ACCIDENT REPORT

Report on the investigation of

the capsize and foundering of the fishing vessel

JMT (M99)

resulting in two fatalities

3.8nm off Rame Head, English Channel

9 July 2015

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

VERY SERIOUS MARINE CASUALTY REPORT NO 15/2016 JULY 2016

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2012 – Regulation 5:

"The sole objective of the investigation of an accident under the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012 shall be the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose of an investigation to determine liability nor, except so far as is necessary to achieve its objective, to apportion blame."

NOTE

This report is not written with litigation in mind and, pursuant to Regulation 14(14) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 2012, shall be inadmissible in any judicial proceedings whose purpose, or one of whose purposes is to attribute or apportion liability or blame.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ALB	-	All weather lifeboat
C	-	Celsius
CGOC	-	Coastguard Operations Centre
cm	-	centimetre
CoC	-	Certificate of Competency
CRT	-	Coast rescue team
DSC	-	Digital selective calling
EPIRB	-	Emergency Position Indicating Radio Beacon
FISG	-	Fishing Industry Safety Group
GM	-	Metacentric Height
GRP	-	Glass Reinforced Plastic
GZ	-	Heel righting lever in metres
HRU	-	Hydrostatic Release Unit
ILB	-	Inshore lifeboat
kg	-	kilogram
kW	-	kilowatt
l	-	litre
(L)	-	Registered length
LOA	-	Length overall
m	-	metre
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
MHz	-	Megahertz
MSN	-	Merchant Shipping Notice
ng/mL	-	nanogram/millilitre
nm	-	nautical miles

PFD	-	Personal Flotation Device
PLB	-	Personal Locator Beacon
RNLI	-	Royal National Lifeboat Institution
ROV	-	Remotely Operated Vehicle
SAR	-	Search and Rescue
SCV	-	Small Commercial Vessel
Seafish	-	Sea Fish Industry Authority
STCW 95	-	The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (as revised 1995)
STCW (F) 95	-	The International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel, 1995
t	-	tonne
UTC	-	Universal Co-ordinated Time
VDR	-	Voyage Data Recorder
VHF	-	Very High Frequency

TIMES: all times used in this report are UTC+1 unless otherwise stated

SYNOPSIS

During the afternoon of 9 July 2015, routine contact was lost with the skipper and crewman on board the 11.4m scallop dredger *JMT*, which was fishing off Plymouth, UK. A search and rescue operation was initiated the following morning when the vessel did not return alongside as expected. The body of the crewman was found floating in a life-ring; he was not wearing a lifejacket. The wreck of the vessel was located 3.8 miles off Rame Head in a depth of 51m but its skipper was not found. There was no pollution and *JMT* was recovered from the seabed the following month.

The investigation identified that:

- *JMT* capsized and sank at approximately 1501 on 9 July 2015.
- The vessel had only 25% of the reserve of stability required for larger fishing vessels.
- The vessel's stability had been adversely affected by structural modifications and by aspects of the vessel's operation.
- Capsize was possibly triggered by the release of the contents of the starboard dredges while the port dredges and their contents remained suspended.
- The crew's likelihood of survival was reduced by not having the opportunity to broadcast a distress message, release the EPIRB from its stowage, lifejackets not being worn and the failure of the liferaft to surface.

Currently, fishing vessels less than 15m length overall do not have to meet stability criteria. Consequently, a number of these vessels, particularly those that have been substantially modified and those engaged in scallop dredging, bulk fishing and trawling are at risk. The Maritime and Coastguard Agency has action in hand to address this situation with regard to new vessels, but the need to ensure the safety of existing vessels through a straightforward and cost-effective means is equally compelling.

The lives of fishermen continue to be lost because they do not routinely wear personal flotation devices when working on the open deck. Much effort has been expended by the MCA and the fishing industry to change the mind set of fishermen through educational campaigns and the provision of free constant wear lifejackets. However, there appears to be no data available that could indicate whether such initiatives are effective and, perhaps more importantly, whether the wearing of personal flotation devices when working on deck should become a mandatory requirement. The MAIB is currently conducting its own review of the use of lifejackets in the UK fishing industry that will be published as part of a safety investigation later this year.

Recommendations have been made to the Maritime and Coastguard Agency, Seafish and national fishing federations that are designed to ensure:

- All small fishing vessels of under 15m are provided with stability information.
- Skippers of small fishing vessels are required to complete stability awareness training.
- Inspections of vessels against the Seafish Construction Standards are consistently robust and thorough.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *JMT* AND ACCIDENT

SHIP PARTICULARS	
Vessel's name	*JMT*
Flag	United Kingdom
Classification society	Not applicable
Fishing numbers	M99
Type	Scallop dredger
Registered owner	Private ownership
Manager(s)	Not applicable
Construction	Steel
Year of build	1988
Length overall	11.4m
Registered length	10m
Gross tonnage	15.16
Minimum safe manning	Not applicable
Authorised cargo	Not applicable
VOYAGE PARTICULARS	
Port of departure	Plymouth, Devon, UK
Port of arrival	Not applicable
Type of voyage	Coastal
Cargo information	Scallops
Manning	2
MARINE CASUALTY INFORMATION	
Date	9 July 2015
Type of marine casualty or incident	Very Serious Marine Casualty
Location of incident	50° 15.711N 004° 17.154W
Place on board	Ship
Injuries/fatalities	2 fatalities
Damage/environmental impact	Vessel lost. No harm to the environment
Ship operation	On passage/emptying dredges
Voyage segment	Mid-water
External & internal environment	Wind: Variable force 3; Sea State: Slight; Weather conditions: Clear; Visibility: Good; Sea water temperature: 13.6°C Daylight
Persons on board	2

JMT (M99)

1.2 NARRATIVE

1.2.1 The fishing trip

At approximately 0605 on 9 July 2015, the 11.4m scallop dredger *JMT* sailed from Sutton Harbour, Plymouth, UK. On board were the vessel's skipper, Michael Hill, and a crewman, Shane Hooper. *JMT* set off towards the scallop grounds between Rame Head and the Eddystone Lighthouse **(Figure 1)**. The wind was variable force 3, the sea was slight and the visibility was good.

During the day, the skipper maintained regular contact with his father by mobile telephone. At about 1430, the skipper informed his father that he had caught 17 bags of scallops and that his target for the day was 25 bags. He also told him that the starboard 'pull-down' winch **(Figure 2)** was not working.

Shortly after 1500, the skipper's father telephoned his son, but the call was immediately diverted to answer phone. About 30 minutes later, the skipper's father telephoned the crewman. This call also diverted to answer phone. The skipper's father continued to try and contact his son and the crewman, but without success.

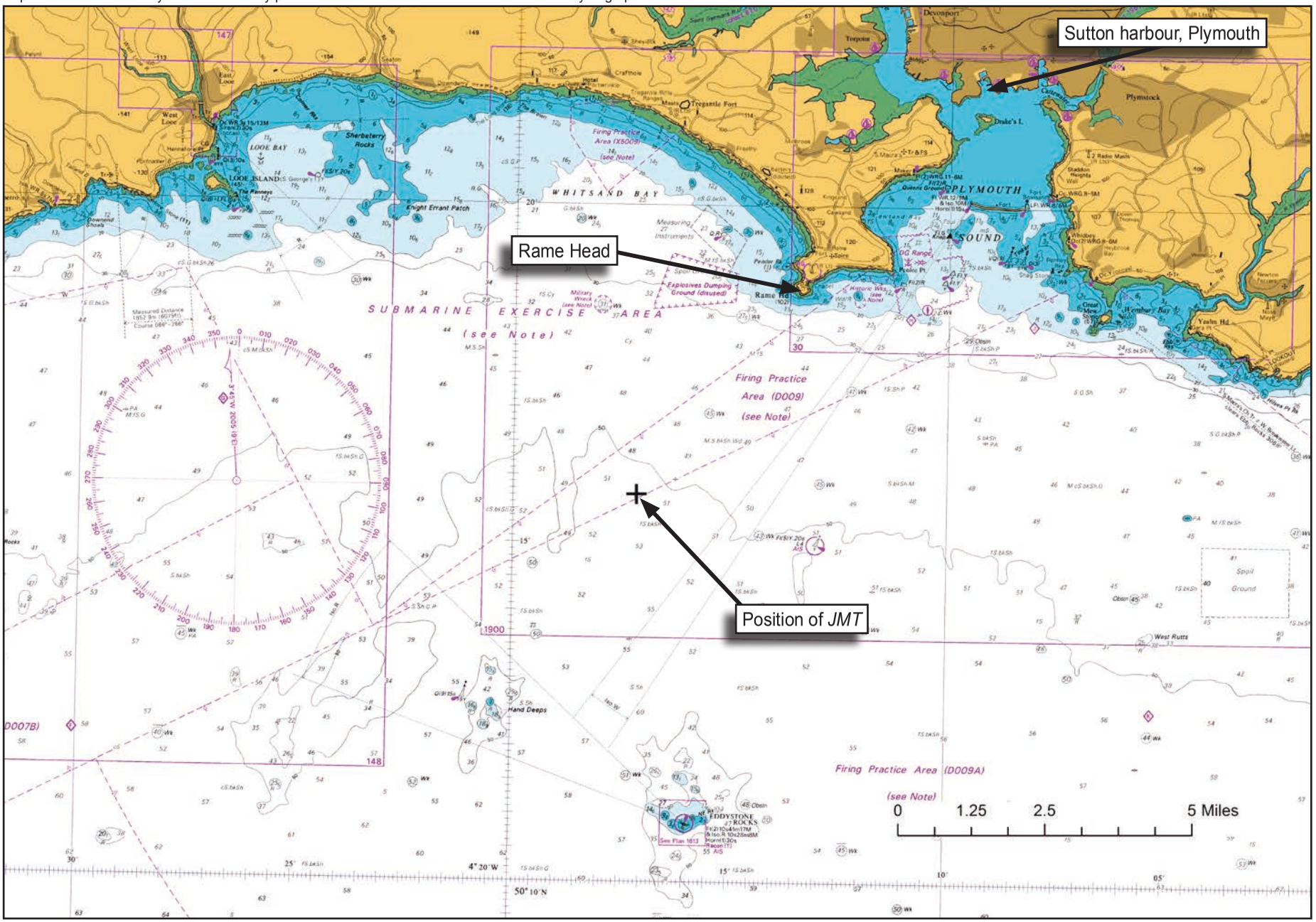

Figure 1: Extract from chart BA 1267 showing the position of the wreck

Image courtesy of www.findafishingboat.com

Figure 2: *JMT*'s working deck

1.2.2 The search

At 2008, *JMT*'s skipper's father informed the Falmouth Coastguard Operations Centre (CGOC) that *JMT* was overdue and that he was unable to contact its crew. Falmouth CGOC transmitted a "Pan Pan" urgency call[1] on very high frequency (VHF) radio channel 16 and attempted to contact and locate *JMT*. As concern for the vessel increased, the CGOC contacted Sutton and Brixham harbours and tasked the Plymouth coast rescue team (CRT) to assist.

At 2125, *JMT*'s skipper's father reported to Falmouth CGOC that he had been informed by a third party that *JMT* might stay at sea overnight and return to either Plymouth or Brixham the following morning. He also informed the CGOC that the vessel had about 600l of fuel on board when it sailed earlier in the day. In response, Falmouth CGOC stood down the CRT. However, it continued to call *JMT* and to monitor fishing vessel movements into local ports. Sunset was at 2127.

By 0827 the following morning, Falmouth CGOC had been unable to locate *JMT* or contact its crew, so further "Pan Pan" urgency calls were broadcast. Soon after, the master of the tug *Careful* reported seeing a life-ring in the water 3.9nm west-south-west of Rame Head. Falmouth CGOC immediately initiated a search and rescue (SAR) operation and tasked the Plymouth and Fowey Royal National Lifeboat

[1] "Pan Pan" calls are used in radiotelephone communications to signify that there is an urgency on board a ship but there is no immediate danger to life or to the vessel.

Institution (RNLI) all weather lifeboats (ALB), the Looe RNLI inshore lifeboat (ILB) and rescue helicopter R193 to assist. A number of local fishing vessels and passing yachts also joined the search for *JMT* and its crew.

At 0920, the Looe ILB spotted a diesel slick 3.8nm south-west of Rame Head. At 0938, the crew on board a yacht found the body of Shane Hooper floating in a life-ring in the same area. Shane was recovered from the sea[2] onto the ILB. He was wearing jogging bottoms and a t-shirt, but no footwear. Shane was then transferred to the Plymouth ALB where a paramedic declared him to be life extinct at 1037.

The lifeboats, helicopter, yachts and local fishing vessels continued to search for *JMT*'s skipper. The wreck of *JMT* was located 3.8nm south-west of Rame Head **(Figure 1)** at a depth of 51m, but Michael Hill was not found.

1.3 VOYAGE DATA RECORDER INFORMATION

During the afternoon of 9 July 2016, the cross-channel ferry *Pont Aven* entered Plymouth. Information from the vessel's voyage data recorder (VDR) indicated that a radar target very close to the position of the wreck of *JMT* disappeared from the ferry's radar display at 1502 **(Figures 3** and **4)**. It also showed that there were no other vessels in close proximity to *JMT* at the time.

1.4 POSTMORTEM

A postmortem examination of Shane Hooper was conducted at Derriford hospital, Plymouth on 14 July 2015. The postmortem report concluded that:

> *[Shane] showed features consistent with immersion in water, with no unequivocal cause of death. Hypothermia and drowning (or a combination of both) are possible in this scenario.*

Toxicology tests identified that Shane had taken amphetamines[3]. A level of 318ng/mL was detected. The toxicology report concluded:

> *It is possible that there may have been either changes in cognition or stimulant effects of amphetamine that may have either lead to immersion or inability to recover once in the water. [sic]*

1.5 CREW

Michael Hill was 22 years old and had been a fisherman since leaving school aged 16. He had worked on a variety of vessels including whelk potters, beam trawlers and scallop dredgers. Michael had completed STCW 95[4] courses in personal safety and social responsibilities, elementary first-aid, personal survival techniques and proficiency in fire prevention and fire-fighting. However, no record was found of

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[2] The sea water temperature was 13.6°C

[3] Amphetamine is a stimulant drug that has a half life of about 12 hours. It is considered to be toxic at levels greater than 500ng/mL and lethal at levels greater than 1000ng/mL

[4] The International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (as revised 1995)

Images courtesy of Brittany Ferries

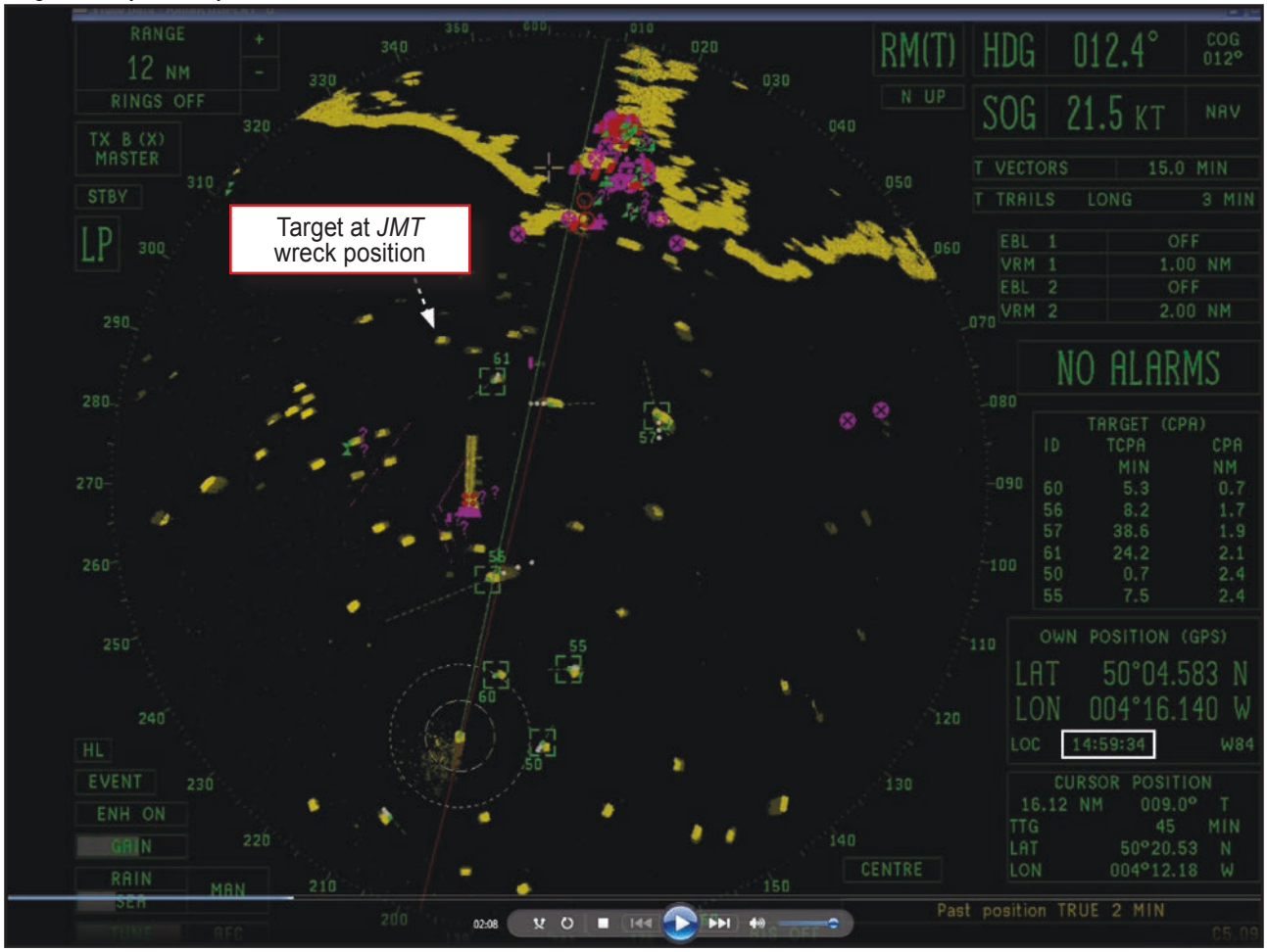

Figure 3: *Pont Aven* radar screen shot at 1459

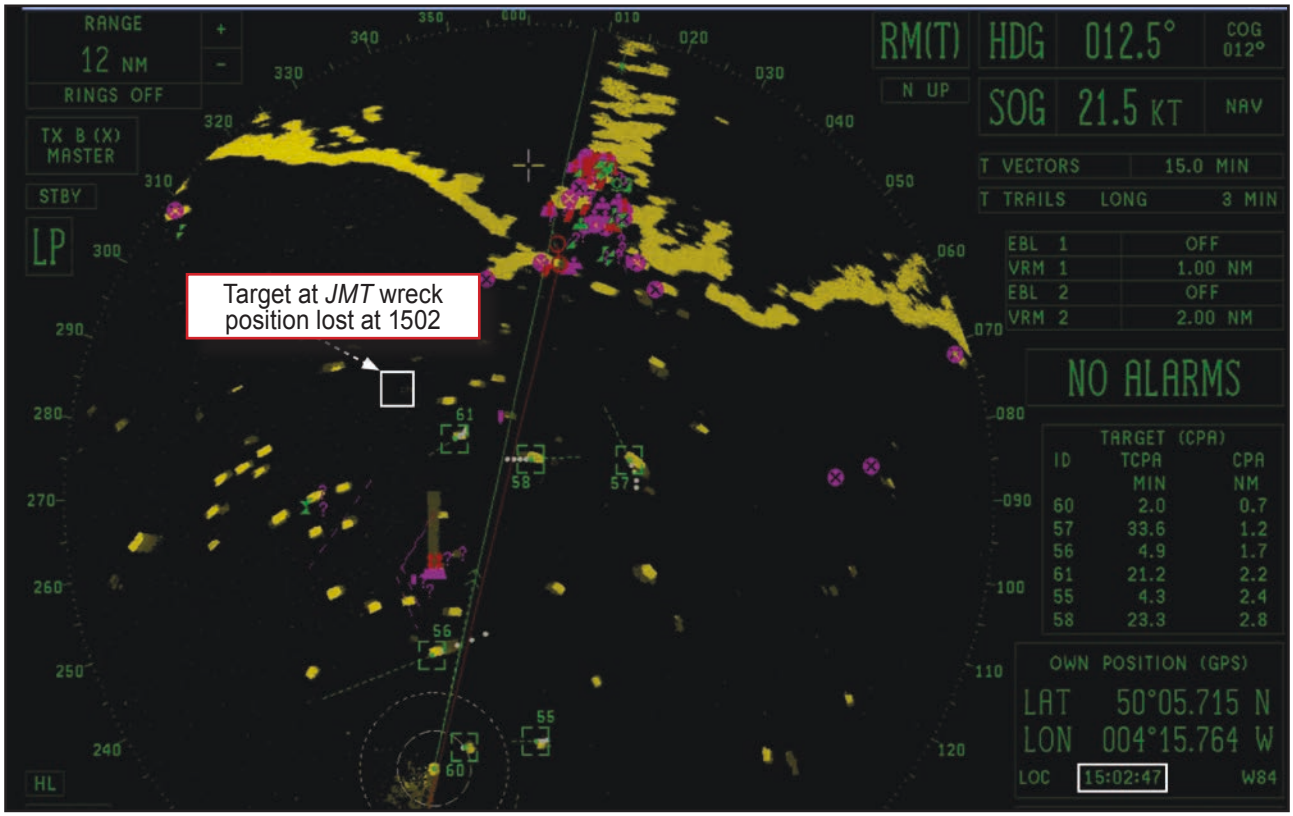

Figure 4: *Pont Aven* radar screen shot at 1502

him having completed the Sea Fish Industry Authority (Seafish) safety or stability awareness courses[5]. Michael had skippered *JMT* between June and September 2014 and again from February 2015 until the time of the accident.

Shane Hooper was 33 years old and had worked periodically on board fishing vessels since leaving school. He was regarded as an experienced fisherman and had completed the mandatory safety training courses.

1.6 CONSTRUCTION

JMT (previously named *Lady Patricia*) was designed and built by 'Kingston Seacraft', Hull in 1988 as a conventional small stern trawler **(Figure 5)**. The wheelhouse was forward, above the engine room; the working deck and the main trawl winch were aft of the wheelhouse. The vessel's length overall (LOA) was 11.4m, and its registered length (L) was 10m.

JMT had four main below-deck compartments: the fore cabin accommodation, the engine room, the fish hold and the steering flat **(Figure 6)**. Access to the accommodation was via a short companionway from the wheelhouse. Access to the engine room was through an opening in the deck of the forward casing. The fish hold, which was lined with glass re-enforced plastic but was not refrigerated, was entered via a hatch located on the aft deck. The steering flat was accessed via a watertight door from the fish hold.

Image courtesy of www.trawlerphotos.net

Figure 5: *Lady Patricia* BH168

[5] Fishermen who work in the UK are required to complete basic safety courses in sea survival, elementary first-aid, fire-fighting and health and safety. Fishermen with over 2 years' experience are also required to complete a Seafish safety awareness course. The Seafish stability awareness course is voluntary **(paragraph 1.17)**.

The common bulkheads between the engine room and the accommodation and between the fish hold and the steering flat were watertight. The common bulkhead between the engine room and the fish hold was penetrated by the propeller shaft at bilge level. The shaft was accessed via a hatch on the fish hold's deck.

JMT was fitted with a 145kW power Cummins main engine that supplied propulsion, hydraulic and electrical power. Two 5000l capacity fuel tanks were located on each side of the engine room. The tanks were connected by a crossover pipe fitted with valves to enable each tank to be isolated.

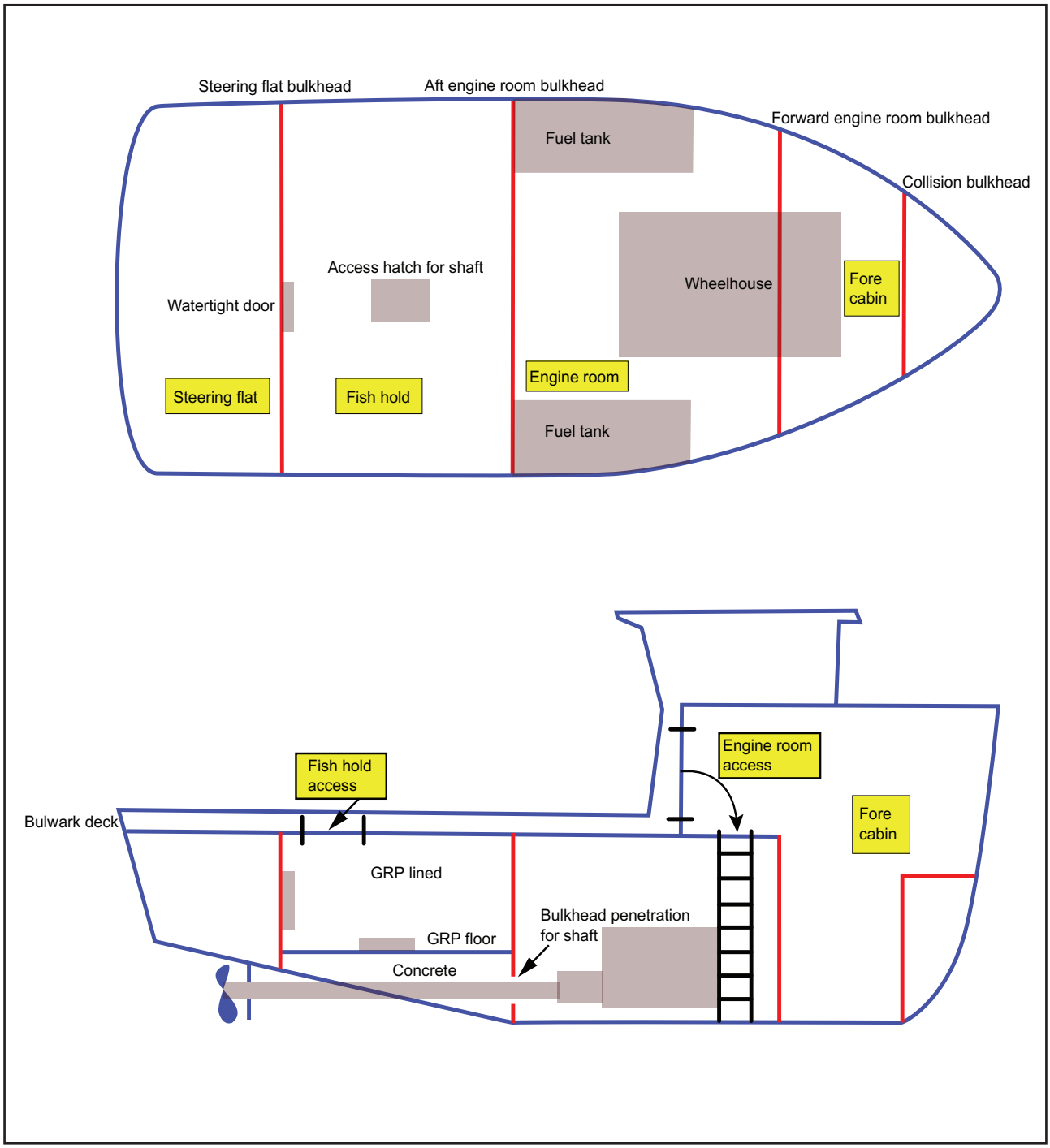

Figure 6: Arrangement of *JMT*'s compartments

1.7 OWNERSHIP AND MODIFICATIONS

Until 2003, *Lady Patricia* was UK owned and registered and was operated as a stern trawler out of Blyth, Northumberland. Between 2003 and 2013, the vessel was owned and registered in Guernsey, Channel Islands. During this period a shelterdeck was fitted on the vessel's port side and the height of the stern gantry was increased **(Figure 7)**.

In June 2013, *Lady Patricia* was sold to a UK national and renamed *JMT*. Between July and October 2013 the vessel was converted for scallop-dredging in East Llanion, Wales.

The conversion work included:

- The replacement of the trawl winch.
- The replacement of the 'scotch poles' **(Figures 5** and **7)** with a 5m high 'goalpost' gantry **(Figure 8)**.
- The addition of two 'pull-down' hydraulic winches on the deck **(Figure 2)** and two hydraulic winches on the aft gantry for lifting the scallop gear **(Figure 8)**.
- The addition of 'outriggers' for towing the scallop gear **(Figure 8)**.

Image courtesy of www.trawlerphotos.co.uk

Figure 7: *Lady Patricia* operating from Guernsey

Other modifications to *JMT* included:

- The relocation of the engine room access from inside the wheelhouse to a side casing door **(Figure 8)**.
- The removal of the shelter on the port side.
- The addition of a collision bulkhead.
- The shaft inspection hatch in the fish hold was secured **(Figure 9)**.

Image courtesy of www.findafishingboat.com

Figure 8: *JMT* post modification in 2013

Image courtesy of www.marinetraffic.com

Figure 9: Shaft inspection hatch in *JMT*'s fish hold floor

1.8 INSPECTIONS

While *JMT*'s conversion to a scallop dredger was in progress, the vessel was surveyed against the requirements of the Seafish Construction Standards[6]. At the request of the vessel's owner, *JMT* was first inspected by a Seafish approved surveyor on 26 June 2013 with the aim of identifying the work that needed to be done in order to meet the standards. The surveyor visited again on 22 July 2013 to conduct an ultrasound hull thickness survey. A further visit was made on 5 September 2013, during which the surveyor produced a 'to do list' containing 17 items to be addressed. The final inspection of the vessel was completed on 12 September 2013 while *JMT* was out of the water. At the time of the inspection, the 'scotch poles' and the trawl winch had been removed but, the replacement trawl winch, the two 'pull-down' hydraulic winches on the deck, the hydraulic winches on the aft gantry, the outriggers and the taller 'goalpost ' gantry had not yet been fitted **(Figures 10** and **11)**. The surveyor's report noted that the trawl winch was to be replaced but it did not identify any other of the structural work that was outstanding.

With regard to the limitations of the inspection, the surveyor's report noted:

> *As the fish hold is lined with GRP it was not possible to access most of the steel structure in this area. The vessel was resting on her keel so it was not possible to view the underside of the keel. There was no internal access to the box keel in the aft section of the vessel.*

[6] Compliance with the Seafish construction standards is a requirement for new vessels. Existing vessels entering the UK fishing vessel register are inspected against the standards **(paragraph 1.19)**.

Images courtesy of Seafish

Figure 10: *JMT* during Seafish inspection (looking aft)

Figure 11: *JMT* during Seafish inspection (looking forward)

During the inspection, the vessel's freeboard was measured as 600mm. The survey report noted:

> *Freeboard measured from the aft freeing port to the dirty mark left by the waterline which is considerably below the level of the anti-fouling. Further weight will be added to the vessel (including a winch) which will decrease the freeboard.*

Also, under 'Seafish requirements' concerning the protection of personnel, the report stated:

> *Ensure the following conditions are met when fitting the winch. All warps and leads running across the working deck are to be fitted with guards. Equipment controls are to be positioned to enable a clear view of the gear being hauled and crew positions. An emergency stop must be fitted at the helm. An additional emergency stop must be fitted at the winch.*

The surveyor's report was subsequently approved by the head of Seafish Marine Survey and four of the authority's principal surveyors. It was then forwarded to the Maritime and Coastguard Agency (MCA) marine office in Falmouth where it was assessed by a principal surveyor.

On 9 October 2013, an initial safety inspection of *JMT* was conducted in Milford Haven, Wales, by an MCA surveyor. *JMT* returned to the UK fishing vessel register on 15 October 2013 and its UK small fishing vessel certificate was issued 6 days later.

1.9 FISHING GEAR

JMT carried two sets of scallop dredges **(Figure 12)**: one set on its port side and one set on its starboard side. Each set comprised four 760cm wide dredges fitted with a spring-loaded toothed bar at the opening and a 'bag' at the rear made of steel rings for collecting the dredged scallops. The top of each dredge was attached to a 3m towing bar with wheels at each end. The towing bar was attached to a 16mm diameter steel towing wire by chains. The bottom of each dredge was attached by a chain to a 'tipping bar' to enable all of the dredges to be inverted at the same time when being emptied. The weight of one side of empty dredge gear was 750kg.

When hauling, the port and starboard dredges were usually recovered simultaneously and then emptied as follows:

- The dredges were hoisted to the surface on the vessel's quarters using the trawl winch **(Figure 13)**.
- Lifting wires suspended from blocks on the midships gantry were hooked into the rings at the head of each of the towing chains.
- The dredges were pulled to the vessel's midships and raised clear of the bulwarks using the hydraulic winches on the aft gantry **(Figure 14)** (lifting wire shown in yellow**)**.
- Ropes from the 'pull-down' winches were attached to the towing bars and then the towing bars were pulled to the deck, leaving the dredges resting on the bulwarks **(Figure 15)**.
- The lifting wires were unhooked from the towing chain rings and hooked into chains connected to the tipping bars.
- The dredge bags were inverted in turn to empty the catch onto the deck, again using the hydraulic winches on the aft gantry **(Figure 16)**.

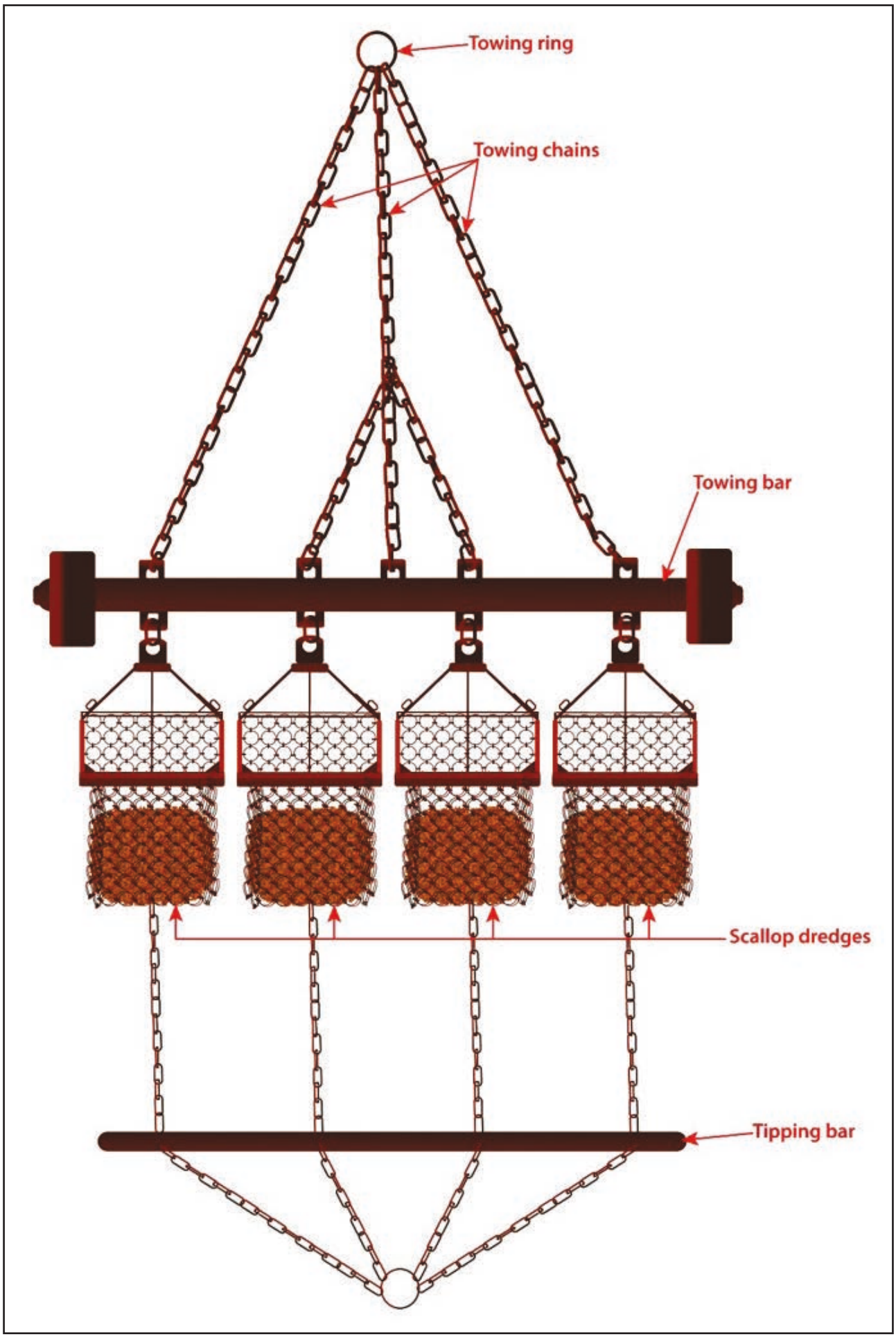

Figure 12: Diagram of a set of scallop dredge gear

Figure 13: Scallop dredges hauled to the surface

Figure 14: Scallop dredges raised above the bulwarks

Figure 15: Towing bars pulled to the deck

Figure 16: Dredges inverted to empty catch

1.10 RECENT OPERATIONS

JMT started fishing as a scallop dredger in October 2013. Initially, the vessel operated off the Welsh coast, but later worked scallop grounds around the UK. In May 2014, beneficial ownership[7] of the vessel was transferred to Michael Hill's father, who agreed to purchase *JMT* from the registered owner in instalments. The final payment for the vessel and the transfer of its ownership was expected to have been completed in July 2015. The registered owner retained all of the shares in the vessel but from May 2014 he was not involved in its operation.

[7] A beneficial owner is a person who enjoys the benefits of *ownership* even though title (or registration) is in another name.

In July 2014, the harbourmaster in Padstow, Cornwall, became concerned about *JMT*'s angle of list **(Figures 17** and **18)** and how 'tender'[8] the vessel appeared to be when it was manoeuvring inside the harbour. *JMT*'s skipper advised the harbourmaster that the list and apparent lack of stability were due to the fact that the vessel had lost one set of its scallop dredges. The harbourmaster requested that *JMT* was not moved inside the harbour until the vessel had scallop dredges on both sides.

In May 2015, *JMT* moved to Plymouth to take advantage of the local scallop fishery. When operating out of Plymouth, the vessel usually sailed at about 0600 and returned around 1800. Occasionally, *JMT* stayed at sea for 36 hours. On 9 July 2015, an onlooker saw *JMT* roll heavily as it turned soon after leaving Sutton Harbour lock.

Figure 17: *JMT* listing in Padstow harbour (Summer 2014)

[8] A vessel which is 'tender' is easier to incline and has a relatively long roll period. Such a vessel may take a large angle of heel when weight is added to one side, and will be more susceptible to capsize. A vessel that has a short roll period is referred to as being 'stiff'.

Figure 18: *JMT* listing in Padstow harbour (Summer 2014)

1.11 SAFETY EQUIPMENT

The safety equipment carried on board *JMT* included:

- A four-man 'Crewsaver Standard International' liferaft manufactured by Eurovinil in Italy in May 2013 and supplied by Survitec. The liferaft was secured in a cradle on the wheelhouse roof by a Hammar hydrostatic release unit (HRU) and a senhouse slip.
- A GME Mt403 emergency position indicating radio beacon (EPIRB) mounted on the inside of the aft wheelhouse bulkhead adjacent to the door; it was not fitted with 'float free' capability. The EPIRB was designed to transmit at 406 and 121.5MHz and was capable of manual or water activation. It was registered with the MCA in the name of *JMT*'s registered owner.
- Two traditional 30" round life-rings fitted with retro-reflective tape and rope loops were carried on the wheelhouse roof.
- Two inflatable 'constant wear' lifejackets and an unknown number of abandon ship lifejackets. The 'constant wear' lifejackets were kept in the wheelhouse; they were not routinely worn by the crew.

1.12 UNDERWATER INSPECTIONS

1.12.1 Independent dive

On 14 July 2015, two leisure divers examined the wreck of *JMT* at the request of the skipper's father. The divers identified:

- *JMT* was resting on its keel with a 30° list to port at a depth of 51m.
- The port side scallop dredge gear was raised and full of stones, debris and scallops **(Figure 19)**.
- The starboard side scallop dredge gear was empty and inverted **(Figure 19)**.
- The wheelhouse door, engine room access and fish hold hatch were open.
- A full bag of scallops was on the port side of the aft deck.
- The liferaft's HRU had activated.
- The liferaft was on the seabed off the vessel's port side and was still attached to the vessel by its painter, which was connected to the weak link from the HRU. The weak link was intact **(Figure 20)**.
- The two life-rings were missing from the wheelhouse roof.

While recovering the shot line at the end of the dive, the divers inadvertently snagged the liferaft's painter, causing the liferaft to inflate and surface. The inflated liferaft was recovered and landed ashore.

1.12.2 Devon and Cornwall Police

On 16 July 2015, Plymouth University conducted a remotely operated vehicle (ROV) survey of *JMT* on behalf of the Devon and Cornwall Police. The survey's aims were to positively identify the vessel and to locate the missing skipper. The skipper was not found but the survey identified that the engine gear lever was in the 'ahead' position and that the engine throttle lever was fully forward (minimum speed) **(Figure 21)**, there were no bags of scallops in the fish hold and that the cover to the shaft inspection hatch was missing **(Figure 22)**.

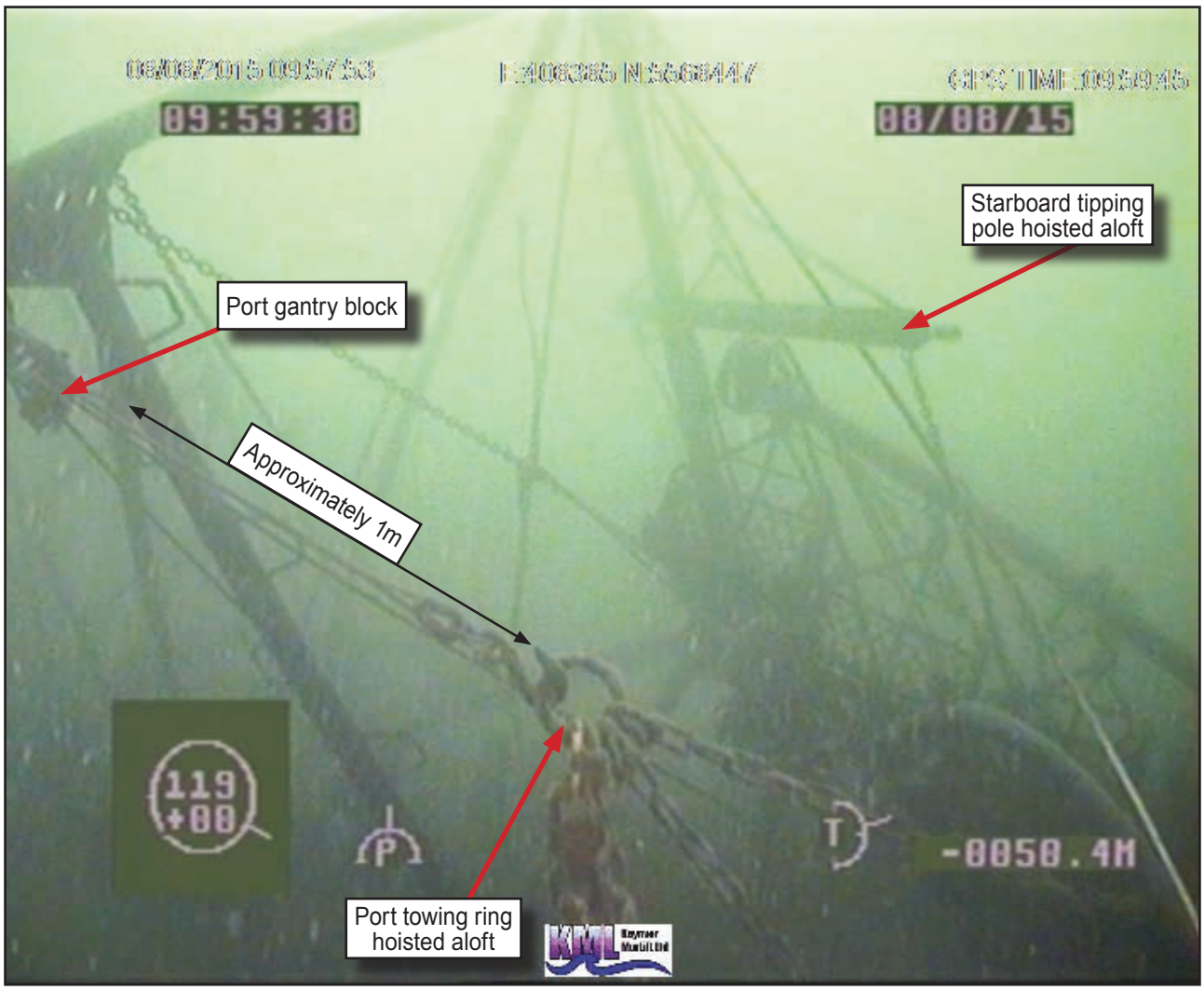

Figure 19: Underwater image of port and starboard scallop gear

Figure 20: Underwater image of *JMT*'s HRU

Figure 21: *JMT*'s throttle position

Figure 22: Missing shaft inspection hatch cover

1.12.3 MAIB

On 17 July 2015, a 200m temporary exclusion zone was established around *JMT*. On 8 August, an MAIB commissioned ROV survey identified that the wreck was on a heading of approximately 070° and the vessel's rudder was hard over to port. It also identified damage to the shell plating along the starboard side.

The ROV searched an area extending to a radius of 100m from the wreck. It was also used to remove the port side scallop dredges with their contents. The port side scallop gear and its contents were landed ashore and was found to weigh 1144kg **(Figure 23)**.

Figure 23: *JMT*'s port side scallop dredges being weighed

1.13 VESSEL RECOVERY AND INSPECTION

On 17 August 2015, airbags were used to raise *JMT* to the sea surface **(Figure 24)**. The vessel was then towed to shallower water and lowered back onto the seabed to enable divers to prepare the vessel for beaching or lifting onto a barge. During two unsuccessful recovery attempts, the airbags being used to lift *JMT* lost buoyancy, causing the vessel to sink to the seabed. No additional hull damage resulted. However, the trawl winch was dislodged from its transverse axis.

On 22 August, lifting strops were placed under *JMT*'s hull and the vessel was lifted alongside and then onto a crane barge **(Figure 25)**. *JMT* was transported to a local boat yard for inspection, stability assessment and storage. A detailed examination of the vessel identified, inter alia:

- Significant implosion damage to both port and starboard wing fuel tanks **(Figures 26** and **27)**.
- A 1m split on the welded joint in way of the engine room/fish hold port side bulkhead **(Figure 28)** that was consistent with the implosion damage to the port fuel tank.
- The valves in the crossover pipe between the fuel tanks were in the 'open' position.
- Impact damage to the rudder skeg.
- Stone chipping ballast in the accommodation bilge had shifted aft and to port.
- The winch hydraulics were clutched in.
- All of the bilge pump switches were in the 'off' position and the engine room and steering locker audible alarms had been taped over **(Figure 29)**.
- The skipper's mobile phone was plugged into a charging socket in the wheelhouse.
- Four retaining bolts were missing from the starboard hydraulic 'pull-down' winch **(Figure 30)**.
- The EPIRB was fastened in its bracket in the wheelhouse **(Figure 31)**.

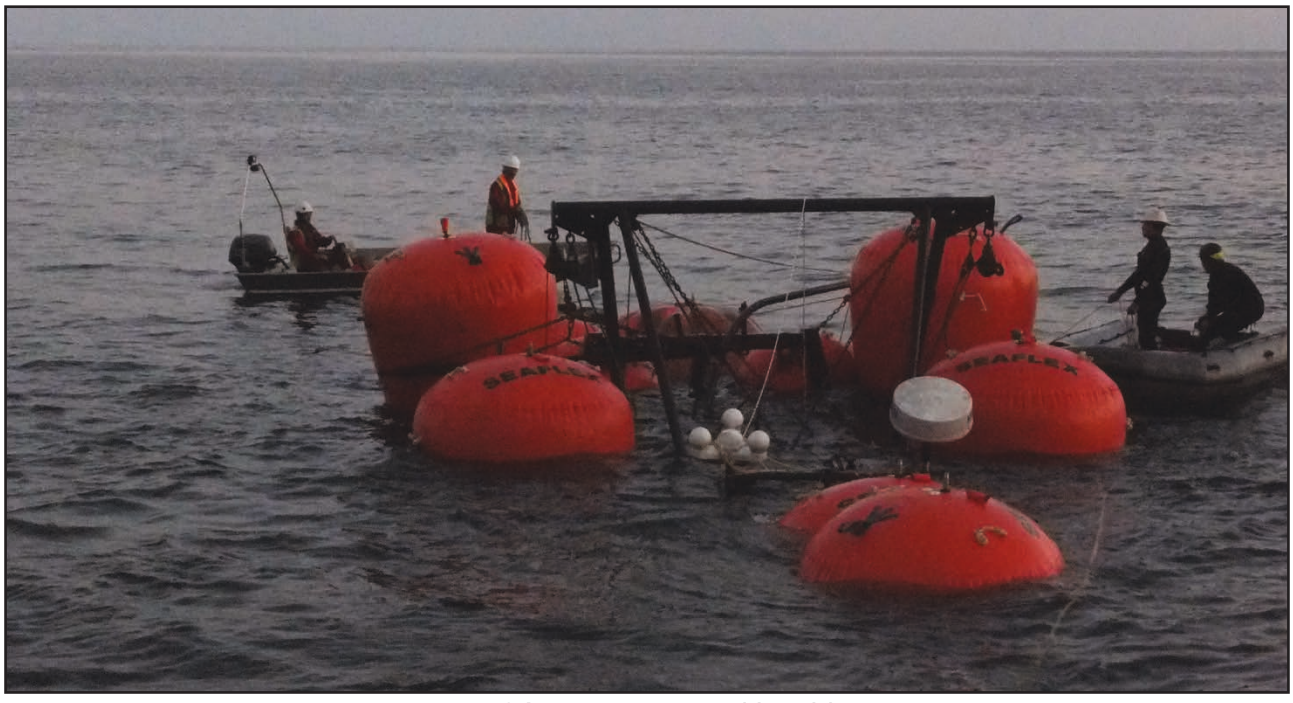

Figure 24: *JMT* supported by airbags

Figure 25: *JMT* suspended in lifting strops

Figure 26: Implosion damage to *JMT*'s starboard side

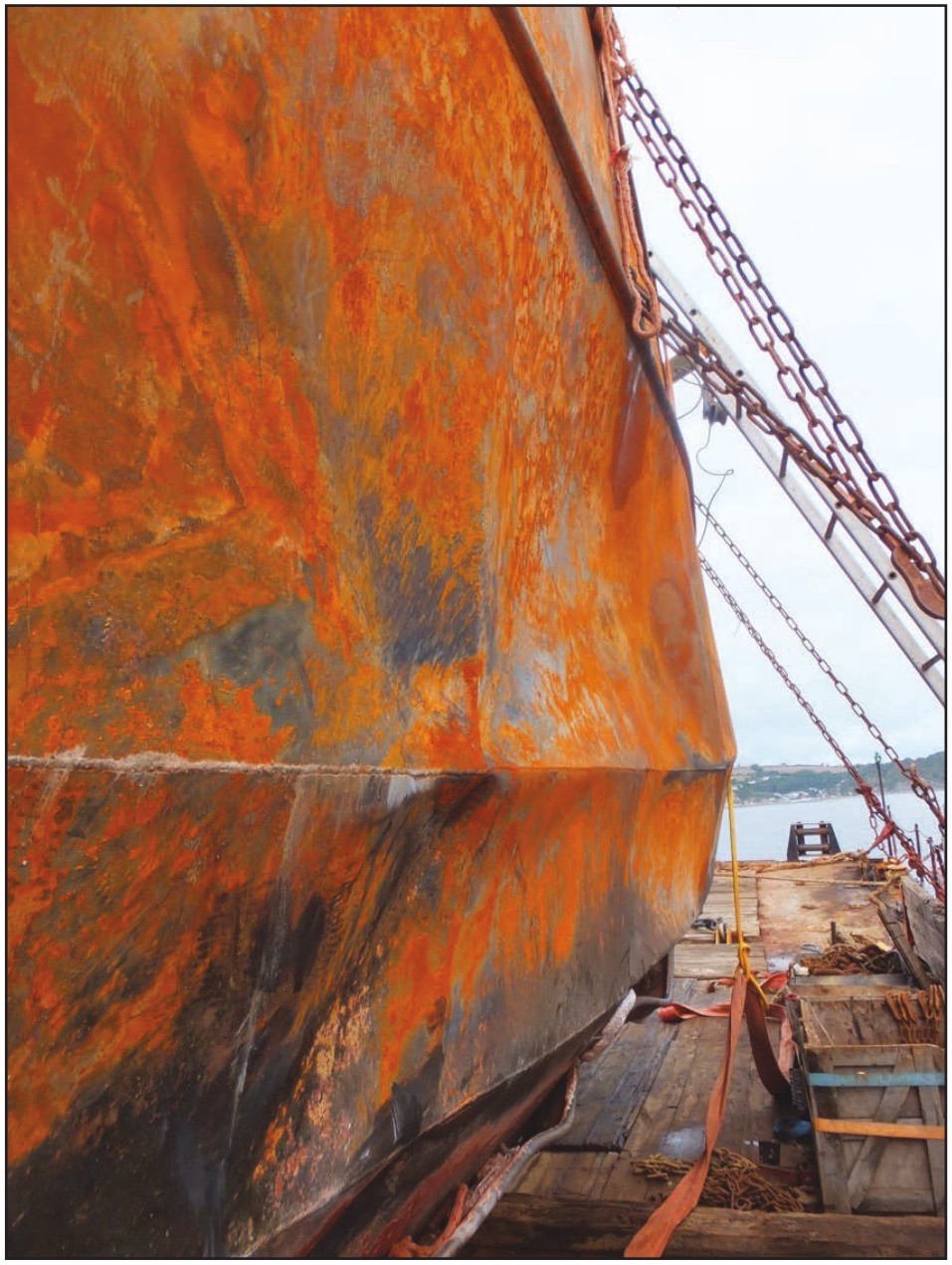

Figure 27: Implosion damage to *JMT*'s port side

Figure 28: Split in welded joint in way of port side engine room/fish hold bulkhead

Figure 29: *JMT*'s bilge pump switch panel

Figure 30: *JMT*'s 'pull down' winches showing missing retaining bolts

Figure 31: *JMT*'s EPIRB located on the wheelhouse bulkhead

1.14 STABILITY ASSESSMENT

On 23 September 2015, an inclining experiment was conducted by the University of Southampton's Wolfson Unit for Marine Technology and Industrial Aerodynamics to assess *JMT*'s stability when it was lost. The experiment determined the vessel's lightship weight and its centre of gravity. The split in the vessel's side was repaired before the experiment took place and the vessel was found to be watertight when in the water.

The Wolfson Unit developed a computer model of *JMT*'s hull that was used to assess the vessel's stability in four conditions representative of a voyage profile (depart port, arrival grounds, depart grounds and arrival port) against the intact stability criteria applied to fishing vessels over 15m LOA. The vessel's stability was also assessed in three operational conditions, including its loss condition.

The Wolfson Unit's report **(Annex A)** is considered to provide an accurate indication of *JMT*'s stability in the various conditions. However, given the approximation and estimation necessary in such an analysis, the resulting numerical values contained in the condition data are not absolute.

1.15 REGULATIONS AND CODES OF PRACTICE

A wide range of safety standards, including stability criteria for fishing vessels, was introduced in *The Fishing Vessels (Safety Provisions) Rules 1975* (known as the 1975 Rules). These rules first introduced mandatory intact stability criteria for all vessels of 12m (L) and over. The 1975 rules were superseded by:

- *The Fishing Vessels (Safety of 15-24 Metre Vessels) Regulations 2002* (known as the 15-24 Code), summarised in MSN 1770 (F) *The Fishing Vessels Code of Safe Working Practice for the Construction and Use of 15 metre length overall (LOA) to less than 24 metre registered length (L) Fishing Vessels* and,
- The Small FV Code, originally summarised in MSN 1756 (F) *The Fishing Vessels Code of Practice for the Safety of Small Fishing Vessels under 12 metres in length.*

Due to an oversight during the development of the 15-24 Code, and the first revision of the *Small FV Code*, the requirement to comply with the intact stability criteria was removed from fishing vessels between 12m (L) and 15m (LOA).

In 2007, the Small FV Code was revised (and summarised in MSN 1813 (F) *The Code of Practice for the Safety of Small Fishing Vessels with a length overall (LOA) of less than 15 metres* to further increase the safety of small fishing vessels and to improve crews' chances of survival in the event of an accident. A major change in this revision was the introduction of a requirement for vessels between 7m (L) and 15m (LOA), whose construction started after April 2001, to comply with the construction and outfit standards issued by Seafish **(paragraph 1.19)**. The requirement to be assessed against the construction and outfit standards also applied to existing vessels entering the UK fishing vessel register, regardless of the date of construction. Section 3.8 of the Code requires that '*on first registration of a new vessel, the owner shall supply the required hull construction, and outfit certificates from Seafish to the Registry of Shipping and Seamen*.

In April 2014, MGN 502 (F) - *The Code of Practice for the Safety of Small Fishing Vessels - Standards which can be used to prepare for your MCA Inspection* was published. The MGN provided a voluntary small fishing vessel code of practice that was based on MSN 1813 and took into account the findings of a number of MAIB investigations. MGN 502 (F) included:

- *Liferafts are required for vessels of 7m Registered Length (L) to less than 12m (L);*
- *Vessels built prior to 2007 newly entering the fishing industry must have a Survey by a Certifying Authority prior to registration;*
- *Structural modifications to be notified to MCA prior to work taking place;*
- *EPIRBs and Stability requirements for vessels of 12m (L)-15m (LOA);*
- *Personal Floatation Devices or Lifelines recommended to be worn whilst working on open decks.* [sic]

The MCA is currently revising the Small FV Code. In 2015, it issued a draft of the revised code to the fishing industry for consultation, which incorporated the voluntary requirements detailed in MGN 502 (F). In particular, it required new vessels between 12m (L) and 15m LOA and vessels that were built before 2007 and coming on to the UK fishing register for the first time, to have approved stability information relevant to their intended method of operation.

The draft revised code also required small fishing vessels to carry either a float-free satellite EPIRB or personal locator beacons (PLB) (one per person) depending on their length[9]. It also strongly recommended that all crew working on the open decks at sea wear personal flotation devices (PFD) and/or safety lines. The revised Small FV Code is expected to be published in October 2016.

1.16 STABILITY GUIDANCE

1.16.1 Fishing vessels of less than 15m LOA

In December 2010, the MCA published MGN 427 (F) – Stability Guidance for Fishing Vessels of under 15m Overall Length **(Annex B)**. The MGN stated that full stability requirements for 12m (L) to 15m LOA fishing vessels were to be reintroduced in the near future but that there was no intention to introduce compulsory stability requirements for vessels under 12m (L).

The MGN states:

> *A number of factors can affect a vessel's stability, for example its length and breadth, the freeboard, the centre of gravity of the ship and equipment, distribution of weights such as in the fish hold, on deck, in hoppers, in nets, fuel, water and stores etc. Research has shown the importance and effect on stability of maintaining adequate freeboard. The weathertight deck, hatches and doors should be kept closed and decks should be kept clear of water and other moveable weights. While a vessel may appear very 'stiff' because of her large beam, if the freeboard is small there may be little reserve of stability when the vessel heels or is in large waves due to the dangers of downflooding. Also a vessel which appears very sea-kindly and comfortable with a slow roll period can actually be potentially unsafe in terms of stability. Keeping water off the deck by closing scuppers or freeing ports may seem sensible and safe, but does have the opposite effect if a wave comes onboard and causes instability because of the trapped water and its free surface effect. It is also vital that a catch is not stored on deck, it should be stored as low as possible in the vessel as soon as is practicable.*

MGN 427 (F) includes five methods of assessing a fishing vessel's stability:

- Full Stability Method. Applies to all vessels over 15m LOA and requires stability data to be formulated from an inclining experiment and calculation.
- Small Commercial Vessel (SCV) Code Standard (heel test). Applies to vessels carrying less than 1 tonne of cargo and requires a heel test resulting in a heel angle less than 7º and sufficient freeboard.
- Small Passenger Vessel Heel Test. An alternative to the Small Commercial Vessel Code heel test standard, which also requires a resulting heel angle less than 7º and specified minimum freeboard, but which can be used for vessels carrying > 1 tonne of cargo.
- Roll period approximation - a simple operational comparative method to determine whether a vessel is stiff or tender. If the roll period in seconds is less than a vessel's beam in metres, the vessel is considered to be stiff. If the roll period in seconds is greater than the vessel's beam, the vessel is considered to be tender.
- Wolfson Guidance **(paragraph 1.16.2)**.

[9] The draft revision of the Small FV Code recommended that both an EPIRB and PLBs are carried.

The details of the requirements of each of the methods are provided in annexes to the MGN. Guidance on the conduct of heel and roll tests was provided in MGN 503 (F) *Procedure for Carrying out a Roll or Heel Test to Assess Stability for Fishing Vessel Owners and Skippers* published in April 2014.

MGN 427 (F) also states that a notice entitled *Simple Efforts for Maintaining Stability* or similar should be posted in a prominent position on board a fishing vessel, and that skippers and crew should attend the Seafish 1-day Stability Awareness course **(paragraph 1.17)**.

1.16.2 Wolfson guidance

In May 2006, the University of Southampton's Wolfson Unit completed a research project commissioned by the MCA, that was aimed at developing guidance for the loading of fishing vessels between 12m(L) and 15m LOA.

The report proposed a method of generating simplified stability guidance linked to recommended maximum wave heights through the application of a freeboard mark on the hull referenced to a stability notice displayed in the wheelhouse. The guidance derived from the Wolfson stability notice and mark is intended to provide fishermen with a basic indication of safety based on a vessel's residual freeboard when loading and lifting, and the sea state.

For decked vessels with no stability data, only a vessel's LOA and breadth are required to calculate where to position the freeboard guidance marks, and the corresponding safety zones. The safety zones are:

Green: *"Safe" in all but extreme sea states*

Amber: *"Low level of safety" and should be restricted to low sea states*

Red: *"Unsafe, and danger of capsize" unless restricted to calm conditions and with extreme caution*

The report recommended:

> *That guidance freeboard marks be placed on fishing vessels for which the guidance information is based on freeboard alone. These will enable the fishermen to relate the guidance information to his vessel directly. [sic]*

1.17 STABILITY TRAINING

Seafish introduced a 1-day intermediate stability awareness course in April 2006. The course is voluntary, free of change and is intended for all fishermen. Completion of the course is one of the prerequisites for award of the Seafish voluntary under 16.5m skipper's certificate[10].

Over 5600 fishermen have completed the stability awareness course, which uses a series of visual animations and a model boat specifically designed to explain key aspects of stability and to provide skippers and crew with a greater understanding

[10] The skippers of fishing vessels that are less than 16.5m LOA are not required to hold a Certificate of Competency. However, Seafish administers a voluntary under 16.5m skippers certificate that is aimed at increasing the navigational and engineering knowledge of skippers and watchkeepers on small fishing vessels.

of the issues involved. The model boat features an interchangeable structure to simulate a range of different fishing vessel types and, in conjunction with a water tank and a variety of weights, a range of operating conditions can be tested to reflect the dangers of additional top weight, free-surface effect, catch on deck etc.

The course syllabus includes:

- The principles of flotation as they apply to fishing vessels
- The terms used to describe basic vessel stability
- How the movement of weight can influence a vessel's stability
- The different states of vessel equilibrium
- How the hauling of gear and landing of catch influences a vessel's stability
- Free surface effect
- Roll periods
- Weight 'creep' or growth.

To further impress upon the fishermen the importance of these areas, specific MAIB accident investigations are highlighted. An end of course multiple choice assessment requires a pass mark of 70%.

1.18 STABILITY INFORMATION

In January 2015, the RNLI initiated a campaign aimed at improving the stability awareness of commercial fishermen, specifically targeting vessels of less than 15m. The campaign was entitled *Keep it stable, bring it home,* and featured five short videos giving practical advice on the hazards associated with:

- Vessel modifications
- Free surface effect
- Hauling operations
- Overloading; and
- Watertight integrity.

The videos were distributed to fishermen via social media.

In May 2015, the MCA published an updated version of the *Fishermen's Safety Guide – A guide to Safe Working Practices and emergency procedures for fishermen*. The guide provides advice on a wide range of operating practices on board fishing vessels. A section on stability explains the effect on a vessel's centre of gravity of: lifting a load from a high point, loose water or fish on deck, loading and unloading, and freeboard.

1.19 SEAFISH CONSTRUCTION STANDARDS

The Seafish Construction Standards for new fishing vessels less than 15m (LOA) define minimum standards for the design, construction, inspection and certification of the hull, and outfit of small commercial fishing vessels. The standards include a

requirement for decked vessels with a continuous watertight weather deck to have a minimum freeboard from the design waterline of not less than 300mm. Vessels with a freeboard less than 300mm are limited in their area of operation to 20 miles from a safe haven and in favourable weather conditions.

Seafish stipulates the conditions required for the conduct of a registration survey in its 'Application for Inspection' (Marine Services, Form 27, Issue 12), which includes:

- The vessel is to be presented in a complete and operational state
- The vessel is to be out of the water
- Prior to inspection and where possible, linings are to be removed for access to the hull structure.

The application also notes:

> *Where the attending surveyor deems the vessel unsafe/unfit for inspection, or inadequate equipment/arrangements have been provided for safe access by the applicant or their representative, then the surveyor may decline to inspect the vessel and further fees may be incurred for re-attendance. [sic]*

On completion of a registration survey/inspection by a surveyor, or delegated surveyor, the resulting report is forwarded to the MCA regional consultant surveyor for a decision on whether to accept, accept with conditions, or reject the report and vessel.

1.20 PREVIOUS SIMILAR ACCIDENTS

1.20.1 *Heather Anne*

On 20 December 2011, the 11.05m LOA fishing vessel *Heather Anne* capsized and foundered with the loss of one crewman in St Gerrans Bay, Cornwall. The vessel was raised and a subsequent stability assessment indicated that it had been operating with a low reserve of stability. *Heather Anne* had been significantly modified since her build in 1971. As a consequence, her displacement had increased by over 50% and, with a catch of an estimated 10.5 tonnes on board at the time of capsize, her freeboard was reduced to only a few centimetres. The deceased crewman was not wearing a PFD.

A number of recommendations were made to the MCA in the subsequent MAIB investigation report.[11] These included:

2013/106 *Revise MGN 427 (F) in order to provide clearer and more comprehensive guidance to surveyors and fishermen on the methods available to assess small fishing vessel stability, taking into account, inter alia:*

- *The limitations of the alternatives to a full stability assessment.*
- *The suitability of the alternative stability assessments for small fishing vessels.*
- *A vessel's stability is dependent on several factors including her upright GM, freeboard and hull form.*

[11] MAIB report 2/2013 - Report on the investigation of the capsize and foundering of the fishing vessel *Heather Anne* (FY 126) resulting in the loss of one crewman in Gerrans Bay, Cornwall on 20 December 2011

- *The need for skippers to be aware of the maximum loading of their vessels and the benefits of a freeboard mark.*
- *The impact of vessel modifications.*
- *Owners' and skippers' awareness of stability considerations while fishing.*

2013/107 *Expedite its development and promulgation of alternative small fishing vessel stability standards, which will ensure that all new fishing vessels under 15m (L) are subject to appropriate stability assessments, and which will eventually be included in the standards based on the Small Commercial Vessel and Pilot Boat Code scheduled for introduction in 2016.*

2013/108 *Specify the improvement in safety culture/behavioural change that it is seeking with respect to the voluntary wearing of personal flotation devices by individuals working on the decks of fishing vessels, and the timescale within which it is to be achieved;*

and

Make arrangements to rapidly introduce the compulsory wearing of personal flotation devices on the working decks of fishing vessels if the sought after changes are not delivered.

The report also recommended the MCA, the Marine Management Organisation and the Cornish Fish Producers Organisation to:

2013/110 *Work together to arrange trials of the 'Wolfson' mark on board a selection of Cornish fishing vessels under 15m (L) in order to gather sufficient data to enable the MCA to provide clear evidence on the marks' practicality, accuracy and usefulness.*

The latest MCA responses to these recommendations include:

2013/108: It is not possible to accurately measure the behavioural change until everyone has PFDs. A method of measuring this change could be investigating how many PFDs are being purchased and repurchased. FISG are investigating ways to measure success and usage of PFDs. New target date is end 2015. [sic]

2013/110: We still have few volunteers to take part in this trial. Discussions are ongoing with FISG to attempt to increase the number of vessels to participate in the trial, and our Fishing vessel team will discuss this point further in their upcoming meeting with MAIB. [sic]

1.20.2 *Stella Maris*

On 28 July 2014, the 9.96m LOA trawler *Stella Maris* capsized and sank while hauling fishing gear. The vessel's two crew were uninjured. *Stella Maris* had been significantly modified prior to its loss, including the fitting of an "A" frame gantry and a winch for lifting the cod end. No calculations had been required or carried out regarding the effects of this work on the vessel's stability.

The subsequent MAIB investigation report[12] identified that *Stella Maris* capsized as a result of insufficient stability due to an overly high gantry supporting a heaving cod end lifted by a winch with excessive power. *Stella Maris* had a sister vessel that was similarly modified.

The report highlighted a number of small fishing vessel losses (*Heather Anne*, *Sally Jane*, *Charisma*, *Kirsteen Anne*, *Amber* and *Auriga*) that had resulted from insufficient stability. It also identified a number of developed nations that required intact stability criteria for small fishing vessels (Norway, New Zealand, Ireland, Denmark, Greenland, Canada, Poland and Russia).

Following the accident, the MCA undertook to:

- *Commit to introducing a requirement for the carriage of EPIRBs on board all registered fishing vessels in its next revision of the Fishing Vessels Code of Practice for the Safety of Small Fishing Vessels.*

- *Include a requirement for fishing vessel owners to notify and seek approval from the agency prior to carrying out substantial modifications in MGN 502.*

The MCA was also recommended (MAIB recommendation 2015/165) to:

Introduce intact stability criteria for all new and significantly modified decked fishing vessels of under 15m in length.

This recommendation was accepted by the MCA, which stated that:

'as part of our work to progressively align the standards of the Small Fishing Vessel Code with the Workboat Code, the MCA will consider the application of suitable stability standards for new and significantly modified vessels of under 15m'

The MCA's target date for the completion of this action is 31 December 2020.

[12] MAIB report 29/2015 - Report on the investigation of the capsize and foundering of FV *Stella Maris* 14 miles east of Sunderland on 28 July 2014

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 LOSS SCENARIO

The VDR data from *Pont Aven* **(Figures 3** and **4)** indicates that *JMT* foundered at, or shortly after, 1501 on 9 July 2015. The positions of the vessel's scallop dredges **(Figure 19)** show that *JMT* was not towing at the time.

It is almost certain that the vessel capsized suddenly and without warning. It also probably sank very quickly. The absence of other vessels in the vicinity and of any significant impact damage to *JMT*'s hull indicate that the vessel had not been involved in a collision. Furthermore, that the bilge pumps were not switched on **(Figure 29)** and the vessel was subsequently found to be watertight during the stability assessment, indicates that there had been no progressive flooding.

Following capsize, sea water would have rapidly entered *JMT* through the openings into the vessel's engine room, fish hold and wheelhouse. As a result, the crew would have had no opportunity to broadcast a distress message or to release the EPIRB from its stowage. Their likelihood of survival was also reduced because they were not wearing lifejackets and the liferaft failed to surface.

2.3 VESSEL STABILITY

The Wolfson unit stability assessment report **(Annex A)** shows that *JMT* did not meet any of the stability criteria required by larger fishing vessels, apart from initial metacentric height (GM), in any of the four voyage conditions (conditions 1 to 4). For example, the maximum righting lever achieved in the arrival port condition was 0.053m against a requirement of 0.2m. In broad terms, *JMT* had only 25% of the stability reserve required of larger fishing vessels. It follows that *JMT* had to be operated with extreme caution.

In addition to assessing *JMT*'s stability against the stability criteria required by fishing vessels greater than 15m LOA, the Wolfson Unit also assessed the vessel's stability against other methods detailed in MGN 427(F). The vessel's damage prevented the conduct of practical tests, but theoretical assessments of *JMT*'s stability against the SCV and the small passenger vessel heel tests indicated that the vessel did not meet the freeboard requirements of either.

The results of the SCV heel assessment, which assumed 1t of catch positioned 1.3m off the centreline, indicated which *JMT* had no positive buoyancy in this condition. In the small passenger vessel heel assessment, which assumed the vessel to be laden with its dredges and catch offset to starboard in order to apply a heeling moment, the freeboard calculated at 4.7º angle of heel was only 75mm against a minimum requirement of 525mm at 7º angle of heel.

A theoretical assessment of *JMT*'s stability was also undertaken using a Wolfson freeboard guidance mark positioned 2.8m from *JMT*'s stern. The vessel's freeboard at the mark was calculated to range between 0.31m and 0.33m in the four standard

conditions and to be only 0.22m in the loss condition (condition 9). **Figures 32** and **33** indicate that the vessel was operating in the amber zone of the associated stability notice (operation recommended only up to sea state 3 or lower end of sea state 4) and that it was in the red zone (danger of capsize) when it was lost.

Vessel's Freeboard at Freeboard Guidance Mark, 25% LOA

Safety Zone	Minimum Freeboard cm	Freeboard at Load Conditions cm						
		STANDARD CONDITIONS				OPERATIONAL CONDITIONS		
		1	2	3	4	7	8	9
Good margin of safety	At least 52							
Low level of safety	26 to 52	31	31	32	33	28	33	
Danger of capsize	Less than 26							22

Key - Standard Conditions
1: STD Depart port
2: STD Arrival Gnds
3: STD Depart Gnds
4: STD Arrival Port

Key - Operational Conditions
7: OP Tow block lift & full dredges
8: OP Full dredges on bwks
9: OP SS tipped, PS full & suspended

Figure 32: Calculated freeboard at the Wolfson guidance mark

Stability Notice and Freeboard Guidance mark for FV JMT

STABILITY NOTICE

Name JMT No. 0 Owner 0 Length 11.42 metres Beam 4.38 metres	Loading & Lifting Guidance	Safety Zone	Minimum Freeboard	Maximum Recommended Seastate
	Good margin of residual freeboard	Good margin of safety	At least 52 cm	
	Loading or lifting reduces minimum freeboard to less than 52 cm	Low level of safety	26 to 52 cm	1.4 metres
	Excessive loading or lifting reduces minimum freeboard to less than 26 cm	Danger of capsize	Less than 26 cm	0.7 metres

Figure 33: Stability notice

2.4 LOSS CONDITION

Despite *JMT*'s low level of stability, other than the significant list experienced in Padstow **(Figures 17** and **18)**, the vessel had been operated without incident since it re-entered service in October 2013. However, during this period, the towing bars on both sets of dredges had usually been pulled onto the deck simultaneously when hauling. With the dredges on the bulwarks, the vessel would generally have remained on an even keel. On 9 July 2015, the breakdown of the starboard 'pull-down' winch meant that the towing bars could only be pulled down to the deck one side at a time.

Underwater surveys identified that, at the time of *JMT*'s loss, the starboard dredges were inverted and empty whereas the port dredges were suspended from the 'goalpost' gantry and were full of debris and scallops. With 1144kg suspended over 4m above the deck on the port side along with the small quantity of fuel carried and 17 bags of scallops stowed on the aft deck (none were found in the fish hold), *JMT*'s righting lever was minimal. **Figure 34** shows that the maximum heel righting lever (GZ) was only 8mm, which diminished to 0mm at 16° of heel. Consequently, it probably only would have taken the impetus resulting from the sudden release of the contents of the starboard dredges, a small roll or heel, or the swinging of the port dredges, to trigger capsize.

2.5 STABILITY REQUIREMENTS

JMT's poor stability and the losses of several other small fishing vessels in similar circumstances highlighted in the *Stella Maris* report **(paragraph 1.20.2)** indicate that the continued absence of a requirement for vessels less than 15m LOA to meet any stability criteria is putting a number of small fishing vessels and their crews at risk.

In this case, the modifications to *JMT* during the vessel's conversion to scallop dredging, although impacting on the vessel's top weight and centre of gravity, were not assessed. As a result, the potential danger of raising the vessel's centre of gravity by suspending the dredges on the taller 'goalpost' gantry was not realised.

The intention for the forthcoming revision of the Small FV Code to require vessel modifications to be notified to the MCA and to re-introduce stability criteria requirements for new fishing vessels between 12 (L) and 15m LOA **(paragraph 1.15)**, is a positive step. So too, is the MCA's stated commitment to eventually require all new and significantly modified fishing vessels less than 15m LOA to meet stability criteria **(paragraph 1.20.2)**. Nonetheless, existing small fishing vessels, particularly those that have been modified or are engaged in bulk fishing or trawling, will remain exposed to the dangers associated with unassessed and insufficient stability for many years to come.

It is not practical for the estimated 5000 existing small fishing vessels under 15m LOA to be required to comply with the stability requirements for larger vessels. It is likely that very few were designed and constructed with specific stability criteria in mind and therefore they would not meet the required standard. Nonetheless, it is important that owners have a baseline from which to gauge the operational limitations of their vessels and to calculate the effect of intended modifications. Therefore, given the apparent reluctance of owners to assess vessel stability voluntarily, a more regulatory approach is warranted, taking into account the principles of proportionality and cost effectiveness.

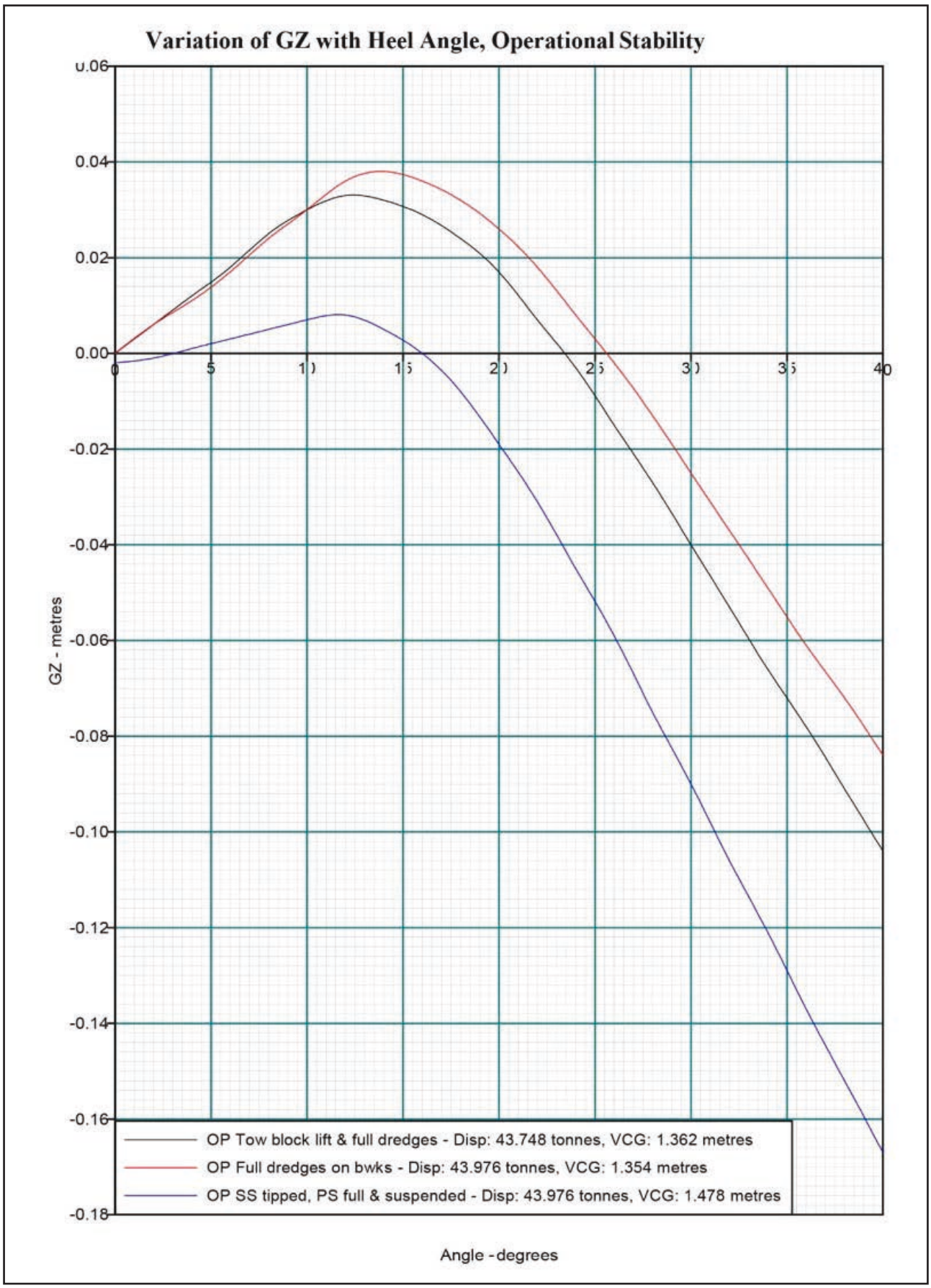

Figure 34: GZ curves (3 operational conditions)

2.6 ALTERNATIVE ASSESSMENT METHODS

The alternative stability assessment methods detailed in MGN 427(F) each have advantages and disadvantages. With respect to *JMT*, the theoretical application of the SCV and passenger heel tests and the Wolfson method **(Annex A)** would have identified the vessel's low level of stability to some degree. However, only the Wolfson method would have provided an indication of the vessel's operational limits and when caution was required.

The Wolfson method is easy to apply and has no financial costs associated with it, but the fishing industry has argued that it is of little practical use as the freeboard mark is difficult to see when underway. However, the mark does not have to be used at sea to be of benefit. The sighting of the freeboard mark on a vessel alongside in conjunction with its associated 'traffic light' chart **(Figure 33)** has the potential to raise the awareness of fishermen to the dangers of low freeboard. In particular, the Wolfson freeboard mark can be used to assess if top weight needs to be removed in order to take into account changes in fishing methods. It can also be used to assess whether or not it is safe to sail and fish in the prevailing and forecast sea conditions.

Of the stability assessment methods included in MGN 427(F), the roll test provides the least practical assistance to fishermen as it identifies only a vessel's initial GM. Assessments of whether a vessel is 'stiff' or 'tender' can also lead to a false sense of security. For these reasons, the use of the roll test to assess the stability of small fishing vessels is of very limited value.

2.7 AWARENESS

Stability is fundamental to the safe operation of all vessels. Therefore, it is important that skippers are fully aware of the factors affecting stability, the warning signs and the precautions available.

It is evident that *JMT*'s skipper was unaware of the risk of leaving the port dredges suspended while the starboard dredges were emptied. **Figure 34** shows that *JMT* would have remained more stable if the port dredges had been lowered onto the bulwark before the starboard dredges were emptied. The high centre of gravity and off-centreline loading were clearly instrumental in the vessel's capsize.

It was extremely unfortunate that *JMT*'s stability was further reduced by: the small amount of fuel carried; the stowage of the bags of scallops on deck rather than in the fish hold; and, by leaving the accesses to the engine room and the fish hold open. Again, it is highly likely that the vessel's crew did not fully appreciate the potential consequences of these actions.

It is of concern that despite attempts to raise the awareness of stability among fishermen, such as the Seafish training **(paragraph 1.17)** and the initiatives administered by the RNLI and the MCA **(paragraph 1.18)**, many fishermen remain ignorant of its dangers. In this case, Neither *JMT*'s skipper nor its crewman had attended the voluntary 1-day stability awareness course as recommended in MGN 427(F). Had they done so, it is likely that they would have been better placed to operate their vessel safely.

The importance of training to improve the knowledge and understanding of stability among fishermen has been recognised by Seafish by its 1-day course that is open to all fishermen and forms part of the voluntary under 16.5m LOA skipper's certificate. However, although over 5600 fishermen have attended this course since it started in 2006, the continuing losses of small fishing vessels due to poor stability warrants stability awareness training to be mandatory. This could possibly be introduced by requiring skippers of fishing vessels less than 16.5 LOA to hold a Certificate of Competency (CoC) which it is understood the MCA is seeking as part of its implementation of STCW(F) 95[13].

2.8 SEAFISH INSPECTION

Despite the Seafish requirement for *JMT* '*to be presented in a complete and operational state'* at its inspection in September 2013, many of the vessel's modifications had not been completed **(Figures 10** and **11)**. Although the attending surveyor's report acknowledged that some items of work remained outstanding, the state of the vessel inevitably reduced the usefulness of the inspection.

Of note, neither the correct fitting of 'emergency stops' for the winches nor the impact of the weight of the winches, outriggers, landing derrick or the 'goalpost gantry' on the vessel's freeboard, could be assessed during the inspection. No emergency stops were subsequently fitted and there was a significant difference between the freeboard as estimated (600mm) during the inspection and the calculated freeboard (between 310mm and 330mm) **(Figure 32)** post-modification.

In this case, the measurement of *JMT*'s freeboard during the inspection, although misleading, was not significant in the context of the vessel's loss as the vessel's freeboard, post-modification, still exceeded the 300mm required by the Seafish construction standards. Even if *JMT*'s freeboard had been less than 300mm, the resulting restriction would have only limited the vessel to operating up to 20m from a safe haven in favourable conditions.

The Seafish requirement for an attending surveyor to measure *JMT*'s freeboard was at odds with the requirement for the vessel to be out of the water. The use of the 'dirty mark' was never likely to provide an accurate measurement of freeboard given the extent of the planned modifications. Moreover, the vessel was so far removed from being presented in '*a complete and operational state'* that a further inspection was almost certainly warranted. It is recognised that the MCA surveyor was reliant on the accuracy of the Seafish report and that, other than highlighting the replacement of the trawl winch, the report did not accurately reflect the unfinished condition of the vessel. However, it was readily apparent from the report's photographs **(Figures 9 and 10)** that *JMT* was not equipped for scallop-dredging. Therefore, it is of concern that the Seafish inspection report appears to have been accepted by Seafish's senior surveyors and the MCA regional surveyor without challenge.

[13] STCW(F) 95 – The International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel, 1995

2.9 SURVIVABILITY

2.9.1 Overview

JMT's lifesaving equipment included abandon ship and constant wear lifejackets, a liferaft and an EPIRB. This equipment, with the exception of the liferaft and abandon ship lifejackets, was not required by regulation but was intended to improve the crew's likelihood of survival. However, although the crewman clearly survived the capsize and was able to use one of the vessel's life-rings to keep him afloat and to kick off his footwear, he was not wearing a lifejacket, the liferaft did not surface and the EPIRB remained in its stowage in the wheelhouse. This was tragic; with a sea water temperature of 13.6°C in slight seas, the crewman could have been expected to survive for between 1 and 6 hours.

It is not known how the taking of amphetamines affected the crewman's ability to survive. However, as he had been in the water for over 18 hours when he was found, it is probable that it did not influence the outcome. Nonetheless, amphetamine may cause dizziness, blurred vision, or restlessness and its use for recreational purposes is potentially hazardous. In this case, the residual level of the drug in the crewman's body suggests that he had probably consumed amphetamine shortly before sailing or while at sea. As a consequence, his performance might have been adversely affected.

2.9.2 Wearing lifejackets

A lifejacket or other PFD would have better supported *JMT*'s crewman in the water than the life-ring. A PFD's light would also have made the crewman more visible to vessels in the area and its whistle was potentially a means of attracting attention. However, despite the advantages of wearing a PFD when working on the open deck at sea, many fishermen still do not wear them.

In 2000 the MAIB made its first recommendation about the compulsory wearing of lifejackets by fishermen working on deck. In the intervening years there has been a succession of discussions, education programmes and research projects that have had very limited success. Since 2012, European funding has also been used by the various fishing industry associations to provide PFDs to thousands of fishermen free of charge. Nevertheless, the culture of the fishing industry has been slow to change, and fishermen continue to drown who might otherwise have lived had they been wearing a PFD when they entered the water. The MCA's responses to the recommendations made by the MAIB in 2013, in relation to measuring behavioural change among fishermen and making the wearing of lifejackets compulsory **(paragraph 1.19.1)**, indicate that no progress has been made in these critical areas.

2.9.3 Liferaft

It is evident from the underwater inspection of *JMT* **(paragraph 1.12.1)** that the liferaft's HRU had activated to release the liferaft from its cradle **(Figure 20)**. However, as the weak link did not break, it is highly likely that the liferaft's rise to the surface was impeded by the gantry arrangement above its stowage. Over time, sea water would have entered the liferaft canister until its buoyancy reduced sufficiently for the canister to drop clear of the gantry and onto the seabed, possibly assisted by the prevailing tidal stream.

The MAIB has investigated a number of small fishing vessel capsizes in which the liferaft has failed to surface and inflate due to similar circumstances. However, the incorrect stowage of the liferaft and the incorrect attachment of the HRU have also been instrumental on some occasions. Identifying a suitable stowage position for a liferaft on a small fishing vessel is frequently problematic[14]. Space is limited and it can be difficult to find a position where the liferaft cannot be damaged, interfere with the fishing operation or have a clear route to the sea surface in the event of capsize.

2.9.4 EPIRB

JMT's EPIRB was mounted in the wheelhouse, and when the vessel capsized suddenly and without warning it is almost certain that the crew did not have the time or the opportunity to reach it. Consequently, the coastguard were not aware that the vessel had sunk. Had a float-free EPIRB been carried on the open deck it is highly likely that the coastguard would have been immediately alerted. Although the coastguard would have initially contacted the vessel's registered owner rather than the beneficial owner, which might have led to a delay in response, the crewman's likelihood of survival would nevertheless have increased dramatically. It is anticipated that the intended requirement in the forthcoming revision of the Small FV Code for similar size vessels to carry a float-free EPIRB or PLBs will help to save fishermen's lives in the future.

[14] Guidance on the positioning of liferafts is provided in MGN 343 (M+F) *Hydrostatic Release Units (HRU) – Stowage and Float Free Arrangement for Inflatable Liferafts*.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. It is almost certain that *JMT* capsized suddenly and without warning and sank very quickly. [2.2]

2. The crew's likelihood of survival was reduced by not having the opportunity to broadcast a distress message, release the EPIRB from its stowage, lifejackets not being worn and the failure of the liferaft to surface. [2.2]

3. *JMT* had only 25% of the stability reserve required of larger fishing vessels, which meant that the vessel needed to be operated with extreme caution. [2.3.]

4. Theoretical assessments of *JMT*'s stability against the SCV and the small passenger vessel heel tests indicated that the vessel did not meet the freeboard requirements of either. [2.3]

5. The breakdown of *JMT*'s starboard 'pull-down' winch meant that the towing bars on the scallop dredges could only be pulled down to the deck one side at a time. [2.4]

6. With the port dredges suspended above the deck, it probably only would have taken the impetus resulting from the sudden release of the contents of the starboard dredges, a small roll or heel, or the swinging of the port dredges to trigger capsize. [2.4]

7. The modifications made to *JMT* impacted on the vessel's top weight and centre of gravity. [2.5]

8. Although it is intended that all new and substantially modified decked vessels less than 15m LOA will have to meet stability criteria, a number of existing small fishing vessels will remain exposed to the danger of unassessed and insufficient stability for years to come. [2.5]

9. *JMT*'s skipper had not completed stability training and was probably unaware of the implications of leaving the port dredges suspended while the starboard dredges were emptied. He was probably also unaware of the adverse effect on stability of carrying little fuel, stowing the catch on deck and leaving doorways and hatches open. [2.7]

3.2 OTHER SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. It is highly likely that *JMT*'s liferaft did not surface and inflate because it became trapped under the gantry arrangement above its stowage. [2.9.2]

3.3 SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT THAT HAVE BEEN ADDRESSED OR RESULTED IN RECOMMENDATIONS

1. Of the alternative stability assessment methods detailed in MGN 427(F), only the Wolfson method would have provided an indication of the vessel's operational limits. [2.6]

2. The usefulness of the Seafish inspection conducted in September 2013 was reduced by the fact that many of the vessel's intended modifications had not been completed and a further inspection was almost certainly warranted. [2.8]

3. It is of concern that the Seafish inspection report appears to have been accepted without challenge. [2.8]

4. Despite the advantages of wearing a PFD when working on the open deck, and a concerted campaign of education providing thousands of fishermen with free lifejackets, many still do not wear them. However, no progress has been made with regard to measuring behavioural change among fishermen or making the wearing of lifejackets compulsory. [2.9.2]

3.4 OTHER SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. The residual level of amphetamine in the crewman's body suggests that he had probably consumed the drug shortly before sailing or while at sea, which possibly adversely affected his performance. [2.9.1]

2. *JMT*'s EPIRB was not float-free. The forthcoming requirement for similar size vessels to carry a float-free EPIRB or PLBs will help to ensure fishermen's safety. [2.9.4]

SECTION 4 - ACTION TAKEN

4.1 MAIB ACTIONS

The **Marine Accident Investigation Branch** has:

- Commenced a review of lifejacket usage in the UK fishing industry. The review will be published as part of the MAIB safety investigation report of the fatal man overboard from the fishing vessel *Annie T*.

- Issued Safety Flyer **(Annex C)** to the fishing industry highlighting the issues raised in this report.

SECTION 5 - RECOMMENDATIONS

The **Maritime and Coastguard Agency** is recommended to:

2016/130 Include in its intended new legislation introducing stability criteria for all new and significantly modified decked fishing vessels of under 15m in length a requirement for the stability of new open decked vessels, and all existing vessels of under 15m to be marked using the Wolfson Method or assessed by use of another acceptable method.

2016/131 Require skippers of under 16.5m fishing vessels to complete stability awareness training.

The **Sea Fish Industry Authority** is recommended to:

2016/132 Amend its construction standards to include a requirement for new fishing vessels and vessels joining the UK fishing vessel register to be fitted with a Wolfson freeboard mark.

The **Sea Fish Industry Authority** and the **Maritime and Coastguard Agency** are recommended to:

2016/133 Work together to ensure that the inspection regime for assessing existing vessels against the Seafish Construction Standards is consistently robust through critical evaluation of the condition of each vessel at the time of survey.

The **Maritime and Coastguard Agency, Scottish Fishermen's Federation, National Federation of Fishermen's Organisations** and the **Sea Fish Industry Authority** are recommended to:

2016/134 Through membership of the Fishing Industry Safety Group, collectively explore ways to encourage owners of fishing vessels of under 15m LOA that are engaged in trawling, scalloping and bulk fishing to affix a Wolfson Mark to their vessels and operate them in accordance with the stability guidance provided.

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

Marine Accident Report

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