ACCIDENT REPORT

Report on the investigation of

the capsize and foundering of the fishing vessel

Heather Anne (FY 126)

resulting in the loss of one crewman

Gerrans Bay, Cornwall

on 20 December 2011

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

VERY SERIOUS MARINE CASUALTY REPORT NO 2/2013 January 2013

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2012 – Regulation 5:

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

NOTE

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

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ALB	-	All weather lifeboat
BA	-	British Admiralty
CIFCA	-	Cornish Inshore Fisheries and Conservation Authority
CPR	-	Cardiopulmonary resuscitation
DECC	-	Department of Energy and Climate Change
DfT	-	Department for Transport
EFF	-	European Fisheries Fund
EPIRB	-	Emergency Position Indicating Radio Beacon
FISG	-	Fishing Industry Safety Group
GM	-	Metacentric Height
GPS	-	Global positioning system
GZ	-	The righting lever through which the force of buoyancy acts
HRU	-	Hydrostatic Release Unit
ILB	-	Inshore life boat
kg	-	kilogramme
kW	-	kilowatt
(L)	-	Registered length
LOA	-	Length overall
MCA	-	Maritime and Coastguard Agency
MFA	-	Marine and Fisheries Agency
MGN	-	Marine Guidance Note
MMO	-	Marine Management Organisation
MSN	-	Merchant Shipping Notice
PFD	-	Personal flotation device
PVC	-	Polyvinyl chloride
RN	-	Royal Navy

RNAS	-	Royal Naval Air Station
RNLI	-	Royal National Lifeboat Institution
ROV	-	Remotely Operated Vehicle
SAR	-	Search and Rescue
Seafish	-	Sea Fish Industry Authority
SIB	-	Stability Information Book
TEZ	-	Temporary Exclusion Zone
UTC	-	Universal Time, Co-ordinated
VHF	-	Very High Frequency
1975 Rules	-	The Fishing Vessels (Safety Provisions) Rules 1975

Times: All times used in this report are UTC unless otherwise stated

SYNOPSIS

At about 2200 on 20 December 2011, the UK registered fishing vessel *Heather Anne* capsized and foundered in Gerrans Bay, Cornwall. The skipper and his crewman were soon recovered from the water by a nearby fishing vessel. Neither the skipper nor the crewman was wearing a lifejacket; the crewman had drowned. There was no significant pollution.

On 23 February 2012, *Heather Anne* was raised and towed to Falmouth for inspection. A stability assessment indicated that the vessel had been operating with a low reserve of stability. *Heather Anne* had been significantly modified since her build in 1971. As a consequence, her displacement had increased by over 50% and, with a catch of an estimated 10.5 tonnes on board at the time of capsize, her freeboard was reduced to only a few centimetres.

Although *Heather Anne* successfully passed a roll-test following her conversion to ring-netting in 2010, the results of this type of test do not provide a full assessment of a vessel's stability and can therefore be misleading. Current guidance on the methods that can be used to assess the stability of small fishing vessels is not sufficient to provide fishermen with the information needed to understand the limitations of the various options available.

Like other fishing vessels of <12m registered length, *Heather Anne* was not required to meet any statutory stability criteria. However, in response to a number of previous similar accidents that have resulted in recommendations from the Marine Accident Investigation Branch, the Maritime and Coastguard Agency intends to introduce legislation by 2016 which will require small fishing vessels of under 12m registered length to comply with similar stability criteria to that which already exists for small commercial vessels. The legislation will apply to new vessels only. New and existing vessels of 12m and over will have to comply with the stability requirements currently applicable to fishing vessels of 15m and over.

Recommendations have been made to the Maritime and Coastguard Agency, the Marine Management Organisation and the Cornish Fish Producers Organisation which seek to improve the stability of small fishing vessels through the timely provision of stability criteria and the promulgation of better guidance on the methods that can be used to assess vessel stability on all small fishing vessels.

A further recommendation has been made to the Maritime and Coastguard Agency which is designed to provide support for ongoing efforts which seek to ensure fishermen wear personal flotation devices when working on the open deck. A recommendation has also been made to the owner of *Heather Anne* which is intended to ensure the safe operation of any vessel that he may own in the future.

SECTION 1- FACTUAL INFORMATION

1.1 PARTICULARS OF *HEATHER ANNE* AND ACCIDENT

SHIP PARTICULARS

Vessel's name	Heather Anne
Flag	UK
Classification society	Not applicable
Fishing numbers	FY126
Type	Ring-netter
Registered owner	Private Ownership
Manager(s)	Not applicable
Construction	Wood
Length overall	11.05m
Registered length	10.0m
Gross tonnage	11.67
Minimum safe manning	Not applicable
Authorised cargo	Fish

VOYAGE PARTICULARS

Port of departure	Mevagissey, Cornwall
Port of arrival	Mevagissey, Cornwall
Type of voyage	Fishing
Cargo information	Cornish sardines
Manning	2

MARINE CASUALTY INFORMATION

Date and time	20 December 2011 at about 2200
Type of marine casualty or incident	Very Serious Marine Casualty
Location of incident	Off Nare Head, Gerrans Bay, Cornwall
Place on board	Not applicable
Injuries/fatalities	One fatality
Damage/environmental impact	Vessel foundered. No significant pollution
Ship operation	On passage
Voyage segment	Mid-water
External & internal environment	Wind: south-west Force 6; Sea State: Slight (1m) Weather conditions: Rain Visibility: Moderate Sea water temperature: 10°C Air temperature:10°C Darkness
Persons on board	2

1.2 NARRATIVE

1.2.1 The fishing trip

At about 1520 on 20 December 2011, the ring-netter[1] *Heather Anne* sailed from Mevagissey, Cornwall. On board were her skipper and two deckhands, one of whom was the skipper's youngest son who was 16 years old. The other deckhand was Ian Thomas.

Heather Anne sailed to Gerrans Bay, about 14 miles south-west of Mevagissey **(Figure 1)**, in company with *Leonora*[2]. At about 1700, as darkness approached, *Heather Anne*'s skipper detected a shoal of Cornish sardines (pilchards) by sonar approximately 5 cables off the shore **(Figure 2)**. To catch the fish, a dhan buoy was dropped and the ring net was shot as the skipper turned the vessel to starboard and encircled the shoal. The two ends of the net were then drawn together and *Leonora* was secured to *Heather Anne*'s port side with 30m of towline.

The bottom of the net was closed by drawing the purse wire. The net was then hauled closer to the vessel's starboard side while *Leonora* pulled on *Heather Anne*'s port side to counter the pull of the net hauler **(Figure 3)**.

Once the net was alongside, *Heather Anne*'s deckhands started to scoop the fish out of the net using a brailer[3]. An estimated 20 tonnes of fish were inside the net. The fish were put into the fishroom, and into 12 orange fish bins that were stacked on deck. The fishroom was filled until the fish were approximately 30cm below the fishroom deck head.

Within an hour, *Heather Anne* was fully loaded with a catch estimated by the skipper to be between 8 and 9 tonnes. The equivalent of between two and three bins of fish was then loaded on to *Leonora*. However, a large quantity of fish remained in the net so the skipper called *Lauren Kate*, another Mevagissey-based ring-netter, by Very High Frequency (VHF) radio and informed her skipper that he had a "*super catch*" which he was able to share. *Lauren Kate* left her fishing grounds in St. Austell Bay and made for Gerrans Bay in company with her tow boat, *Venus*. Meanwhile, an anchor was dropped from *Heather Anne*'s port quarter to help keep the vessel in position.

Lauren Kate and *Venus* arrived in Gerrans Bay at about 2100. By 2140, *Lauren Kate*'s crew had brailed on board between 3 and 4 tonnes of fish from *Heather Anne*'s net, much of which was transferred to *Venus.* In the meantime, the son of *Heather Anne*'s skipper had transferred to *Leonora*, which then started to head towards Mevagissey. *Venus* followed soon after.

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[1] Ring-netting is similar to purse-seining and uses a bottom weighted wall of net to encircle a dense school of pelagic fish. The two ends of the net are brought together and the purse wire is drawn in to close the bottom of the net. The net is then hauled, bringing the fish to the surface alongside the vessel.

[2] Fishing vessels that have been converted to ring-net fishing usually use a second vessel as a towing vessel. Prior to the net being hauled in, the towing vessel is attached to the fishing vessel by a tow line on the side opposite to the net. The towing vessel is then used to counter the pulling effect of the fishing vessel's net hauler and so prevent the ring net from being overrun.

[3] A brailer is a hand-held net used to transfer fish from a seine or ring net.

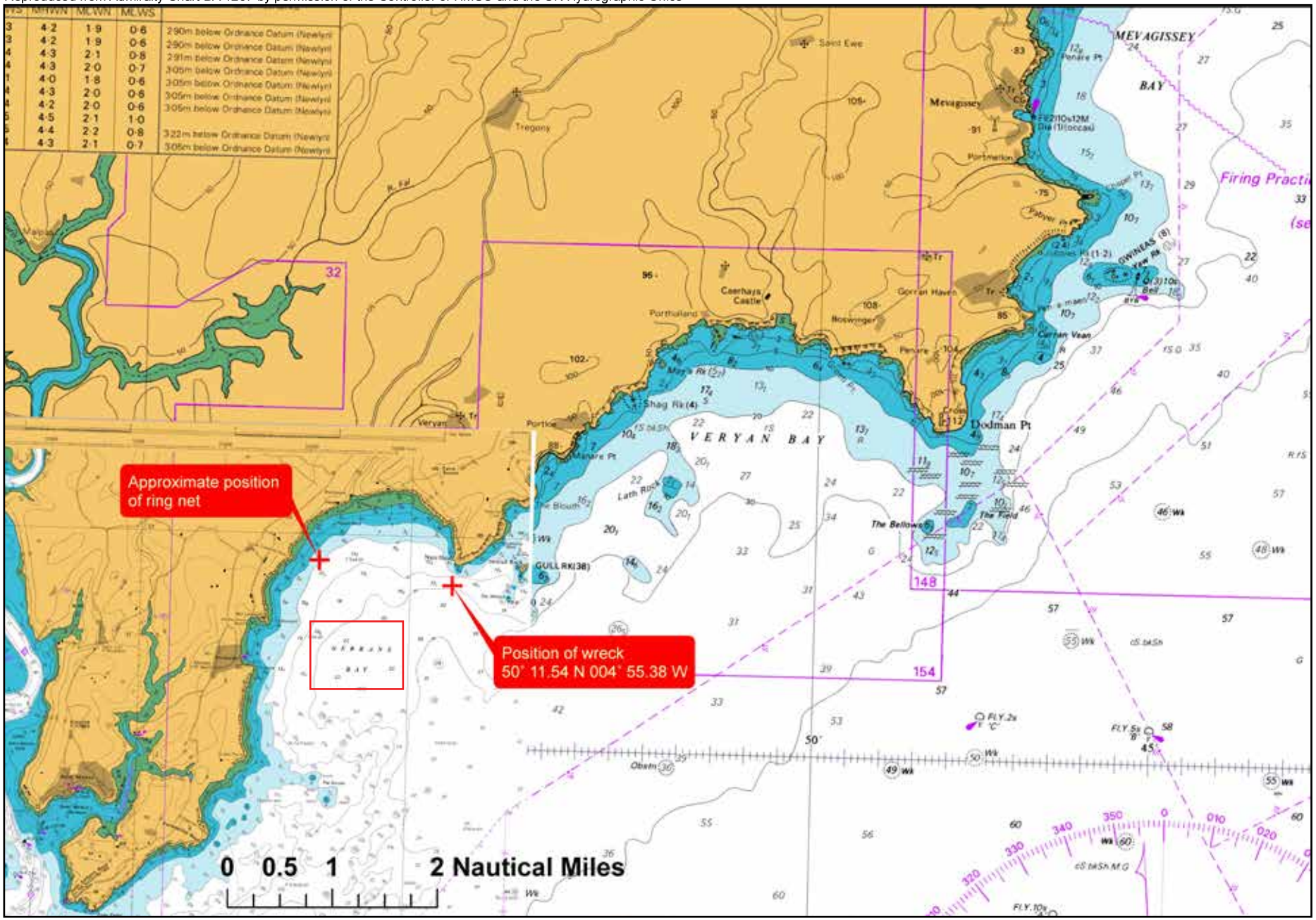

Figure 1: Extract of chart BA 1267

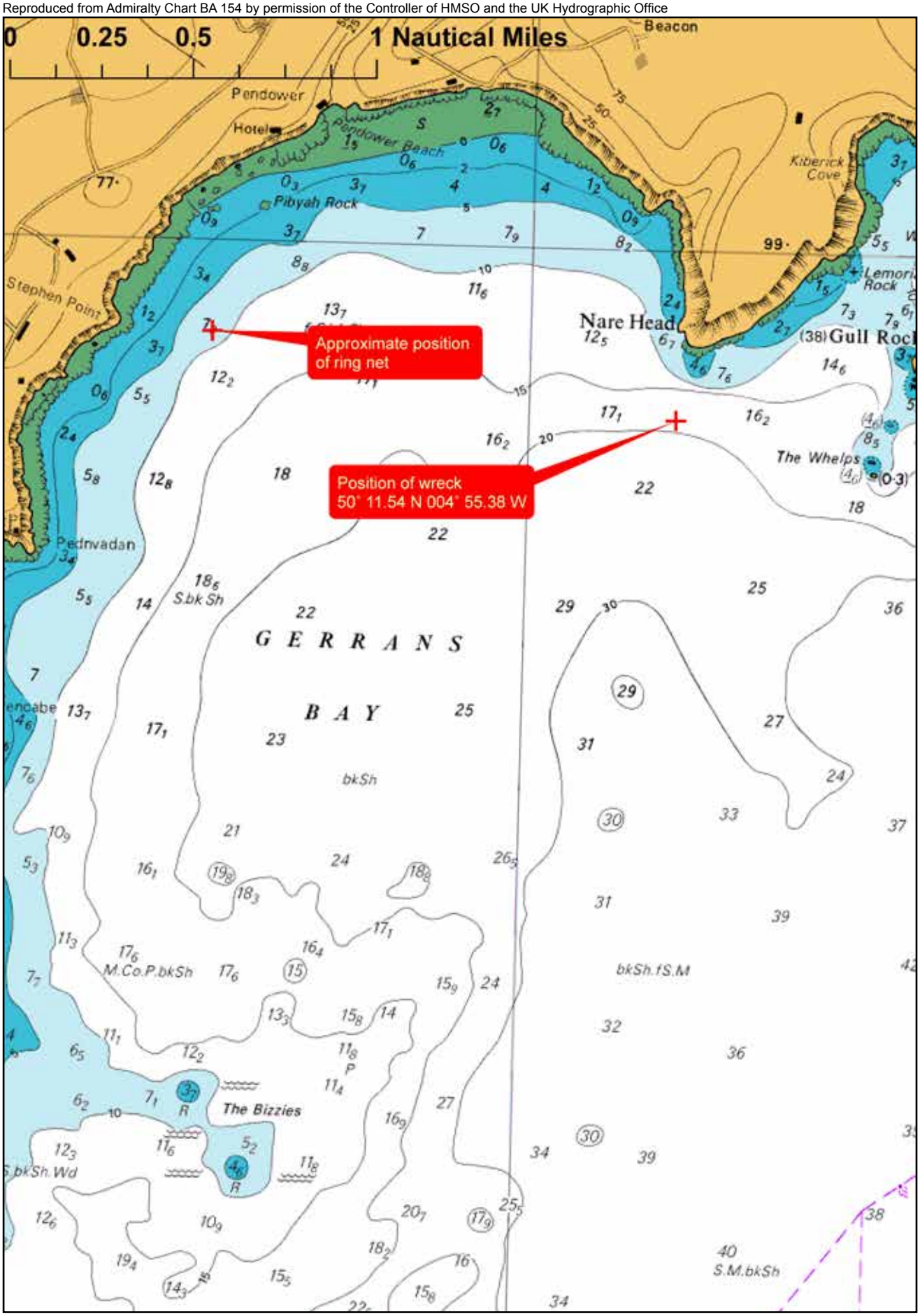

Figure 2: Extract of chart BA 154

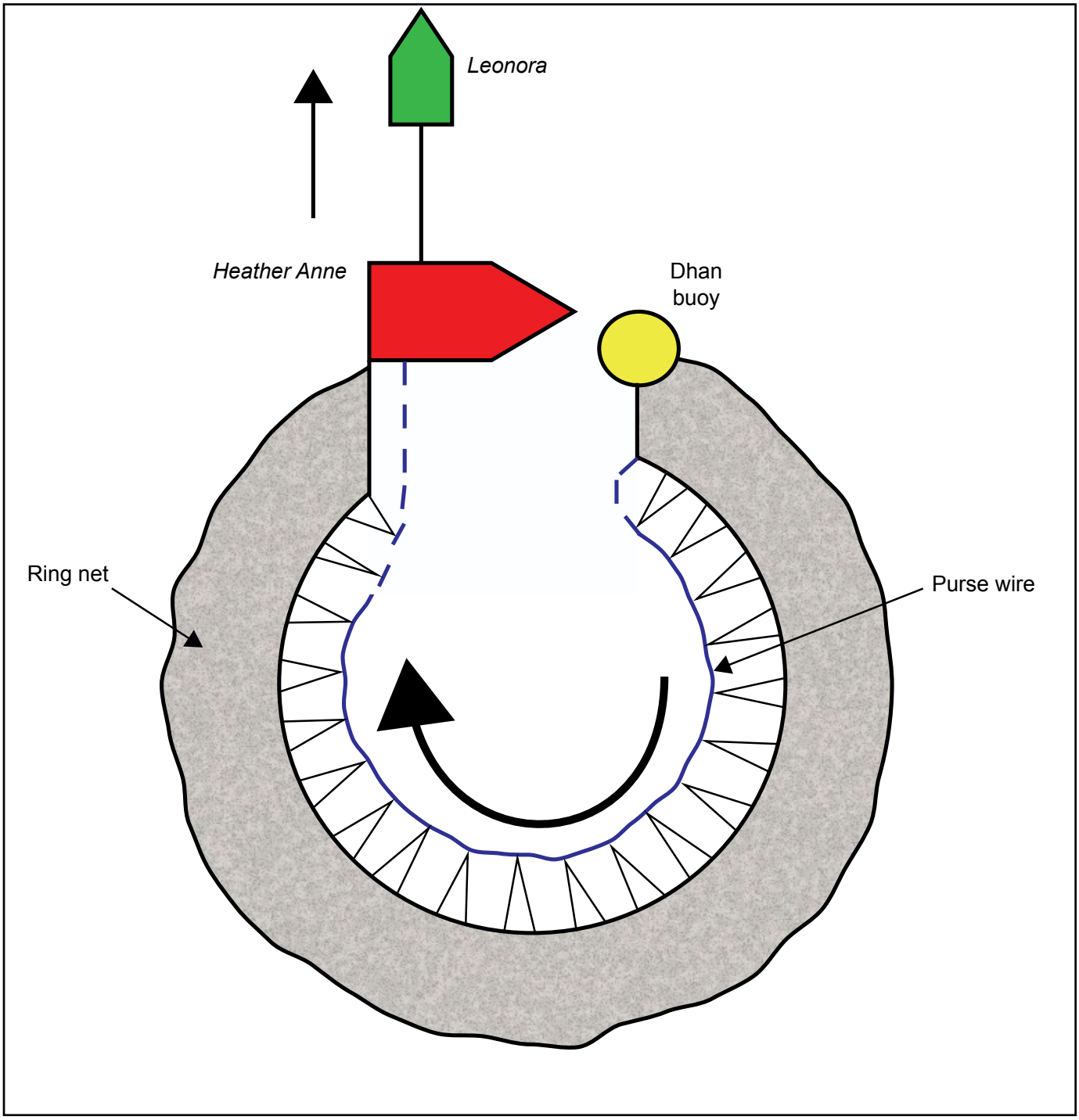

Figure 3: Diagram showing the ring net operation

1.2.2 The capsize

When *Heather Anne*'s net was empty it was hauled on board and stowed. The vessel's anchor rope was passed across to *Lauren Kate* for her crew to recover the anchor using a winch.

Heather Anne's skipper set a heading on the autopilot to take the vessel south of Nare Head towards Mevagissey **(Figures 1** and **2)**. He also adjusted the throttle lever to increase the vessel's speed to about 7 knots and secured the lever with a piece of rope to prevent it from vibrating out of position.

The skipper remained in the wheelhouse while Ian Thomas tidied the deck and fishing gear forward. The vessel was deep in the water and trimmed by the bow. The skipper noticed that she was sheering excessively with the autopilot engaged, so he changed to hand-steering. Large amounts of helm were then required in order to keep the vessel on her intended course.

The vessel was rolling gently and the equivalent of several bucketfuls of water came onto the deck through the shuttered freeing ports in the vessel's bulwarks. The skipper put the deck lights on and opened the shutter on the freeing port sited outside the wheelhouse door to allow the water on the deck to run over the side.

Soon after, the skipper became concerned at the way the vessel was handling. He moved the throttle lever back and slowed the engine. However, during a roll to starboard, *Heather Anne* continued to roll until capsizing and cork-screwing under the water. The skipper and Ian soon surfaced, but they were not wearing lifejackets and the skipper had to help Ian to stay afloat.

1.2.3 The rescue

As soon as *Lauren Kate*'s crew had recovered *Heather Anne*'s anchor*, Lauren Kate* also started to return to Mevagissey. The vessel was about one quarter of a mile behind *Heather Anne* when her skipper noticed *Heather Anne*'s white stern and deck lights disappear, and the vessel's radar target ceased to display on the radar screen.

Lauren Kate's skipper immediately increased speed. As his vessel neared *Heather Anne*'s last known position, the skipper saw a glow under the water. He then saw and heard *Heather Anne*'s skipper, with Ian, on the sea surface. Life-rings were thrown towards the men and, as soon as the vessel was close enough, one of *Lauren Kate*'s crew reached over the vessel's side and grabbed Ian. However, he was unable to lift him on board due to the vessel's freeboard.

Lauren Kate's landing derrick was quickly made ready and was used to winch, first Ian, and then *Heather Anne*'s skipper on board. Ian showed no signs of life so cardiopulmonary resuscitation (CPR) was started. At 2210, *Lauren Kate*'s skipper broadcast a "Mayday" call via VHF radio Channel 16. The "Mayday" was received by Brixham Coastguard, which tasked the Falmouth all weather and inshore lifeboats (ALB and ILB) and a Royal Navy (RN) rescue helicopter, R193, from Royal Naval Air Station (RNAS) Culdrose to assist.

At about 2245, Ian was transferred to the ILB and then to the ALB. He was then winched on board R193 and flown to Malpas near Truro where he was met by an ambulance and taken to the Royal Cornwall Hospital. Ian was declared deceased a short while later. The subsequent postmortem examination concluded that he had drowned.

On 22 December 2011, the Maritime and Coastguard agency (MCA) established a Temporary Exclusion Zone (TEZ) covering a radius of 200m around the wreck position **(Figure 2)**.

1.3 ENVIRONMENT

During the early evening of 20 December 2011, the wind in Gerrans Bay was west-south-west between Beaufort force 2 and 3, and the sea was calm. The wind increased during the evening and, by the time of the accident, was south-westerly force 6 and the sea was 1m high. The weather was overcast with rain. The air and sea water temperatures were both about 10°C.

1.4 CREW

1.4.1 The skipper

Heather Anne's skipper was 42 years old and had been a fisherman since leaving school in 1985. The skipper had worked with Ian Thomas on board the fishing vessel *Trevose* between 1985 and 1995, and had purchased *Heather Anne* from his father in 1995. He had completed the following mandatory Sea Fish Industry Authority (Seafish) courses:

- First-aid: February 1999, May 2002 and July 2006;
- Fire-fighting: September 2004;
- Sea survival: November 1984; and,
- Safety awareness: April 2002.

The skipper had also attended a Seafish intermediate stability awareness course in July 2006 (see paragraph 1.19) and a 2-day engine room watchkeeping course in May 2011.

1.4.2 The deceased

Ian Thomas was 50 years old and had worked as a fisherman in the south west of England for about 35 years, including 4 years as a skipper. He had worked as a deckhand on board *Heather Anne* on a 'share' basis[4] since 2002.

Ian had completed all of the mandatory Seafish training courses, except sea survival. He had also attended the Seafish intermediate stability awareness course with *Heather Anne*'s skipper in July 2006. Ian was not a strong swimmer.

1.5 VESSEL

1.5.1 Design

Heather Anne was originally designed as a netter and, although not specified, her loading capacity was expected to be about 5 tonnes; 4 tonnes stowed in the fishroom and 1 tonne stowed on the deck. She was built in 1971 by G Percy Mitchell & Sons, in Port Mellon, Cornwall and was originally named *Aquarius of Cawsand* **(Figure 4)**.

[4] A share fisherman is someone who gets all or part of their pay by sharing the profits or gross earnings of the fishing boat.

Figure 4: Photograph of *Aquarius of Cawsand* in 1972 (later re-named *Heather Anne*)

1.5.2 Construction

Heather Anne was constructed of oak frames and larch hull and deck planking attached with iron fastenings. Her length overall (LOA) was 11.05m, and her registered length (L) was 10m. A general arrangement of the vessel is shown at **Figure 5**.

The vessel's internal spaces (fishroom, fore peak, engine room, and accommodation) were separated by non-watertight bulkheads. Access to the fishroom was via a hatch on the foredeck **(Figure 6)** covered by a reinforced fibreglass coated plywood cover which was secured by two hinged 'dog' clips. Access to the accommodation and engine room was via the fibreglass wheelhouse. A sliding door was fitted on the starboard side of the wheelhouse which led to the deck. A net stowage area was sited aft of the wheelhouse.

Four freeing ports were sited on the main deck, two on each side. The freeing ports could be closed using wooden vertical shutters. The freeing ports were not watertight when the shutters were closed.

The vessel was fitted with a Leyland Thornycroft 164kW diesel engine, which had been in situ since build.

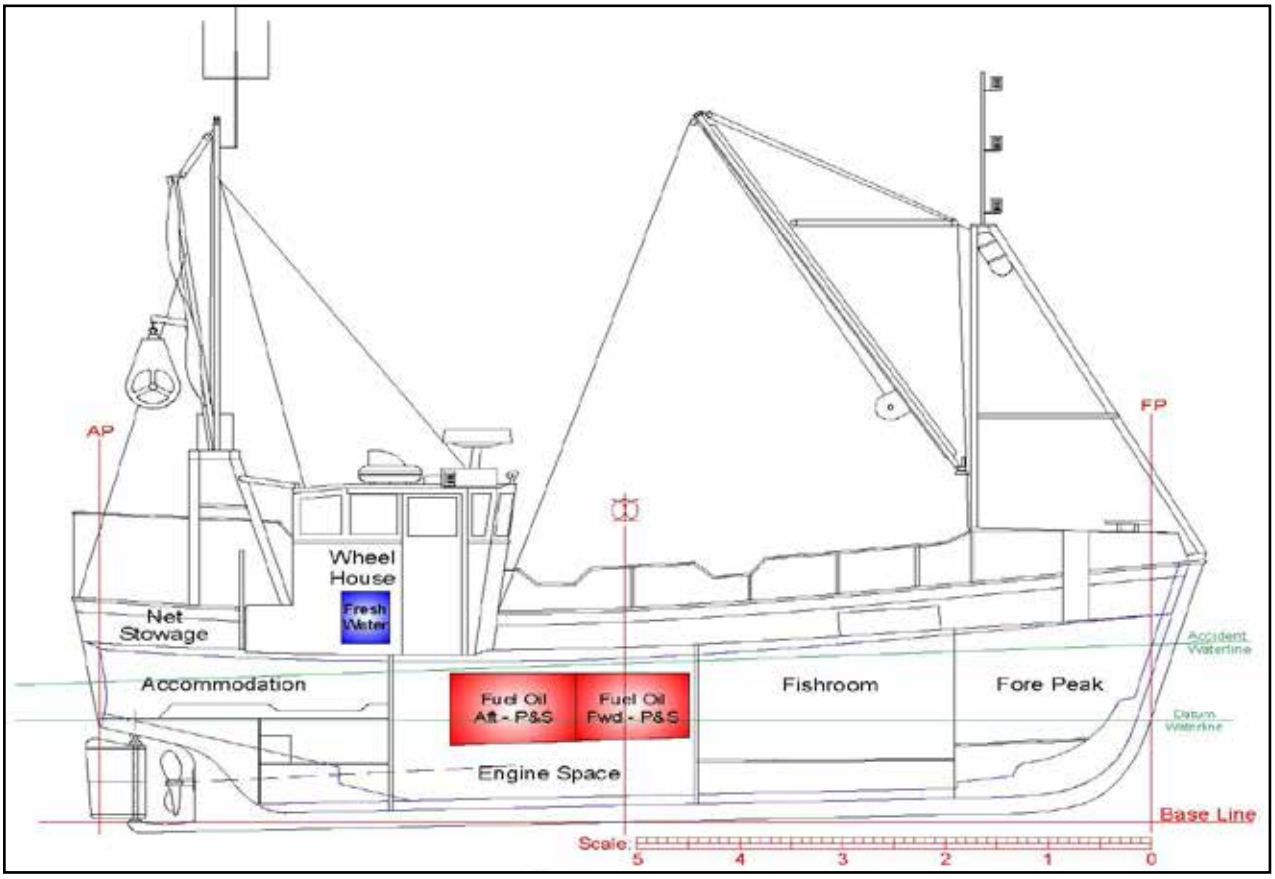

Figure 5: General arrangement

Figure 6: Fishroom hatch

1.5.3 Modifications

Since build, *Heather Anne* had changed ownership several times and had been extensively modified. Since 1995, the modifications had included:

- The replacement of the steel A-frame with an aluminium whaleback and mast.
- The replacement of the aft wooden mast with an aluminium mast.
- The fitting of a refrigeration plant comprising a main engine-driven compressor and a condenser in the engine room, and refrigerant cooling pipes in the fishroom deck head.
- The replacement of two fuel tanks with four fuel tanks (two port and two starboard) providing an equivalent total capacity of about 2000 litres. The tanks were cross-connected and the filling points were underneath removable plates on the deck.
- In 2009 and 2010, *Heather Anne* was operated with a polyvinyl chloride (PVC) tarpaulin with welded seams **(Figure 7)** fitted inside the fishroom to form a central 'tank'. The tarpaulin was held in place by longitudinal pound boards on both sides. The 'tarpaulin tank', which had a capacity of about 3.4m³, was fitted to simplify the stowage and removal of catch within the fish hold when ring-netting. The 'tank' also helped to prevent the bilge pipework and pumps becoming blocked by tough but flexible fish scales that resulted from the brailing process.

Figure 7: PVC tarpaulin

In April 2010, *Heather Anne*'s skipper applied for, and obtained, a European Fisheries Fund (EFF) grant to support a change in fishing method to ring-netting[5]. The EFF grant was approved on 16 July 2010 and was managed and disbursed by the Marine Management Organisation (MMO).

During 2010, the conversion work was undertaken by C Toms and Son Ltd, in Polruan, Cornwall. The structural work included the fitting of:

- An aluminium ring net derrick fitted on the forward 'A' frame
- A main landing derrick, complete with hydraulic landing winch and controls
- An aluminium gantry aft of the wheelhouse to take the new mizzen mast and sail, and a net hauler
- An aluminium solid bulwark and associated stanchions on top of the bulwark rail, including a cut-out section and heavy pipe for shooting the net.

The ring net gear, which weighed approximately 1.3 tonnes when dry, was supplied by specialist fishing equipment manufacturers and included:

- A 208m ring net with a maximum fishing depth of 46 metres made from black nylon 20mm full mesh netting.
- 260m of lead ground line (weighing 1kg per metre)
- Headline floats – four boxes of 144 float pieces (total 576)
- Main headline – 220m of 8mm rope
- Float line – 220m of 12mm rope
- Main sole line – 260m of 8mm rope
- Ring net drawing rope (purse wire) – 220m of 14mm steel-core rope.

During the conversion, several planks on the turn of the bilge in way of the fishroom on the starboard side, which had been covered by a protective rubber sheet, were discovered to be suffering from wood worm. These planks were replaced, and the new planks were secured with galvanised nails which had an expected lifespan of 15 years.

In November 2011, *Heather Anne*'s skipper replaced the tarpaulin tank in the fishroom with another PVC tarpaulin with a capacity of 5.02m^3. As the replacement tank extended to the port and starboard sides of the fishroom, its fitting required the removal of the pound boards. The replaced tarpaulin was moved to the fore peak and was used as a ballast tank.

[5] In the south-west of England, Newlyn, Mevagissey and Looe are commonly recognised as the main ring-netting ports. The success of the Newlyn ring-netters, including the introduction of purpose-built vessels, prompted other fishermen along the coast to move to this method of fishing. Four Mevagissey-based fishing vessels have been converted to ring-netting with the aid of an EFF grant.

1.5.4 Bilge equipment

Three 4000 litre/hour electric pumps, two of which operated in tandem, were fitted below the deck in the fishroom. The pumps operating in tandem discharged through a 75mm diameter strengthened rubber hose, that passed through the deck via a steel deck fitting and overboard through the starboard bulwark **(Figure 8)** via a brass non-return valve.

Figure 8: Fishroom discharge overboard - starboard side

The third pump discharged overboard on the port side below main deck level via a 30mm diameter rubber hose. The discharge hose on the port side was not fitted with a non-return valve.

An electric and a hand-operated bilge pump were fitted in the engine room. A bilge alarm float switch was fitted on a frame at the forward end of the engine room about 30cm above the keel. This alarm was tested on an occasional basis.

The bilge alarm panel was sited in the wheelhouse. When activated it emitted a loud audible alarm which could be muted by a toggle switch.

1.6 MCA INSPECTIONS

1.6.1 Roll test

In July 2010, the MMO advised the MCA of the EFF grant made in respect to the conversion of *Heather Anne*. The MCA did not object to the conversion but requested that a condition of the grant should be that the vessel was inspected on completion of the work.

The MCA inspected *Heather Anne* on 29 September 2010. The attending surveyor raised concerns over the extent of the work undertaken and the potential effect this might have on the vessel's stability. As a result, *Heather Anne*'s skipper was informed that the vessel's stability and the heights of the starboard bulwark and the fishroom hatch coaming were required to be assessed before the vessel could resume fishing.

On 9 November 2010, an MCA surveyor conducted a roll-test on *Heather Anne* in Mevagissey harbour in her depart port[6] condition. Three rolls were conducted, comprising five oscillations each, giving a mean roll period of just over 3.8 seconds.

The metacentric height[7] (GM) for *Heather Anne* indicated by the roll period was 0.761m, which was 0.071m greater than the calculated minimum GM required of 0.69m. The attending surveyor considered the calculated GM to be acceptable, but he advised the skipper that he should not carry too much fish on deck.

1.6.2 Exemption from stability requirements

On completion of *Heather Anne*'s roll test in November 2010, her skipper was provided with written guidance, which was attached to the roll test results. The guidance confirmed the vessel's exemption from the Fishing Vessel (Safety Provisions) Rules 1975, (1975 Rules) and also included:

> *It is important to appreciate that by virtue of meeting the criterion in only one loading condition does not ensure immunity against capsizing or absolve the skipper from his responsibilities. It is assumed that adequate stability will be maintained throughout the whole voyage cycle. This will only be valid if best practices with regard to operation of the vessel, use of consumables and stowage of catch are followed.*

[6] Depart Port condition: fuel and water tanks full; nets and wires on board; 1.5 tonnes of ice; 100kg of fish boxes.

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

In order to ensure that adequate stability is maintained throughout the voyage cycle you are advised that:

Fish landed on deck should be stowed below as soon as possible. Fish hold and deck area should be suitably divided by boards to prevent shifting of fish/ice.

Cargoes of bulk fish that can move freely MUST NOT BE CARRIED.

Good seamanship should be exercised having regard to the influence on the vessel's stability of beam winds, following seas and trapped water on deck (Freeing ports should be closed only as necessary during fishing).

1.6.3 Records

Fishing vessels <15m LOA are not subject to MCA survey and the MCA does not hold survey records for them unless a vessel has been subject to an incident requiring its intervention. Consequently, the MCA did not maintain a survey file on *Heather Anne* until its inspection of the vessel following her conversion to ring-netting in 2010.

1.7 VESSEL OPERATION

Between 1995 and 2010, *Heather Anne*'s skipper had primarily fished using wreck netting and drift net techniques to catch pressure stocks[8] up to 60 miles from land. Following *Heather Anne*'s conversion to ring-netting in 2010, the skipper also targeted non-pressure stocks, such as Cornish sardines, along the coast. *Heather Anne*'s skipper had no previous experience of ring-netting, and had sought and obtained advice on the use of this technique from a crewman working on board a Newlyn-based ring-netter. Details of the quantities of fish landed by *Heather Anne* in 2011 are shown in **Table 1**.

Date	No. of bins landed	Landed weight (kg)	Average kg/bin
5/1/2011	19	7453	394
9/1/2011	2	750	375
12/1/2011	19	7500	405
17/1/2011	25	10075	406
19/1/2011	25	10100	411
21/11/2011	5	1770	370
23/11/2011	19	7220	368
2/12/2011	23	8106	352
6/12/2011	22	8505	400
7/12/2011	n/a	6638	n/a
11/12/2011	n/a	1580	n/a
19/12/2011	17	n/a	n/a

Table 1: *Heather Anne* – Landings of Cornish sardines in 2011

[8] Some fish species in particular areas (stocks), for which the UK share of quota is considered insufficient to allow unrestricted fishing, are designated as 'pressure stocks'. Other stocks subject to quota and licensing are designated as 'non-pressure stocks'. All fishing vessels >10m require a licence to fish for 'pressure' and 'non-pressure' stocks.

Figures, 9, 10 and **11** show *Heather Anne* returning to Mevagissey from a fishing trip on 19 January 2011 with 10.1 tonnes of Cornish sardines on board. The vessel carried 12 bins (7 bins on the deck with 4 bins on top and 1 bin on the fish hatch) **(Figure 11)**. Each bin was 1.15m wide, 0.96m deep and 0.6m high, and could hold approximately 450kg of fish. Several, smaller blue bins were also carried. It was not uncommon for *Heather Anne*'s freeboard to reduce by between 70cm and 80cm when carrying a good catch.

When the vessel was un-laden it was her skipper's usual practice to fill the tarpaulin tank in the fore peak with about 0.5 tonne of water to trim the vessel by her head and improve the visibility ahead. The tank was drained when fishing commenced by lowering one corner and allowing the water to drain into the fishroom. The water was then pumped overboard.

When wreck or drift-netting, the vessel had also carried in the region of 10 tonnes of fish on board, split between the fishroom and in bins on deck. However, when wreck or drift netting, the tarpaulin tank was removed from the fishroom and centreline pound boards were re-fitted.

Figure 9: *Heather Anne* returning to Mevagissey on 19 January 2011, carrying 10.1 tonnes of Cornish sardines

Figure 10: *Heather Anne* returning to Mevagissey on 19 January 2011, carrying 10.1 tonnes of Cornish sardines

Figure 11: *Heather Anne*'s catch 19 January 2011

1.8 SAFETY EQUIPMENT

The safety equipment carried on board *Heather Anne* included:

- One four-man ML Lifeguard 'Forties' canister-type inflatable liferaft stowed on a wooden frame on the wheelhouse roof. The liferaft, which was owned by the skipper, was manufactured in September 2003 and had a service interval of 3 years. It had been inspected and serviced by authorised service agents in March 2007 and on 9 August 2010. The last service test and survey report indicated the liferaft was in good condition. Following the service, the liferaft had been connected to the wheelhouse roof by Ian Thomas using a Hammar H20R hydrostatic release unit (HRU). The length of the liferaft's painter was 7m.

- Seven auto-inflate 175kN lifejackets, and four solid buoyancy lifejackets. Neither the skipper nor his crew wore lifejackets when working on board *Heather Anne.*

- A Royal National Lifeboat Institution (RNLI) 'MOB Guardian' man overboard alert system with four personal wear devices[9]. The system was fitted on board *Heather Anne* several weeks before the accident to replace an emergency position indicator radio beacon (EPIRB), the batteries of which were out of date. The MOB Guardian was intended to be used when the vessel was operated single-handed. It had only been used by the skipper's youngest son.

1.9 UNDERWATER SURVEYS

1.9.1 MAIB

On 11 January 2012, an underwater inspection of *Heather Anne* was conducted on behalf of the MAIB to confirm her location and to assess her condition. The wreck was found to be resting on her keel on a mix of sand and shale at a depth of 24m. No structural damage was detected.

Inspection of *Heather Anne* identified:

- The wreck was on a north-east heading and was listing to starboard at an angle of about 20°

- The rudder was hard-over to starboard

- The throttle position indicated that the engine had been on tick-over at the time of the accident **(Figure 12)**

- The liferaft was not on the wheelhouse roof

- The non-return valve in the fishroom bilge system which discharged overboard through the vessel's starboard side was jammed open

[9] The personal devices maintain radio contact with an onboard base unit until the radio signal is broken when the wearer falls in the water. The breaking of radio contact triggers the transmission of an emergency signal which is intended to alert the search and rescue services. The onboard base station also transmits hourly messages via satellite to the RNLI operation centre. A missed report will automatically be detected by the system and the RNLI will attempt to contact the vessel. If contact cannot be made and the vessel is assessed to be at sea, the vessel's last known position is passed to the coastguard to enable a search and rescue operation to commence.

- The fishroom hatch was missing and a substantial quantity of fish remained within the hold.

A further underwater inspection was conducted on behalf of the MAIB on 15 February 2012, which identified that the shutter on the starboard aft freeing port was closed and that the liferaft painter was not on the wheelhouse roof.

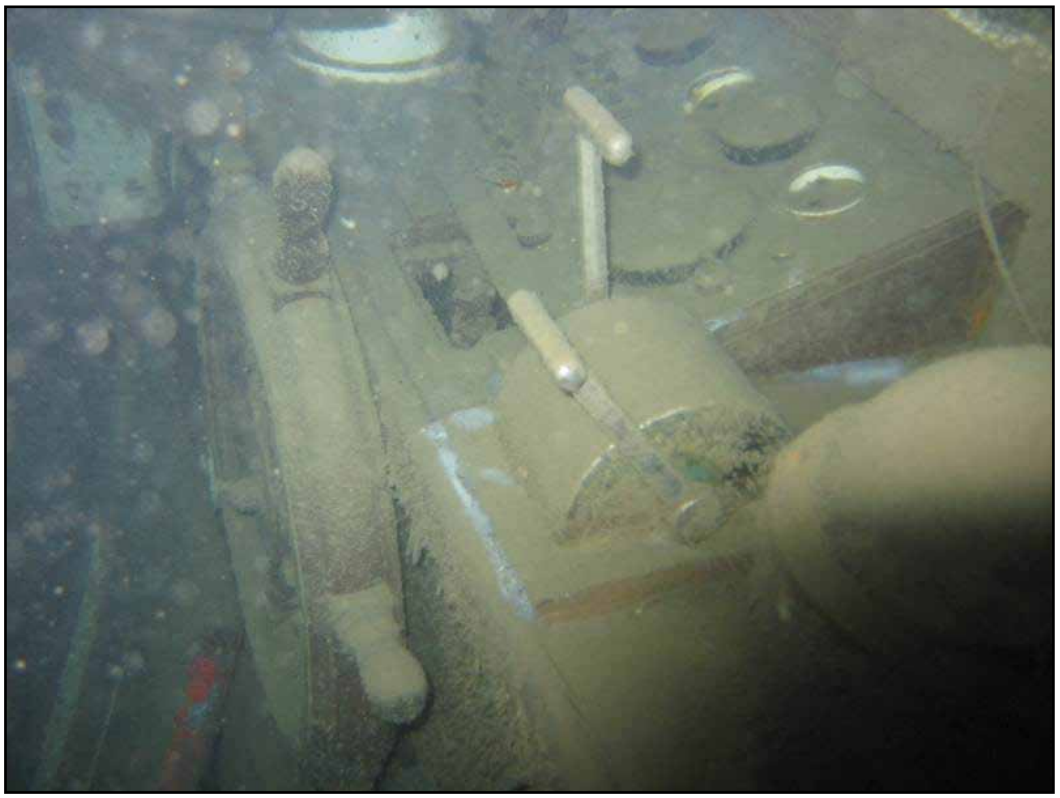

Figure 12: Position of engine throttle

1.9.2 Other surveys

On 11 January 2012, the Devon and Cornwall Police diving team recovered the vessel's chart plotter, the global positioning system (GPS) receiver and the fish finder from the wheelhouse. The HRU was also removed from the wheelhouse roof.

At the same time as the police dive team were on site, the Cornish Inshore Fisheries and Conservation Authority (CIFCA)[10] conducted a survey of the wreck using a remotely operated vehicle (ROV). The ROV confirmed the condition of the hull and also showed that the vessel's bow was gently bumping up and down on the seabed in the benign sea conditions. The seabed in the immediate vicinity of the wreck was searched but *Heather Anne*'s liferaft was not found.

1.10 WRECK RECOVERY

On 23 February 2012, *Heather Anne* was lifted to the surface using air bags **(Figure 13)**. The vessel was then towed to shallower water to enable the hull condition to be verified. The following day, *Heather Anne* was towed to Queens Jetty, A&P Falmouth, where lifting strops were placed under the hull.

[10] CIFCA was established on 1 April 2011 as a result of the Marine and Coastal Access Act 2009, and is responsible for marine fisheries and environmental management of the Cornish inshore waters and estuaries.

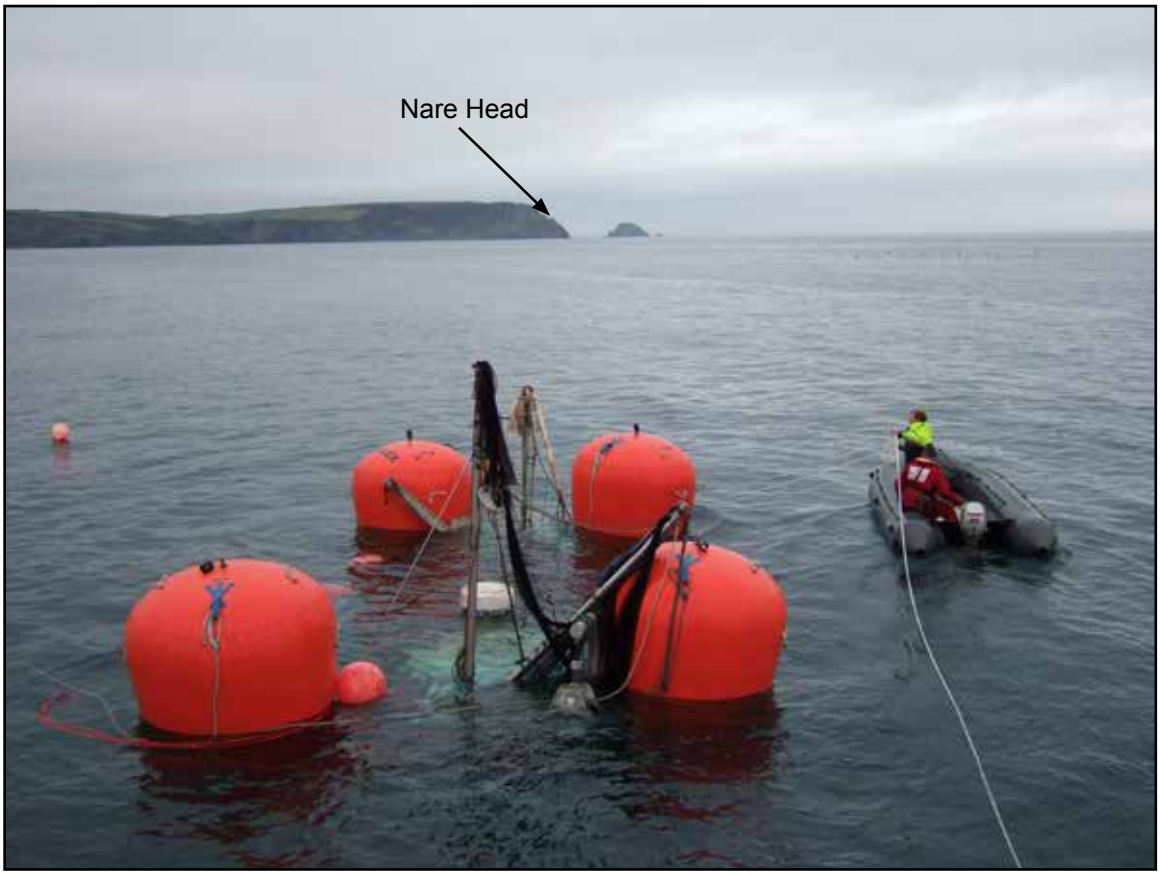

Figure 13: *Heather Anne* being refloated

The vessel was then lifted out of the water by a shore crane **(Figure 14)**. Water entrapped within the hull was then pumped out before the vessel was lowered and chocked **(Figure 15)**.

Figure 14: *Heather Anne* being lifted out of the water

Figure 15: *Heather Anne* ashore

Close examination found that a localised area of planking on the starboard side turn of the bilge in the area of the fishroom was damaged **(Figure 16)**. The damaged area was coincident with an area of the hull that had rested on the seabed and the position of a lifting strop used during the vessel's recovery.

Figure 16: *Heather Anne* - damage to planking

1.11 POST-RECOVERY INSPECTION

Heather Anne was inspected between 27 February and 15 March 2012 by an independent marine surveyor on behalf of the MAIB. The surveyor's inspection report (with addendum) **(Annex A)** included:

> *From our general examination of the hull we found the planking, away from the damage, and hull equipment in reasonable order for the age and type of vessel.*
>
> *The hull damages found were all on the starboard side just forward of amidships where we understand the vessel had been sitting on the bottom. There were no hull damages on the port side in this area.*
>
> *The timbers in way of the damages were all in reasonable condition with no sign of any rot. The 10th timber out from the keel appeared to have been renewed recently in a different wood from the original hull. There appeared to have been some refastening carried out fairly recently in way of the damaged area but this was not as extensive as it could have been with several planks having not been refastened over quite some considerable length. The two sprung planks, 5 & 7, were examples of this.*
>
> *With the very poor state of the fastenings in the general area around the missing sections of planking the damage could have occurred when the vessel was lying on the bottom and may have been moving slightly.*
>
> *Whilst we were unable to fully examine the skin fittings they all appeared to be in place and intact, in view of other findings with the hull etc, we do not consider hull penetrations or skin fittings to have contributed to the vessels sinking in any way.*
>
> *We consider the freeing port arrangements on the vessel to be adequate providing the shutter boards which were noted were not kept in place.*
>
> *From the position of the switch on the bilge alarm panel it is more than likely that the bilge alarm was in the mute position.*

1.12 EXAMINATION OF THE HRU

Examination of the liferaft HRU following its retrieval by the Devon and Cornwall Police **(Figure 17)** identified that the device had operated. A hologram on the HRU indicated that it had been fitted after 24 February 2009 but the date tabs showing its required replacement date had not been removed. The 'in service' life of the HRU was a maximum of 2 years.

The remains of the HRU lower thimble which incorporated the 'weak link' was found on the starboard side of the wheelhouse roof. The 'weak link' appeared to have broken as intended **(Figure 18)**.

An identical rope thimble and pad eye was attached to the roof on the port side of the wheelhouse roof. No remains of the strap which held the liferaft in place and which should have been connected to the HRU, were found.

Figure 17: Recovered HRU

Figure 18: Broken ‘weak link’

1.13 STABILITY ASSESSMENT

To assess *Heather Anne*'s stability when she capsized, a computer model of the hull was developed. An inclining experiment was also conducted on 18 March 2012 to determine the vessel's lightship weight and her centre of gravity.

The vessel was assessed in various standard conditions, representative of a voyage profile, against the 1975 Rules. The vessel's stability was also assessed in the estimated loss condition and the condition on 19 January 2011 when she landed 10.1 tonnes of fish. The assessment report **(Annex B)** is considered to provide an accurate indication of *Heather Anne*'s stability in the various conditions. However, given the approximation and estimation necessary in such an analysis, the resulting numerical values contained in the condition data are not absolute.

1.14 STABILITY REGULATIONS

The 1975 Rules introduced a wide range of safety standards, including the requirement for stability criteria for all vessels of 12m (L) and over. The 1975 Rules were superseded by The Fishing Vessels (Code of Practice for the Safety of Small Fishing Vessels) Regulations 2001 and The Fishing Vessels (Safety of 15-24 Metre Vessels) Regulations 2002. As a result, the requirement for stability criteria to be met was limited to vessels of 15m LOA or longer. The Code of Practice for the Safety of Small Fishing vessels was promulgated in MSN 1756 (F), which was published in March 2001. The stability requirements for vessels >15m LOA was promulgated in MSN 1770 (F) The Fishing Vessels Code of Safe Working Practice for the Construction and Use of 15 Metre Length Overall (LOA) to less than 24 metre registered length (L) Fishing Vessels.

In 2007, MSN 1756 (F) was superseded by MSN 1813 (F) The Fishing Vessels Code of Practice for the Safety of Small Fishing Vessels. MSN 1813 (F) was issued to increase the safety of fishing vessels in foreseeable operating conditions, and the survival of the crew in the event of an accident. The revised Code of Practice required new fishing vessels (whose construction started after April 2001) of between 7m LOA and 15m LOA to comply with the construction and outfit standards issued by Seafish. It also recommended that vessels of between 12m (L) and less than 15m LOA comply with the 1975 Rules and its subsequent amendments.

In addition, MSN 1813 (F) states:

> *It is recommended that vessels of between 12m registered length (L) and less than 15 metres length overall (LOA) continue to comply with the stability requirements contained in Section 16 and 74 of the Fishing Vessel (Safety Provisions) Rules 1975, and its subsequent amendments. Vessel owners are also advised to comply with the requirements contained in Annex 4 of this Code and MGN 281 (Fishing Vessel Freeboard and Stability Information Booklet).*
>
> *It is recommended that stability information should be checked and the continuing validity certified at intervals not exceeding five years by a MCA or MCA approved surveyor. When changing, repositioning or adding equipment, e.g. fishing gear, winches, or shelters advice should be sought from MCA on the effect this could have on the stability of the vessel.*

When a vessel changes its mode of fishing, in addition to having a stability check, the MCA will review any exemptions that may have previously been applied associated with the original fishing method(s). The MCA, through the Fishing Industry Safety Group and its Small Fishing Vessel Code Sub-Group is currently developing legislation that will reintroduce these stability requirements.

1.15 MAIB FISHING VESSEL SAFETY STUDY

1.15.1 General

In November 2008, MAIB published its '*Analysis of UK Fishing Vessel Safety 1992 to 2006*'. The study analysed all 256 deaths of commercial fishermen operating on UK-registered fishing vessels that had occurred during the period, 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 views from across the industry.

1.15.2 Fishing vessel losses

The analysis identified:

- *The majority of vessel losses (52%) were due to flooding/foundering, and most of these involved vessels with lengths <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 <12m vessels:*
    - *Stability issues 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.*
    - *<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.*
    - *34 of the 63 fishermen killed in these accidents were known not to have been wearing PFDs, and it is considered likely that neither were many of the other 29 deceased.*

1.15.3 Review of MAIB safety recommendations

The analysis also highlighted a number of recommendations made to the MCA related to fishing vessel stability. It included:

Following the investigation into the capsize of Charisma in 2002[11], probably due to undetected flooding combined with a heavy deck load of bagged mussels, MAIB recommended that:

[11] www.maib.gov.uk/publications/investigation_reports/2002/charisma__ob588_.cfm

"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 <12m vessels, without the need for expensive inclining tests and stability books, and to produce a simplified stability notice for use on >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[12], although resulting in separate reports, effectively made three parallel recommendations regarding small fishing 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 <15m vessels would materially affect the accident rate. In confirming this intention to MAIB, 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 <15m fleet'.

1.15.4 Study recommendations

Recommendation 2008/178 made to the MCA included, inter alia:

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

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

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

Recommendation 2008/173, also made to the MCA, included:

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

[12] www.maib.gov.uk/publications/investigation_reports/2003/amber.cfm and www.maib.gov.uk/publications/investigation_reports/2003/kirsteen_anne.cfm

1.16 RESEARCH PROJECTS

The research projects commissioned by the MCA aimed at developing guidance for the loading of fishing vessels under 15m (L) were undertaken by the University of Southampton's Wolfson Unit for Marine Technology and Industrial Aerodynamics.

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

> *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.*

The 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 report recommended:

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

1.17 STABILITY GUIDANCE

1.17.1 Fishing vessels of less than 15m LOA

In December 2010, the MCA published MGN 427 (F) – Stability Guidance for Fishing Vessels of under 15m Overall Length **(Annex C)**. The MGN stated that full stability requirements 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).

The MGN states:

> *A number of factors can affect a vessel's stability, for example its length and breadth, the freeboard, the centre of gravity of the ship and equipment, distribution of weights such as in the fish hold, on deck, in hoppers, in nets, fuel, water and stores etc. Research has shown the importance and effect on stability of maintaining adequate freeboard. The weathertight deck, hatches and doors should be kept closed and decks should be kept clear of water and other moveable weights. While a vessel may appear very 'stiff' because of her large*

beam, if the freeboard is small there may be little reserve of stability when the vessel heels or is in large waves due to the dangers of downflooding. Also a vessel which appears very sea-kindly and comfortable with a slow roll period can actually be potentially unsafe in terms of stability. Keeping water off the deck by closing scuppers or freeing ports may seem sensible and safe, but does have the opposite effect if a wave comes onboard and causes instability because of the trapped water and its free surface effect. It is also vital that a catch is not stored on deck, it should be stored as low as possible in the vessel as soon as is practicable.

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

- Full Stability Method. Applies to all vessels >12m (L) and requires stability data to be formulated from an inclining experiment and calculation.

- Small Commercial Vessel Code Standard (heel test). Applies to vessels carrying less than 1 tonne of cargo and requires a heel test resulting in a heel angle less than 7º and sufficient freeboard.

- Small Passenger Vessel Heel Test. An alternative to the Small Commercial Vessel Code heel test standard which also requires a resulting heel angle less than 7º and specified minimum freeboard, but which can be used for vessels carrying > 1 tonne of cargo.

- Roll period approximation - a simple operational comparative method to determine whether a vessel is stiff or tender. If the roll period in seconds is less than a vessel's beam in metres, the vessel is considered to be stiff. If the roll period in seconds is greater than the vessel's beam, the vessel is considered to be tender.

- Wolfson Guidance (see paragraph 1.16).

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

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

1.17.2 Freeboard

MSN 975 – *Freeboard of fishing vessels* was published in 1981 and provided advice on freeboard and stability, including:

It has been observed that many vessels engaged primarily in bulk fishing are frequently loaded such that the reserves of stability or freeboard remaining may be small to counter any adverse effects of sea or wind with consequent danger to crew on deck or to the vessel itself.

Maintenance of adequate freeboard in all parts of the vessel is an important feature of safe operation. When a vessel designed for a particular mode of fishing is altered to suit an entirely different method with new arrangements and rates of stowage, the stability and freeboard must be verified and assessed for compliance with Rule 15(1).

Vessels to be employed in bulk fishing can be particularly vulnerable to the effects of small reserves of stability, trim and freeboard. Safe limits of loading should be made available to skippers in a readily understandable form.

MSN 975 did not apply to fishing vessels <12m (L).

1.17.3 Fishermen's Safety Guide

The MCA publication *Fishermen's Safety Guide – A guide to Safe Working Practices and emergency procedures for fishermen* provides advice on a wide range of operating practices on board fishing vessels. A section on stability explains the effects of a vessel's centre of gravity, loose water or fish on deck, loading and unloading, and freeboard.

1.18 CONSTRUCTION STANDARDS

New vessels are required to comply with Seafish construction standards in order to be eligible to register as a UK fishing vessel. For vessels <15m the standards specify that stability for new vessels should be properly assessed by a person having appropriate qualifications. The standards also highlight that full stability assessments are required for fishing vessels between 12m (L) and 15m LOA and recommend that current stability requirements are also applied to vessels of between 10m LOA to 12m (L).

Revised Seafish construction standards for vessels <15m (L) were published in September 2012, and were effective from 1 January 2013. The standards include a new requirement that decked vessels with a continuous watertight weather deck have a minimum freeboard from the design waterline of not less than 300mm. Vessels with a freeboard less than 300mm are to be limited in their area of operation to 20 miles from a safe haven and in favourable weather conditions.

1.19 STABILITY TRAINING

Seafish provides both mandatory and voluntary training for fishermen. The non-mandatory 1 day intermediate stability awareness course was introduced in April 2006 in close conjunction with the MCA and has been completed by nearly 4500 fishermen. The course used a series of visual animations and a specially designed model boat to explain key aspects of stability and to provide skippers with a greater understanding of the issues involved.

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

The course syllabus covers key areas affecting stability including, buoyancy, centre of gravity, metacentre, vessel equilibrium, effect on the movement of weights, free surface effect, roll periods and general stability guidance including weight 'creep' or growth.

To further impress upon the fishermen the importance of these areas, specific MAIB accident investigations are highlighted. An end of course assessment requires a pass mark of 60%.

1.20 MARINE MANAGEMENT ORGANISATION

1.20.1 Background

The MMO was established and given powers under the Marine and Coastal Access Act 2009 to contribute to sustainable development in the marine area, with respect to planning, regulating and licensing.

The MMO incorporates the work of the Marine and Fisheries Agency (MFA) including, since 1 April 2010, responsibility for the administration of the European Fisheries Fund (EFF). It also undertakes specific functions previously associated with the Department of Energy and Climate Change (DECC) and the Department for Transport (DfT).

Within its range of responsibilities, the MMO also manages the English fishing fleet capacity (approximately 22% of the total UK fleet) and English fisheries' quotas. With funding from the EFF, the MMO is able to assist fishermen through, for example, diversification in to other fish stocks, purchase of non-mandatory safety equipment, update of equipment to become more productive, and improvement of crew facilities.

1.20.2 EFF grants

The EFF grant scheme commenced in September 2008 and was administered by the MFA prior to April 2010. The general conditions for receiving a grant included:

> *The beneficiary agrees] 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.*

From 5 July 2010, the MMO has informed the MCA of the grants awarded for vessel modifications, regardless of whether or not the modifications affect vessel stability. In addition, as part of the project application process, MMO coastal officers comment on the suitability of the proposed projects and inspect the works after completion to ensure they meet the terms of the grant.

1.20.3 Ring-netting

Between 18 February 2010 and 17 August 2011, six applications for funding toward ring-net conversions or modifications were received by the MFA or latterly the MMO. Five of these related to Mevagissey based fishing boats, including *Heather Anne*, and one for a Newlyn based vessel. One of the six, not relating to a full conversion, was declined. The grants were intended to:

- Improve selectivity with virtually no unwanted by-catch or discards
- Diversify away from pressure stocks
- Reduce steaming to fishing grounds resulting in less fuel consumption.

1.21 LIFEJACKETS

In 2000, in its investigation report into the capsize of *Donna M*[13] the MAIB recommended that the Fishing Industry Safety Group (FISG):

> *Raise an agenda item on the compulsory wearing of lifejackets for fishermen when working on deck, and to seek the views of fishermen's representatives on this subject.*

The MAIB's '*Analysis of UK Fshing Vessel Safety 1992 to 2006'* (paragraph 1.15) recommended that the MCA:

> *Review international safety initiatives and transfer best practice to the UK fishing industry with particular reference to the use of PFDs and Personal Locator Beacons.*

A recommendation was later made in 2009 to the MCA following the death of a crewman from the fishing vessel *Maggie Anne*[14] to:

> *Expedite its current work on the use of personal flotation devices and personal locator beacons in the UK fishing industry.*

In 2010, after reviewing these and previous similar recommendations, the MCA concluded that the compulsory wearing of personal flotation devices (PFDs) on the working deck of fishing vessels would have a positive effect on safety and dramatically reduce the number of fatalities. This issue has since been a standing agenda item at the FISG meetings at which the MCA has taken into account fishing industry concerns. Getting fishermen to wear PFDs is now a key part of the MCA's fishing vessel safety project, and its business plan for 2011-2015 included:

> *Put arrangements in place to require fishermen to wear Personal Flotation Devices (PFDs) by December 2012.*

The MCA has since widened its focus on PFDs to include safety lines as an addition or alternative to PFDs. After close consultation with the fishing industry, and to enable the continued provision of PFDs with the assistance of EFF grant, the FISG has also decided to prioritise its efforts to engend a culture change in fishermen so that PFDs are worn voluntarily in appropriate circumstances, such as when working on the upper deck at sea. The MCA intends to implement the mandatory wearing of PFDs if it becomes clear that this non-regulatory approach is not working.

[13] www.maib.gov.uk/publications/investigation_reports/2000/donna_m.cfm

[14] www.maib.gov.uk/publications/investigation_reports/2009/maggie_ann.cfm

1.22 SIMILAR RECENT ACCIDENTS

From 2007 until the loss of *Heather Anne* in December 2011, 20 UK registered fishing vessels of <12m (L) have capsized[15]. These resulted from: fishing gear being caught on an underwater obstruction (10), flooding (5), heavy weather (4) or uneven weight distribution (1). These accidents included:

- On 10 November 2008, the fishing vessel *Louisa*[16] had been raking the seabed for "white weed" off Shoebury Ness when the weather deteriorated, with winds gusting up to Force 8 and rough seas. As the vessel headed back into her mooring she was lost about 1.2nm off Southend Pier. No distress signal was received, and the owner, who was the only person on board, lost his life.

- On 26 November 2008, the fishing vessel *Georgie Fisher*[17] was dredging for mussels in The Wash, and had loaded about 14 tonnes of mussels when she was beached to wait for the next tide. When *Georgie Fisher* returned to the mussel beds and resumed dredging she was heading into shallower water when the starboard dredge came fast. The vessel quickly heeled to starboard, taking water onto the deck. Despite the skipper's efforts, he was unable to free the dredge or correct the heel; downflooding occurred into the engine room, via the vents, and the vessel capsized to starboard. The vessel's three crew were rescued by a nearby vessel. Following this accident the Chief Inspector of Marine Accidents wrote to *Georgie Fisher*'s owner recommending that the vessel's engine room vents be modified to increase the level at which downflooding occurs, and that an inclining test be conducted on the vessel to assess its stability and determine its safe operating limits. He also wrote to the Chief Executive of the MCA highlighting that both *Georgie Fisher* and *Ellie May* represent further examples of the foundering or capsize of small fishing vessels, identified as an area of concern in MAIB's November 2008 report *Analysis of UK Fishing Vessel Safety 1992 to 2006*.

- At about 1540 UTC on 20 July 2009 the fishing vessel *Aquila*[18], with a crew of four, capsized while dredging for scallops to the east of the Isle of Muck, off the west coast of Scotland. Three of her crew lost their lives in the accident; none were wearing lifejackets. *Aquila* was trawling when her starboard trawl warp became snagged on the seabed. She yawed and heeled to starboard in following seas. The skipper put the engine out of gear, but had no time to take further action before the vessel capsized as large waves broke over her starboard side. At the time of her build, *Aquila* met the stability standard for larger fishing vessels, there being no standard for vessels<12m (L). However, analysis undertaken by the MAIB found that, due to an increase in her displacement tonnage, at the time of the accident she no longer met this standard. Following the accident, Seafish agreed to include in its stability awareness course the importance of ensuring that a vessel's stability is assessed by a competent person when modifications or additions are made.

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[15] Excludes capsizes that occurred as a result of beaching.

[16] www.maib.gov.uk/publications/completed_preliminary_examinations/completed_preliminary_examinations_2009/louisa.cfm

[17] www.maib.gov.uk/publications/completed_preliminary_examinations/completed_preliminary_examinations_2008/georgie_fisher.cfm

[18] www.maib.gov.uk/publications/investigation_reports/2010/aquila.cfm

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 VESSEL STABILITY

The stability assessment report **(Annex B)** shows that *Heather Anne* was operating with a very low reserve of stability before her capsize. The difficulties experienced when steering, the vessel's slow rate of roll from side to side, and the ingress of water through the closed freeing ports, were all symptoms of her perilous condition.

With an estimated cargo of 10.5 tonnes of fish and entrained seawater, the vessel's freeboard was about 131mm[19] from deck level and the corresponding righting levers were very low indeed (see Annex B, Diagram 6). Once *Heather Anne*'s final roll to starboard reached an angle in the region of 13°, capsize was inevitable.

There is no doubt that *Heather Anne* had been at an increased risk of capsize since her conversion to ring-netting in 2010. Indeed, when the vessel was loaded with 10.1 tonnes of fish on 19 January 2011 **(Figures 9, 10** and **11** and **Table 1)** her stability condition was only marginally better than on 20 December 2011 **(Table 4** in **Annex B)**. It is possible that capsize was only avoided on that occasion due to better sea conditions and the fact that the larger tarpaulin had not yet been fitted in the fishroom.

As it would have taken only a very small change in the vessel's condition during *Heather Anne*'s return passage to Mevagissey on 20 December 2011, to cause her to capsize, the final event that triggered her total loss of stability is difficult to determine. However, it was almost certainly due to one or a combination of several factors, including: the free surface effect[20] of the fish and entrained seawater inside the fishroom and the seawater on deck; the heeling due to the use of high angles of rudder or the increasing sea state; and the movement of weights on the deck such as fish boxes or the vessel's crew.

Given that the planks in way of the damaged area on the vessel's starboard side **(Figure 16)** had been replaced in 2010, and the probability that the damage was caused by the vessel's movement on the seabed **(Annex A)** or by a lifting strop when the vessel was raised **(Figures 13** and **14)**, it is unlikely that the capsize was initiated by flooding resulting from a sprung plank in this area. In addition, as the discharges overboard were relatively high on the vessel's side **(Figure 8)**, it would not have been possible for seawater to enter the hull via this pipework during passage, even with the vessel's very low freeboard. Nonetheless, had the vessel started to flood for whatever reason, the skipper would not have been alerted because the bilge alarm was muted. In any event, the time available to take any action would have been minimal due to the vessel's low freeboard and low reserve of stability.

[19] The 131mm minimum freeboard identified at Annex B was measured on the low side of the vessel with the vessel heeled at an angle of 1.76°. Therefore, the freeboard would have been marginally greater on the opposite side.

[20] In a partly filled tank or hold, the contents will shift with the movement of a vessel. This 'free surface effect' increases the danger of capsize.

2.3 IMPACT OF MODIFICATIONS

2.3.1 Weight growth

The comparison of **Figures 4** and **Figure 15** clearly shows that since build in 1971, *Heather Anne* had been extensively modified. Such changes added significant weight on the upper and lower decks. As a result, when the vessel was inclined in March 2012, her lightship displacement had increased from an estimated 15.7 tonnes at build to 23.9 tonnes, an increase of over 50%.

Important ramifications of the vessel's increased displacement were that her centre of gravity was raised and her freeboard was lowered. Consequently, although the vessel in her loaded condition at build was likely to have met the later stability requirements introduced in the 1975 Rules (which were not obligatory for the vessel), it is clear that the vessel's in-service modifications reduced her reserve of stability to the point where the vessel no longer complied with the stability requirements of the 1975 Rules in any seagoing condition **(Table 3** in **Annex B)**.

2.3.2 Free surface effect

The fitting of a tarpaulin 'tank' in the fishroom was a seemingly minor addition. However, when the capacity of the tarpaulin was increased from 3.4m^3 to 5.02m^3 in November 2011, although this was an increase of 48% in volume, along with the removal of the longitudinal pound boards it increased the tank's free surface moment by 240% **(Table 1** in **Annex B)**.

The upper edges of the tarpaulin tank did not abut the deck head, so it could not be pressed full without fish overflowing its edges. Therefore, even with a 'full' tank on completion of fishing on 20 December 2011, the upper level of the mixture of fish and residual seawater within the tarpaulin was 30cm below the main deck. Consequently, the estimated 4.7 tonnes of cargo was free to move from side to side to some degree, providing a free surface moment as the vessel rolled. Inevitably, such movement and corresponding shift in weight would have exacerbated *Heather Anne*'s final roll, which ultimately led to capsize.

2.3.3 Catch size

When *Heather Anne* was built, the maximum weight of her catch was expected to be about 5 tonnes (4 tonnes in the fishroom and the remainder on the deck). The vessel's conversion to ring-netting undoubtedly increased the likelihood of frequently carrying much larger quantities. The catch on board when she capsized was estimated in the stability assessment **(Annex B)** to be about 10.5 tonnes, which was more than twice the weight originally envisaged by her designer. The weight of the fish and entrained seawater increased *Heather Anne*'s displacement to about 38.5 tonnes and reduced her freeboard until it was only a few centimetres.

2.4 RELIABILITY OF THE STABILITY ASSESSMENTS UNDERTAKEN

2.4.1 Roll test

After being informed by the MMO that *Heather Anne* had been converted to ring-net fishing, the MCA surveyor's concern over the vessel's stability was warranted. However, in November 2010 a roll test was the only viable means available to the

surveyor to assess *Heather Anne*'s stability. A full stability assessment would have been relatively expensive and the surveyor considered it would be difficult to justify. The use of a roll test on this occasion was therefore understandable. However, *Heather Anne*'s capsize only 13 months after the roll test is serious cause for concern and highlights that a vessel's stability should not be assessed by a roll test alone.

In this case, the roll test provided an approximation of *Heather Anne*'s GM in only her 'depart port condition'; it did not accurately reflect the vessel's 'fully loaded condition'. Crucially, the roll test did not sufficiently take account of the adverse effects on the vessel's stability caused by her increased displacement and reduced freeboard since build. Consequently, while the measured GM was greater than the minimum calculated GM required by the 1975 Rules, by itself the GM did not provide a meaningful or accurate measurement of *Heather Anne*'s stability, nor did it provide the skipper with guidance as to how much catch his vessel could carry. The results of *Heather Anne*'s roll test were therefore misleading to both the MCA and the vessel's skipper.

2.4.2 Dynamic assessment

As *Heather Anne* was <12m (L), the vessel did not have to meet any specific stability criteria and, like many similar sized fishing vessels, it was left to her skipper to ensure that his vessel remained fit for purpose in this respect. However, the vessel had passed the roll test following her conversion and had subsequently carried large catches divided between the fishroom and on the deck. In such circumstances, it is possible that the skipper had gained a false impression of his vessel's capabilities.

On the night of the capsize, *Heather Anne*'s skipper realised that he would not be able to brail on board the full contents of his net. However, when *Lauren Kate* arrived to share his catch, he was unaware that his vessel had already been loaded to the point where her safety was in jeopardy.

The skipper was an experienced fisherman who had completed training in stability awareness, but it is also clear from his use of the tarpaulin tank that he either did not fully understand or did not follow the loading guidance provided along with the results of the roll test (paragraph 1.6.2). He also did not recognise the danger signs of seawater entering the deck even though the freeing ports were closed, the difficulties in maintaining his intended heading, or by the vessel rolling slowly. It was not until moments before capsize that he realised that something was wrong. By then, it was too late for any effective preventative action to be taken.

2.5 METHODS OF ASSESSING SMALL FISHING VESSEL STABILITY

2.5.1 Maximum safe load

Heather Anne's capsize could have been avoided had her skipper known the maximum load his vessel was capable of carrying safely. However, determining the maximum safe load of fishing vessels <12m (L) is problematic. The five methods of assessing the stability of small fishing vessels detailed in MGN 427 (F) **(Annex C** and paragraph 1.17.1**)** vary considerably in their approach, complexity, cost, and the margins of safety they afford. Moreover, despite MGN 427 (F) emphasising the importance of maintaining an adequate freeboard, not all of the methods suggested in the MGN provide any indication of a vessel's maximum loading.

2.5.2 Full stability assessment

The full stability method is by far the most comprehensive and accurate method from which a vessel's maximum load can be derived. However, this method requires a hull computer model to be constructed, an inclining experiment, and a stability information book (SIB) to be produced. New fishing vessels are built to the Seafish construction standards and sometimes have stability analyses completed as part of their design. However, the retrospective use of this method would be problematic as many existing small fishing vessels have inherently low reserves of stability, and many fishermen do not consider the expense is justified.

In the case of *Heather Anne*, the minimum freeboard extrapolated from the stability requirements for fishing vessels >15m LOA (MSN 1770 (F)) was 256mm **(Table 3** in **Annex B)**.

2.5.3 The Small Commercial Vessel Code Standard and the Small Passenger Vessel Heel Test

The methods adapted from the Small Commercial Vessel Code and the Small Passenger Vessel Code Heel Test require a vessel to heel to an angle of less than 7º when a prescribed load is placed on the vessel's sides. They also provide a minimum freeboard which is interpolated from a vessel's length and which therefore enables skippers to derive a safe loading limit.

However, the Small Commercial Vessel Code Standard is limited to vessels carrying less than 1 tonne of cargo, so it can only be applied to the smallest fishing vessels; it could not have been applied to *Heather Anne*. The Small Passenger Vessel Code method permits greater cargo capacity, and therefore could have been applied to *Heather Anne*.

Using the methods adapted from the Small Commercial Vessel Code Standard and the Small Passenger Vessel Code Heel Test, the minimum required freeboard for *Heather Anne* would have been 430mm and 515mm respectively.

2.5.4 The Roll Period Approximation Test

The simplest, but by far the least informative method of assessing stability is the roll period approximation, but this only categorises a vessel as stiff or tender, which is wholly insufficient for a vessel's safe operation. Furthermore, roll period is linked to inertia, which will vary widely between vessels depending on their upper deck equipment and underwater appendages such as bilge keels and skegs. Therefore, the results of a roll period approximation test might be misleading.

2.5.5 The Wolfson Guidance Method

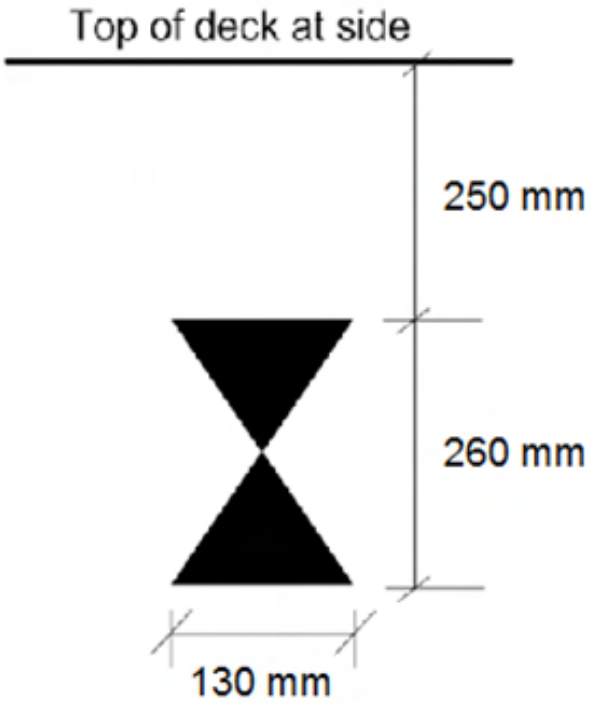
The Wolfson Guidance method calculates the position of a freeboard guidance mark on a vessel's hull based on a vessel's length and beam. The mark is then intended to be used by a vessel's skipper in conjunction with a stability notice which links the freeboard mark to the sea state to indicate a level of safety in a 'traffic light' format. A completed stability notice for *Heather Anne* is shown at **(Figure 19)** and the freeboard guidance mark, which was put on the vessel after her recovery, is shown at **Figure 20**.

WOLFSON UNIT

STABILITY NOTICE

Name Heather Anne No. FY126 Owner 0 Length 11 metres Beam 4.2 metres	Loading & Lifting Guidance	Safety Zone	Minimum Freeboard	Maximum Recommended Seastate
	Good margin of residual freeboard	Good margin of safety	At least 51 cm	
	Loading or lifting reduces minimum freeboard to less than 51 cm	Low level of safety	25 to 51 cm	1.3 metres
	Excessive loading or lifting reduces minimum freeboard to less than 25 cm	Danger of capsize	Less than 25 cm	0.7 metres

Freeboard Guidance Mark - size and location



MAIB NOTE

Equates to Red zone

Equates to Amber zone

Equates to Green zone

Figure 19: Stability notice and guidance mark

Figure 20: *Heather Anne* with freeboard guidance mark

2.5.6 Summary

It is evident from the review of the assessment methods suggested in MGN 427 (F) that the note fails to provide meaningful practical guidance to owners and skippers regarding the assessment of small fishing vessel stability. Moreover, its lack of clarity through inclusion of extracts from the source standards and the resulting inclusion of irrelevant references in some areas is confusing.

Table 2 summarises the application of the five methods suggested in MGN 427 (F) with regard to *Heather Anne.* The proposed minimum freeboard for the Seafish construction standards for new vessels <15m LOA is also included for comparison. As *Heather Anne*'s freeboard was only about 131mm when she capsized, it was significantly less than the minimum freeboards derived from the stability assessments suggested (where applicable).

Method	Minimum Freeboard	Comments
Full stability	256mm	Maximum load must be used to derive a vessel's SIB Extrapolated from the requirements of MSN 1770 (F) **(Table 3** in **Annex B)**
Approximate Roll Period	Not defined	Only provides guidance on whether a vessel is stiff or tender
Small Commercial Vessel Code Standard	430mm	In association with a heel test and only for vessels carrying less than 1 tonne
Small Passenger Vessel Code Heel Test	515mm	In association with heel test for vessels carrying more than 1 tonne
Wolfson Guidance Mark	250mm (amber/red) 510mm (green/amber)	Used in conjunction with a stability notice and linked to sea state
Proposed Seafish Construction Standard	300mm	Only required if operating >20nm from safe haven

Table 2: Summary of stability assessment methods – *Heather Anne*

However, in the case of *Heather Anne*, the Small Commercial Code Standard could not have been applied, the roll approximation method would have been of little value, and the minimum freeboard required by the Small Passenger Vessel Code Heel Test (515mm) and the Small Commercial Code Standard (430mm) would have reduced the cargo which she could have carried to the extent that the vessel would possibly have been economically unviable as a ring netter. Only the approximate minimum freeboard extrapolated from the requirements for larger fishing vessels (256mm), and the minimum freeboard derived from the Wolfson Guidance method (250mm), appear to be credible.

The lack of stability requirements for vessels <12m (L) makes the need to provide clear guidance which is relevant to the operation of these vessels compelling. Such guidance should take account of, inter alia:

- The limitations of the alternatives to a full stability assessment.
- The suitability of the alternative stability assessments for small fishing vessels.
- That a vessel's vulnerability to capsize is not necessarily related to her GM, and that a large GM does not guarantee that a vessel has a sufficient righting lever.
- The importance of vessels having both a freeboard mark and a maximum load calculation.

- The impact of vessel modifications.

- Owners' and skippers' awareness of stability considerations.

The Wolfson Guidance method potentially provides a practical and inexpensive way for fishing vessel skippers to gauge the loading of their vessels in varying sea conditions. Unfortunately, as the method has yet to be fully validated due to the lack of fishing vessels that were willing to participate in its trials in 2006, it is viewed with scepticism within some quarters of the fishing industry. Given its potential usefulness in contributing to small fishing vessel safety, it is important that the practicality and accuracy of the method is tested as soon as possible.

2.6 FISHING VESSEL STABILITY STANDARDS

The continuing loss of small fishing vessels and their crews through capsize (paragraph 1.22) remains a serious cause for concern. It is apparent from these accidents that small fishing vessels that operate with low reserves of stability, often as a result of modification or loading, have a reduced likelihood of recovery following unforeseen events such as their fishing gear being caught on an underwater obstruction, worsening sea conditions, or flooding.

The stability requirements for small fishing vessels contained in the 1975 Rules and developed through to the subsequent Codes of Practice, do not include any requirements for fishing vessels of <12m (L). Although the proposed minimum freeboard requirements for vessels <15m required by the Seafish construction standards (paragraph 1.18 and Table 2) should help improve the safety of new small fishing vessels, the current exemption of existing fishing vessels <12m (L) from any stability criteria is unjustified, particularly considering their accident rate and the hazards associated with fishing compared to other small commercial vessel activities.

Although the MCA stated an intent in MGN 427 (F) in 2010 not to introduce stability criteria for fishing vessels <12m (L), the inclusion of a milestone in its 2012 to 2016 business plan to develop alternative small fishing vessel standards based on other commercial codes, is a change in direction which should improve the safety of all small fishing vessels in the longer term.

To be fully effective, any stability requirements which are developed for fishing vessels of <12m (L) must ensure that all new vessels and vessels which have been substantially modified are subject to appropriate stability assessments. Other existing vessels must have a minimum freeboard marked on their hull, otherwise skippers will have no means of accurately determining the maximum safe load.

2.7 FUNDING CONDITIONS

The adverse effects that bulk fishing can have on fishing vessel stability are well described in MSN 975. Although the MSN is aimed at larger fishing vessels, *Heather Anne*'s weight growth and increased displacement following her conversion to ring-netting in 2010, together with the size of her catch on 20 December 2011 which led to her eventual capsize, show that such dangers apply equally to smaller fishing vessels.

Following *Heather Anne*'s conversion to ring-netting in 2010, not only was the vessel's stability considerably reduced, but the vessel was also likely to catch and carry large quantities of fish. When the MMO informed the MCA about *Heather Anne*'s intended conversion, the MCA immediately recognised the potential adverse impact the conversion work could have had on the vessel's stability. Unfortunately the roll test that was conducted failed to confirm the MCA's concerns. There is no doubt that had a full stability assessment been undertaken, the viability of operating *Heather Anne* as a ring-netter would have merited critical review.

Furthermore, although the MMO bestowed responsibilities on the beneficiaries of EFF grants to maintain compliance with all applicable regulations, *Heather Anne*'s capsize and the death of Ian Thomas show that such a system is flawed where no regulation exists. The safety of fishing vessels which are converted or substantially modified with the support of an EFF grant would be better protected if the MMO and the MCA worked more closely together to ensure that the vessels concerned maintain sufficient reserves of stability. In many cases this would only be possible through a full stability assessment. Therefore, given the relatively high costs involved, the linking of the provision of such assessments to the funding or grant conditions is worthy of exploration.

2.8 SURVIVABILITY

2.8.1 Lifejackets

Suddenly entering sea water at a temperature of about 10°C, Ian was likely to have experienced shock to some degree when first immersed. Such a shock can cause a person to gasp and inhale water. However, despite not being a strong swimmer, Ian was able to surface. Although the skipper then tried to support him until *Lauren Kate* arrived, it would have been extremely difficult for the skipper to keep Ian's mouth clear of the water. Neither of the men was wearing a lifejacket, and it would have been difficult for even the best of swimmers to cope in the sea and wind conditions experienced. Given the relatively small length of time Ian spent in the water, there is little doubt that his chances of survival would have been dramatically increased if he had been wearing one of the lifejackets carried on board *Heather Anne*.

In 2000, the MAIB made its first recommendation about the compulsory wearing of lifejackets by fishermen working on deck. In the intervening years, there has been a succession of discussions, education programmes and research projects, yet fishermen continue to drown who might otherwise have lived had they been wearing a PFD when they entered the water. The MCA's initiative to introduce a requirement for fishermen to wear PFDs when working on the open deck by December 2012 was a positive step forward. However, the decision to delay this implementation date to allow European Fisheries Fund grants to be used to purchase PFDs has merits: for example, the Scottish Fishing Federation has applied for funding to equip all Scottish fishermen with a personal PFD to wear on the working deck, and it is understood that the other UK fishing federations have similar initiatives planned. Nonetheless, simply providing fishermen with PFDs is not enough. MAIB investigations have frequently discovered that PFDs for use while working are available on board fishing vessels, yet they were not being worn when the accident occurred. The culture of the industry therefore needs to change to make wearing a PFD a matter of routine when working on deck.

That lifelines are being considered a viable alternative to PFDs on small fishing vessels is also a source of concern. Lifelines are useful for helping prevent an individual from being washed overboard in heavy weather, though there are currently no equipment standards for their use on fishing vessels. Moreover, the wearing of lifelines on board smaller fishing vessel which might capsize or founder with little warning is potentially dangerous. Since the loss of *Heather Anne*, five UK fishermen have lost their lives while working on small fishing vessels due to their vessel either rapidly capsizing or rapidly foundering. As it was, these individuals had no time in which to collect and don their 'abandon ship' lifejackets but had they been attached to their vessel by a lifeline, their chances of survival would have been reduced even further.

There are many reasons why fishermen might suddenly find themselves in the water, including unsafe working practices on deck; poor stability, overloading and snagging leading to vessel capsize; and internal flooding resulting in foundering, to name a few. All these safety issues are being addressed, but their resolution is likely to take years. In the meantime lives, such as that of Ian Thomas, can be saved by fishermen wearing a PFD when working on deck. The MCA should therefore define the safety improvement it seeks, and the time by which it is to be achieved, and if the necessary progress is not evident then move swiftly to introduce mandatory wearing of lifejackets on small fishing vessels.

2.8.2 Liferaft

Ian Thomas's chances of survival would also have been increased had *Heather Anne*'s liferaft floated to the surface and inflated close to the men in the water. Therefore, the liferaft's disappearance is of serious concern. The liferaft was in date for service and was reported to have been in good condition. In addition, both the HRU and the 'weak link' appear to have operated correctly. As the liferaft has not been found, it is impossible to determine why it did not function as expected. It can only be assumed that the liferaft inflated sufficiently for its buoyancy force to break the 'weak link' but that it only partially inflated, floated away and then eventually sank.

2.8.3 MOB Guardian

Following *Heather Anne*'s capsize, it was fortunate that *Lauren Kate* was nearby and that her skipper quickly realised that *Heather Anne* was in trouble when he saw her lights and radar target disappear. Otherwise, it is highly likely that the alarm would have been raised only when *Heather Anne* did not return to Mevagissey as expected. Had that been the case, the resultant time delay would have meant that *Heather Anne*'s skipper might also have perished.

Heather Anne was fitted with an MOB Guardian in lieu of an EPIRB, but the system was not switched on (see paragraph 1.8). However, although when an MOB Guardian system is operating it provides immediate notification ashore in the event of a man overboard, it does not provide immediate notification in the case of the loss of a vessel. Therefore, even if the system on board *Heather Anne* had been switched on, the loss of communication with the system's shore station following capsize would not have prompted a search and rescue as quickly as an EPIRB.

SECTION 3 - CONCLUSIONS

3.1 SAFETY ISSUES DIRECTLY CONTRIBUTING TO THE ACCIDENT WHICH HAVE RESULTED IN RECOMMENDATIONS

1. *Heather Anne* was operating with a very low reserve of stability and it would have taken only a very small change in the vessel's condition to cause her to capsize, [2.2]

2. Since build in 1971, *Heather Anne* had been extensively modified. The modifications had significantly increased her displacement, raised her centre of gravity and reduced her freeboard. [2.3.1]

3. The roll which ultimately led to the vessel's capsize would have been exacerbated by the free surface effect of the fish and entrained water contained in a PVC tank fitted in the fishroom. [2.3.2]

4. *Heather Anne* was carrying an estimated 10.5 tonnes of fish (including entrained water) split between her fishroom and the deck. This was over twice the weight of catch envisaged by her designer. [2.3.3]

5. *Heather Anne*'s capsize only 13 months after successfully passing a roll test highlights that caution needs to be taken when a vessel's stability is assessed by a roll test alone. The results of the roll test were misleading. [2.4.1]

6. The skipper did not appreciate the dangers of fitting the tarpaulin tank in the fishroom. He was also unaware of the vessel's perilous condition until moments before she capsized. By then, it was too late for any effective action to be taken. [2.4.2]

7. Other than his previous experience on board, the skipper had no information or indication of the maximum load *Heather Anne* was able to safely carry. [2.5]

8. The deceased would have had a greater chance of survival had he been wearing a lifejacket. The MCA should now specify what behavioural change it requires and, if this is not delivered, move rapidly to mandate the wearing of PFDs while working on the decks of fishing vessels. [2.8.1]

3.2 OTHER SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION ALSO LEADING TO RECOMMENDATIONS

1. The limitations of the stability assessment methods suggested in MGN 427 (F) make the note of little practical use to fishermen. There is a compelling need to provide stability criteria for fishing vessels <12m (L), which are relevant to their size, construction and operation. [2.5]

2. The Wolfson Guidance mark is potentially a very useful tool to help fishing vessel skippers decide on the loading of their vessels in varying sea conditions. Unfortunately, its accuracy has not yet been validated. [2.5]

3. The current exemption of existing fishing vessels <12m (L) from any stability criteria is unjustified, particularly considering their accident rate and the hazards associated with fishing compared to other small commercial vessel activities. [2.6]

4. The safety of fishing vessels which are substantially modified with the support of an EFF grant would be better assured if the agencies involved worked together to ensure that the vessels concerned maintained sufficient reserves of stability, possibly through the linking of stability assessments to the grant conditions. [2.7]

5. It was fortunate that *Lauren Kate* was nearby. Otherwise, it is highly likely that *Heather Anne*'s skipper would have also perished. [2.8.3]

6. The vessel was not fitted with an EPIRB. [2.8.3]

3.3 SAFETY ISSUES IDENTIFIED DURING THE INVESTIGATION WHICH HAVE BEEN ADDRESSED OR HAVE NOT RESULTED IN RECOMMENDATIONS

1. As the liferaft has not been found, it is impossible to determine why it did not function as expected. It is assumed that the liferaft inflated sufficiently for its buoyancy force to break the 'weak link' but that it only partially inflated, floated away and then eventually sank. [2.8.2]

SECTION 4 - RECOMMENDATIONS

The Maritime and Coastguard Agency is recommended to:

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

- The limitations of the alternatives to a full stability assessment.
- The suitability of the alternative stability assessments for small fishing vessels.
- A vessel's stability is dependent on several factors including her upright GM, freeboard and hull form.
- The need for skippers to be aware of the maximum loading of their vessels and the benefits of a freeboard mark.
- The impact of vessel modifications.
- Owners' and skippers' awareness of stability considerations while fishing.

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

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

and

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

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

2013/109 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 Maritime and Coastguard Agency, the **Marine Management Organisation** and the **Cornish Fish Producers Organisation** are recommended to:

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

The owner of *Heather Anne* at the time of the accident is recommended to:

2013/111 Take steps to ensure that any vessel he may own in the future is operated safely, taking into account the need to:

- Accurately determine the vessel's maximum safe loading and be guided accordingly with regard to the size of catch that may be taken on board.
- Re-apprise himself of the guidance available to fishermen regarding stability, particularly with regard to the stowage of cargo and free surface effect.
- Carefully consider the impact on a vessel's stability before making any modifications.
- Carry an EPIRB in order to enable a swift response by shore authorities in the event of vessel loss or abandonment.
- Ensure that all persons working on a vessel's open deck wear PFDs while at sea.
- Ensure that all crew have completed their mandatory safety training courses.

Marine Accident Investigation Branch
January 2013

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

Marine Accident Report