MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

ACCIDENT REPORT

SERIOUS MARINE CASUALTY REPORT NO 5/2020 FEBRUARY 2020

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Collision between the bulk carrier *Gülnak* and the moored bulk carrier *Cape Mathilde* River Tees, England on 18 April 2019

SUMMARY

On 18 April 2019, the Turkey registered bulk carrier *Gülnak* collided with the Panama registered bulk carrier *Cape Mathilde*, which was moored alongside the Redcar bulk terminal, Teesport, England. Both vessels were damaged but there were no injuries and there was no pollution.

Images courtesy of Kenneth Karsten and www.shipspotting.com

Gülnak (top) *Cape Mathilde* (bottom)

The MAIB investigation identified that control of *Gülnak*'s heading was lost towards the end of an intended turn to port in the main navigation channel. Despite the use of full starboard rudder and full speed ahead, the port turn was not fully arrested and subsequent application of full astern power was insufficient to avoid a collision with *Cape Mathilde*.

During the investigation, which was hindered because rudder angle and engine speed information was not recorded by *Gülnak*'s voyage data recorder, a number of factors that possibly contributed to the loss of control were analysed. These included the actions of the bridge team, equipment malfunction, vessel manoeuvrability, and hydrodynamic effects. However, no direct cause was identified.

Following the accident, the Teesport harbour authority, PD Teesport, has implemented measures to ensure that the harbourmaster is informed should *Gülnak* or a sister vessel visit in the future. It has also: provided greater detail to pilots with respect to changes to water flows and depths; dredged the main navigable channel; and, reinforced the importance of tug waiting positions. A recommendation has been made to *Gülnak*'s owner, Gülnak Shipping Transport & Trading Inc., aimed at ensuring that Gülnak's shiphandling characteristics and manoeuvring data are validated, and that the bridge equipment on all its vessels is fully operational.

FACTUAL INFORMATION

Narrative

At 0249 on 18 April 2019, a harbour pilot boarded the handysize[1] bulk carrier *Gülnak* in Tees Bay for passage to Teesport **(Figure 1)**. The pilot was escorted to the bridge **(Figure 2)** by the third officer (3/O), who then took over as the helmsman. The master was on the bridge and the vessel was in hand-steering. The pilot requested a heading of 260º and for the engine to be set to 'full ahead' (105 revolutions per minute (rpm) – 10 knots (kts)). It was dark, the visibility was about 2 miles and the wind was light from the north-east. The predicted time of high water at the entrance to the River Tees was 0335 with a height of 5.31m. The tidal stream was predicted to be flooding at a rate of about 0.5kt.

The pilot and *Gülnak*'s master discussed the passage plan to the bulk carrier's intended berth, Tees Dock No 1. Topics included the mooring plan, the securing of two tugs that would be waiting by the Redcar bulk terminal, and the under keel clearance (UKC), which was not expected to be less than 8m. The master informed the pilot that *Gülnak* was fully loaded with gypsum and had a draught of 10.27m even keel. He also advised that the vessel had no deficiencies and that its anchors were cleared away and ready for use. Following the discussion, the pilot advised Tees vessel traffic service via very high frequency radio that he had boarded *Gülnak*, which was now inbound.

Between 0302 and 0312, *Gülnak*'s heading was adjusted incrementally to 212º and the pilot noted that the 3/O had no difficulty steering the fully loaded vessel by using about 5º of helm. At 0315, the vessel was making good a speed of 10.4kts over the ground and the pilot ordered a heading of 210º to aim towards the navigable channel's leading lights. As *Gülnak* approached No 9 buoy, the pilot ordered 'half ahead' (85rpm – 8.5kts). The 3/O confirmed that the engine was at 'half ahead' 45 seconds later.

As *Gülnak* approached No 11 buoy **(Figure 3a)**, the pilot ordered 'port 10', to start to turn the vessel towards a heading of about 170º, keeping towards the centre of the main channel. Within 1 minute, *Gülnak* was turning towards the south at a rate of 23°/minute (min) **(Figure 3b)** and the pilot ordered 'slow ahead' (64rpm – 7kts). The order of 'midships' soon followed in order to reduce the rate of turn. At 0321:17, *Gülnak*'s heading was passing through 190° at about 28°/min **(Figure 3c)**, which was quicker than the pilot expected. The pilot ordered 'starboard 20°' quickly followed by 'hard-a-starboard'.

[1] Handysize bulk carriers have a deadweight of between 15,000 and 35,000 tonnes and are equipped with cranes for loading and discharging.

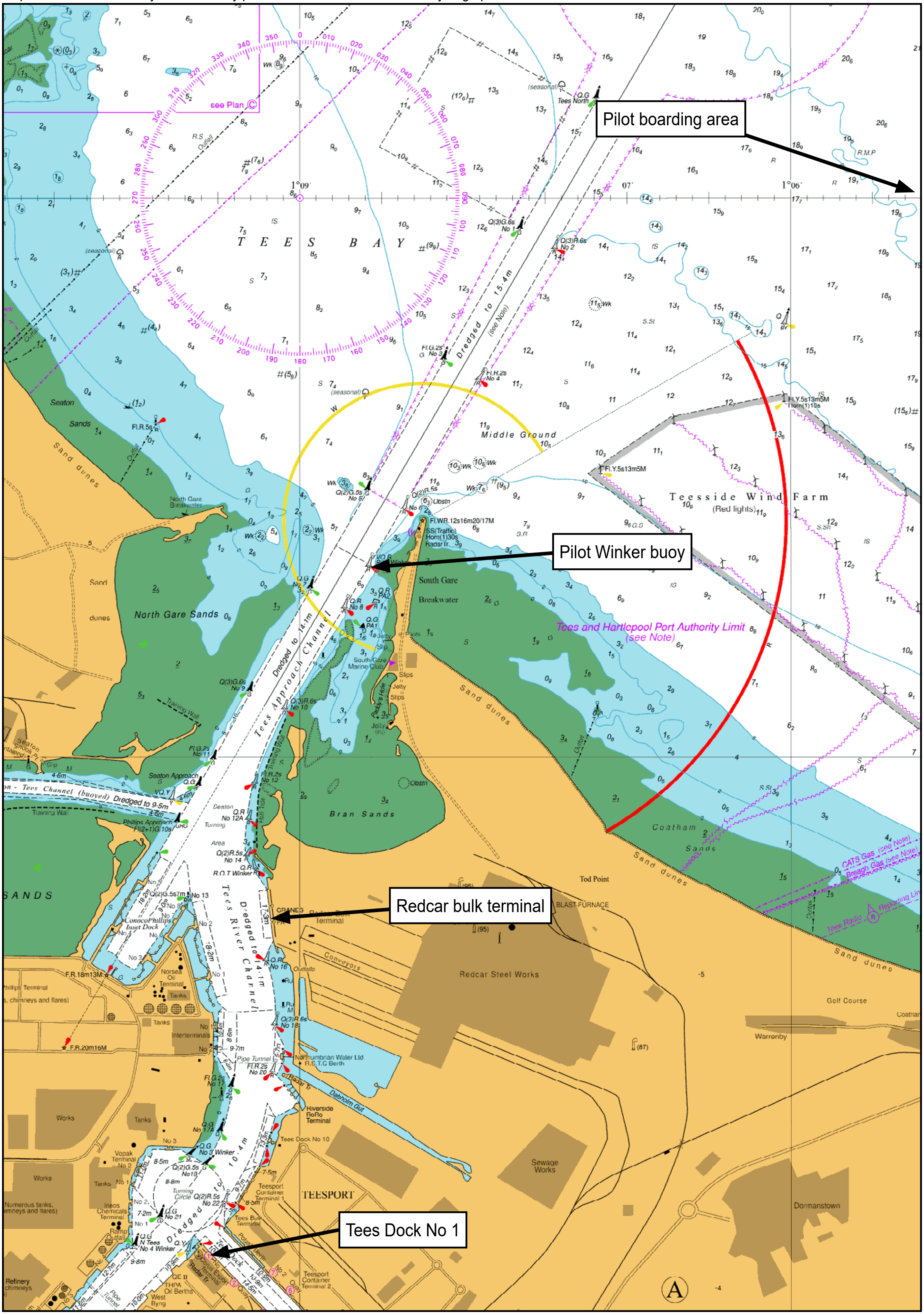


Figure 1: Extract from chart BA2566 showing key locations

Gülnak's master was standing by the engine telegraph and saw that the rate of turn was not decreasing. He suggested an increase in engine speed "*to stop the vessel turning*". The pilot agreed, and ordered 'half ahead'. Accordingly, the master moved the engine telegraph. However, the vessel's heading was now passing 166° with a rate of turn to port of 22º/min **(Figure 3d)** and the master increased the engine speed to 'full ahead'. Soon after, the pilot requested 'full ahead' to which the master replied "*full now*".

At 0322:44 the rate of turn was 21º/min and the master confirmed that the engine was at 90rpm and increasing. By 0323, the pilot's concern that *Gülnak* was still turning to port prompted him to check with the master that the engine was at 'full ahead'. The master confirmed that it was, and told the pilot that he would advise the engine room to increase the engine speed to 'full sea speed'.

By 0323:23, *Gülnak*'s speed was 7kts, the rate of turn had reduced to about 10º/min to port and the vessel's heading was passing 147°. The bulk carrier *Cape Mathilde* was moored 220m ahead **(Figure 4)** and the master ordered the forward mooring party to be ready to let go the anchors. The skippers of the two tugs that were waiting to assist off the bulk terminal saw the potential hazard and manoeuvred towards *Gülnak*. Although *Gülnak*'s rate of turn continued to decrease, the pilot and master realised that a collision was inevitable. The pilot moved to the port bridge wing and ordered 'full astern'.

At 0324:20, *Gülnak*'s port bow collided with *Cape Mathilde*'s port side at a speed of 6.7kts and an angle of 29º. Following the collision, the pilot gave a series of helm and engine orders to keep *Gülnak*'s stern clear of the moored bulk carrier. During these manoeuvres the pilot noticed that the main engine speed indicator on the port bridge wing was operating erratically. The tugs were then made fast while the master initiated an assessment of the damage.

At the time of the collision, *Cape Mathilde*'s crew had been resting. The gangway and deck watch had not seen *Gülnak* prior to the collision and were alerted by the force and noise of the impact.

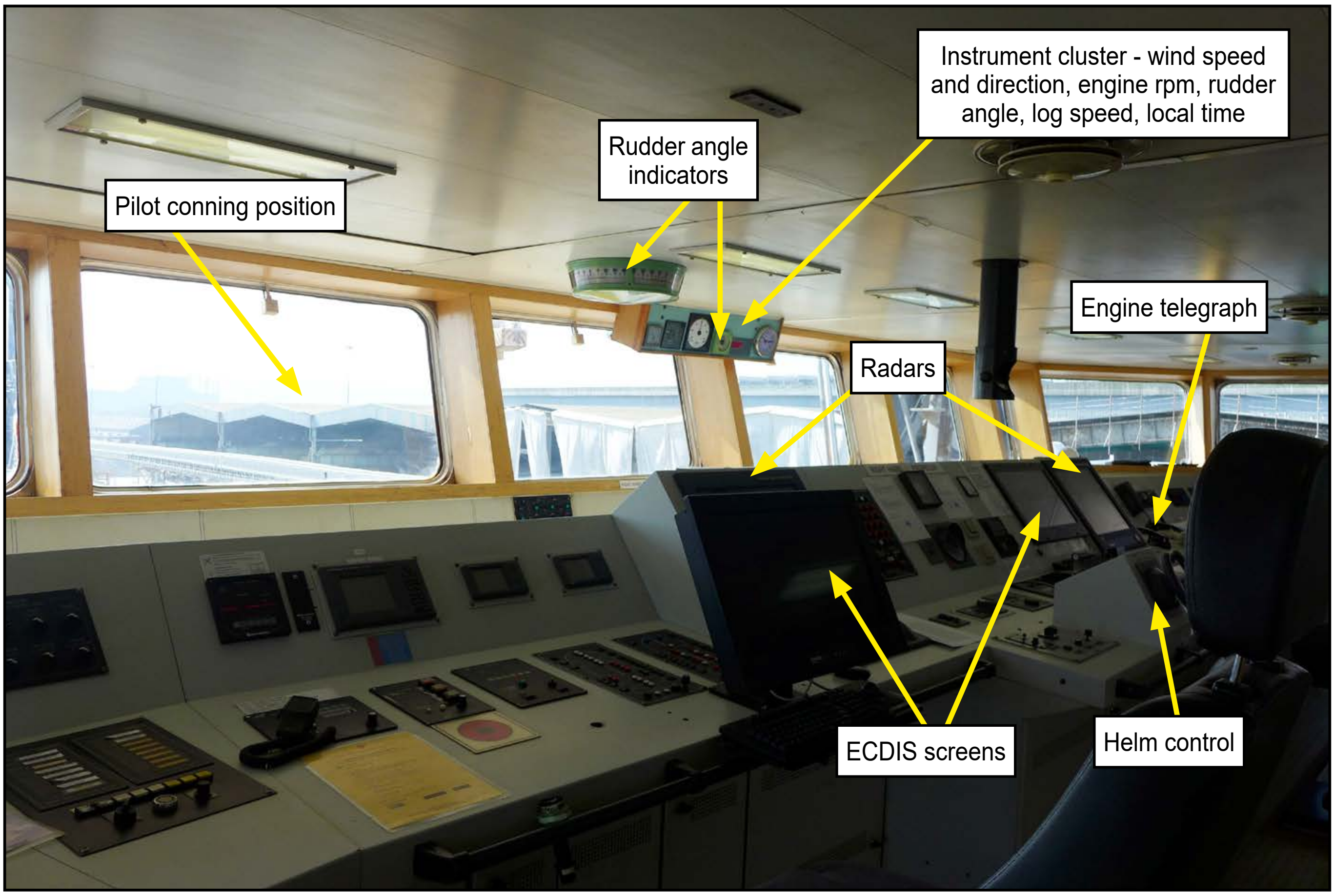
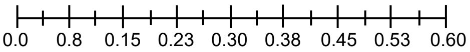


Figure 2: *Gülnak* bridge and navigation equipment

Chart scale - nautical miles



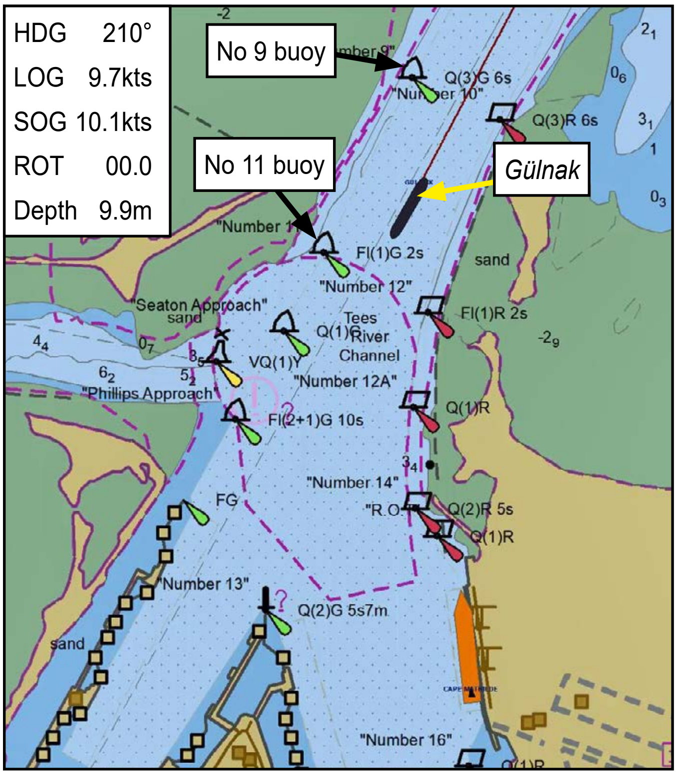


Figure 3a: Position at 0320:10 when rudder put to port 10°

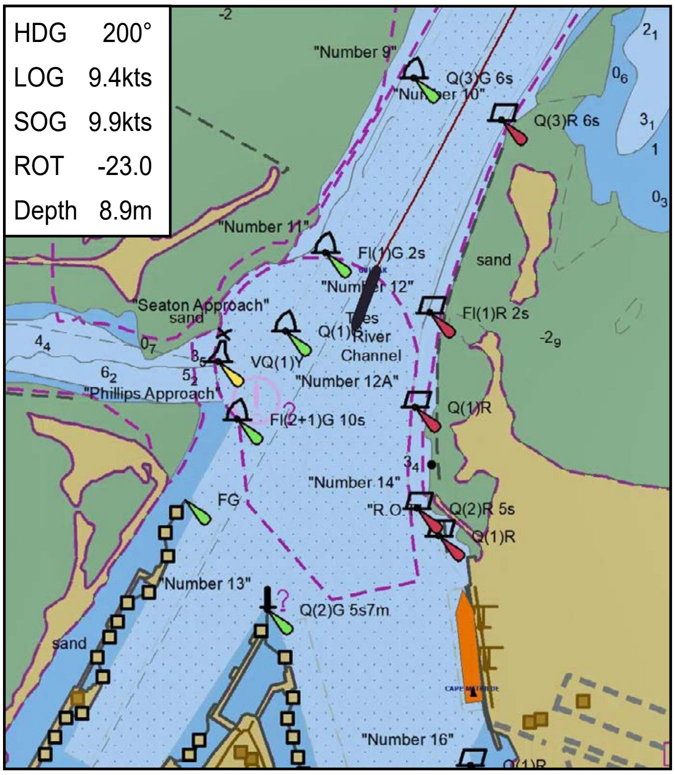


Figure 3b: Position at 0321:01 when rudder put to midships

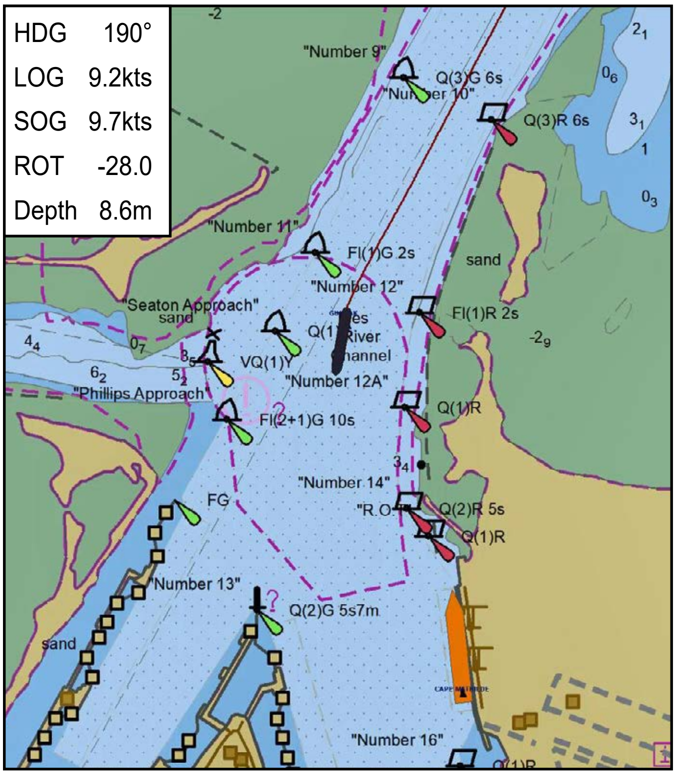


Figure 3c: Position at 0321:24 when rudder put to starboard 20° to steady the heading

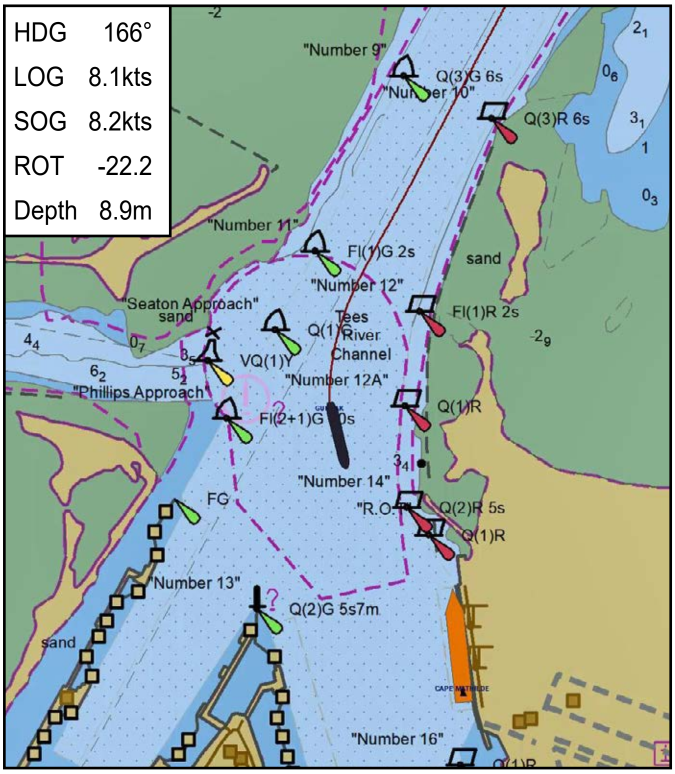


Figure 3d: Position at 0322:22 when engine put to 'full ahead'

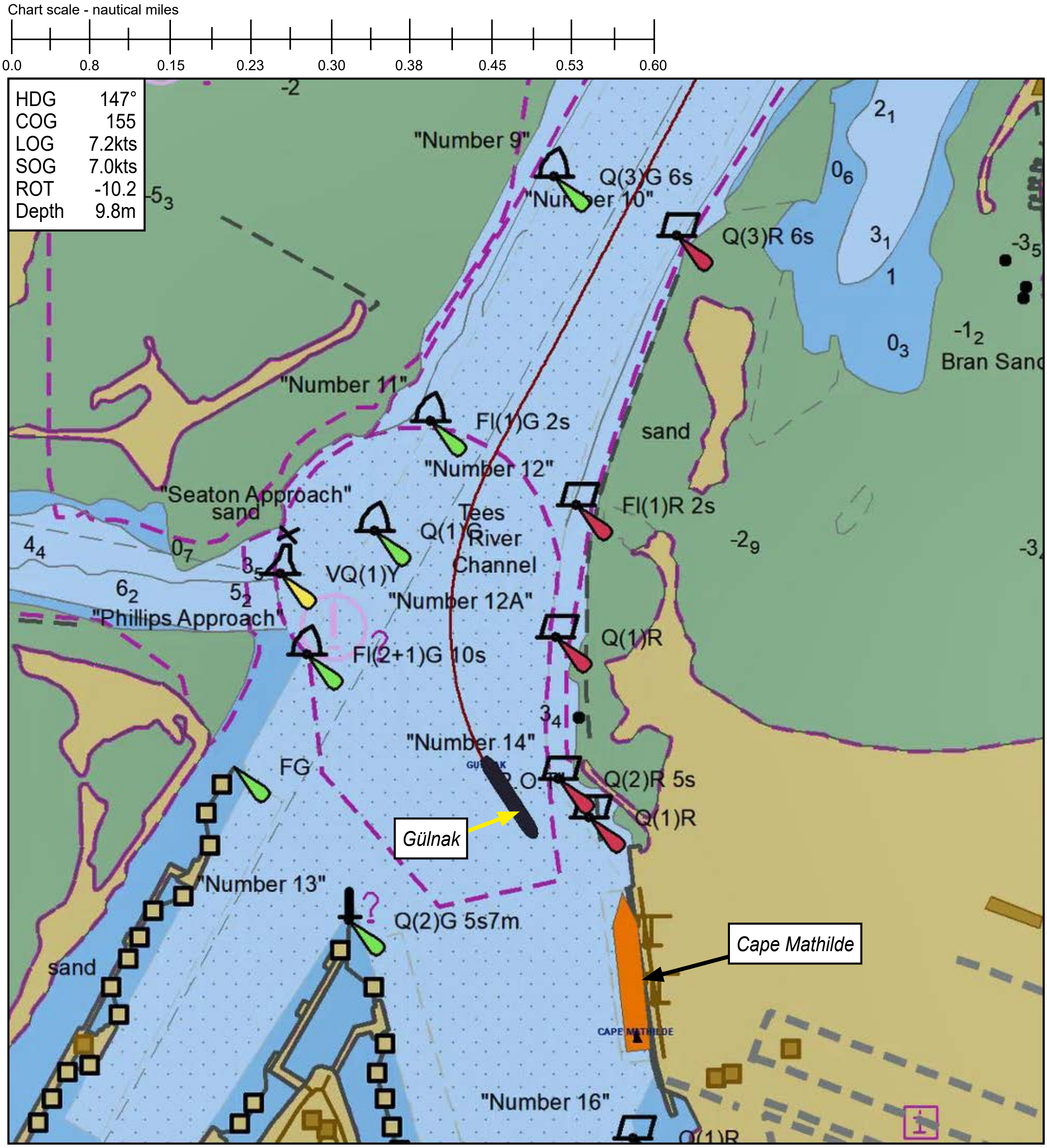


Figure 4: Position at 0323:23 when engine put to 'full astern'

Damage and repair

The collision resulted in significant indentation and steelwork damage to *Gülnak*'s port bow **(Figure 5)** and the shearing of the port anchor at the stock. *Cape Mathilde*'s port side was damaged above the waterline in way of the No 1 and No 2 wing ballast tanks **(Figure 6)**, with the lower section of *Gülnak*'s port anchor embedded in the forward part of No 1 ballast tank. The vessel's mooring lines remained intact.

Temporary repairs to both *Gülnak* and *Cape Mathilde* were completed in Teesport. The vessels were then authorised by the Maritime and Coastguard Agency and their respective classification societies to sail for permanent repairs. *Cape Mathilde* arrived in Dunkerque, France on 10 May 2019 and *Gülnak* arrived in Turkey on 12 May 2019. During *Gülnak*'s departure from Teesport, the embarked pilot noted that the master seemed uncertain about whether the main engine speed indicator on the centre console gauge was operating correctly.

Figure 5: Damage to port bow of *Gülnak*

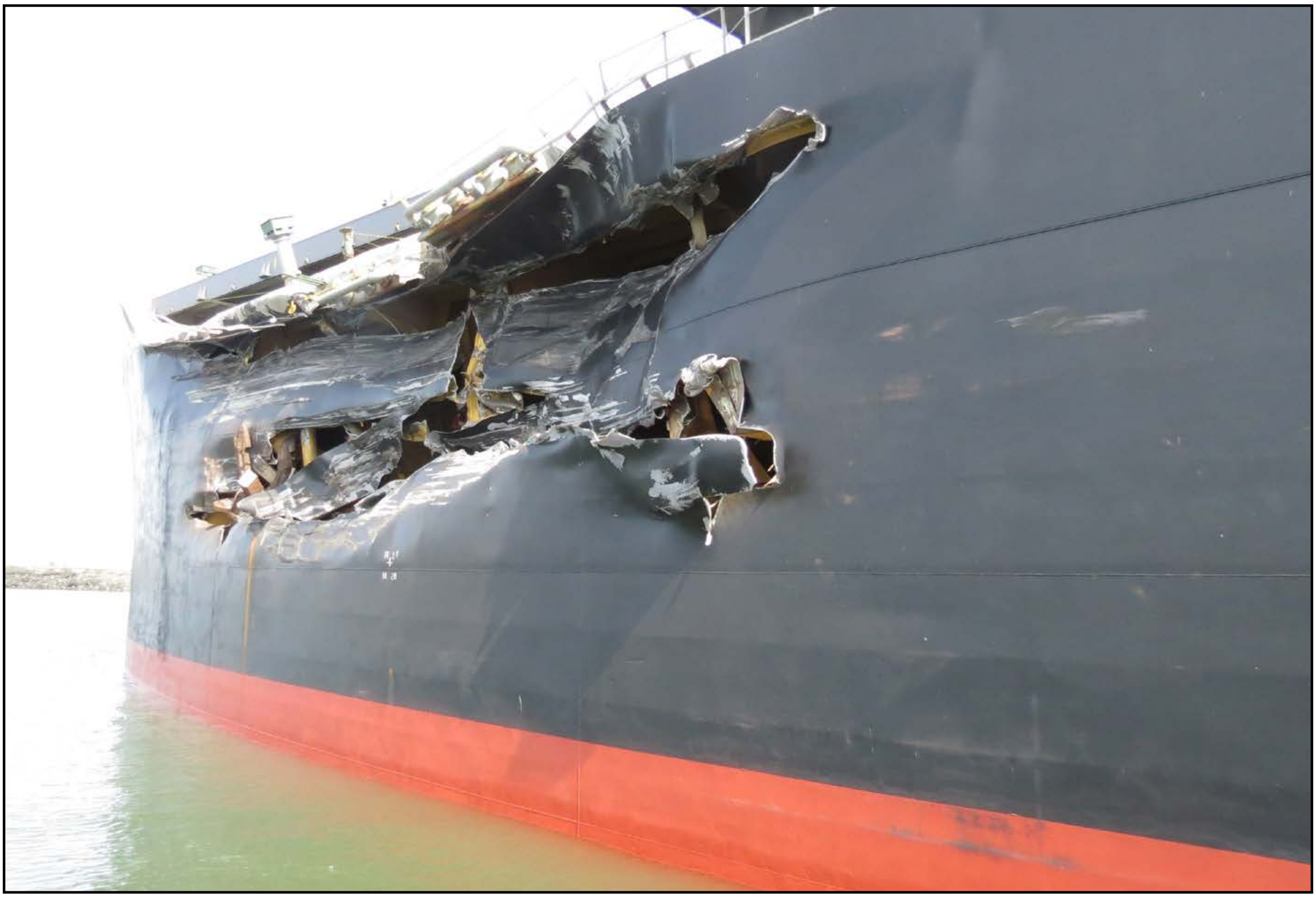


Figure 6: Damage to port side of *Cape Mathilde*

Inspection and recorded data

Gülnak's master had saved the vessel's voyage data recorder (VDR) soon after the collision, and the recorded data was recovered by the MAIB that day. No helm, rudder or engine speed information had been recorded, and the vessel was not equipped with a course recorder or an engine data logger.

Following the accident, an underwater inspection of *Gülnak* identified that the rudder was undamaged. It was also identified that the vessel's electro-hydraulic steering system was operating satisfactorily, with the rudder moving from hard-over to hard-over in 21 seconds.

The bridge audio recordings from *Gülnak*'s VDR showed that all helm and engine orders given by the pilot were repeated by the 3/O, who informed the pilot as soon as the action ordered had been completed. In the case of helm orders, this was within 7 seconds.

Vessel

Gülnak was a 35167 tonnes deadweight (dwt) bulk carrier with a block coefficient[2] of 0.8328. The vessel was one of 24 sister ships built in several different shipyards in China, and one of four handysize bulk carriers owned and managed by Gülnak Shipping Transport & Trading Inc. (Gülnak Shipping). The company based in Izmir, Turkey was formed in 1989 and had operated Gülnak worldwide since the vessel's build in 2011. No evidence was found to indicate that *Gülnak* or any sister vessels had previously experienced unexpected difficulties when manoeuvring.

Propulsion was provided by a slow speed diesel engine producing a maximum power of 6480kW at 136rpm, coupled to a fixed pitch right-handed propeller. The vessel did not have a bow thruster.

Engine speed was controlled from the bridge telegraph. *Gülnak*'s maximum sea speed was 14kts and, according to the vessel's manoeuvring data, the time taken for the engine to change from manoeuvring 'full ahead' to manoeuvring 'full astern' was 7 minutes and 46 seconds.

Gülnak was equipped with a semi-spade rudder with electro-hydraulic steering gear. The rudder was limited to an angle of 35º, and was designed to move from 35º one side to 30º the other side in 22 seconds. The rudder to hull ratio was 0.019 and the steering was last fully tested before the vessel's departure from Ravenna, Italy, on 20 March 2019.

The primary means of navigation was an electronic chart display and information system, and visibility ahead from the bridge centreline was impeded by a 4.75º blind arc due to the deck cranes. At a draught of 10.3m, the predicted squat of the vessel at speeds of 7kts and 10kts was 0.41m and 0.83m respectively. It was reported that when moving ahead, the squat experienced usually resulted in the the vessel trimming by the head.

Gülnak was equipped with a Consilium M4 VDR. The VDR's annual performance test was last completed in the Ukraine on 19 October 2018.

Bridge team

Gülnak's master was a Turkish national who started his career at sea in 2004. He held an STCW[3] II/2 'Master Unlimited' certificate of competency (CoC) and had served as master since 2011. The master had joined the vessel 6 months before the accident. It was his first contract on board, and his second contract with Gülnak Shipping. The master's previous vessel was *Gülmar*, a 28,000dwt bulk carrier.

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[2] The shape of a hull is often expressed in terms of measured ratios, known as hull coefficients, which compare the immersed section of a hull shape to that of rectangular shapes of the same overall dimensions. The block coefficient is the principal measure of a vessel's underwater hull form.

[3] International Convention on Standards of Training, Certification and Watchkeeping for Seafarers 1978, as amended.

The 3/O was a Turkish national who had completed his cadetship with Gülnak Shipping in 2018 and held an STCW II/1 'Officer in Charge of a Navigational Watch' CoC. This was his first contract as 3/O and he had been on board for 5 months. He had served with *Gülnak*'s master on board *Gülmar*.

The pilot was a UK national who had been in the marine industry since starting his cadetship in 1977. He qualified as a class 4[4] Tees Bay pilot in 1995 and had been a senior class 1[5] pilot since 2000. The pilot had been assessed annually by the harbour authority and his last certificate of re-authorisation was issued on 13 December 2018. He had piloted ships up to 350m in length and more than 200,000dwt.

Harbour authority

The River Tees leads to the ports of Teesport and Hartlepool, which handle around 28 million tonnes of various cargoes through about 4100 ship movements each year. PD Teesport was the statutory harbour authority (SHA)[6], and was responsible, among other things, for vessel traffic management, ensuring safe navigation and maintaining depths in the channel. PD Teesport was also the competent harbour authority (CHA)[7] and supplied pilotage services through Tees Bay Pilots Limited (Tees Bay Pilots).

Channel depths and tidal stream

The main navigation channel in the River Tees from the Pilot Winker buoy **(Figure 1)** to the Redcar bulk terminal was dredged nominally to 14.1m with a minimum allowed depth of 13.3m. The channel was surveyed at intervals not exceeding 6 weeks to identify areas requiring to be dredged. More detailed depths were shown on survey charts held by PD Teesport, which promulgated reductions in depths that were likely to affect navigation via 'Weekly Navigational Bulletins' on the port's website and by email. At the time of the accident, the depths between buoys 11 and 13 were reduced by about 4m due to slippage of the bank on the channel's northern side.

The maximum predicted rate of tidal streams in the main channel was 1.5kts at spring tides. Although fresh water run off, and water discharge from the Hartlepool power station and the Tees Barrage, increased the rate of ebb streams and decreased the rate of the flood streams, the degree of change from the predicted rates of tidal stream was not significant at the time of the incident. PD Teesport held detailed tidal stream data determined from three-dimensional modelling and validated by observation. The tidal stream between No 11 buoy and Redcar bulk terminal at 0320 was predicted to be almost slack **(Figure 7)**.

Tees Bay Pilots

During the investigation, discussions were held with Tees Bay Pilots to determine the usual practice when navigating a 35000dwt loaded bulk carrier in the River Tees. On viewing of a video reconstruction of *Gülnak*'s movement between No 11 buoy and the Redcar bulk terminal, the pilots agreed that their actions in similar circumstances would not have differed to any significant degree to those of *Gülnak*'s pilot. The only difference in practice identified between *Gülnak*'s pilot and his peers was that some pilots noted that *Gülnak*'s speed when passing No 11 buoy was faster than the 8kts that they typically preferred.

Tees Bay pilots were also requested to complete an online survey to identify previous issues or difficulties when navigating between No 9 buoy and the Redcar bulk terminal. Out of the 21 pilots who participated in the survey, eight had experienced difficulty when stopping vessels continuing to turn to

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[4] Class 4 – vessels up to 4000 tonnes and 95m length overall

[5] Senior Class 1- unlimited

[6] SHA - a harbour authority that has been given a range of statutory powers or duties for the purpose of improving, maintaining or managing a harbour.

[7] CHA - any harbour authority with statutory powers in relation to the regulation of shipping movements and the safety of navigation within its harbour and which may exercise pilotage functions.

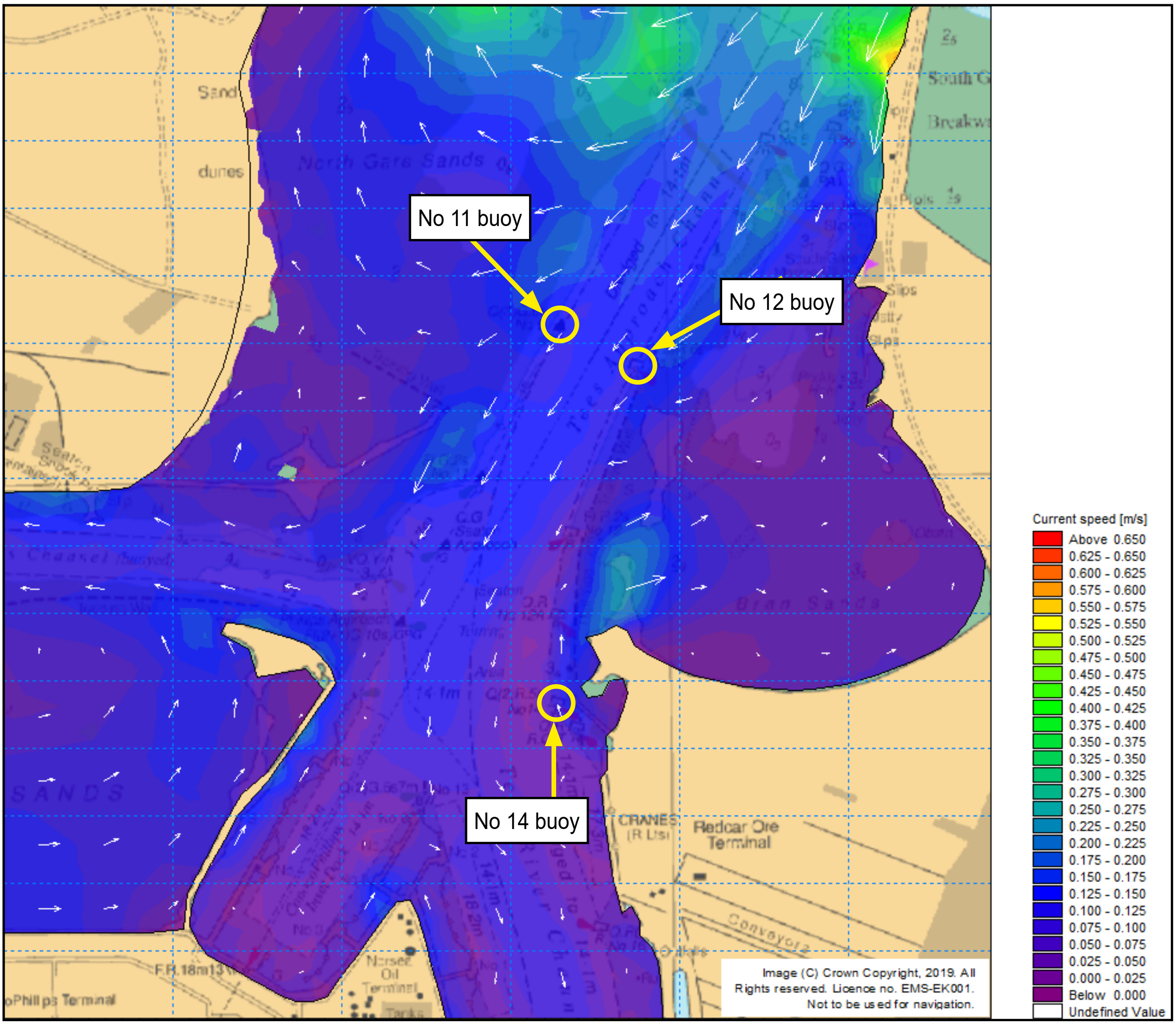

Figure 7: Tidal stream at 1 hour before high water (spring tides)

port south of No 11 buoy. However, they attributed these difficulties to specific environmental conditions or small UKCs. Thirteen pilots also commented that the tidal flow in this area of the the River Tees was not affected by bank slippages into the main channel further to the north.

It was usual practice for pilots embarked on vessels proceeding to Tees Dock or berths upriver to arrange for attending tugs to wait south of the Redcar bulk terminal, and for the tugs to be secured with the inbound vessel's speed at about 7kts.

ANALYSIS

Loss of control

Control of *Gülnak*'s heading was lost when turning to port to follow the main channel towards the Redcar bulk terminal. The intended 40° alteration to port from a heading of 210° after passing No 11 buoy to 170° had been initiated with 10° of port helm, which was taken off as the rate of turn and heading reached 23°/min and 200° respectively.

Figure 8 shows that the helm movement to 'midships', 'starboard 20°' and 'hard to starboard' within a 50 second period decreased the rate of port swing to some extent, but it was not until the engine telegraph

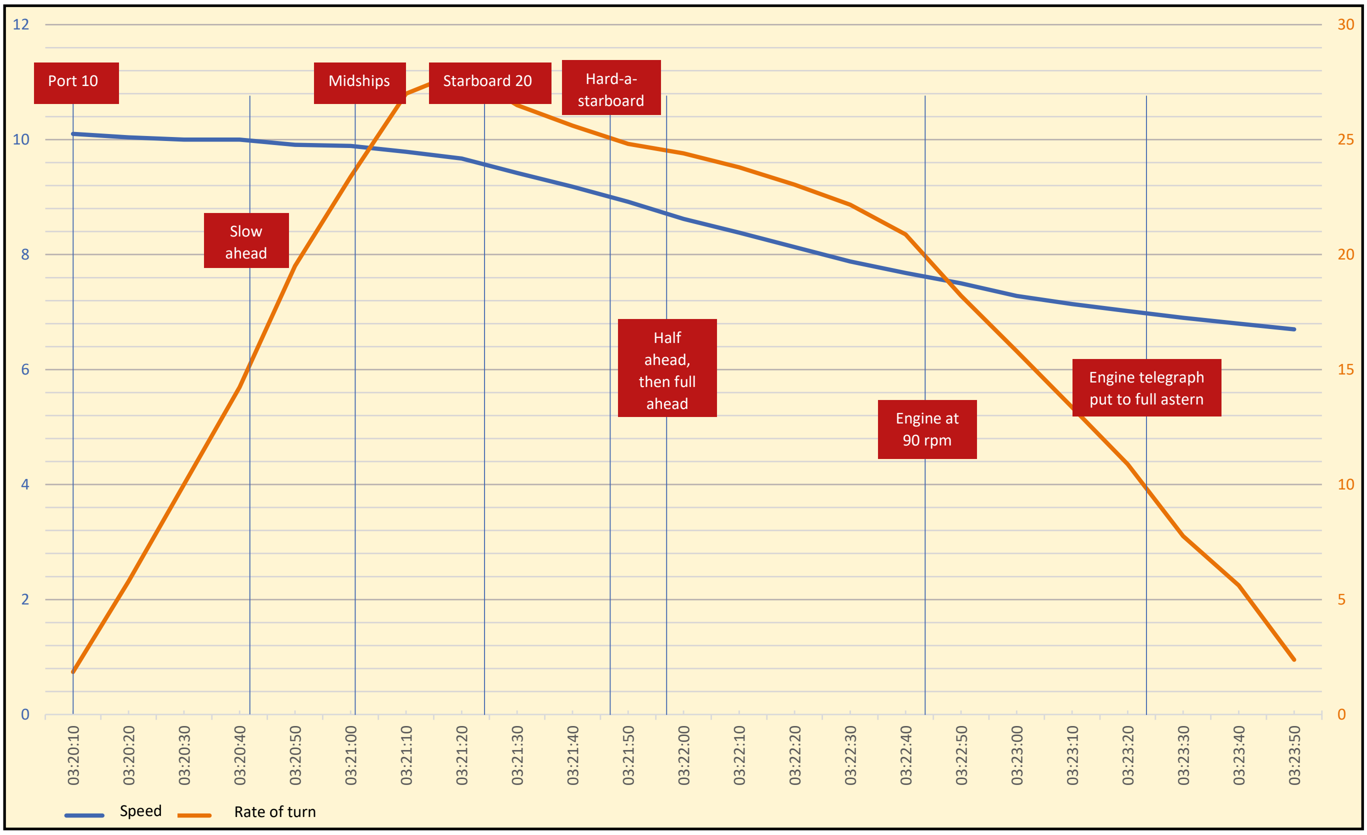

Figure 8: *Gülnak*'s speed and rate of turn to port

had been set to 'full ahead' and engine speed was reported to have reached 90rpm that the rate of turn to port started to decrease significantly. Despite the subsequent use of 'full astern' power, the decrease in the rate of turn was too late for the collision with the moored *Cape Mathilde* to be avoided.

The factors contributing to the inability to fully arrest *Gülnak*'s turn to port are not readily apparent. Although the vessel's 'right-handed' propeller would have resulted in a slight tendency for turns to port to be easier than turns to starboard when moving ahead at slow speed, the speed in the turn towards the Redcar bulk terminal was faster than 8kts. *Gülnak*'s handling characteristics were also typical for a vessel of its type and size. In addition, the wind was light, the tidal stream was negligible, and the water depth afforded a UKC in excess of 8m throughout.

Furthermore, the vessel was steered without difficulty before the loss of control, and the bridge audio from the VDR identified that the 3/O had repeated and then confirmed all helm and engine orders during the turn. Although the actual positions of the helm and rudder, and the engine speed, could not be verified as this data had not been recorded, the master and pilot were able to monitor the rudder angle indicated on the bridge. Inspection and function tests following the accident also identified that the rudder was undamaged and the steering system's performance was within expected parameters.

Route

When plotted alongside the inbound routes taken by eight other handysize bulk carriers that had visited Tessport before the accident **(Figure 9)**[8], it is evident that *Gülnak*'s route, although about 30m further to the west during the turn, was generally similar to that of other vessels. However, whereas the speed of the other vessels at the start of the turn to 170° was around 8kts, which accorded with the preferences of some Tees Bay pilots, *Gülnak*'s speed was 10kts. Although a faster speed would have reduced the time and safe water available to react to the loss of control, it should not have adversely affected the vessel's steering.

[8] The routes were based on data from the vessels' automatic identification systems.

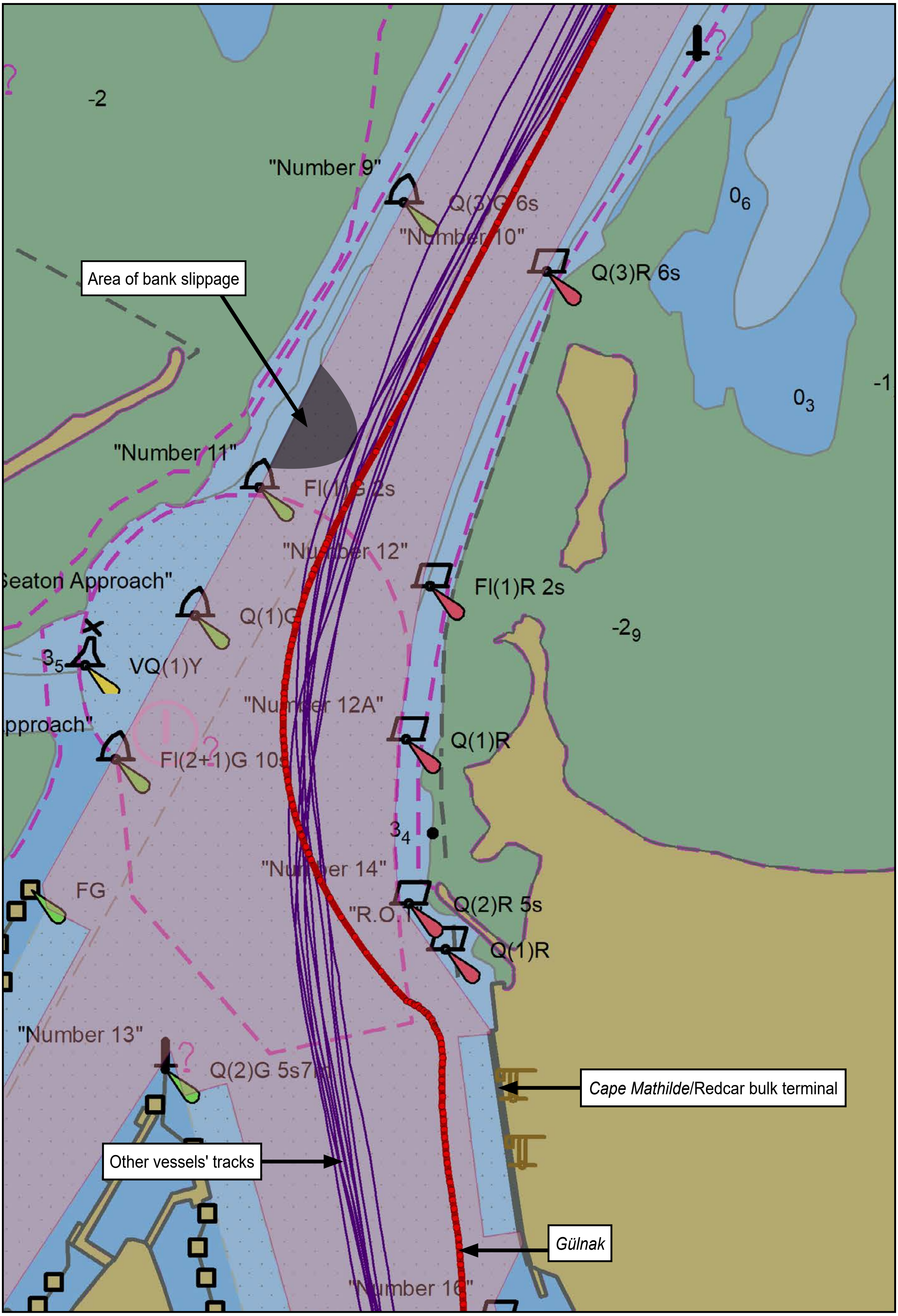

Figure 9: Tracks of *Gülnak* and other handysize bulk carriers

Shallow water effects

The possibility that *Gülnak*'s heading and directional stability were influenced to some degree by shallow water effects resulting from the interaction between the vessel and the river-bed, and by squat, cannot be eliminated. *Gülnak*'s dynamic draught was 11.1m (draught (10.27m) + squat (0.83m)) and the predicted water depth was 19.3m (charted depth (14.1m) + height of tide (5.2m)), therefore the echo sounder depths recorded during the passage **(Figure 3)** were consistent with the minimum expected UKC of 8.2m. Although shallow water effects, such as erratic steering and increased turning circles, are likely to be experienced in water depths less than 1.5 times a vessel's draught, a UKC in excess of 8m at speeds below 10kts would not usually give cause for concern. However, in this case, any shallow water effect might have been exacerbated by *Gülnak* trimming by the head when moving ahead, which would have increased the squat at the bow.

As the main channel from No 11 buoy to the Redcar bulk terminal was about 300m wide, and *Gülnak* was close to the channel centreline at the time control of heading was lost, it was very unlikely the vessel experienced other shallow water effects such as 'bank', 'bank-cushion' or 'smelling the ground'[9].

River flow

Figure 7 shows that the predicted tidal stream in the main channel between No 12 buoy and No 14 buoy, where control of *Gülnak*'s direction was lost, was still flooding. However, it was negligible and would not have been sufficient to significantly impact on *Gülnak*'s movement and manoeuvrability. Although a counter-current was evident outside the main channel's eastern side, this was also less than 0.2kt. There is no evidence to indicate that the tidal flows experienced differed from the predictions, with the slippage of the bank into the main channel between No 11 and No 13 buoys being unlikely to have significantly affected the water flow further to the south.

Engine speed

The problems related to the engine speed indicators on *Gülnak*'s centre and port wing consoles, which were noticed after the accident, possibly indicate that either the engine or the speed indicators were not performing as expected. However, the 3/O did not raise any concerns when monitoring the engine speed and informing the master and the pilot on each occasion the main engine had reached the speed set on the telegraph. In addition, although there was no increase in the vessel's speed following the increase to 'half ahead' and then 'full ahead' at 0322 **(Figure 8)**, this was probably due to the designed response time of the engine and the speed lost while turning along with the drag of full starboard rudder. The reduction in the rate of turn after the engine speed was reported to have reached 90rpm also indicates that an increased water flow from the propeller was making the rudder more effective.

Response

The pilot and the master were quick to realise that *Gülnak*'s intended turn to port towards the Redcar bulk terminal was not progessing as planned. The use of full starboard helm and 'full ahead' on the engine to arrest the turn were also prompt, and probably accorded with the actions taken by others in similar situations. In most cases, such actions are likely to be successful. However, in this case, they were not, despite the pilot and the master allowing about 1.5 minutes for the counter-measures to take effect. By then, although the engine was set to 'full astern', collision with *Cape Mathilde* could not be avoided and the two tugs, which had closed, were unable to assist because they were not secured.

[9] Effects on a vessel's heading when passing close by or approaching a bank or area of shoal water.

CONCLUSIONS

- Control of *Gülnak*'s heading was lost when turning to port to follow the main channel towards the Redcar bulk terminal. Consequently, the turn could not be arrested and collision with *Cape Mathilde* could not be avoided.

- The factors contributing to the inability to fully arrest *Gülnak*'s turn are not readily apparent.

- *Gülnak*'s route was similar to that followed by other bulk carriers of similar size and, other than the vessel's speed at the start of the turn to port being marginally faster compared to previous entries of similar sized bulk carriers, the pilot's actions accorded with usual practice in the port.

- Although the minimum UKC experienced exceeded 8m, the possibility that *Gülnak*'s heading and directional stability were influenced to some degree by shallow water effects cannot be eliminated.

- The negligible tidal stream and the light winds would not have influenced *Gülnak*'s movement to any significant degree.

- The vessel's steering and propulsion appeared to be operating correctly, but this could not be confirmed due to helm, rudder and engine speed information not being recorded on the VDR.

ACTION TAKEN

Actions taken by other organisations

PD Teesport has:

- Reviewed the circumstances of the accident and its navigational risk assessment. In the absence of an identifiable direct cause or contributory factors, actions taken in the support and reinforcement of current practices that are intended to prevent similar accidents in the future include:

    - Dredging the channel between No 9 buoy and No 11 buoy to clear the slippage of the northern bank, which was commenced immediately following its discovery by survey.

    - Introducing measures to ensure that the harbourmaster is alerted to *Gülnak* or its sister vessels visiting Teesport in the future.

    - Providing pilots with tidal stream atlas and other outputs from tidal modelling.

    - Stressing to pilots under training the importance of taking vessel handling characteristics into account when determining tug waiting positions.

RECOMMENDATIONS

Gülnak Shipping Transport & Trading Inc. is recommended to:

2020/109 Take action to ensure:

- *Gülnak*'s masters and embarked pilots are aware of the circumstances of this accident and the potential for similar accidents to occur in the future.
- *Gülnak*'s shiphandling characteristics are closely monitored and that the accuracy of the available manoeuvring data is validated.
- Bridge equipment on its vessels, including engine speed indication, is checked frequently to ensure it is operating correctly.

Safety recommendations shall in no case create a presumption of blame or liability

SHIP PARTICULARS		
Vessel's name	*Gülnak*	*Cape Mathilde*
Flag	Turkey	Panama
Classification society	Bureau Veritas	Nippon Kaiji Kyokai
IMO number/fishing numbers	9579028	9409120
Type	Bulk carrier	Bulk carrier
Registered owner & manager	Gülnak Shipping Transport & Trading Inc.	Tokei Kaiun KK
Year of build	2011	2010
Construction	Steel	Steel
Length overall	179.88m	292.00m
Gross tonnage	23397	92290
Deadweight	35167	178831
Minimum safe manning	17	Not relevant
Authorised cargo	Dry bulk	Dry bulk
VOYAGE PARTICULARS		
Port of departure	Ravenna, Italy	Not applicable
Port of arrival	Teesport, England	Not applicable
Type of voyage	International	Not applicable
Cargo information	33888 tonnes gypsum	Coal
Manning	25	Not relevant
MARINE CASUALTY INFORMATION		
Date and time	18 April 2019 0324 UTC+1	
Type of marine casualty or incident	Serious Marine Casualty	
Location of incident	Port bow	Port side hull number 1 and number two upper ballast tanks
Place on board	Forecastle	Hull
Injuries/fatalities	None	None
Damage/environmental impact	Port bow and port anchor	Number 1 and number 2 starboard upper wing ballast tanks
Ship operation	On passage	Alongside
Voyage segment	Pilotage	Not applicable
External & internal environment	Wind NE Beaufort force 1-2. Night, good visibility. High water at 0335, height 5.31m	
Persons on board	26	Not relevant