond if such conditions do occur on board. This has a negative impact on their ability to recognize and prevent dangerous asymmetric loading conditions. This in turn increases the risk that crew members unconsciously compromise the stability of their vessel through incompetence, even if the safety systems on board are deployed. This applies for example to the use of the slip construction for the trawl block at the tip of the outrigger boom.

The Safety Board concludes there is no insight into the extent to which the stability of beam trawlers is compromised in asymmetric loading conditions. A surprising conclusion from this investigation is that for beam trawlers with a length of less than 24 metres, in asymmetric loading conditions, the stability can be dangerously compromised.

The Safety Board also concludes that the risks of asymmetric loading conditions are therefore considerable. The risk of asymmetric loading conditions occurring is real and can lead to very serious and potentially fatal occurrences.

Finally, the Board concludes that the failure to include stability under asymmetric loading conditions in the design and certification processes, in stability books and in fishery training programmes contributes to the fact that the risks occurring in the event of asymmetric loading conditions on beam trawlers with a length of less than 24 metres remains unrecognized.

6 RECOMMENDATIONS

The investigation focuses on the occurrences involving the UK-165 and the UK-171. Both vessels were beam trawlers with a length of less than 24 metres. To chart out the safety risk for trawlers of capsizing and sinking as a result of dangerous asymmetric loading conditions and with a view to achieving safety improvements, it is recommended that a more broad-based investigation be carried out within the entire sector. That investigation should focus on all trawlers - both those with a length of less than and more than 24 metres.

The Dutch Safety Board issues the following recommendations.

To the Minister of Infrastructure and Water Management:

1. Recognize that asymmetric loading conditions occur regularly on beam trawlers and that the stability of these vessels can be considerably less favourable than in symmetric loading conditions. On that basis, calculate and analyse the stability in asymmetric loading conditions as part of the legal certification process.
2. Ensure full compliance with the statutory obligations to include in the stability book loading conditions that have an unfavourable influence on vessel stability, and provide specific relevant instructions. Do this by also including asymmetric loading conditions in the stability book. Involve the fishery sector in drawing up these specific relevant instructions.
3. Investigate the scale of the safety risk of the capsizing and sinking of trawlers as a result of dangerous asymmetric loading conditions within the entire Dutch trawler fleet. Include all fishing vessels in this investigation, irrespective of their length. Take measures to counter this safety risk.

To the Fishery Sector Council Foundation (Stichting Sectorraad Visserij):

4. Ensure that crews of beam trawlers with a length of less than 24 metres receive structural information on the risk of dangerous instability in the event of asymmetric loading conditions. Assist the Minister of Infrastructure and Water Management in drawing up specific relevant instructions which must be included in the stability book in the event of loading conditions with an unfavourable influence on vessel stability.

The competences necessary to enable crew members to recognize and prevent dangerous asymmetric loading conditions are not a fixed element of fishery training programmes. To improve the potential for response by (future) skippers, the Safety Board issued the following recommendation:

To the Foundation for Cooperation on Vocational Education, Training and Labour Market (Samenwerkingsorganisatie Beroepsonderwijs Bedrijfsleven) and Industry and the Fishery Sector Council Foundation:

5. Ensure that within fishery training programmes, attention is focused explicitly on the safety risk of asymmetric loading conditions and how to respond in practice to manage this risk. Include this in the teaching material, for example.

In addition to improving the potential for response by skippers, it is equally important that safety gains be achieved through improvements in vessel design. For that reason, parties within the maritime manufacturing industry must also be involved in preventing the safety risk of asymmetric loading conditions on fishing vessels. These parties include shipyards, shipbuilders and ship designers. In the Netherlands, all these parties can be reached via the sector organization Netherlands Maritime Technology.

To Netherlands Maritime Technology:

6. Ensure that parties in the maritime manufacturing industry are informed of the safety risk of dangerous instability in the event of asymmetric loading conditions. Arrive at a situation in which these parties contribute to preventing this safety risk by including the principle of maintaining stability in asymmetric loading conditions in the design, construction and conversion of fishing vessels, and fishing equipment.

APPENDIX A

Accounting / justification of the investigation

A.1 Background to the investigation

In accordance with EU Directive 2009/18/EC and the Dutch Safety Board Act, the Dutch Safety Board has a legal obligation to investigate certain types of shipping accidents. On 28 November 2019, pursuant to this obligation, the Safety Board launched an investigation into the loss of the beam trawler UK-165 Lummetje near Texel. The two crew members lost their lives in this occurrence.

During the course of the investigation into the loss of the UK-165, it became clear that from a certain point, the vessel was insufficiently stable. A series of events and coincidences meant that the beam trawler eventually capsized.

While the investigation into the loss of the UK-165 was in full swing, the beam trawler UK-171 Spes Salutis was lost to the north of the Rottumerplaat on 9 December 2020, after capsizing. All persons on board were rescued. Because in the run-up to capsizing, the UK-171 also became insufficiently stable at a certain point, the decision was taken to combine the investigations into the loss of the two trawlers.

A.2 Investigation questions

Trawlers regularly become snagged on obstacles, with their nets. In the vast majority of cases, the vessels do not sink as a consequence. To determine the cause of the sinking of the UK-165 and UK-171, it was necessary to reconstruct the situation on board at the moment of capsizing as accurately as possible.

The purpose of this investigation is to answer the following investigation questions:

1. What are the direct and indirect causes of the capsizing and sinking of the trawlers?
2. What lessons can be learned from the investigation into these occurrences?

A.3 Demarcation

The immediate reason for launching the investigation was the occurrence with the UK-165 Lummetje. Because the wreck of the UK-165 could not be recovered during the first months of the investigation, it was expected that a great deal of important information would be lost the longer the wreck remained on the seabed. The realistic way in which the team approached this expectation meant that the initial focus of the investigation was limited to the following underlying causes and factors:

- Engine power;
- The vessel as the weak link;
- Loss of stability;
- Weather conditions and sea conditions;
- Correct wreck data on the chart.

On the basis of information shared with the Safety Board during the investigation, a further investigation question was added:

- How did the Search and Rescue operation (SAR operation) run and did this have any influence on the chances of survival of the crew of the UK-165?

Once the wreck of the UK-165 was recovered and investigated in June 2020, a number of the causes and factors listed above could be excluded. By analysing the investigation data, the focus was placed increasingly on the question of stability in asymmetric loading conditions.

Precisely in the period when the investigation became focused on stability, the UK-171 Spes Salutis capsized and sank. In the initial phase of the investigation into that occurrence, it became clear that here, too, stability had been a factor. For that reason, the Safety Board decided to combine the two investigations.

A.4 Investigation approach

During the course of the investigation, the Dutch Safety Board collected a great deal of data.

UK-165

Initially only sonar images and video recordings of the wreck of the UK-165 taken by divers were available to the investigation. Based on interviews with former crew members of the UK-165, photographs, technical drawings of the vessel and a model built using simple means, combined with interviews with experienced fishermen from other fishing boats, it was possible to partly reconstruct the course of events. However, this was insufficient to obtain a complete and workable overview of the situation on board. For the purposes of the investigation, it was therefore essential to recover the UK-165 from the seabed. Eventually, the beam trawler was brought to the surface in June 2020, approximately seven months following her sinking, in the presence of investigators of the

Dutch Safety Board. On the instructions of the Safety Board, the vessel was subsequently made available for investigation.

Using the data available, it was possible to reconstruct the situation on board at the moment of sinking. Stability calculations were made for the situation during the sinking of the fishing boat. Using those data, it was also possible to ascertain what must have happened on board, between the moment at which the fishing boat snagged on the wreck and when she subsequently capsized.

UK-171
In the investigation into the occurrence involving the UK-171, information was collected in a similar way to the UK-165 investigation. The reports of the crew members quickly made it clear that the boat had first capsized, prior to sinking. In addition to the information supplied by the crew members, within just one week, sonar images and underwater survey data from Rijkswaterstaat were made available. Together with underwater pictures from the salvagers, our own observations during the salvage operation and an investigation of the wreck following its recovery, here, too, it was possible to reconstruct the situation on board during the capsizing, and to carry out stability calculations.
Public sources and consulted documents

The Safety Board requested documentation from various stakeholders:

- Dutch Coastguard;
- The Royal Netherlands Navy Hydrographic Service;
- Rijkswaterstaat;
- Training institute ROC De Friese Poort;
- Training institute ROC Kop van Noord-Holland;
- Training institute Scalda;
- Human Environment and Transport Inspectorate (ILT).

In a number of cases, interviews were held or telephone conversations made to representatives of these organizations. One public source[36] provided a wealth of knowledge about beam trawl fishery, relevant to the investigation.

Legislation and regulations
In addition to the document study, interviews and conversations, the Safety Board mapped out and analysed the relevant legislation and regulations.

A.5 Method of investigation into the course of events

Based on the information collected as described above, it was not possible to immediately determine the precise course of events, with absolute certainty. Despite the volume of data, there were initially too many uncertainties about the course of events. For that reason, in the investigation into the course of events, the Safety Board decided to employ

36 www.vistikhetmaar.nl.

an ‘uncertainty tolerance’ approach. In other words, specifically taking the uncertainties in the analyses into account, by allocating them a central role. According to this method, for the occurrence involving the UK-165, only one scenario for the course of events eventually proved viable. With regard to the occurrence involving the UK-171, however, it was not possible to determine the entire course of events.

Although uncertainty does offer space for interpretation, that space remains finite. The space for interpretation is bound by what is known (the facts) and by other limiting factors such as the laws of nature and what is and what is not technically feasible. The interpretation space is further limited by knowledge of and experience in working within the sector in question. The limiting and restricting factors provided guidelines during each stage of the reconstruction process, within which multiple sub scenarios were assessed. By consistently excluding impossible sub scenarios, in the ideal situation, only one scenario remains (in other words, conclusion through exclusion). If at any point in the construction process multiple scenarios still prove possible, the process has to be halted, to allow lessons to be learned from the process up to that point.

In this investigation, the Safety Board made use of technical analyses and the knowledge and experience available in the fishery sector as limiting and restricting factors, to make up the interpretation space. On that basis, sub scenarios could be excluded. This was made possible according to the question: which sub scenarios fit both the uncertainties and the limits to interpretation, and which do not? In other words, during each stage of the reconstruction process, the Safety Board drew up multiple sub scenarios, and tested these against the available data, and verified the outcome against the limiting and restricting factors. Eventually, only one possible scenario remained for the course of events. The use of this method and its outcome are above all reflected in the investigation into the course of events into the occurrence involving the UK-165.

A.6 Analysis

The information available in this investigation was analysed according to the linear causal analysis method.

Method

A large number of different methods have been developed for analysing accidents and safety risks. The large number of methods available does not necessarily mean that accidents can be analysed in many different ways. The majority of methods are very similar, but use different jargon or are adapted to a specific sector, for example. Methods for analysing accidents can broadly be divided into two categories.

1. Linear-causal methods
2. Systemic methods

The majority of the analysis methods available are linear-causal methods. These methods start with the direct causes of the accident and work back to identify underlying causes. They do this for example by chronologically examining which causal events and/or circumstances preceded the accident, by considering barriers that failed and then studying the causal path to the underlying causes. Another technique examines human errors, classifies these errors and causal errors at a higher level, or applies a flowchart/decision-tree-based system.

The systemic methods view accidents as a symptom of an unsafe system. The aim of these techniques is to examine the interactions and feedback loops within and between the components that make up the system. The assumption is that by identifying and analysing shortcomings of this kind within the system, safety can be improved. These methods barely refer to causes of accidents or accident factors, but instead discuss mechanisms and functions of the system.

A.7 Cooperation with third parties

During the course of the investigation, the Safety Board worked alongside the Infrastructure Service of the National Police Unit. Members of the EXO division of the Traffic Specialist Team of this Service and of the Maritime Police Team were involved in the investigation, after the Netherlands Public Prosecution Service (OM) decided to not undertake any further (criminal) investigation. Both teams provided technical and staff support, and shared their investigation material with the Dutch Safety Board, with permission from the Public Prosecutor.

Naval engineers from Scheepsbouwkundig Bureau Herman Jansen B.V. were commissioned by the Safety Board to carry out the stability calculations necessary for this investigation.

A.8 Quality Assurance

To guarantee the quality of the investigation, the following steps were taken:

- Scheepsbouwkundig Bureau Herman Jansen B.V. were also involved in carrying out compulsory stability calculations prior to the certification of both the UK-165 and the UK-171. To guarantee an objective assessment of the findings, the calculations carried out as part of this investigation were also submitted to SB Shipbuilding Solutions B.V., as a second expert organization;
- Assessments were also carried out by colleagues from the Shipping, Research & Development and Administrative Affairs, Consultancy and Communication departments. These assessments were focused on critically challenging and arguing hypotheses, assumptions and underlying theoretical frameworks, and identify any potential blind spots.
- In accordance with the Dutch Safety Board Act, a draft version of this report was submitted to the involved organizations and persons, with the request to check the report for errors, omissions and inaccuracies and to provide comments where applicable. Appendix B lists those parties that were given access to the draft report and how their responses were processed.

A.9 Project team

The project team consisted of the following persons:

Name	Position
Prof. M.B.A. van Asselt	Board member, portfolio holder
Dr A. Umar	Investigation manager
M. Schipper	Project manager, investigator
M. Rustenburg	Investigator
E.V. de Vilder	Investigator
R.J.H. Damstra	Investigator
R.D. de Wit	Secretary
Y.S.A. Balk	Secretary
Dr E.M. de Croon	R&D consultant
Dr A.E.Q. van Delden	R&D consultant
Dr C.F. Smeets-Hekkink	Investigator
H. J. Korver	Investigator
L.A. van Vliet	Investigator
F. Gisolf	Investigator
R. Smits	Investigator
S. Lalmohamed	Project support

APPENDIX B

Reactions to the draft report

As laid down in the Dutch Safety Board Act, a draft version of this report was presented to the next of kin of the crew members of the UK-165 Lummetje. The crew members of the UK-171 were also given (partial) access to the draft report. They were asked to check (parts of) the report for factual inaccuracies and uncertainties.

The same request was put to the following stakeholders:

- Dutch Coastguard;
- Minister of Defence;
- Minister of Infrastructure and Water Management.

The reactions received were dealt with in the following manner:

- Rectifications to factual inaccuracies, additions at detail level and editorial comments were adopted by the Safety Board (wherever relevant). The appropriate sections of text have been adjusted in the final report.
- Wherever the Dutch Safety Board did not adopt the content of reactions, an explanation is given as to why the Board made that decision.

All reactions and the explanatory notes appear in a table that can be accessed via the website of the Dutch Safety Board (www.safetyboard.nl).

APPENDIX C

Fishing gear for beam trawling

C.1 Fishing gear for beam trawling

This section explains in more detail the fishing gear on board a beam trawler. In the drawings, the UK-165 is taken as a model but the principle is the same as on all beam trawlers with the accommodation and wheelhouse at the stern.

To be able to fish with beam trawls, *outrigger booms* have been installed on both sides of the boat. In Figure 20a, the starboard boom is shown in green.

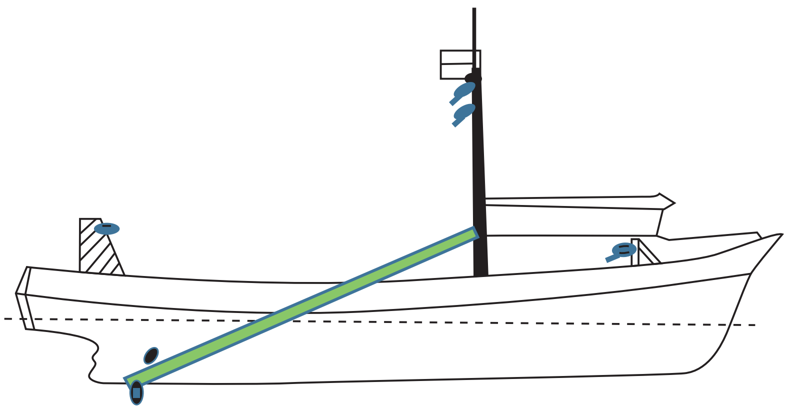


Figure 20a: The outrigger boom. (Source: Dutch Safety Board).

The boom is attached to the mast with a double hinge, see Figure 20b. This component is known is as the gooseneck. The construction of the gooseneck means that the boom can move up and down as well as backwards and forwards.

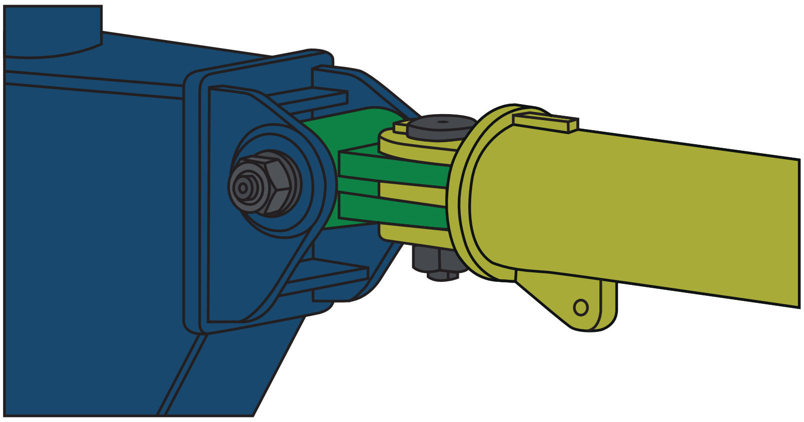


Figure 20b: The gooseneck. (Source: Machinefabriek Luyt B.V.)

As far as possible, the backward and forward motion is prevented by the front and rear guy wires, whereby the front guy wire is stronger than the rear guy wire. While fishing, the fishing gear is pulled via the end of the outrigger boom. The front guy wire is required to absorb the majority of the pulling force that is applied to the head of the boom and transfer it to the vessel. The front and rear guy wires also ensure that when the outrigger boom is raised, it always follows the same trajectory. The guy wires are marked in orange in Figure 20c.

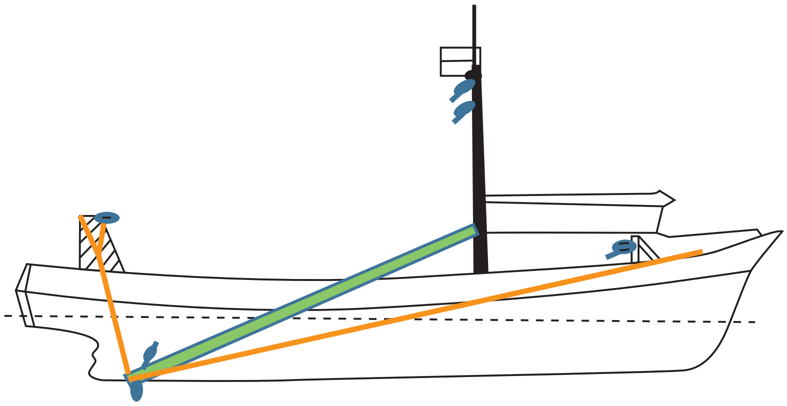


Figure 20c: The guy wires. (Source: Dutch Safety Board).

Figure 21 shows the blue *trawl wire*. On the UK-165, this ran from the winch below the wheelhouse to a block on the stern part, and from there via a guide pulley on the mast to a block in the fore part. This final block is known as the *suspension block* and was suspended from a small davit. The trawl wire then travelled from the suspension block via the trawl block to the underwater block on the fishing gear, and from there back once again to the trawl block. The end of this wire was then attached to the davit to which the suspension block was also attached.

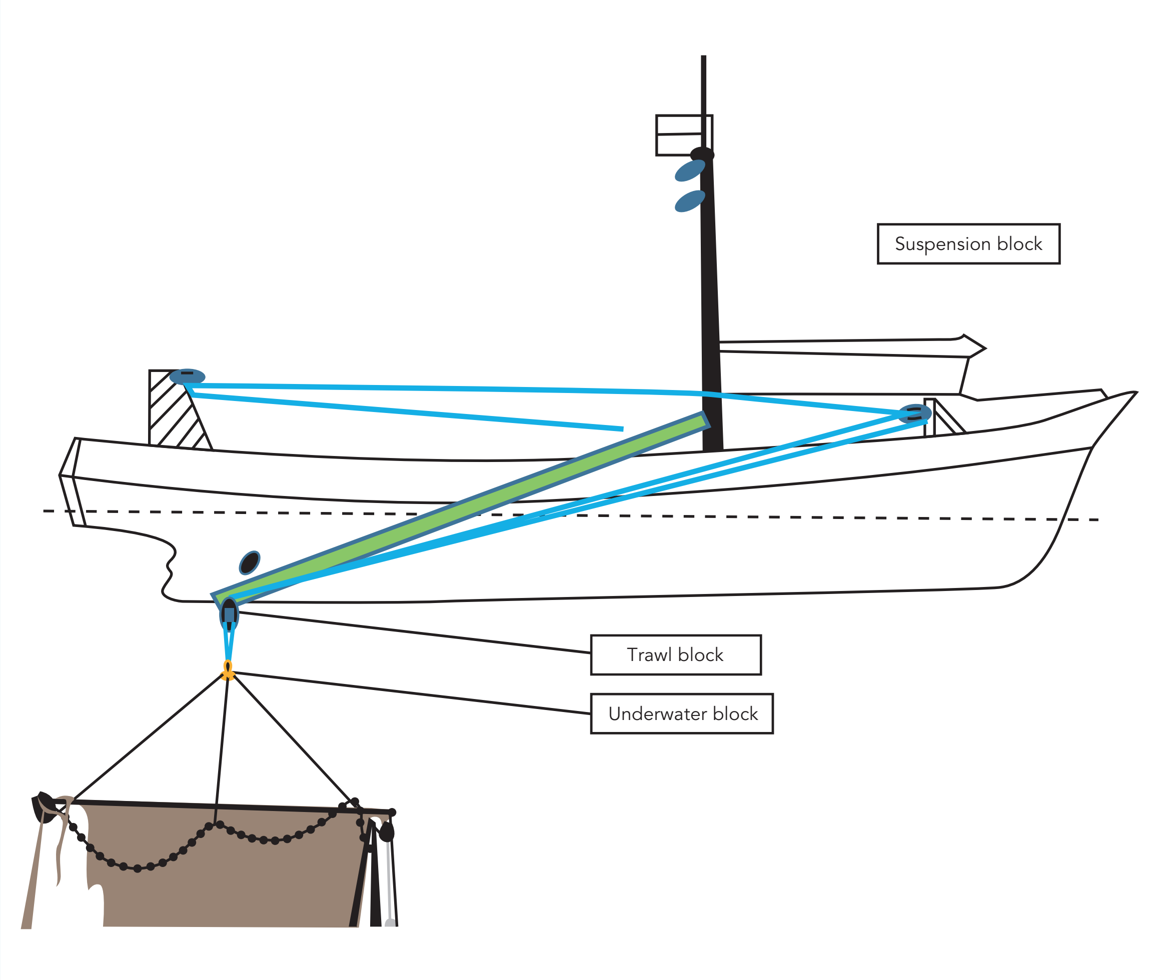


Figure 21: The outrigger boom and trawl wire. (Source: Dutch Safety Board)

The boom is raised and lowered using the boom wire. This wire is attached to a winch, and from the winch runs via the mast up to a block, and from there to another block near the end of the outrigger boom. This second block is attached to the underside of a lever, itself attached to the end of the boom. After passing through this block, the boom wire runs back to a third block attached higher up the mast, and finally back to the end of the boom. The boom wire is shown in red in Figure 22.

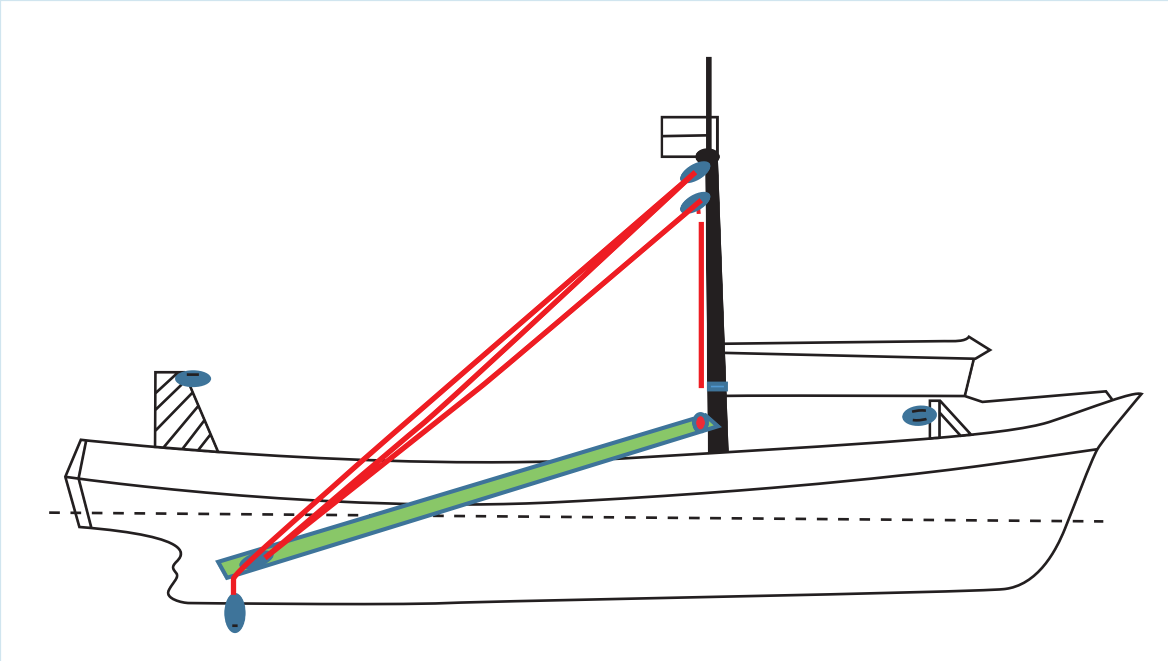


Figure 22: The outrigger boom and boom wire. (Source: Dutch Safety Board).

C.2 Slip construction

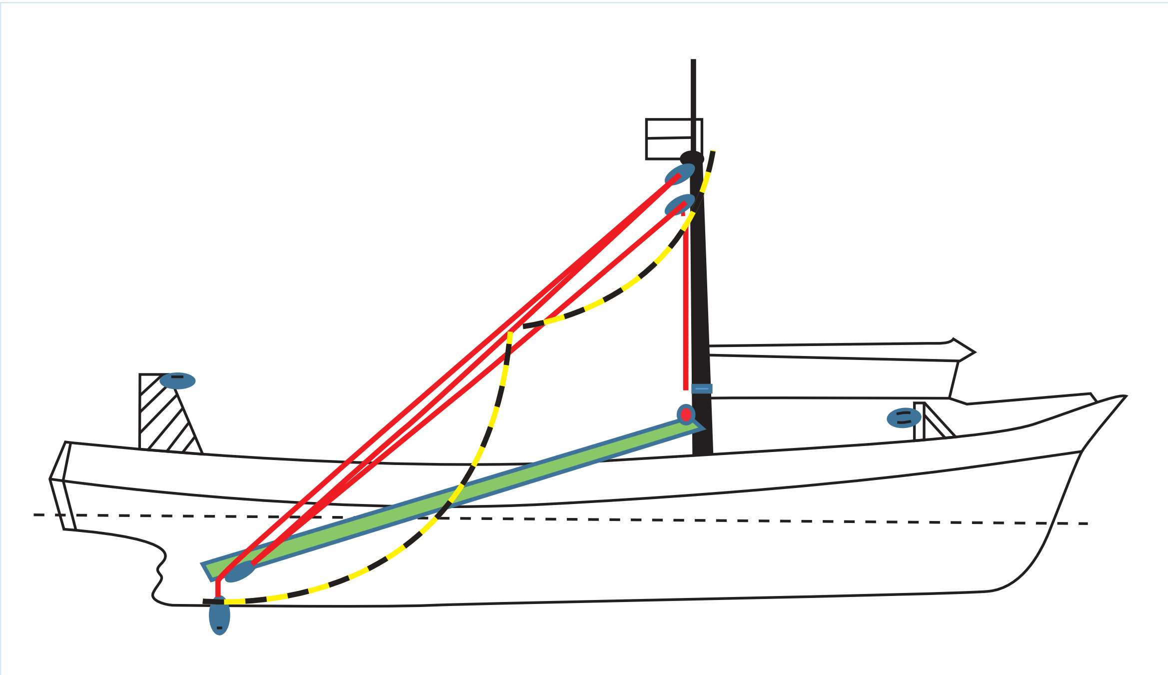


Figure 23: Outrigger boom, boom wire and fixed part. (Source: Dutch Safety Board)

A second wire ran from the mast to the end of the boom. This was the fixed guy wire for the boom, also known as the fixed part, and is shown in Figures 23 and 24 in a yellow and black dotted line.

This *fixed part* is attached to the mast and at the end of the boom is attached to the top of the lever referred to in the paragraph above. This fixed part normally hangs loose and only comes under tension when the outrigger boom is paid out close to the surface of the water. The fixed part is attached to the boom wire via a guide bracket or brackets, in order to prevent excessive loops in the slack wire. This prevents the risk of these loops becoming caught on any objects on board. On the UK-165, the fixed part was suspended from the boom wire with a single bracket.

As shown in Figure 24, the boom wire was not fixed to the end of the boom. The wire ran through the boom to the trawl block. The boom wire was clamped against the boom via a cam in the end of the boom. This construction enabled the boom to be raised and lowered, while the trawl block remained suspended just below the boom. This cam was operated by the lever referred to above, and held firmly in place by the tension from the boom wire on the block at the underside of the lever.

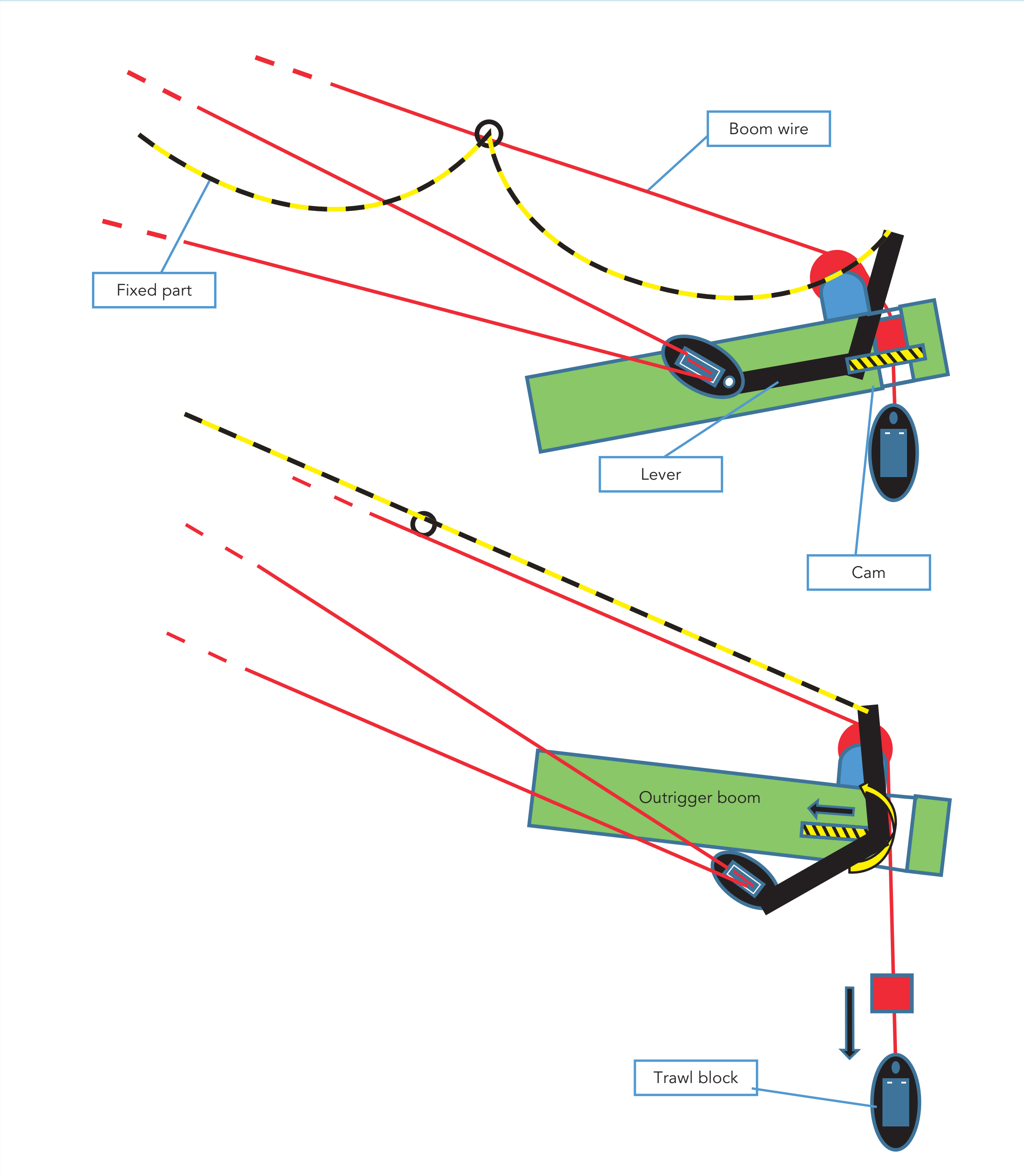


Figure 24: Diagrammatic representation of trawl block slip construction (Source: Dutch Safety Board)

If the boom was lowered so far that the fixed part was pulled taut, then the lever was activated. This in turn shifted the cam, so that the boom wire was no longer clamped in position. This enabled the trawl block to be paid out further, while the boom remained suspended in the fixed part. In other words, the trawl block could be *slipped*.

This slip construction had an important function in situations in which the fishing gear became snagged behind an obstacle on the seabed. The trawl wire attached to the fishing gear passed through the trawl block. Pulling on the fishing gear to release it, while the block was clamped against the boom would have resulted in the applied force being transferred to the boat, via the boom. At that point, the end of the boom was relatively far from the transverse midpoint of the boat, which would result in a relatively large heeling moment, with the risk of capsizing. By slipping the trawl block, the block could be pulled towards the gangway, a position far closer to the transverse midpoint. As a result, the heeling moment would be far lower, and consequently so would the risk of capsizing. This is shown in Figure 25.

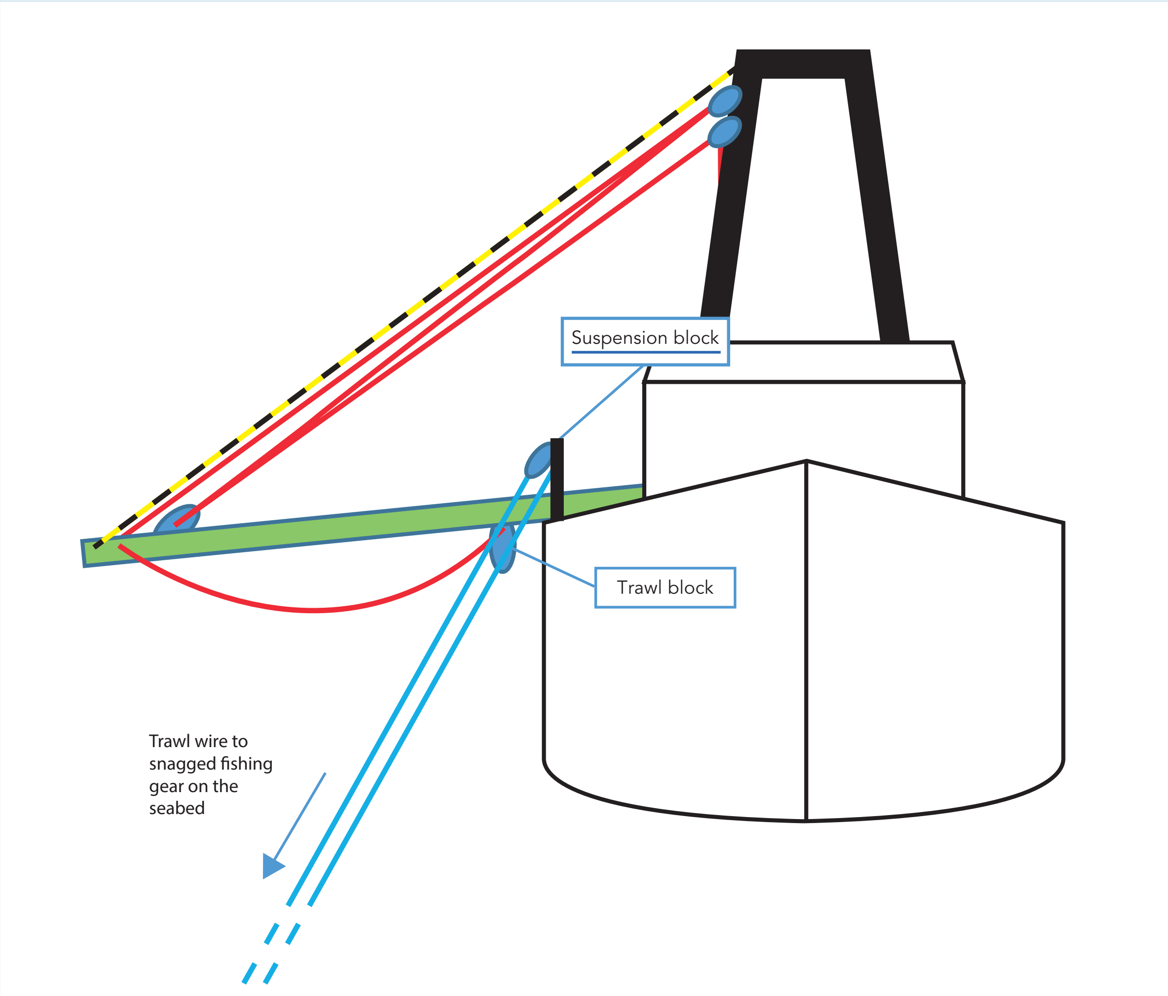


Figure 25: The slipped trawl block is paid out to below the suspension block. In other words, there is no more force applied to the slack hanging boom wire, and as a consequence to the (tip of the) boom. (Source: Dutch Safety Board)

APPENDIX D

Position of the wreck of the Ruth on the sea chart

In response to the occurrence involving the UK-165 and the investigation by the Safety Board, the Hydrographic Service launched an internal investigation into the following two main points:

1. *How was it possible that the position of the Ruth recorded on the paper sea chart did not match the position as recorded during a survey in 2008?*
   The internal investigation by the Hydrographic Service revealed that a number of factors played a role in this discrepancy. The wreck of the Ruth was last investigated by a Hydrographic Survey Vessel in 2008. The position during that survey deviated from the charted position as appearing on the chart at that moment. However, the difference was so small that it was not necessary to issue a Notice to Seafarers to enable users to correct the position of the Ruth on existing charts.

   However, when new charts are issued, or if new charts are made, the last-known data must be included on these charts. In this case, this means that the correct position of the Ruth should have been recorded in the current sea charts, on the basis of the survey of the wreck in 2008. This did not happen because the most recent data were not recorded at the correct location in the system used by the Hydrographic Service.

   The Hydrographic Service identified a lack of clarity in its own procedures as the possible cause. Those procedures contained work instructions which could give rise to contradictory interpretation. This shortcoming has been corrected by adjusting the relevant work instructions.

   In addition, the Hydrographic Service discovered that the position as determined in the 2008 survey was not correctly entered in the system used by the Service. The cause could no longer be identified. It seems most likely that a mistake was made during the (manual) transfer of the Hydrographic Report, drawn up during the survey in 2008, to the database from which the system used by the Hydrographic Service retrieves its data.

2. *Are there more wrecks in Dutch waters, the position of which deviates from the position marked on the chart, in a similar manner?*

The Hydrographic Service has identified a number of deviations of this kind, and made the relevant corrections on the charts.

APPENDIX E

Stability

This appendix is published as a separate document on the Dutch Safety Board's website.

APPENDIX F

Interim warning

The Dutch Safety Board considered it irresponsible to wait until the publication of the report to publish the conclusion that the stability of fishing boats can rapidly become dangerously compromised in the event of asymmetric loading conditions. For that reason, on 8 April 2021, the Safety Board published an interim warning. The press release containing a link to the warning is available on the Internet site of the Dutch Safety Board via https://www.onderzoeksraad.nl/en/page/15703/kapseizen-en-zinken-viskotters---lessen-uit-de-voorvallen-met-de-uk.

Reactions to the warning

The primary addressee of the warning was the Fishery Sector Foundation (*Stichting Sectorraad Visserij*) The Foundation responded almost immediately in the form of a letter containing the following text:

"We have taken note of the letter from the Dutch Safety Board (OVV) dated 8 April 2021 (reference 21.0002462, project PR2021.005) regarding two very serious occurrences involving beam trawlers.
The Dutch Safety Board wrote:

> *The investigation has revealed that beam trawlers with a length of less than 24 metres can become extremely unstable in asymmetric loading conditions. An asymmetric loading condition occurs for example if fishing gear is suspended from the outrigger boom on one side of the ship, and not on the other. In that situation, the ship no longer floats upright in the water, but adopts a permanent list. In the event of an asymmetric loading condition, this type of beam trawler experiences a rapid and extreme loss of stability. At that point, even a slight increase in the degree of list is sufficient to cause the ship to rapidly capsize and sink.*

On the basis of this letter, we will be informing skippers of beam trawlers with a length of less than 24 metres of the safety risks raised by the Dutch Safety Board in its letter, via their various interest groups, and will urgently advise them to ensure that they are aware of the stability characteristics of their vessels, and that they take the appropriate measures to prevent the undermining of the vessel's stability as far as possible.

We will also be cooperating fully in any initiatives by our government in respect of the construction of such sea fishing vessels, and the training provided to their crews."

Reactions from abroad

The interim warning was also published internationally. The Marine Accident Investigation Branch (MAIB) of the United Kingdom sent five investigation reports of accidents involving fishing vessels. In all five cases, stability was a decisive factor:

- https://assets.publishing.service.gov.uk/media/547c707bed915d4c10000095/Noordster.pdf
- https://assets.publishing.service.gov.uk/media/547c6f27ed915d4c0d000015/Sally_Jane.pdf
- https://assets.publishing.service.gov.uk/media/54c162f5e5274a15b3000021/MAIBReport_GreyFlamingo-1989.pdf
- https://assets.publishing.service.gov.uk/media/547c6f52e5274a428d00001f/BettyG.pdf
- margaretha__maria_pub_1999.pdf

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