ACCIDENT REPORT

Report on the investigation of

the capsize and foundering of

FV *Stella Maris*

14 miles east of Sunderland

28 July 2014

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

VERY SERIOUS MARINE CASUALTY REPORT NO 29/2015 DECEMBER 2015

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.

Cover image courtesy of Jon Irwin

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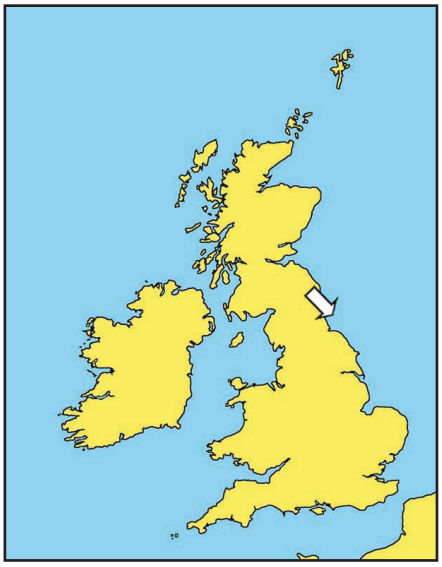
GLOSSARY OF ABBREVIATIONS, ACRONYMS AND TERMS

CM	-	Centimetre
Defra	-	The Department for Environment, Food and Rural Affairs
DSC	-	Digital selective calling
EC	-	European Commission
EFF	-	European Fisheries Fund
EMFF	-	European Maritime and Fisheries Fund
EPIRB	-	Emergency Position Indicating Radio Beacon
FAO	-	Food and Agriculture Organization
FISG	-	Fishing Industry Safety Group
GM	-	Metacentric Height
GMDSS	-	Global Maritime Distress and Safety System
GPS	-	Global Positioning System
GRP	-	Glass reinforced plastic
GZ	-	Heel righting lever in metres
HRU	-	Hydrostatic release unit
ILO	-	International Labour Organization
IMO	-	International Maritime Organization
ISO	-	International Organization for Standardization
LOLER	-	The Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment) Regulations 2006
kg	-	kilogramme
L	-	Registered length
l	-	litres
LOA	-	length overall
m	-	metres
MAIB	-	Marine Accident Investigation Branch
MCA	-	Maritime and Coastguard Agency

MGN	-	Marine Guidance Notice
MHz	-	Megahertz
MIN	-	Marine Information Note
mm	-	millimetres
MMO	-	Marine Management Organisation
MSN	-	Merchant Shipping Notice
PLB	-	Personal Locator Beacon
PUWER	-	The Merchant Shipping and Fishing Vessels (Provision and Use of Work Equipment) Regulations 2006
Seafish	-	Sea Fish Industry Authority
SOLAS	-	International Convention for the Safety of Life at Sea 1974, as amended
t	-	tonnes
TPC	-	Tonnes per centimetre
UTC	-	Universal Co-ordinated Time

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

SYNOPSIS



At around 0910 BST on 28 July 2014, the 9.9m trawler *Stella Maris* capsized and sank while attempting to lift a heavy cod end of fish and debris. The two crew successfully abandoned the vessel and were later rescued, uninjured, from their liferaft.

Stella Maris listed as its cod end was being lifted from the sea by a high, stern-mounted gantry sited above the vessel's fish hopper and shelter deck. The skipper recognised that the weight of the cod end was excessive and attempted to lower it back into the sea. Unfortunately the netting became ensnared on a net drum guide pole and the gilson winch was unable to re-lift the cod end to clear this obstruction. The vessel's list continued to increase, causing the starboard quarter bulwark to become submerged, prompting the crew to abandon the vessel.

The two men escaped from the capsizing vessel's shelter deck and successfully launched and boarded their liferaft as *Stella Maris* sank. After several hours in the liferaft they were rescued uninjured by a passing sailing yacht.

Almost 1 year before its loss, *Stella Maris* had been significantly modified with the aid of an EU grant provided via the Marine Management Organisation. The modifications included the fitting of an "A" frame gantry and a dedicated gilson winch for hoisting the cod end above a catch hopper. No calculations had been required or carried out regarding the effects of this work on the vessel's stability nor on the weight that could be safely lifted from the new gantry.

It was found that *Stella Maris* capsized as a result of insufficient stability due to an overly high gantry and an overweight cod end, coupled with excessive winch power.

Recommendations have been made to:

- The Marine Management Organisation to improve its procedures for distribution of public funds.
- The Seafish Industry Authority to amend its small vessel construction standards to reduce the vulnerability of new vessels to downflooding when heeled.
- The Maritime and Coastguard Agency to introduce; intact stability criteria for all new and significantly modified decked fishing vessels of under 15m in length; and a revision to its guidance on the applicability to fishing vessels of PUWER and LOLER.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *STELLA MARIS* AND ACCIDENT

SHIP PARTICULARS	
Vessel's name	*Stella Maris*
Flag	United Kingdom
Classification society	Not applicable
IMO number/fishing numbers	Not applicable / HL705
Type	Demersal trawler
Registered owner	Privately owned
Manager(s)	Not applicable
Year of build	1999
Construction	Glass reinforced plastic (GRP)
Length overall	9.96m
Registered length	9.53m
Gross tonnage	12.08
Minimum safe manning	Not applicable
Authorised cargo	Not applicable
VOYAGE PARTICULARS	
Port of departure	Hartlepool
Port of arrival	Not applicable
Type of voyage	Otter board trawling
Cargo information	Not applicable
Manning	Two
MARINE CASUALTY INFORMATION	
Date and time	28 July 2014 at 0910
Type of marine casualty or incident	Very Serious Marine Casualty
Location of incident	14 miles east of Sunderland
Place on board	Not applicable
Injuries/fatalities	None
Damage/environmental impact	Vessel lost / minor pollution
Ship operation	Fishing
Voyage segment	Mid water
External & internal environment	Light airs, sea state calm, visibility good
Persons on board	2

1.2 NARRATIVE

At around 0320 on 27 July 2014, *Stella Maris* departed Hartlepool with the skipper, who was also the vessel's owner, and a crewman on board. The weather conditions were benign, with light, variable airs and calm seas.

At about 0415, *Stella Maris* was at the fishing grounds, approximately 6 miles north-east of Hartlepool, when the crew shot away the vessel's demersal trawling gear **(Figure 1)** and began towing in a north-easterly direction. Thereafter, the skipper kept the watch while the deckhand went below to rest.

Shortly before the planned end of the tow, at approximately 0845, the vessel's speed slowed and the angle of spread between the trawl wires narrowed, indicating to the skipper that something heavy had been picked up by the trawl net or adjoining gear.

The skipper called the deckhand and commenced hauling in the demersal trawling gear. The engine was set to slow ahead and the vessel was being steered by autopilot. The trawl winch was used to recover the trawl doors to the vessel's side and, once these had been disconnected from the trawl warps, the bridles were hove onto the same winch. The bridles were seen to be at an unusually steep angle, which suggested that there was a heavy weight in the net.

After the bridles had been hauled, the wing ends of the net were transferred onto the centrally-mounted net drum **(Figure 2)**. During this time *Stella Maris* continued to make way, slowly ahead. When transferring the net from the bridles to the net drum, the net would normally float astern of the vessel, but on this occasion the net hung vertically down from the vessel's stern.

As the net was wound onto the net drum, mud and sand could be seen in both the netting and the sea astern of the vessel. On reaching the extension piece (the tunnel of netting between cod end and net mouth) the density of the mud and sand increased, confirming the skipper's belief, based on similar previous incidents, that this was the cause of the additional weight.

The skipper attempted to clear the cod end of the mud and sand by putting a chain strop around the extension piece **(Figure 3)** before slackening back on both the strop and the net to position the cod end in a turbulent area of the vessel's wake. He then powered *Stella Maris* ahead so as to wash the mud and sand from the cod end. After a few minutes he stopped towing and, although some mud and sand had been removed from the net, it was apparent that there was still a substantial weight in the cod end.

1.2.1 Capsize

At about 0905, having removed the chain strop from the extension piece, the skipper wound the net onto the net drum until the cod end lifting strop could be recovered from the sea using a boat hook. The wire from the gilson winch was then attached to the lifting strop to enable the cod end to be hoisted from the "A" frame gantry, the top of which was almost 6m above deck level, into position above the catch hopper **(Figure 2)**. The gilson winch controls were operated by the skipper from the starboard side of the net drum, about 1m inboard of the transom bulwark, while the deckhand was positioned to the port side of the net drum.

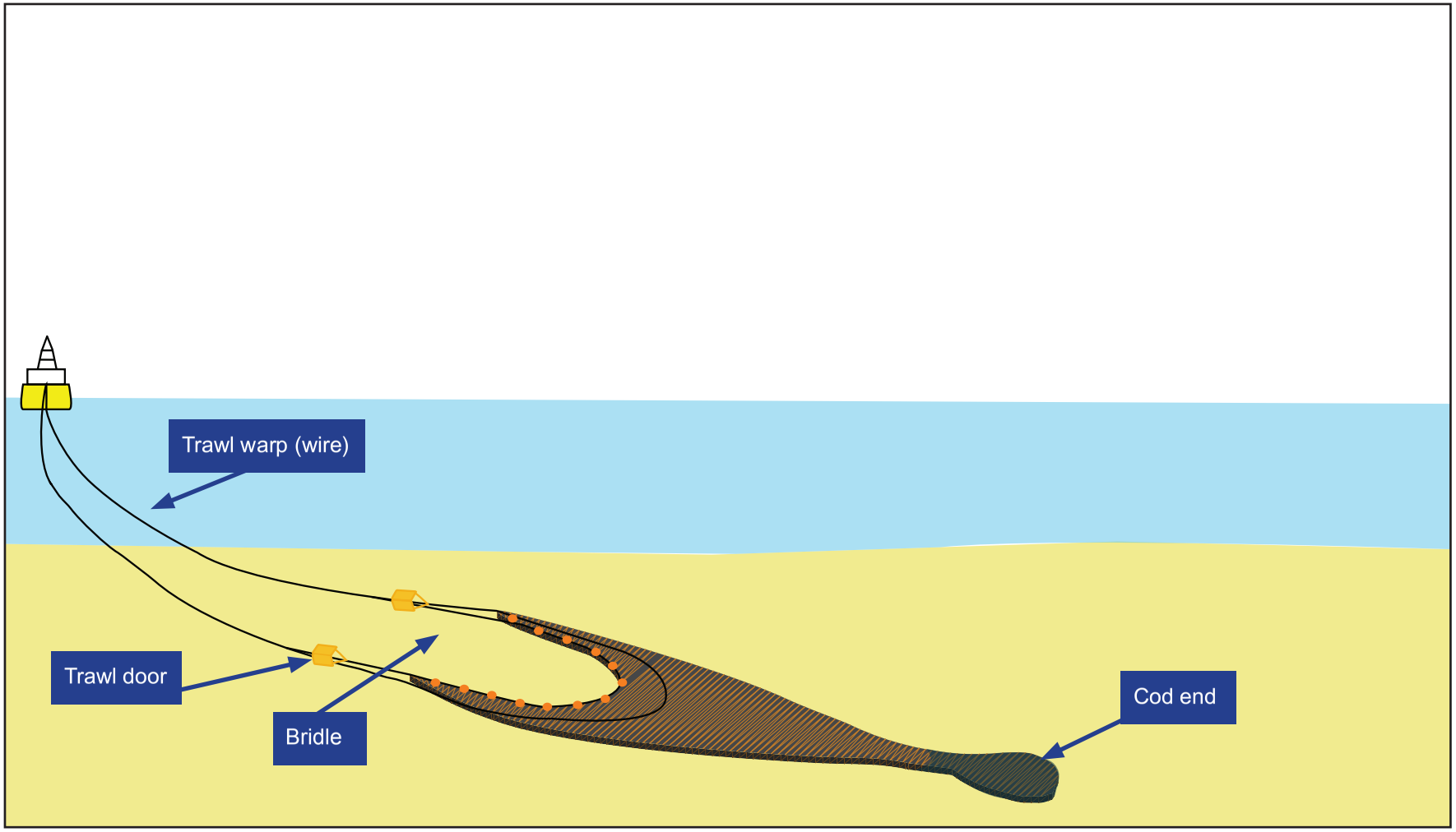


Figure 1: Diagram of *Stella Maris*'s trawling gear and components

Figure 2: Net drum and gantry arrangement

Figure 3: Depiction of cod end being towed to wash out mud

The gilson winch, which had a 2.8t first layer pull capacity, hoisted the heavy cod end from the sea until it was almost above the transom bulwark. As successive layers of wire built up on the winch, its pulling capability reduced **(Figure 4)**. The skipper realised that the weight was too great to be safely lifted at about the same time as the winch's pressure relief valve lifted, due to the excessive load, preventing further hoisting of the cod end.

Figure 4: Gilson winch showing build up of wire

Stella Maris listed to starboard as a result of the suspended weight, and the skipper veered the gilson winch in an attempt to lower the load back into the sea. The list caused the cod end to hang directly above the starboard vertical net drum guide pole **(Figure 5)**, which then snagged the net as it was lowered **(Figure 6)**. The skipper immediately attempted to re-lift the snagged cod end clear of the net drum guide, but was unable to do so as the gilson winch's pressure relief valve lifted again.

At this stage, the starboard freeing ports were submerged, causing the deck to flood and the list to increase, until the starboard quarter bulwark was also submerged. The skipper then ran forward with the intention of fetching the saw stored by the wheelhouse door to cut the net free from the guide pole, while the d eckhand, aware that the vessel was on the verge of capsizing, ran forward on the port side to escape the shelter deck by the midships door **(Figure 5)**.

Figure 5: Pertinent fabrications and equipment

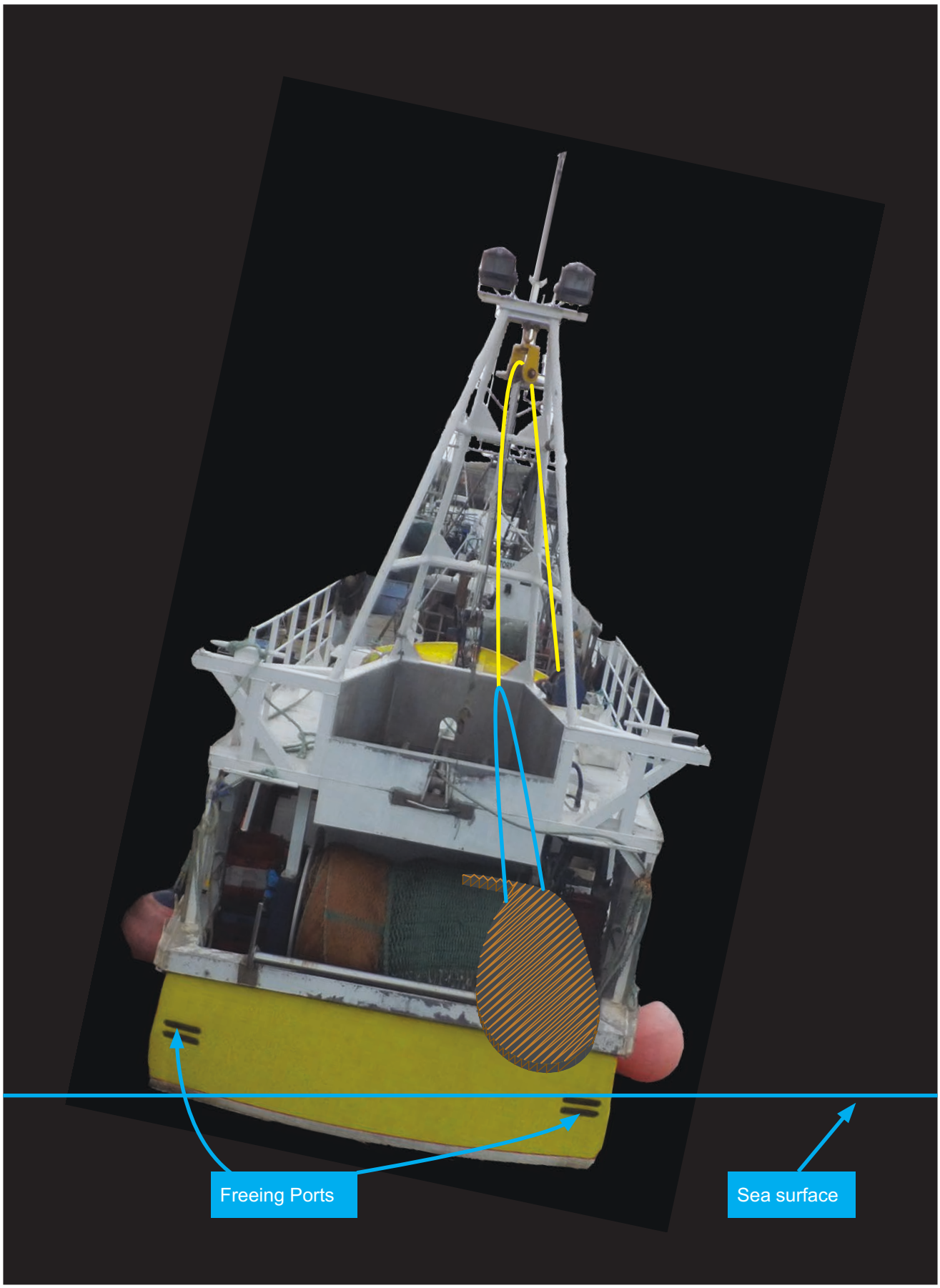


Figure 6: Depiction of *Stella Maris* listing with cod end impaled on net drum guide

The deckhand successfully exited the shelter deck onto the port side of the hull and shouted to the skipper, who by that time was making his way aft again, to come and join him. The skipper recognised the futility of going aft to attempt to cut the cod end free and, by standing on the port coaming of the fish room hatch and with the deckhand's assistance, was able to climb up through the port side shelter deck door as the deck rapidly tilted towards the vertical **(Figure 7)**.

1.2.2 Abandonment

Standing on the now horizontal port side plating of the shelter deck, the deckhand released the liferaft's retaining strap and inflated it by pulling on the painter, before removing the raft from its cradle **(Figure 8)**. As a result, when the raft inflated it became trapped under the port guardrail. Fearing that the trapped raft would go down with the vessel, the skipper clambered forward and untied a buoy from the port bow area to ensure that he and the deckhand would have something to support them in the sea as they were not wearing lifejackets and had not had time to don them. As *Stella Maris* continued to sink, the deckhand was able to pull the liferaft free from the port guardrail and put it in the water. He then swam to it and climbed in. The skipper, who was now in the sea and clinging to the buoy, also made his way to the liferaft where the deckhand assisted him on board.

Once on board the liferaft the two men cut the painter and started bailing water. After a few minutes they realised they were not drifting away from the almost totally submerged *Stella Maris,* and it became apparent that the liferaft was still attached to the trawler by something underneath the liferaft. The deckhand got out of the liferaft and, by standing on *Stella Maris*'s submerged gantry, was able to reach under the raft and cut away the raft's towing bridle **(Figure 9)**, which had become caught on the trawler. Once the liferaft was free the deckhand pulled himself back into it.

A few minutes later *Stella Maris* sank, leaving the two crewmen adrift on a flat, calm sea. No one was aware of their situation as there had not been time to transmit a radio distress call and *Stella Maris* had not been equipped with an emergency position indicating radio beacon (EPIRB).

Another trawler was visible about 1.5 miles from the liferaft and was towing north-easterly at about 3 knots. *Stella Maris*'s crewmen set off the two parachute distress rockets in an attempt to attract attention, but these were not seen by the crew of the other trawler, which was towing away from the scene. This left only three hand flares, which the crewmen chose not to use since the parachute flares had not been seen. They continued attempting to attract attention using the heliograph mirror contained in the liferaft's survival pack.

1.2.3 Rescue

Over the next 7 hours three ships and one fishing vessel passed within sight of the liferaft, one of them at an estimated range of 0.75 mile. Two of the hand-held flares and the heliograph mirror were used in an unsuccessful attempt to attract attention. The last hand-held flare was retained for use during darkness, when it was expected to be more visible than in the day's bright sunshine.

The two men kept a continuous lookout for approaching vessels and, at about 1610, two sailing yachts appeared on the horizon, heading in their general direction. *Stella Maris*'s crewmen attempted to propel their raft into the path of the approaching

Figure 7: Depiction of skipper escaping as vessel rolled onto its beam ends

Figure 8: Liferaft stowage position

Figure 9: *Stella Maris* liferaft showing remains of towing bridle

craft using its paddles and drogue. The liferaft was spotted by the yachtsmen, and by 1640 the skipper and the crewman had been recovered onto one of the yachts. The yachtsmen notified Humber MRCC by radio and Hartlepool RNLI lifeboat was deployed, picking up the two men from the yacht at 1735.

1.3 THE CREW

1.3.1 Skipper

The 40 year old skipper was the owner of *Stella Maris.* He had been a fisherman for most of his working life and had commissioned *Stella Maris* in 1999.

The skipper held all the mandatory training certification for a vessel the length of *Stella Maris.* Specifically, the Maritime and Coastguard Agency (MCA) endorsed Sea Fish Industry Authority (Seafish)[1] training in Safety Awareness, Basic Sea Survival, Basic Fire-fighting and Basic First Aid. Additionally, he had attended non-mandatory training in engineering and intermediate stability awareness.

[1] Sea Fish Industry Authority: an executive non-departmental public body established under the Fisheries Act 1981 that has statutory duties defined by that Act.

1.3.2 Deckhand

The 27 year old deckhand had worked as a fisherman since leaving school at the age of 16 and had sailed on board *Stella Maris* for 6 years. He held the relevant mandatory training certification and he had also attended non-mandatory training in Global Maritime Distress and Safety System (GMDSS) short range radio and intermediate stability awareness.

1.4 THE VESSEL

Stella Maris was a 9.53m registered length (L) glass reinforced plastic (GRP) type GM33 stern trawler built by Cygnus Marine Ltd in 1999; it had been commissioned and fitted out by the skipper.

As built, *Stella Maris* **(Figure 10)** was arranged as a conventional small stern trawler, with the wheelhouse forward and the working deck aft of the wheelhouse. The hull and deckhouse were constructed of GRP, the gutting shelter was GRP sheathed 25mm thick plywood and all other original fabrications (gallows, gilson derrick, gantry and landing derrick) were made of steel. The air vents for the engine room were built into the bulwarks athwartships of the trawl winch **(Figure 11)** and terminated below top rail height.

Image courtesy of Trawler Photos

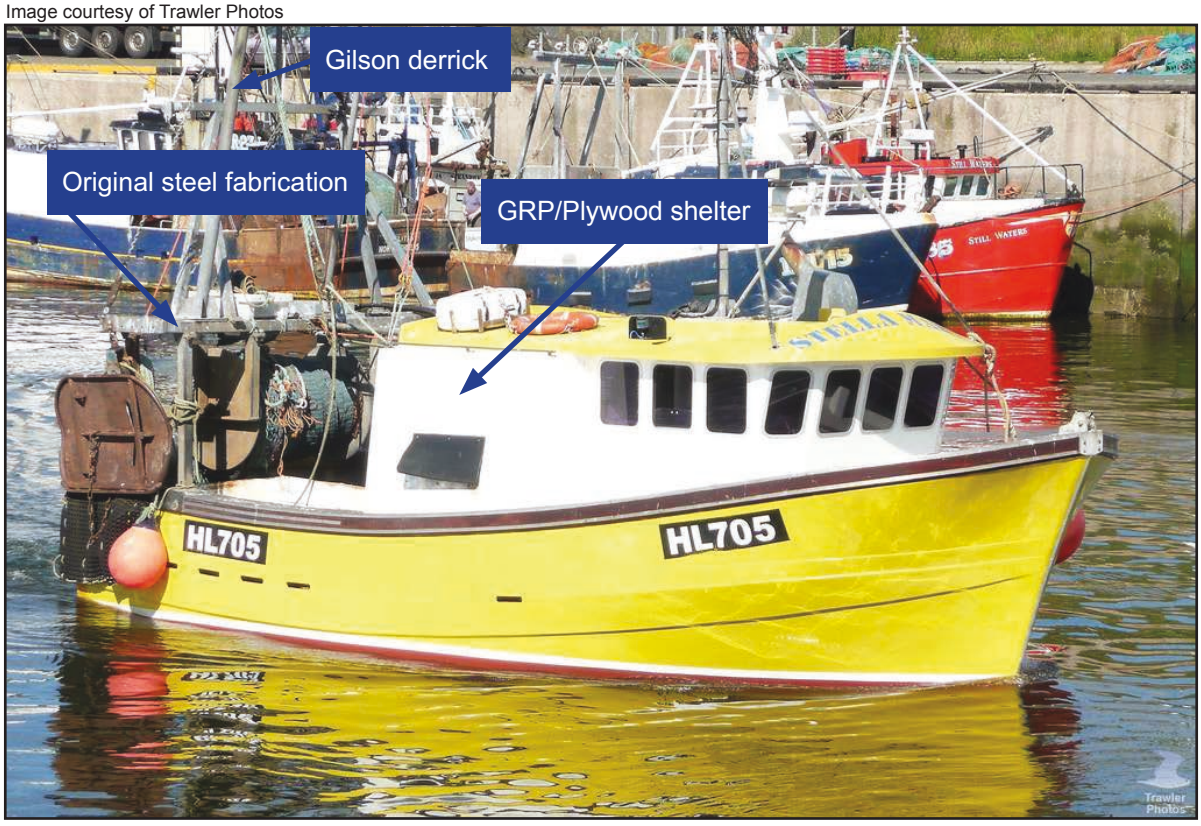


Figure 10: *Stella Maris* before modernisation modifications

Figure 11: Position of port side engine room air intakes between bulwark frames

The hull was sub-divided by watertight bulkheads from forward into accommodation, engine room, fish room and a small steering gear compartment. The forward wheelhouse was positioned above the engine room and gave access to the accommodation via a short companionway and to the engine room by way of a non-weathertight hatch set into the wheelhouse deck. The wheelhouse was accessed from the aft deck through a weathertight door. The fish room was accessed from a non-weathertight hatch on the main deck, which sat on top of a 40cm high coaming. The steering gear compartment, aft of the fish room, was entered through a non-watertight hatch between the two spaces.

The skipper had equipped the wheelhouse with radar, track plotter, Global Positioning System (GPS), echo sounder, digital selective calling (DSC) radio and autopilot.

As well as the Daewoo 235kW main engine and ancillary equipment, the engine room housed a 243l capacity hydraulic oil tank and two 1300l fuel tanks that were located to port and starboard and inter-connected by a 45mm diameter crossover pipe. The isolating valve in the crossover pipe was kept in the open position to ensure both tanks drained to the engine simultaneously so as to keep the vessel on an even keel.

1.4.1 Vessel modernisation

1.4.1.1 Modifications

In July 2013 *Stella Maris* underwent major structural modifications with the aims of making the vessel safer and improving catch quality. These modifications were 40% funded by a European Fisheries Fund (EFF) grant administered by the Marine Management Organisation (MMO).

The modernisation followed a trend for small stern trawlers to hoist cod ends over the stern into catch hoppers, as opposed to hoisting over the side and depositing the catch directly onto the deck. The main purpose of the modernisation was to enhance crew safety and improve catch quality by:

- Removal of the predominantly steel deck fittings and fabrications, and replacing them with lighter equipment, thus improving stability.

- Removal of the GRP coated, 1 inch thick marine plywood canopy **(Figure 10)** and fitting a 2.13m high, non-weathertight, aluminium shelter deck to protect the crew from the weather and seas and reduce top weight **(Figure 5)**. This also screened the catch from the deteriorating effects of sun and wind.

- Running the trawl wires safely over the top of the shelter deck, as opposed to their previous head-height route along the main deck where they were in close proximity to crew working on deck.

- Fitting a dedicated gilson winch **(Figure 4)** to replace the trawl winch whipping (warping) drum and remove the associated dangers of occasional riding turns and possible entrapment when manually hoisting the cod end on board.

- Removal of the starboard side gilson derrick **(Figure 10)**, and thus the need to lay broadside on to wind and seas when lifting the cod end on board. This was replaced with an “A” frame gantry aft **(Figure 5)** with a lifting point that was at least 1m higher than the original derrick. This enabled the cod end to be lifted over the stern as the vessel made way slowly ahead.

- Replacement of the original net drum with a lighter unit, further reducing top weight.

- Installation of a catch hopper **(Figure 12)** below the “A” frame gantry, enabling deposited catch to gravity feed onto a sorting table for processing **(Figure 13)**. This removed the previous requirement of manually shovelling the fish from the deck, which was labour intensive and damaged the catch. The catch hopper also enabled faster processing, allowing the fish to be put on ice earlier, further improving their quality.

- Insulating and lining the fish room with GRP to reduce ice melt and improve cleanliness.

The shelter deck also created additional storage space on top, which was used for spare equipment such as ropes, anchor and chain.

Figure 12: Position of catch hopper below gantry

Figure 13: Catch hopper on main deck

Stella Maris was delivered to the repair yard with the aft deck already stripped of all its equipment by the owner; it is therefore difficult to quantify exactly how much top weight was removed. However, the skipper estimated that he had removed approximately 5.5t of steel construction, fabrication and deck equipment. This was replaced by 3.5t of equipment and fabrications, with most of the new fabrication constructed from aluminium.

The repair yard modified the vessel according to the owner's wishes and by emulating other similar modernisations it had previously completed. No scale drawings of the proposed works were produced by the skipper or the yard.

Following the modifications, a small amount of ballast was added by the skipper to rectify a port list. Having added this ballast, the vessel's freeboard was very similar to its pre modifications value.

1.4.1.2 Cod end hoisting arrangements

Prior to the modifications, the cod end was hoisted over the bulwark rail using a conventional, stayed gilson derrick **(Figure 14)** and the catch was emptied onto the deck for manual shovelling onto a sorting table. Once inboard of the bulwark, and during periods of heavy rolling, the unopened cod end could be lowered to the deck to relieve weight from the derrick head and to prevent it swinging. If the weight of the cod end was unmanageable, it would be readily apparent from the vessel's list during lifting, and the cod end could be lowered back into the sea before reaching the bulwark.

Following modification, *Stella Maris*'s cod end was hoisted over the stern from the "A" frame gantry **(Figure 15)**. Hoisting directly over the stern acted on the vessel's longitudinal stability, although any lateral movement once the load was suspended would act upon transverse stability. Once clear of the sea, the cod end was then lifted over the bulwark and then by a further 1.65m to clear the lip of the catch hopper **(Figure 15)**. Once above the hopper, the cod end was emptied into the hopper where the catch was retained, gravity feeding onto the sorting table for processing. The bottom of the hopper was situated about 1m above deck level. A normal full cod end typically held 0.5t of catch.

1.4.1.3 Deck machinery

Modifications carried out to *Stella Maris* included the replacement of its main trawl winch and net drum and the addition of a dedicated gilson winch. The capacity of the gilson winch was:

Wire layer	Diameter (mm)	Winch pull	Hauling speed (12.4mm diameter wire)
First layer	199	2.8t	41.0 m/min
Top layer	274	2.0t	57.0 m/min

Figure 14: Depiction of cod end being hoisted over the side of the vessel before modernisation

Figure 15: Depiction of cod end being hoisted above the catch hopper

1.4.1.4 European Fisheries Fund grant scheme assistance

The Department for Environment, Food and Rural Affairs (Defra) was the government department with responsibility for fisheries in the United Kingdom (UK), including oversight of EFF administration. In accordance with European Council Regulation No 1198/2006, the UK's EFF administration process was decentralised to take account of the fishing industry's diversity throughout the UK. In England, responsibility for fisheries was delegated by Defra to the MMO, an executive agency of Defra. Frameworks were also in place for co-operation between Defra and the Northern Ireland executive and the Scottish and Welsh governments, who delegated responsibilities for these matters in their respective nations.

The MMO was empowered under the Marine and Coastal Access Act 2009 to contribute to sustainable development in the marine area, with respect to planning, regulation and licensing. Within its range of functions the MMO not only administered the European Commission (EC) fisheries funds, such as the EFF in England, but was also the scheme's managing authority for the UK, responsible for ensuring that EFF funds were administered in accordance with the requirements of the EC, throughout the UK. The EFF scheme ran from September 2008 until November 2014. A replacement scheme, the European Maritime and Fisheries Fund (EMFF) is due to be implemented in the UK in 2016.

The EFF scheme partially funded commercial fishermen with projects that improved: onboard working conditions, product quality, hygiene, the selectivity of fishing gear and non-mandatory vessel safety. The EFF outlined the types of measures supported under the scheme, but decisions regarding the implementation of EFF rules were left to the individual Member States. In this respect, Member States were able to set additional selection criteria for projects funded under the EFF.

Projects eligible for non-mandatory safety funding included vessel stability verification. For instance, in Northern Ireland, in 2010, 25 owners of vessels ranging between 10m registered length (L) and 15m length overall (LOA) were awarded grants from the EFF to have their vessels' stability verified for compliance with the intact stability rules for over 15m (LOA) vessels. Although not mandatory, this knowledge provided owners with a better understanding of their vessels' limitations and enabled them to decide how best to make improvements and modifications.

The general conditions for receiving EFF assistance required that:

> [The beneficiary agreed] *to meet any legal obligations imposed under EU and UK law, statutory instrument or bye-law, to obtain any necessary consents, rights and way leaves, give any necessary notices and meet any specific rules, regulations and/or standards that may be relevant to the project.*

Additionally, by way of a precaution to protect public funds, the MMO issued all successful EFF applicants with the following caveat along with their offer of award:

> *All work undertaken by the owner/skipper of the vessel must meet MCA safety/ stability requirements, whether funded by The European Fisheries Fund or otherwise. Responsibility for any work undertaken which renders a vessel unstable or unsafe remains entirely with the owner/skipper of the vessel.*

This caveat enabled the MMO to recover funding where a vessel was proven to be unsafe following modification, an action that the MMO had taken once during the 6 years of the EFF.

The process for receiving EFF grant assistance in England was as follows:

- The candidate completed and sent the application form to the MMO.
- MMO staff carried out an initial check to ensure the form was filled out appropriately, with all relevant sections completed and signed as required.
- Inappropriately completed forms were returned to the candidate for correction.
- Upon receipt of an appropriately completed application, the MMO acknowledged its receipt and commenced processing the application. A self-imposed target time of 10 working days from a satisfactory application being passed to the MMO coastal inspection team to the issue of a formal letter of offer, or rejection, started at this point.
- Depending upon the timescale of the modifications, interim grant payments were made, with final payments being made upon completion of the works and presentation of invoices.

The self-imposed target time of 10 days was set by the MMO in order to demonstrate efficiency in fund distribution to the EC and in the belief that if this period was extended, it would inhibit vessel owners from applying. No guidance regarding target times had been issued by the EC.

The process required applicants to clearly demonstrate eligible improvements through a business case for the project. This required a detailed explanation of the proposed changes and the benefits arising from these changes. There was no requirement to provide drawings for any proposed fabrication work or structural alterations.

The MMO was aware of the *Small FV Code* and the lack of stability criteria for vessels under 15m (LOA) and did not require any formal assessment of stability for projects involving these vessels, as it believed the cost for owners would inhibit grant applications. Recognising that it lacked detailed knowledge of fishing vessel operations, from July 2010 the MMO had been sending copies of grant applications to the MCA, requesting that it review the proposed modifications with regard to vessel stability and general safety. The MCA was expected to respond to these requests within the MMO's target time of 10 working days although, in practice, this was not usually achievable. If no response was received from the MCA within the MMO's target time, the application was assumed to be safe and was processed accordingly.

A sample audit carried out by the MMO during the period of this investigation identified that of 15 recent requests to the MCA to review applications, only one had been processed within the MMO's target time.

1.4.1.5 *Stella Maris*'s EFF application

In June 2012, *Stella Maris*'s skipper applied to the MMO for an EFF grant to assist with the modernisation of his vessel. The grant was approved and the modifications were completed in July 2013, following identical modifications to *Stella Maris*'s sister vessel.

Before approving *Stella Maris*'s EFF application, the MMO requested confirmation from the MCA that the changes would not adversely affect the vessel's stability. The project application included a detailed business case and explanation of the changes, but no drawings of the proposed alterations were supplied to, or required by, the MMO. As there was no requirement for stability within the *Small FV Code*, the MCA simply compared the weights removed from the vessel (5.5t, as notified by the owner) against those to be added (3.54t, as confirmed by the yard). The MCA considered that, since the application indicated that more weight would be removed from the vessel than would be added, its stability would not be impaired by the proposed changes. Due to an oversight, the MCA did not reply to the MMO regarding *Stella Maris* at any point. Nevertheless, in accordance with its policy to respond to applicants within 10 working days, the MMO approved the grant applications on the strength of the owner's business case.

Following *Stella Maris*'s modernisation, and before the final funds were released, the vessel was inspected by the MMO to ensure that the work had been completed. No post-modification inspection by the MCA was required, or carried out, following the modernisation, and *Stella Maris* returned to fishing.

1.4.1.6 Inspections

The *Small FV Code* **(see section 1.5.1)** required that vessels be presented to the MCA for a safety inspection at 5-yearly intervals and at any other time at the MCA's request.

Stella Maris had last been inspected by the MCA in March 2011 when it was issued with a Small Fishing Vessel Certificate, indicating that the vessel and its equipment complied with the *Small FV Code*. The next scheduled inspection for *Stella Maris* was not due until March 2016.

There was a note on the Small Vessel Certificate issued that stated:

> *Any unauthorised modification to the vessel or its equipment may invalidate this certificate or endanger the crew. If you intend to modify the vessel, seek professional advice.*

Despite this note, there was no specific requirement for vessels to undergo any additional inspection by the MCA following modernisation or major structural alterations.

1.5 REGULATIONS GOVERNING SMALL FISHING VESSELS

1.5.1 Equipment and outfitting

The Fishing Vessels (Code of Practice for the Safety of Small Fishing Vessels) Regulations 2001 (Small FV Code) was the applicable regulation governing vessels such as *Stella Maris.* The Small FV Code, summarised and promulgated in Merchant Shipping Notice (MSN) 1813 (F) *The Fishing Vessels Code of Practice for the Safety of Small Fishing Vessels*[2] specified the safety requirements for all fishing vessels less than 15m (LOA). Vessel lengths were further categorised within the Small FV Code at 7m, 10m and 12m (L).

Stella Maris was 9.53m (L) and the applicable section of the Small FV Code was titled, *Decked Vessels of less than 10m Registered Length.* This section listed the mandatory and recommended safety equipment for vessels 7-10m (L). Recommended equipment included liferafts, hydrostatic release units (HRU) for liferafts, radar reflectors and EPIRBs. *Stella Maris* had been equipped with all this recommended equipment, with the exception of an EPIRB, in place of which the skipper had fitted an MOB Guardian system[3]. Unfortunately, due to an oversight by the skipper, the airtime transmitting facility for this device had expired 2 weeks before the accident.

Stella Maris carried four MCA type approved, abandon ship lifejackets in addition to two constant wear inflatable lifejackets, all of which were stowed in the wheelhouse and were rarely worn.

1.5.2 Lifting equipment

The Small FV Code makes no reference to lifting equipment, unlike the *Small Commercial Vessel and Pilot Boat Code of Practice* (SCV Code) as promulgated in Marine Guidance Note (MGN) 280[4], which is not applicable to fishing vessels. In addition to a number of specific requirements relating to the stability of the vessel during lifting operations, the SCV Code includes reference to the need for vessels to comply with the *Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment) Regulations 2006* (LOLER).

LOLER applies to any equipment that is used to lift a load and requires such equipment to be inspected by a competent person to ensure that it is safe to operate. The MCA guidance issued on the application of LOLER in MGN 332a[5] (M+F) states, inter alia:

> *Inappropriate use of lifting equipment and failure of lifting equipment can also have an adverse effect on a vessel's stability, and on smaller vessels this could possibly lead to capsize.*

And goes on to say:

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[2] MSN 1813 (F): www.gov.uk/government/uploads/system/uploads/attachment_data/file/281956/msn1813.pdf

[3] MOB Guardian: The MOB Guardian system transmitted a vessel's position to the RNLI operation centre at predetermined intervals, via the Iridium satellite network. A missed report would result in the vessel's last known position being passed to the Maritime Rescue Coordination Centre.

[4] https://www.gov.uk/government/publications/mgn-280-small-vessels-in-commercial-use-for-sport

[5] https://www.gov.uk/government/publications/mgn-332a-ms-fv-lifting-operations-lifting-equipment-regulations-2006

Accidents can be avoided through careful design and selection of lifting equipment. In this respect employers may wish to consider the use of a suitable design code, with survey and certification carried out by a competent authority

In addition to the design requirements, lifting equipment such as *Stella Maris*'s "A" frame gantry, the gantry head block and gilson winch is required to be thoroughly examined by a competent person at least every 12 months.

The MCA also produced a document titled *Guidance on the Application of Merchant Shipping and Fishing Vessels (Provision and Use of Work Equipment) Regulations 2006 and the Merchant Shipping and Fishing Vessels (Lifting Operations and Lifting Equipment Regulations) 2006 to fishing vessels* **(Annex A)** intended to provide fishermen with concise guidance on the application of these regulations. This document includes the following statement:

For LOLER to apply the principal function of the work equipment should be 'to lift a load'. Winches or similar equipment used only for hauling loads "horizontally" would not attract the application of LOLER but would be subject to PUWER[6]. If such winches etc are also used for lifting then LOLER will also apply.

The guidance also includes a template for setting out and recording the periodicity and completion dates of equipment inspections.

1.5.3 Liferaft

Stella Maris carried a Seago four-person liferaft, which complied with ISO 9650-1[7]. The liferaft was stowed in a cradle above the deck shelter on the port side **(Figure 12)** and was secured using a Hammar H20 HRU.

The safety pack within the liferaft was designated as a "less than 24 hour" pack and contained basic essentials for up to 24 hours adrift, including: paddles, bellows pump, bailer and a selection of locator aids. The locator aids consisted of 2 parachute flares, 3 hand-held pinpoint flares, a heliograph mirror and a torch. Contrary to the crew's expectations, the raft contained no water or food rations and fewer flares than they had experienced during their sea survival training, which had been conducted using SOLAS type liferafts.

1.6 STABILITY

1.6.1 Stability regulations

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 stability criteria for all vessels of 12m (L) and over and these are referred to throughout this report as the intact stability criteria. 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*

[6] Merchant Shipping and Fishing Vessels (Provision and Use of Work Equipment) Regulations 2006

[7] ISO 9650-1: International Organization for Standardization approved liferaft designed for extended voyages, where high wind and significant wave heights may be experienced.

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)) to further increase the safety of small fishing vessels and 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.

In December 2010, the MCA published MGN 427 (F) *Stability Guidance for Fishing Vessels of under 15m Overall Length*[8]. This MGN stated that intact stability criteria for the 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).

A further review of the Small FV Code was published as a voluntary code of practice in 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*[9] in April 2014. This voluntary code of practice was expected to become mandatory in 2016. The main changes proposed in MGN 502 (F) were:

- 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;
- Inspections of the vessel are required at change of ownership;
- Emergency drills are now required;
- Radar Reflectors are now to be fitted to all vessels;
- Bilge Alarms for Open vessels (7m (L) -15m Length Overall (LOA));
- Certificates to be issued for Small Fishing Vessels;
- Structural modifications to be notified to MCA prior to work taking place;
- EPIRBs and Stability requirements for vessels of 12m (L)-15m (LOA);
- Personal Flotation Devices or Lifelines recommended to be worn whilst working on open decks.

[8] MGN 427 (F): www.gov.uk/government/uploads/system/uploads/attachment_data/file/282137/mgn427.pdf

[9] MGN 502 (F): www.gov.uk/government/uploads/system/uploads/attachment_data/file/296318/mgn502.pdf

MGN 502 (F) placed no intact stability criteria on vessels under 12m (L), such as *Stella Maris*.

1.6.2 General stability guidance

MGN 427 (F) states: *In the absence of specific statutory requirements for stability and its subsequent approval of stability, owners may use other methods to assess stability and support skippers and fishermen to meet their health and safety general duties and responsibilities.* The MGN goes on to offer five methods of assessing stability for fishing vessels that are not required to comply with the intact stability criteria:

1. Full Stability Method (mandatory for all vessels over 15m (LOA)); which requires stability data to be formulated from an inclining experiment and calculation.

2. Small Commercial Vessel Code Standard (known as the 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.

3. 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 more than 1 tonne of cargo.

4. IMO Roll Period Approximation - a simple operational comparison method to determine whether a vessel is stiff or tender (see 1.6.3). 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.

5. Wolfson Guidance **(see section 1.9)**.

The details of the requirements of each of the methods are provided in annexes to the MGN.

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

In addition to the guidance on various stability conditions and considerations for skippers, MGN 427 (F) also stresses that:

No vessel can be designed to be inherently safe; this depends upon the way it is operated. Therefore a vessel must be operated in such a manner that keeps it stable and provide a safe working platform for those onboard, whatever the purpose of the vessel or the operational circumstances.

At the time of this investigation, the MCA was revising MGN 427 (F) to incorporate extant recommendations from the MAIB report on the investigation of the capsize and foundering of the fishing vessel *Heather Anne* (FY126) resulting in the loss of one crewman.[10]

1.6.3 Assessing stability by roll and heel test

MGN 503 (F) *Procedure for Carrying out a Roll or Heel Test to Assess Stability for Fishing Vessel Owners and Skippers*[11], published in April 2014 explains *the need for owners and skippers of small fishing vessels (most appropriately those under 15m (LOA)) to make an assessment of the state of stability of their vessels.*

The instructions within the MGN are based on those developed for the Food and Agriculture Organization (FAO), International Labour Organization (ILO) and the International Maritime Organization's (IMO) *Voluntary Guidelines for the Design Construction and Equipment of Small vessels, 2005*.

These guidelines described how to carry out a basic stability check by measuring the roll period of the vessel, and were identical to the IMO Roll Period Approximation outlined in MGN 427 (F). This roll test indicates to the operator whether the vessel is stiff, or tender. MGN 503 (F) states:

> ***A vessel could be defined as tender or stiff as below***
>
> ***Vessel Tender*** = *If the time for one roll in seconds is more than the beam in metres.*
>
> ***Vessel Stiff*** = *If the time for one roll in seconds is less than the beam in metres.*
>
> ***Essentially, a very slow roll is likely to indicate a problem with stability, and a fast roll is likely to suggest that the vessel has a good reserve of stability.***
>
> ***E.g****. If the vessel has a beam of 3.5m, a roll period of more than 3.5 seconds would make the vessel tender. If the roll period is less than 3.5 seconds then the vessel could said to be stiff.*

The MGN also includes procedures for calculating a heel test by moving weights on board the vessel and recording the angle to which the vessel heels. By carrying out the heel test after changes such as vessel modifications, the operator is able to compare the heel angle against the original. Professional advice should be sought if the heel angle of subsequent tests is found to be 10% greater than the original test.

MGN 503 (F) also advises that decked fishing vessels such as *Stella Maris* should have a minimum freeboard of at least 300mm. *Stella Maris*'s minimum freeboard was about 470mm.

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[10] MAIB Report No 2/2013: Report on the investigation of the capsize and foundering of the fishing vessel *Heather Anne* (FY126) resulting in the loss of one crewman, Gerrans Bay, Cornwall on 20 December 2011. https://www.gov.uk/maib-reports/capsize-and-sinking-of-under-12m-ring-netter-heather-anne-in-gerrans-bay-cornwall-england-with-loss-of-1-life

[11] MGN 503 (F): www.gov.uk/government/uploads/system/uploads/attachment_data/file/311669/MGN_503.pdf

1.6.4 Seafish

The *Small FV Code* required fishing vessels new to the UK registry to comply with the Seafish Construction Standards in order to be registered as a UK fishing vessel. Similar wording is incorporated in MGN 502 (F), recommending that vessels built since 16 July 2007 or new to the registry are to conform to the recognised standards of MCA approved Certifying Authorities or to standards recognised by the MCA applicable at the time of their build.

Revised Seafish construction standards for vessels under 15m (LOA) were published in September 2012, and came into effect from 1 January 2013. For new vessels these standards specified, inter alia, that:

- Stability should be properly assessed by a person having appropriate qualifications.

- The minimum heights for engine room vents on vessels of under 10m (LOA) (such as *Stella Maris*) be no less than 450mm above deck level.

- Decked vessels with a continuous watertight weather deck have a minimum freeboard from the design waterline of not less than 300mm, in accordance with MGN 503 (F).

Stella Maris's freeboard was about 470mm and its engine room vents were 570mm above deck level.

Prior to the EC offering improvement grants such as the EFF, grant assistance had been offered by the UK government to enhance efficiency and safety by way of vessel construction and modernisation. These national grant and loan schemes were latterly administered by Seafish on behalf of the UK government. The last national scheme was the *Fishing Vessels (Acquisition and Improvement) (Grants) Scheme 1987*. This was initially set to run for 6 years, but was superseded by the *Fishing Vessels (Acquisition and Improvement) (Grants) (Amendment) Scheme 1990*. To benefit from these schemes, vessels of less than 12m (L) were not obliged by regulation to be compliant with any stability criteria. However, to enhance vessel safety and protect public funds, Seafish required decked vessels of any length to demonstrate compliance with the intact stability criteria if constructed with assistance from the scheme.

1.6.5 Fishing-specific safety guidance

As well as MGNs relating to stability, the MCA publication entitled *Fishermen's Safety Guide – A guide to Safe Working Practices and emergency procedures for fishermen* provided advice on a wide range of operating practices on board fishing vessels. A section on stability explained the effects on a vessel's centre of gravity of lifting heavy weights clear of the water and the dangers of deck edge immersion.

1.6.6 Stability training

Stability training is embedded within the MCA's syllabus for Class 1 and Class 2 Certificates of Competency for Fishing Vessel deck officers. However, Certificates of Competency are not required for operating vessels under 16.5m (L), such as *Stella Maris*.

Following the loss of *Chelaris J*[12] in October 2003 the MAIB made a joint recommendation to the MCA and Seafish to:

> *Develop a mandatory course, which must include good visual and practical elements, to raise practical stability awareness among fishermen.*

This recommendation was partially accepted and resulted in a voluntary 1 day intermediate stability awareness course being developed and delivered by Seafish in conjunction with the MCA. As a result of its voluntary status, the course attracted grant assistance from the EFF and had been completed by over 5600 fishermen, including *Stella Maris*'s skipper and deckhand, between its inception in 2006 and 2014.

1.7 STABILITY ASSESSMENT

The MAIB commissioned a naval architect to complete a stability assessment of *Stella Maris* and produce a report on the findings. A copy of this report is included at **Annex B**.

To assess the level of *Stella Maris*'s stability when it capsized, an existing computer model of the hull was used following an inclining experiment, conducted in December 2014, on an identical sister vessel.

As there was no applicable stability standard for fishing vessels under 15m (LOA), the sister vessel was assessed against the intact stability criteria applicable to fishing vessels of 15m (LOA) and over. The sister vessel's stability was also assessed in the estimated loss condition of *Stella Maris*. The stability assessment report is considered to provide an accurate indication of *Stella Maris*'s stability in the various conditions. However, given the approximations resulting from the use of a sister vessel, the results are not absolute. The assessment concluded that *Stella Maris* would not have complied with the stability criteria required by vessels of 15m (LOA) and over.

The assessment calculated that a weight of 1.8t suspended from the "A" frame gantry would have been sufficient to capsize *Stella Maris*. Had *Stella Maris* been able to just comply with the intact stability regulations, a weight of 4.1t suspended from the gantry would have been needed to capsize it in similarly benign sea conditions.

In addition to the intact stability assessment for fishing vessels of 15m (LOA) and over, the sister vessel also underwent assessments in accordance with three of the four alternative methods of assessing fishing vessel stability indicated in MGN 427 (F):

1. A roll test was carried out from which the vessel was found to have a roll period of about 4 seconds; marginally less than the vessel's 4.1m beam, indicating that the vessel was just within the MGN's and IMO's recommended roll period.

2. The vessel underwent, and passed, a heeling assessment by an MCA Certifying Authority for the Small Commercial Vessel Code Standard to carry

[12] https://www.gov.uk/maib-reports/snagging-capsize-and-sinking-of-stern-trawler-chelaris-j-on-the-banc-de-la-schole-near-alderney-channel-islands-with-loss-of-4-lives

up to 1000kg of cargo.

3. The Wolfson guidance mark (section 1.9) was temporarily applied, indicating the vessel was on the dividing line between green and amber safety zones in the depart port condition.

1.8 PREVIOUS ACCIDENTS

1.8.1 *Sally Jane* (1)

In 1998 the 13.6m beam trawler *Sally Jane*[13] capsized when alongside in Aldrington basin, Shoreham. *Sally Jane* had just returned from her first trip following a 3-week refit, and was light on fuel, water and ice. The fishing gear had been hauled to the tops of the raised derricks when the vessel suddenly capsized.

The MAIB investigation identified that the immediate cause was inadequate transverse stability. The owner was recommended to:

> *Engage a naval architect to produce a condition for the trim and stability book to cover the operation of repairing gear in port, clearly setting out the required loading of the vessel and including limitations on the movement of the derricks. The skipper should be instructed in the use of the information by the naval architect.*

This was fully accepted and several tonnes of ballast were added to the vessel.

The MCA was recommended to:

> *Ensure that twin beam trawlers' compliance with the new requirements for fishing vessels of under 12m registered length (currently being developed) is dependent on a thorough assessment of the risk of capsize, not only in seagoing conditions but also when the fishing gear is being worked.*

This was also fully accepted, however the requirements for fishing vessels of under 12m (L) were never issued as intended and so the recommendation was not completed.

1.8.2 *Charisma*

On 13 January 2002, the 9.68m fishing vessel *Charisma*[14] capsized with the loss of one life.

The report concluded that the vessel was lost as a result of undetected flooding coupled with the heavy load of mussel bags on deck.

The MCA was recommended to:

> *In consultation with the fishing industry develop and promulgate guidance for the loading of fishing vessels under 15m (LOA).*

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[13] https://www.gov.uk/maib-reports/capsize-of-twin-beam-trawler-sally-jane-alongside-in-shoreham-harbour-england

[14] https://www.gov.uk/maib-reports/capsize-and-sinking-of-mussel-dredger-charisma-in-carlingford-lough-near-rostrevor-pier-northern-ireland-with-1-person-injured-and-loss-of-1-life

The recommendation was fully accepted and is discussed in section 1.8.6.

1.8.3 *Kirsteen Anne*

On 31 December 2002, the 6.5m fishing boat *Kirsteen Anne* and her crew of two failed to return, as planned, from a fishing trip. The vessel was found partly submerged, but with no sign of the crew.

The investigation concluded that *Kirsteen Anne*[15] capsized as a result of poor stability caused by modifications made since it was built, the weight of the fishing gear carried, and a build-up of water in the bilge.

The Department for Transport and the MCA were recommended to:

> *Develop a simple method of assessing stability, including freeboard, of small fishing vessels, and issue guidance accordingly.*

This was fully accepted and is covered in section 1.8.6.

A number of further recommendations were made to the MCA, including that it should:

> *Conduct a formal safety assessment of the introduction of a mandatory stability requirement for existing fishing vessels under 15m.*

This was rejected and is covered in section 1.8.6.

1.8.4 *Amber*

In January 2003 the 9.98 trawler, *Amber*[16], sank with the loss of its skipper while he attempted to tow a net with a boulder in the cod end into shallow water for recovery.

Poor stability was identified as a causal factor in the loss of the vessel.

The report re-iterated many of the recommendations made in the *Kirsteen Anne* report.

1.8.5 *Auriga*

In June 2005 the 9.74m trawler, *Auriga*[17] capsized and sank in very similar circumstances to *Stella Maris*. A cod end heavy with boulders was being hauled from the top of a stern mounted “A” frame gantry, causing the vessel to list and capsize. Her two-man crew succeeded in launching and boarding their liferaft and were rescued several hours later following a successful distress alert being transmitted from the vessel’s non-mandatory EPIRB.

No relevant additional recommendations were made but the report made reference to the recommendations made in the *Amber* and *Kirsteen Anne* reports.

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[15] https://www.gov.uk/maib-reports/capsize-and-sinking-of-creeler-kirsteen-anne-off-oban-scotland-with-loss-of-2-lives

[16] https://www.gov.uk/maib-reports/capsize-and-sinking-of-prawn-trawler-amber-in-the-firth-of-forth-scotland-with-loss-of-1-life

[17] https://www.gov.uk/maib-reports/capsize-and-sinking-of-stern-trawler-auriga-off-portavogie-northern-ireland

1.8.6 MAIB fishing vessel safety study

In November 2008, MAIB published its *'Analysis of UK fishing vessel safety 1992 to 2006'*[18], referred to hereafter as the Analysis. The deaths of 256 commercial fishermen operating on UK-registered fishing vessels that had occurred during the period were reviewed in the Analysis, with a view to identifying causal and contributing factors, drawing conclusions and making recommendations. All sectors of the industry were contacted and asked to contribute, and the report was based upon a consensus of the views obtained.

The Analysis identified:

- The majority of vessel losses (52%) were due to flooding/foundering, and most of these involved vessels with lengths under 12m. 13% of losses were due to groundings, whilst capsize/listing caused 12% of vessels to be lost.

- Just under 40% (99) of all fatalities between 1992 and 2006 were due to flooding/foundering, capsize/listing or missing vessels.

- 63 of these (25% of all fatalities) involved under 12m vessels:

    - Stability shortcomings were identified in many of these accidents, with 18 fatalities attributed to vessels with low freeboard, 9 caused by inadequate stability and 8 due to vessel modifications.

    - Under 12m vessels are not required to carry emergency positioning indicating radio beacons (EPIRB), and only 1 of the vessels had one fitted; problems with this EPIRB, however, led to a delay in starting the search and rescue, and 3 crew died.

Recommendations

The Analysis also highlighted a number of previous recommendations made to the MCA related to fishing vessel stability, along with the MCA's responses, including:

- Following the investigation into the capsize of Charisma in 2002, probably due to undetected flooding combined with a heavy deck load of bagged mussels, MAIB recommended that:

    MCA, in consultation with the fishing industry, develop and promulgate guidance for the loading of fishing vessels under 15m (LOA).

- The MCA commissioned two research projects, RP559 and RP560, which were to develop a simplified method of assessing stability on under 12m vessels, without the need for expensive inclining tests and stability books, and to produce a simplified stability notice for use on over 12m vessels. The projects were completed in May 2006, but despite the efforts of the MCA and Seafish it has not proved possible to identify any vessels to participate in the validation of the results.

- The *Amber* and *Kirsteen Anne* investigations, although resulting in separate reports, effectively made three parallel recommendations regarding small fishing

[18] https://www.gov.uk/government/publications/fishing-vessel-safety-study

vessel stability. Two of these recommendations revisited the areas of devising a simple method of assessing stability and of enhanced stability awareness among the operators of small fishing vessels, and were considered to be addressed by the actions above. A further recommendation was also made to the MCA to:

> *Conduct a formal safety assessment of the introduction of a mandatory stability requirement for existing fishing vessels under 15m.*

- This was rejected, although the MCA agreed to conduct a risk and cost-benefit assessment into whether a stability standard for under 15m vessels would materially affect the accident rate. In confirming this intention to the MAIB, the MCA noted that even if a mandatory stability standard on small fishing vessels was proven to significantly enhance stability, it would be almost impossible to implement such a measure given the large number of vessels in the under 15m fleet.

The Analysis went on to make further recommendations to the MCA with regard to stability:

- Clarify the requirements for risk assessment to include risks which imperil the vessel such as: environmental hazards; condition of the vessel; stability etc.

- This recommendation was accepted by the MCA, but to date there has been no implementation.

- Work towards progressively aligning the requirements of the Small Fishing Vessel Code, with the higher safety standards applicable under the Workboat Code.

  In response, the MCA included in its business plan for 2012 to 2016 a milestone for the recommendation to be completed by April 2016, viz:

  - Develop and issue alternative small fishing vessel standards based on the Small Commercial and Pilot Boat Code.

The Analysis also included a recommendation to the MCA on the carriage of EPIRBs:

> *Introduce a requirement for under 15m vessels to carry EPIRBs.*

Although this recommendation was accepted by the MCA, no acceptance date was given and it is understood that, at the time of writing, an impact assessment for the effect of this upon industry is being considered by economists, with strong indications that it will be incorporated into the revised *Small FV Code* due for implementation in 2016.

1.8.7 *Heather Anne*

In December 2011 the 10.0m fishing vessel *Heather Anne*[19] foundered with the loss of a crewman while returning to port heavily laden with pilchards.

[19] https://www.gov.uk/maib-reports/capsize-and-sinking-of-under-12m-ring-netter-heather-anne-in-gerrans-bay-cornwall-england-with-loss-of-1-life

Heather Anne had previously undergone modifications with EFF assistance administered by the MMO. Issues identified in the investigation included vessel stability and administration of the EFF.

The MCA was recommended to:

> *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.*
> - *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.*

And to:

> *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.*

The MCA and the MMO were recommended to:

> *Work together to link the funding provided for modifications to small fishing vessels with a full assessment of the impact such modifications will have on such vessels' stability, particularly where the proposed modifications will substantially alter the method of fishing to be undertaken.*

The MCA and the MMO and the Cornish Fish Producers Organisation were recommended to:

> *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.*

All of these recommendations were fully accepted.

1.8.8 *Betty G*

On 23 July 2012 the 9.9m fishing vessel *Betty G*[20] capsized while beam trawling. The three crew were rescued from their liferaft approximately 10 hours later. The vessel capsized as a result of the load in the starboard trawl net releasing suddenly as the skipper attempted to clear the nets, that were suspended from the derrick heads, of suspected mud. No distress message was transmitted and no alarm was raised, even though the vessel was fitted with an EPIRB.

The investigation report concluded that the vessel capsized due to the imbalance between the beam trawls caused by the load in one net suddenly releasing.

Although *Betty G* was provided with stability information at build, the validity of the information was unknown as no subsequent lightship checks had been conducted.

1.8.9 *Sally Jane* (2)

In September 2013, 15 years after the vessel's earlier capsize in 1998, *Sally Jane*[21] capsized again while beam trawling in Christchurch Bay, England. The investigation identified that the cause was, again, inadequate transverse stability. This time probably caused by a difference in the weights of the contents between its port and starboard trawl nets being hauled from unnecessarily long derricks.

In the intervening years between capsizes, no lightship checks had been carried out and compared against the stability book produced after the first capsize, and so the vessel's owners were not able to establish how much the vessel's centre of gravity had altered.

1.9 RESEARCH PROJECTS

The recommendations listed in section 1.8.3 were instrumental in the MCA commissioning research projects RP559 and RP560 aimed at developing guidance for the loading of fishing vessels under 15m (LOA). The projects were undertaken by the University of Southampton's Wolfson Unit for Marine Technology and Industrial Aerodynamics (Wolfson).

The executive summary of phase II of the project's *Loading Guidance for Fishing Vessels Less than 12m Registered Length* (Report No.1903/2), which was passed to the MCA in May 2006, stated:

> *The remit of this study was to develop effective methods of assessing the stability of fishing vessels, which do not unduly disadvantage the existing fleet. Based on this assessment, to provide clear guidance on loading, freeboard and operation, in a simplified format for ease of understanding and use by fishermen, which will enhance safety.*

[20] https://www.gov.uk/maib-reports/capsize-of-multipurpose-fishing-vessel-betty-g-while-beam-trawling-in-lyme-bay-england

[21] https://www.gov.uk/maib-reports/capsize-and-sinking-of-beam-trawler-sally-jane-in-christchurch-bay-england

The Wolfson report proposed a method of generating simplified stability guidance through colour-coded 'Safety Zones', with freeboard guidance marks linked to recommended maximum sea states. For decked vessels with no stability data, only the vessel's (LOA) and breadth are required to calculate the freeboard guidance marks and the corresponding zones. The safety zones were defined as:

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 research 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.

The MCA has had little success in attaining the recommendations of the Wolfson report and, despite actively seeking volunteer vessels, few skippers were willing to permanently apply the proposed freeboard guidance marks to their vessels.

The Wolfson guidance mark was temporarily applied to *Stella Maris*'s sister vessel **(Figure 16)** during the post-accident stability assessment. The mark shown is in position with the vessel in the depart port condition of full tanks and loaded with an additional 1250kg of inclining equipment. Draught was calculated to increase at a rate of 0.313 tonnes per centimetre (TPC), thus increasing freeboard by 4cm from the position shown in **Figure 16**. The reduction of 4cm draught would result in the sister vessel being just in the Wolfson guidance mark green safety zone in the depart port condition.

1.10 INTERNATIONAL BEST PRACTICE ON SMALL FISHING VESSEL STABILITY

Stability requirements for small fishing vessels vary throughout the world, with more countries enhancing regulation as time goes on. A sample from developed countries requiring intact stability criteria for small fishing vessels is given below:

- Norway implemented criteria closely aligned to the IMO Intact Stability Code for all new and substantially modified vessels over 6m in length from 1 January 2015. This requirement supersedes the slightly lesser requirements of the Nordic Boat Standards that had been applied to new vessels since 1 January 1992.

- Since May 2004, New Zealand has required all fishing vessels over 6m in length, operating beyond 2nm from the coast and using towed gear, to comply with intact stability criteria.

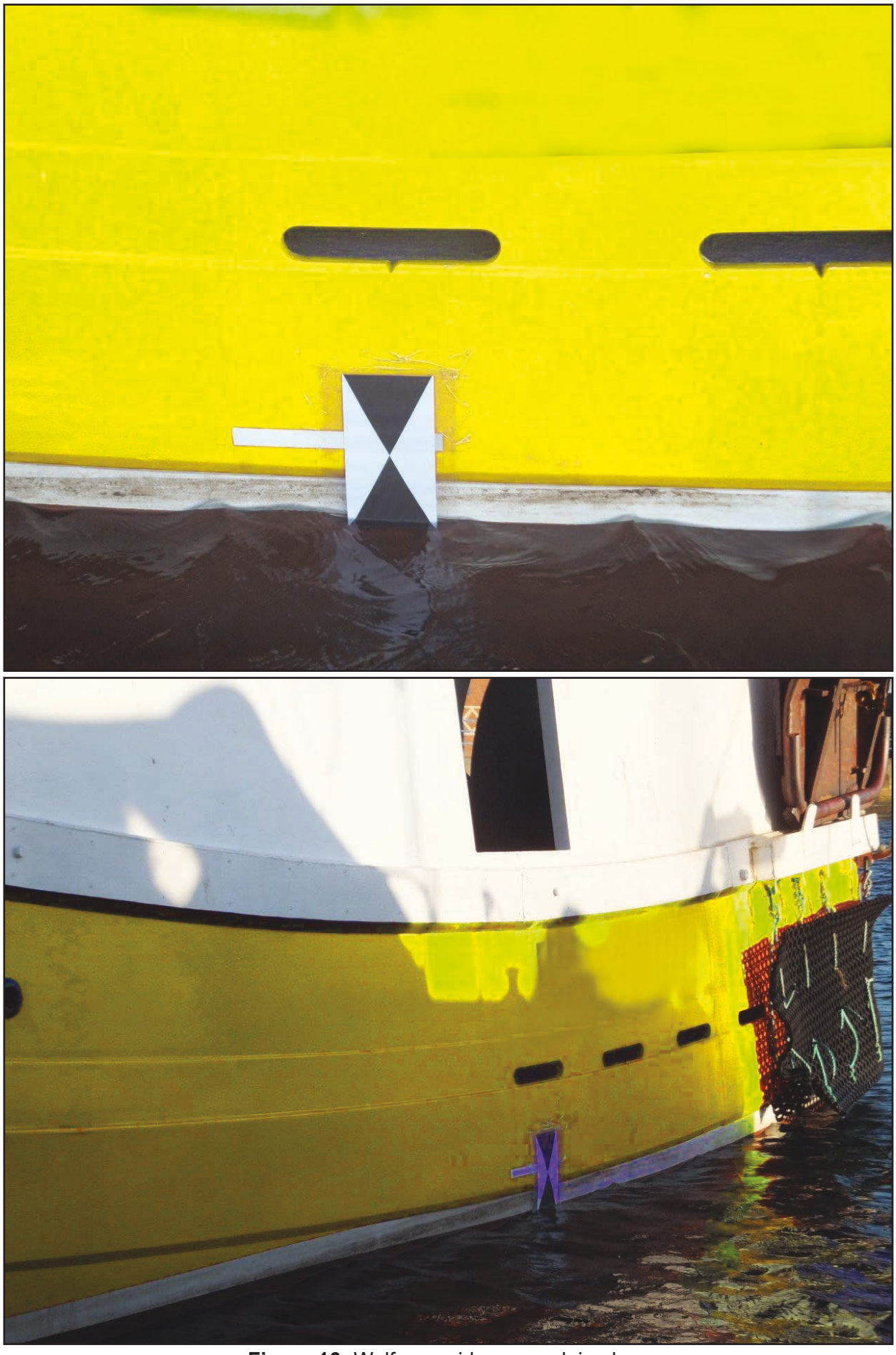

Figure 16: Wolfson guidance mark in place

- In 2004 Ireland introduced a *Code of Practice for Small Fishing Vessels of less than 15m (LOA),* which included intact stability criteria for all fishing vessels. Vessels constructed before May 2004 were required to establish their metacentric height[22] (GM) by a roll test similar to that proposed by the IMO *Voluntary Guidelines for the Design Construction and Equipment of Small vessels, 2005*. The GM is to be at least 10% greater than the minimum metacentric height obtained using the IMO roll test formula. Vessels built since April 2004 are required to comply with the IMO Code on Intact Stability or other such rules acceptable to the Marine Survey Office.

- Since 2001 Denmark and Greenland have had intact stability criteria closely aligned to the IMO Intact Stability Code, that applies to all new or substantially modified decked vessels with a scantling number of 20[23] or above. Denmark and Greenland also categorise vessels by length and area of operation, e.g. vessels under 12m normally operate within an area of 30nm from the coast.

- Canada requires intact stability criteria for vessels over 15 gross tonnes.

- Poland requires all decked fishing vessels to comply with the intact stability criteria, with areas of operation categorized by the distance from the shore.

- Russia requires compliance with the intact stability criteria for decked vessels over 4.5m, with vessels classed and areas of operation categorized by distance/ time from shore, season and wind speed. In addition, it has separate stability requirements for fishing vessels hauling by means of deck machinery and derricks; specifically, during hoisting from these points the vessel must not heel to an angle greater than 10°, or beyond the angle at which the deck edge immerses, whichever is less.

[22] Metacentric height (GM) is a measure of the initial static stability of a vessel. A larger GM indicates a greater resistance to capsize, along with a shorter roll period.

[23] Scantling number: a collective dimension of the length overall multiplied by the breadth of the vessel. Varying dimensions of structural members are applied to vessels dependent upon their scantling numbers.

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 THE ACCIDENT

Stella Maris capsized because the vessel did not have sufficient stability to accommodate an overweight cod end being lifted from a high gantry. Recent modifications to the vessel had raised the height of the gantry used to lift the cod end and added a winch capable of lifting more weight than the vessel could withstand without capsize. However:

- There was no requirement for modifications to the vessel to be assessed or approved.
- The vessel did not have, and was not required to have, any stability information, nor were there any applicable standards against which its stability should have been assessed.
- Approval of grant funding for the modifications did not include any assessment of the impact the proposed modifications would have on the vessel's safety.
- The lifting equipment had not been identified as having to comply with the requirements of LOLER, the owner had not assessed the effect on stability of using the new gantry arrangement for lifting heavy weights, and no procedures had been developed for dealing safely with overly heavy weights in the net.

2.2.1 The mechanics of the capsize

The conclusions of the stability assessment report into *Stella Maris* **(Annex B)** summarised the mechanics of the capsize as follows:

> *Stella Maris did not comply with the stability requirements for fishing vessels of greater than 15 metres length by a considerable margin in any of the conditions assessed. This made the boat particularly vulnerable in the accident condition when its centre of gravity was raised significantly by a load in the cod end of at least 1.8 tonnes (including entrained water) hanging from a point more than 8 metres above the Base Line. Positive righting levers, already small, turned negative as the load came on the gilson block and capsize then became almost inevitable.*
>
> *Given the calm sea conditions prevailing at the time, lowering the cod end back into the sea to reduce the load by its displaced volume plus the weight of entrained water would probably have reinstituted small positive righting levers. However, the cod end caught on the starboard guide horn as it was lowered. On the one hand, if it had not caught and the cod end had dropped into the water before the boat heeled to the angle of vanishing stability, the boat might not have*

capsized. On the other hand, the fact that the cod end was effectively tethered by the horn prevented it, albeit temporarily, from swinging out in a manner which would only have accelerated the rate of capsize.

Nevertheless, throughout the time the boat was heeled to starboard (i.e. since the haul had commenced) fuel oil was flowing through the cross-connect from the Port to the Starboard tank thereby increasing heel and with it the fuel flow transfer rate and the resultant heeling moment. Seawater was also flooding onto the deck through the Starboard freeing ports and over the top of the bulwarks, reducing the small additional contribution to righting moments that the bulwarks offered. The combination was sufficient to overcome any residual positive righting levers and complete the capsize.

2.2.2 The excessive weight in the net

Stella Maris's speed slowed and its trawl wire spread was seen to reduce, indicating severe weight in or on the trawl gear. However, it is not possible to state with any certainty what caused this additional weight. Although boulders had been dragged up in the area where *Stella Maris* initially shot away, they were not regularly caught in the area where the accident occurred.

Other options for trawled seabed debris could include many things, but the crew only saw mud and sand in the sea and on the net during hauling. The sea state on the day of the accident was flat calm and there had been a long period of calm sea conditions. Such conditions can lead to an accumulation of mud and sand in trawl nets as the lack of surface movement being transmitted to the net reduces the riddling effect, which normally helps to keep the nets clean. Therefore, mud and sand are considered to be the most likely cause of the weight.

Fishermen have little control over weights such as mud, sand or stones once they are in the cod end. When this causes the cod end to become too heavy to recover safely, alternative means of net recovery need to be considered. These include:

- Jettisoning the gear for retrieval by a larger, more capable vessel.
- Towing the net onto hard seabed to cause the obstruction to be torn free.
- Cutting away the cod end.
- Towing the net, from a low point on the vessel so as not to reduce stability, back to harbour, and employing a suitable crane to lift it onto the quayside.

These options all result in lost fishing time, damage to fishing gear and/or loss of the catch. Therefore, it is understandable that skippers will strive to recover their nets back on board. Nevertheless, in such situations it is essential to review the situation with regard to the stability of their vessel as it is better to lose the net than capsize the vessel.

Excessive weight in the net due to a large catch, foreign object(s) or accretion of mud or sand was a foreseeable risk. However, the risk had not been sufficiently recognised by the owner and so no safe procedure for dealing with excessive weight in the net had been developed.

2.3 STABILITY

2.3.1 Lack of requirement

At less than 15m (LOA) *Stella Maris* did not have to comply with the stability and freeboard requirements of the 15-24 Code. However, many vessels of *Stella Maris*'s size had achieved the intact stability criteria and, when Seafish administered grants for fishing vessel construction, stability compliance was a prerequisite for approval of grant applications.

The absence of any statutory stability requirement for under 15m (LOA) fishing vessels leaves owners without a baseline requirement against which to assess their operations, lifting capacity or planned modifications.

Within the *Small FV Code* there was a requirement for new vessels (where the keel was laid or moulding started after 1 April 2001) to be constructed and outfitted in accordance with the latest Seafish construction and outfitting standards. This included having the vessel's stability *properly assessed by a person having appropriate professional experience.* However, there was no similar requirement within the *Small FV Code* or Seafish construction standards for existing vessels being substantially modified to have their stability assessed. Consequently an existing vessel could be stripped back to the bare hull and rebuilt without having to meet the standards required of new build vessels. This is wholly inappropriate and, while it has been addressed in MGN 502 (F), which it is intended will become statute in 2016, it is not addressed in the Seafish construction standards, to which MGN 502 (F) refers.

2.3.2 Intact stability

To enable consideration of *Stella Maris*'s probable stability condition at the time of capsize, its sister vessel was assessed against the intact stability criteria applicable to vessels of 15m (LOA) and over. This assessment **(Annex B)** concluded that *Stella Maris* did not comply with these criteria.

Any vessel can be capsized, and it is the duty of vessels' operators to work within the vessel's safe limits. However, this is not easily achieved when those limits are not known. Had *Stella Maris* complied with the intact stability criteria for over 15m (LOA) vessels, it should (in similar sea conditions) have been able to lift 4.1t from its gantry before capsize occurred. In reality, it took only a 1.8t lift to capsize the vessel. This mathematical comparison cannot be used to suggest that it would have been safe to lift such weights, but it does highlight the additional safety margins that compliance with the intact stability criteria can achieve.

2.3.3 Alternative stability assessment methods

At the time of the accident, there was no requirement for vessels under 15m (LOA) to comply with the intact stability criteria. In the absence of such regulation, guidance in the form of MGNs 427 (F) and 503 (F) offered a range of methods for skippers of small vessels to assess their vessels' stability. Of the five methods offered only full intact stability assessment by inclining provided a specific measure of a vessel's stability. The four remaining methods offered vessel operators a rudimentary idea of their vessel's stability condition but they needed to be used with caution even when more than one of the methods were used at the same time.

Assessment of *Stella Maris*'s sister vessel by Roll Test, Small Commercial Vessel Heel Test and Wolfson Guidance indicated that the craft had a reasonable measure of stability. However, the assessment by inclining demonstrated that the vessel did not comply with the intact stability criteria for vessels 15m (LOA) and over **(Annex B)**.

The sister vessel complied with only one of the eight parameters included in the intact stability criteria: GM. It was this large GM that enabled the vessel to pass the roll test. The vessel also had a minimum freeboard of 470mm, which was well in excess of the 300mm minimum recommended within MGN 503 (F) and the Seafish construction standards. This freeboard was instrumental in assisting the vessel to comply with the Small Commercial Vessel Heel Test.

These results demonstrate that while the simplified stability assessments listed in MGNs 427 (F) and 503 (F) may give some indication of a vessel's stability, they are not an effective or suitable substitute for assessing a vessel's stability using the intact stability criteria.

2.3.4 Lifting equipment

The guidance document issued by the MCA on the application of PUWER and LOLER **(Annex A)** clarifies the applicability of the regulations and provides a template for recording the frequency and date of inspections/thorough examination of equipment. Nevertheless, the lifting equipment made up of the "A" frame gantry, head block and gilson winch had not been recognised by the owner as falling under the requirements of LOLER and so had not been subject to design verification or inspection and examination.

There is no evidence to suggest that the equipment was not in a good operational condition. However, had the equipment been recognised as lifting equipment under LOLER when the modifications had been designed and sent to the MMO for approval, the potential for capsizing the vessel could have been assessed and limitations to the lifting capacity appropriate to the vessel's stability would have been required. This, in turn, would have necessitated the stability of the vessel to have been assessed.

It is unfortunate that MGN 502 (F) has not yet been aligned with the requirements regarding lifting appliances made by the SCV Code. Alignment of these codes prior to the MGN 502 (F) becoming mandatory, as intended in 2016, would provide owners and operators with better guidance on the appropriate application of the regulations.

2.3.5 Progress against recommendations

The MAIB has made numerous recommendations to the MCA regarding the stability of small fishing vessels. One of the most forceful was in 2003, following the loss of *Kirsteen Anne*[13], when MAIB recommended that the MCA: *Conduct a formal safety assessment of the introduction of a mandatory stability requirement for existing fishing vessels under 15m.*

The recommendation was rejected by the MCA on the grounds that *it would be almost impossible to implement such a measure given the large number of vessels in the under 15m fleet.* However, it would have been possible to implement such a requirement on future new builds, or vessels substantially modified from a given date; an option that was not offered by the MCA in its response.

Despite voluntary stability awareness training and alternative stability assessments for under 15m (LOA) vessels, losses due to poor stability have continued since the *Kirsteen Anne* recommendation made in 2003. In many of the accidents, lives were also lost (see section 1.8.6).

The majority of developed countries with significant numbers of small fishing vessels have introduced intact stability criteria or similar requirements on new and substantially modified vessels. These stability compliant vessels have increasingly replaced older non-compliant tonnage and, as a result, some countries now have no non-compliant vessels left in service. The continued failure in the UK to apply intact stability criteria to small fishing vessels has resulted in these vessels being more dangerous than comparable vessels of other developed nations. The evidence from this and previous accidents indicates there is a compelling case for the UK to introduce stability standards for small fishing vessels, in line with the approach taken by many other developed countries.

2.3.6 Downflooding

As *Stella Maris* listed under the load acting upon its gantry, the bulwark rails submerged quickly, leading to downflooding through the engine room vents located between the frames on the bulwarks.

The Seafish construction standards for new vessels required vessels under 10m (LOA), such as *Stella Maris,* to have vent openings a minimum of 450mm above deck level. *Stella Maris*'s vent opening exceeded these requirements by 120mm, yet they would have submerged at a 29.11° angle in the lightship condition. Had the vents been located higher and/or well inboard, the area under the righting lever curve would have increased, providing a greater range of stability. However, this measure alone would not have ensured compliance as the maximum righting lever and the angle at which it occurred still failed the intact stability criteria.

Placing vents within the bulwarks on small vessels with limited space is not unusual as it produces a tidy appearance, but it is not the best place for either functionality or safety. Placing vents towards the centre of the deck, even at the same height as in the bulwarks, would increase the angle at which they downflood and so improve vessel survivability.

2.4 MODIFICATION OF VESSELS

The Small FV Code required that vessels be presented to the MCA for a safety inspection at 5-yearly intervals or at any other time at the discretion of the MCA. *Stella Maris* was not due an inspection until 2016.

Despite the note on the Small Fishing Vessel Certificate, there was no requirement for vessel owners to notify the MCA of substantial modifications, seek its approval or undergo inspection following modernisation or major structural alterations.

The MCA was aware of the proposed changes to *Stella Maris* as it had been notified by the MMO. However, since the weights being removed from the vessel were believed to be substantially greater than those being added, there was little concern regarding stability. Simply comparing 'weights off' versus 'weights on' does not consider the position of those new weights above the centre of gravity. Equally importantly, weight off/weight on took no account of the vessel's operation, in particular the new gantry 6m above deck level and the new catch hopper standing from 1m and rising to 2m above deck level.

The shortcoming regarding notification of substantial modifications and seeking MCA approval is addressed in the current voluntary *Code of Practice for the Safety of Small Fishing Vessels*, MGN 502 (F), which it is anticipated will become statutory in 2016.

2.4.1 Effect of the modifications to *Stella Maris*

Built in 1999, *Stella Maris* complied with all the MMO guidance for an EFF vessel modernisation grant. Much thought went into the vessel's modernisation, which focused primarily on improved catch quality and crew safety. These improvements were achieved by removing heavy steel deck fabrications on a previously open deck style craft and replacing them with a lightweight aluminium deck shelter with integrated catch hopper and "A" frame gantry.

In total it was reported that during the modifications to *Stella Maris* approximately 5.5t of weight was removed and 3.5 t was added. As the weights removed cannot be confirmed, it is difficult to pass comment on *Stella Maris*'s previous condition of stability. Nevertheless a comparison of the vessel's weight before and after would broadly indicate that, following modernisation, *Stella Maris* should have had a better level of stability in normal operating conditions. However, the vessel's draught did not differ much after modification; removing approximately 2t in weight from the vessel should have reduced its draught by 6.4cm. Since this was not the case, it is likely that the weight removed was, in fact, similar to the added weight of 3.5t.

Comparison of *Stella Maris* **(Figure 10**) before and after modification **(Figure 5)** identifies the following points relating to stability:

- The "A" frame gantry was approximately 1m higher than the previous gilson derrick, increasing the effect that lifting the cod end would have on the vessel's stability.

- Hoisting the cod end on board with the original derrick only required it to be lifted over the bulwark rail **(Figure 14)** and then lowered to within a few inches of the deck. The modifications required the cod end to be lifted 1.65m higher than the bulwark rail to enable the cod end to pass above the edge of the hopper **(Figure 15)**. Once above the hopper, the cod end was lowered onto the grid **(Figure 17)** to prevent swinging and to take the weight off the gilson block while it was being opened to release the catch. During this process the cod end would be at a height of over 2m above deck level, with no option of lowering it to the deck at any point during the opening period so as to improve the vessel's stability.

- Prior to conversion, the catch was emptied from the cod end onto the deck, requiring that it then be manually shovelled into boxes or a sorting tray for processing, but predominantly keeping the weight of the catch at deck level.

Following modification, the catch was stowed in a gravity feeding hopper at a height of between 1 and 2m above deck level and, although this greatly reduced the manual effort and improved catch quality, the vessel's stability would have been greatly impaired while the weight was in the hopper (although the hopper had a capacity of 1.1t, it is understood that it was not loaded to more than half of its capacity by the operators of *Stella Maris*.)

Figure 17: Catch hopper seen from above

- The primary function of the deck shelter was to protect the crew and catch from the elements, and to route the trawl wires completely away from crew on deck. However, the space created on top of the shelter deck encouraged the stowage of items such as rope, chain and anchor. These items might not have weighed much individually, but stowed at over 2m above the deck this weight further reduced the vessel's stability.

- Crew safety was also improved by fitting a dedicated gilson winch to hoist the cod end rather than use the trawl winch whipping (warping) drum. However, although direct crew safety was improved, vessel safety was compromised due to this winch's lifting capability being five times greater than the average cod end weight of fish

It is possible that *Stella Maris*'s operators had not recognised the dramatic reduction in their vessel's transverse stability during hoisting, caused by raising the height of the gantry, since this might have been less apparent as a result of hoisting directly over the stern.

2.4.2 Winch power

It could be argued that had there been no net drum guide poles for the cod end to snag on *Stella Maris*'s skipper would have been able to lower the weighty cod end back into the sea and then consider an alternative method of net recovery or weight removal. However, should a hydraulic winch lose power or the system render when lifting a heavy load, then the fail-safe mode is normally for the brake to apply to prevent the load from dropping. If this happened when lifting from an inappropriately high derrick or gantry, a capsizing moment could still be induced. Nevertheless, this accident emphasises how a most innocuous item, such as a guide pole, can be instrumental in the loss of a vessel, and reinforces the truism that if there is anything to become snagged on, a fishing net will find it.

The winch was capable of lifting 2.8t on its first layer, the lifting power reducing as layers of wire built up on the drum; by the fourth layer the winch's lifting potential reduced to 2.0t. The gilson winch had no spooling arrangement to ensure an even build-up of wire, so it is possible that the wire built up unevenly to beyond four layers. Subsequent stability assessments carried out on the sister vessel indicated that a weight of 1.8t acting upon the gantry would have be sufficient to capsize *Stella Maris* **(Annex B)**. Had the winch's lifting capacity been restricted to slightly more than the weight of catch normally lifted, it would not have been capable of hoisting the abnormally heavy cod end from the sea and the vessel would not have capsized.

Skippers normally make or modify their cod ends to hold a pre-determined amount of fish. In the case of *Stella Maris* this was about 0.5t. While an element of additional winch power may be desirable to counteract forces induced by sea motion, to be able to hoist five times the weight of a normal catch is excessive and, as can be seen from this case, has the potential to be dangerous.

LOLER requires that lifting equipment, including winches and lifting gantries, are assessed to ensure that they are compatible with each other so that, combined, they do not have the ability to capsize a vessel when load is applied. However, without comprehensive stability calculations it is not possible to establish what such a combination would be.

Fishing vessel operators are advised to review their lifting equipment and identify where that equipment falls under the requirements of LOLER. However, it is common sense to keep lifting points as low as possible and to ensure that gilson winch capability is not too dissimilar to the maximum weight of catch to be lifted at any one time.

2.5 APPROVAL AND AWARD OF EUROPEAN FISHERIES FUND GRANT

2.5.1 Grant application

Once EFF grant applications passed initial assessment by the MMO, the internally-imposed deadline of 10 working days to confirm award status to applicants was applied. This target time was not imposed by the EFF, but had been decided by MMO, without consulting the MCA, as an attempt to demonstrate England's efficiency in Fund distribution to the EC. The MMO assessed *Stella Maris*'s EFF grant application and informed the MCA of the proposed modification. Although it sought confirmation from the MCA that the vessel's stability and modification

proposals were appropriate, confirmation was not received and the application was approved regardless. It was not unusual for the MCA to be unable to carry out the required assessments within the deadline set by the MMO.

The importance of the MCA properly assessing the stability implications of proposed modifications was reinforced by the MAIB's recommendation No 2013/109, arising from the loss of *Heather Anne*, whereby the MMO and MCA were recommended to:

Work together to link the funding provided for modifications to small fishing vessels with a full assessment of the impact such modifications will have on such vessels' stability, particularly where the proposed modifications will substantially alter the method of fishing to be undertaken.

In response to this recommendation, the MCA stated that it was in favour of assisting the MMO with vessel assessments, provided that it was given sufficient time to do so. The MMO initially agreed to work with the MCA but then became entrenched in the belief that any increase to the deadline for applicant notification would reduce the number of applications for funding and therefore be counterproductive to the EC's desire to assist fishing communities. No evidence was provided to support this concern and it is hard to believe that fishermen would not apply for grant aid and would ignore available financial assistance on the grounds that approval may take more than 10 days.

2.5.2 Conditions for approval

The MMO required that owners' vessels, *meet any legal obligations imposed under EU and UK law* before EFF assistance would be granted. It was aware that the legislation for small fishing vessels centred upon the *Small FV Code*, which has no stability requirement.

Historically, when Seafish administered grant applications on behalf of the UK government, it implemented stability criteria over and above the minimum regulatory requirements as a condition of grants for small vessels, thus protecting public funds and enhancing vessel safety. The MMO could have taken a similar stance for the same reasons without compromising EC rules. However, instead of introducing a specific stability requirement, the MMO decided to delegate responsibility for the stability and safety of grant-aided modifications to owners and skippers, even though there were no parameters applicable to vessels under 15m (LOA) by which this could be measured.

This decision was based on the assumption that requiring enhanced stability requirements for modifications to under 15m (LOA) vessels would inhibit grant applications and be contrary to the spirit of EC financial assistance to fishing communities. Nevertheless, the provision of public funds for modifications that compromise vessels' stability and safety, as in this case, is clearly contrary to the spirit of the EFF grant scheme.

It is accepted that intact stability assessment, as required for over 15m (LOA) and over vessels, would be costly and that applicants' projects may then be rejected by the MMO on other grounds, thus creating a needless expense for owners seeking assistance to modify their vessels. However, since the EFF scheme assisted

non-mandatory safety initiatives, stability assessment for vessels under 15m (LOA) should have fallen within the MMO's remit, and attracted funding, as it had in Northern Ireland in 2010.

2.5.3 Review of the proposed modifications

Stella Maris's application for EFF assistance included a comprehensive, well-reasoned case for alterations to the vessel, which included the benefits of the shelter deck, "A" frame gantry and catch hopper. However, the MMO did not require the business case to include detailed information regarding the proposed modifications such as scale drawings, machinery installation details or winch power information.

The MCA reviewed *Stella Maris*'s proposed modifications at the MMO's request, but failed to respond due to an administrative oversight. In the absence of relevant regulation, and with the limited information available in the business case, this review was perfunctory, relying on a comparison between the weights removed and those to be added. On the information supplied, this comparison raised no concerns and so a response from the MCA to the MMO would not have led to the proposal being denied.

To be of value, any professional review of proposed modifications to a vessel needs a remit and sufficient information with which to fulfil that remit. In this case, given the lack of applicable regulations and no conditions set by the MMO, it is not clear what the remit of the MCA was when asked by the MMO to review *Stella Maris*'s proposal. In any case, the time constraints and the absence of scale drawings, machinery installation details, winch power information etc. in the business case would have made anything more than a perfunctory review impossible.

Given an appropriate remit, together with the required resources, it would be quite possible for a review of proposed modifications to consider the operational procedures of lifting from the proposed gantry, the power of winches used in the lifting operation, the potential effects upon vessel stability created by catch in the hopper along with many other aspects affecting the safety of the vessel following modification.

Where substantial structural modifications are to be made to a vessel, it is essential that the business case contains all the information required to enable a full, clear and accurate review of the proposal. To ensure appropriate use of public funds; it is equally essential that this review makes clear the safety implications of the proposal for the decision makers.

2.6 STABILITY OF SMALL FISHING VESSELS – THE RATIONALE FOR LEGISLATION

The MAIB has consistently advocated the introduction of legislation designed to reduce the number of avoidable accidents that occur on commercial fishing vessels. However, the current policy preferred by organisations tasked with improving safety culture within the fishing industry is one of education and persuasion, rather than regulation. For example, the MCA actively encourages fishermen to wear personal flotation devices when working on the open deck, rather than impose a mandatory requirement on them to do so. Similarly, voluntary courses on stability awareness are provided by Seafish. However, improving fishermen's awareness of stability can

do little to improve the safety of small fishing vessels, which make up the majority of the UK fleet, unless the vessels are provided with minimum stability criteria – a benchmark - against which operators can gauge the consequences of their actions.

At present, all new small commercial fishing vessels must be designed and built in compliance with the Hull Construction and Outfit Standards produced by Seafish. These standards are endorsed by the regulator, the MCA, on the basis that they meet the requirements of The Fishing Vessels (Code of Practice for the Safety of Small Fishing Vessels) Regulations 2001. While the Seafish standards could be arbitrarily amended to introduce minimum stability criteria, such a move might be open to challenge unless the requirement is underpinned by appropriate legislation.

The continued rate of stability related fatal accidents **(Section 1.8)** and the weaknesses in the voluntary stability assessment methods in MGNs 427 (F) and 503 (F) **(Section 2.3.3)** provide compelling justification for the introduction of legislation requiring small commercial fishing vessels to meet minimum stability criteria. Such legislation would also bring the UK fishing industry in line with the standards adopted by many other developed nations. Clearly, the legislation would need to be introduced in a controlled way that does not unfairly impact upon the industry and, from a practical point of view, a phased approach to its introduction would seem to be most appropriate. Accordingly, all new fishing vessels and existing vessels undergoing modification should be required, within a relatively short period, to comply with minimum stability criteria comparable to that already required for fishing vessels of 15m or more in length. Thereafter, the same requirements should be extended to all small fishing vessels following an appropriate period of grace.

2.7 ABANDONMENT

2.7.1 Lifejackets

Stella Maris carried four MCA type approved lifejackets and two constant wear inflatable lifejackets. Due to the speed of capsize *Stella Maris*'s crew had no time to don either type of lifejacket.

The purpose of constant wear inflatable lifejackets is for them to be worn on deck at all times as a warning is seldom given before they are required, even on a flat calm day. It may not be considered practical to wear them at all times while working in the shelter, however, it should have been common sense to don lifejackets before attempting to lift an unusually heavy net, even though the full extent of the dangers had not been recognised.

Had the crew worn their constant wear inflatable lifejackets they would have had some support in the water if their liferaft had gone down with the boat. Given the benign seas and good weather conditions, wearing them would have increased their survival chances if the liferaft had not been accessible.

The 'Sea you home safe' safety initiative by Seafish is intended to encourage the use of constant wear lifejacket by fishermen through education and the provision of free personal floatation devices. Unfortunately this accident demonstrates that considerable work still needs to be done if the wearing of lifejackets on deck is to become the norm.

2.7.2 Liferaft

As *Stella Maris* capsized to starboard the two-man crew clambered through the port shelter deck door onto the side of the vessel where they were able to launch the four-person liferaft that was stowed on top of the shelter deck aft of the wheelhouse. Had the liferaft been stowed in the same position on the other side, it would have been inaccessible to the crew and its deployment would have been dependent on the HRU activating, the raft floating clear of the wreck to the surface, and the crew being able to board the raft from the sea.

Positioning of liferafts on small vessels such as *Stella Maris* is often difficult as space is limited. However, it is very unusual for a vessel to sink bodily without capsizing in the process, and operators are advised to consider whether the chosen position will be clear of obstruction should the vessel be on its beam ends.

As an under 10m (L) vessel, *Stella Maris* was not obliged to carry a liferaft. However, without the liferaft and since they were not wearing lifejackets, the crew would almost certainly have died in the hours between abandonment and rescue. The liferaft was an ISO 9650-1 type raft containing a less than 24 hour pack. Contrary to expectations, the survivors found they had no water within the raft. It should be noted that such rafts do not carry the same equipment as larger SOLAS type rafts, and if operators require such a level of equipment they must specify it at the time of acquisition.

Although currently only recommended in the current *Small FV Code*, it is hoped that the carriage of liferafts will become mandatory for all vessels 7m (L) and above in the revised *Small FV Code* in 2016. Nevertheless, all fishermen are advised to carry a liferaft.

2.7.3 Distress alerting

Due to the speed of capsize, the skipper of *Stella Maris* had no opportunity to transmit a distress alert by radio. The crew then spent about 7 hours adrift in their liferaft with no one aware of their predicament.

Stella Maris's skipper had had the foresight to recognise he may need an automatic distress alerting system one day. He had chosen MOB Guardian, which works on a polling system rather than the triangulation[24] method of older EPIRBs or the GPS of modern EPIRBs. Until 2 weeks before the vessel's loss, the skipper of *Stella Maris* had subscribed to the MOB Guardian system. However, due to an oversight he omitted to renew his annual air time contract, resulting in the system being deactivated.

Like the liferaft, there was no obligation for the under 10m (L) vessel to carry an EPIRB, although it is recommended in the *Small FV Code* and MGN 502 (F). It is hoped that this shortcoming will be addressed with the revision of the *Small FV Code* in 2016, and that EPIRBs will then become mandatory for all fishing vessels.

[24] EPIRB triangulation: Older style EPIRBS transmit a distress alert on 406 MHz, requiring detection by two or more passes of Cospas/Sarsat satellites to establish a position, which may take upwards of 20 minutes. GPS embedded EPIRBs transmit a distress alert position which is pinpointed almost instantaneously.

Another means of distress alerting could have been personal locator beacons (PLB) that, like EPIRBs, transmit a distress alert on 406 MHz when manually activated. PLBs are now small enough to be integrated within constant wear inflatable lifejackets. However, to be effective, these lifejackets have to be worn at all times when on deck.

SECTION 3 - CONCLUSIONS

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

1. *Stella Maris* capsized as a result of insufficient stability coupled with excessive winch power, an overly high gantry and an overweight cod end. [2.2]

2. The risks associated with excessive weight in the net had not been sufficiently recognised by the owner and so no safe procedure for dealing with it had been developed. [2.2.2]

3. At less than 15m (LOA) *Stella Maris* did not have to comply with the stability and freeboard requirements of the 15-24 Code. [2.3.1]

4. The absence of any stability requirement for under 15m (LOA) fishing vessels leaves owners without any information on which to base their operations, lifting capacity or planned modifications. [2.3.1]

5. The requirement in the *Small FV Code* for new vessels to be constructed and outfitted in accordance with the latest Seafish construction and outfitting standards, including having stability *properly assessed by a person having appropriate professional experience,* was not applicable to vessels being substantially modified. [2.3.1]

6. *Stella Maris* did not comply with the intact stability criteria applicable to vessels of 15m (LOA) and over. [2.3.2]

7. Had the “A” frame gantry and gilson winch been recognised as lifting equipment under LOLER when the modifications had been designed and approved, the potential for capsizing the vessel would have been assessed and limitations to the lifting capacity appropriate to the vessel’s stability would have been required. [2.3.4]

8. The failure to apply any intact stability criteria on the UK’s small fishing vessels has resulted in these vessels being more dangerous than comparable vessels of other developed nations. [2.3.5]

9. As *Stella Maris* listed under the load acting upon its gantry, the bulwark rails submerged quickly, leading to downflooding through the engine room vents placed between the frames on the bulwarks. [2.3.6]

10. There was no requirement for vessel owners to notify the MCA of substantial modifications, seek its approval or undergo inspection following modernisation or major structural alterations. [2.4]

11. Had the gilson winch’s lifting capacity been restricted to slightly more than the weight of catch normally lifted, it would not have been capable of hoisting the abnormally heavy cod end from the sea and the vessel would not have capsized. [2.4.2]

12. The MMO delegated responsibility for assessing the stability of vessels subject to grant-aided modifications to owners and skippers even though there were no applicable parameters by which this could be measured. [2.5.2]

13. In the absence of relevant regulation, and with the limited information available in the business case, the MCA could only perform a perfunctory review of the modification proposal, which raised no concerns, and so a response from the MCA to the MMO would not have led to the proposal being denied. [2.5.3]

14. To ensure appropriate use of public funds, it is essential that a professional review makes clear the safety implications of the proposal for the decision makers. [2.5.3]

15. Improving fishermen's awareness of stability is unlikely to be effective unless their vessels meet minimum stability criteria against which they can gauge the consequences of their actions. Consequently, the need for legislation requiring small commercial fishing vessels to be provided with minimum stability criteria appears to be compelling. [2.6]

3.2 OTHER SAFETY ISSUES CONTRIBUTING TO THE ACCIDENT

1. The stowage of items such as rope, chain and anchor on top of the shelter, 2m above the deck, reduced the vessel's stability. [2.4.1]

2. It is possible that *Stella Maris*'s operators had not recognised the dramatic reduction in transverse stability during hoisting, caused by the height of the gantry, since this may have been less apparent as a result of hoisting directly over the stern. [2.4.1]

3.3 OTHER SAFETY ISSUES NOT DIRECTLY CONTRIBUTING TO THE ACCIDENT

1. The simplified stability assessments listed in MGNs 427 (F) and 503 (F) may give some outward indication of a vessel's condition but they are not a substitute for assessment against the intact stability criteria. [2.3.3]

2. Although the MMO sought confirmation from the MCA that the vessel's stability and modification proposals were appropriate, confirmation was not received and the application was approved regardless. [2.4]

3. Following modification, the catch was stowed in a gravity feeding hopper at a height of between 1 and 2m above deck level, impairing the vessel's stability while the weight was in the hopper. [2.4.1]

4. The provision of public funds for modifications that compromise vessels' stability and safety, as in this case, is clearly contrary to the spirit of the EFF grant scheme. [2.5.2]

5. Although constant wear inflatable lifejackets were carried on board, they were seldom worn on deck. [2.7.1]

6. Due to the speed of capsize, *Stella Maris*'s crew had no time to don lifejackets. [2.7.1]

7. Had *Stella Maris* not been equipped with a liferaft the crew would almost certainly have died following the abandonment. [2.7.2]

8. Due to the speed of capsize, the skipper had no opportunity to transmit a distress alert by radio and the vessel was not equipped with an EPIRB. The crew then spent about 7 hours adrift in their liferaft with no one aware of their predicament. [2.7.3]

SECTION 4 - ACTIONS TAKEN

The **owner of *Stella Maris*'s sister vessel** has:

- Taken measures to improve the vessel's stability, remove net snagging points and restrict the gilson winch's pulling capacity.

- Repositioned the vessel's liferaft to facilitate better activation in the event of a capsize.

The **Maritime and Coastguard Agency** has:

- Committed 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.

- Inspected *Stella Maris*'s sister vessel to ensure measures have been implemented to improve the vessel's safety.

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

SECTION 5 - RECOMMENDATIONS

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

2015/165 Introduce intact stability criteria for all new and significantly modified decked fishing vessels of under 15m in length.

2015/166 Revise as necessary and re-issue its guidance to fishing vessel owners and skippers on the application to fishing vessels of:

- The Merchant Shipping (Provision and Use of Work Equipment) Regulations 2006, and
- The Merchant Shipping (Lifting Operations and Lifting Equipment) Regulations 2006.

The Sea Fish Industry Authority is recommended to:

2015/167 Amend its construction standards for new registered vessels to increase the angle at which downflooding occurs by reviewing the placement of ventilation ducts in or adjacent to the bulwarks.

The Marine Management Organisation is recommended to:

2015/168 Mandate stability verification for current and future European Commission funded projects involving decked vessels undergoing significant modifications that might impact on their stability.

2015/169 Include vessel stability verification as an eligible safety related undertaking for attracting grant aid from European Commission fund schemes.

2015/170 Require scale drawings, machinery installation details, winch power information and all other relevant details of proposed structural modifications to vessels to be included in all applications for assistance from future European Commission funded schemes.

The Maritime and Coastguard Agency and the Marine Management Organisation are recommended to:

2015/171 Work together to ensure European Commission funded modifications are fully reviewed for their impact on vessel stability and safety by agreeing the remit of such reviews and setting realistic target times to enable such co-operation.

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

Marine Accident Report

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