ACCIDENT REPORT

Report on the investigation of

the capsize and foundering of the fishing vessel

Sarah Jayne (BM 249)

with the loss of one life

6nm east of Berry Head, Brixham

11 September 2012

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

VERY SERIOUS MARINE CASUALTY REPORT NO 13/2013 JUNE 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.

All MAIB publications can be found on our website: www.maib.gov.uk

For all enquiries:
Marine Accident Investigation Branch
Mountbatten House
Grosvenor Square
Southampton
United Kingdom
SO15 2JU

Email: maib@dft.gsi.gov.uk
Telephone: +44 (0) 23 8039 5500
Fax: +44 (0) 23 8023 2459

CONTENTS

FIGURES

TABLES

ANNEXES

GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AIS	-	Automatic Identification System
BST	-	British summer time
DSC	-	Digital Selective Calling
EPIRB	-	Emergency Position Indicating Radio Beacon
FISG	-	Fishing Industry Safety Group
GPS	-	Global Positioning System
HRU	-	Hydrostatic Release Unit
kW	-	Kilowatt
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
MSN	-	Merchant Shipping Notice
PFD	-	Personal Flotation Device
RFA	-	Royal Fleet Auxiliary
RNLI	-	Royal National Lifeboat Institution
ROV	-	Remotely Operated Vehicle
RYA	-	Royal Yachting Association
Seafish	-	Sea Fish Industry Authority
SIB	-	Stability Information Booklet
SOLAS	-	The International Convention for the Safety of Life at Sea 1974, as amended
te	-	Tonne
UTC	-	Universal time, co-ordinated
VCG	-	Vertical Centre of Gravity
VHF	-	Very High Frequency (radio)

Times: All times used in this report are BST (UTC +1) unless otherwise stated.

SYNOPSIS

On 11 September 2012, the 14.94m fishing vessel *Sarah Jayne* was lost approximately 6nm east of Berry Head. While loading the catch, two waves swamped the deck, leading to flooding of the fish hold and eventual capsize, resulting in the loss of the skipper.

Sarah Jayne was trawling for sprats and had loaded approximately 20 tonnes of fish into her fish hold via a flush deck scuttle. The fish hold hatch cover had been removed for access and two freeing ports within the fish pound on the vessel's starboard side had been closed. There was a significant catch still left in the net and, as the next portion of the catch was being lifted on board, a wave swamped the starboard quarter. The crew replaced the fish hold hatch cover and the skipper started pumping out the fish hold. A second wave then swamped the deck, leaving *Sarah Jayne* with a starboard list and substantial water on deck.

A rope securing the net to the starboard side was released and the vessel was steered slowly round into the wind. Shortly afterwards, she capsized to starboard. The mate and crewman managed to swim clear of the vessel and were rescued 20 minutes later by the crew of another fishing boat that was near by. The skipper was lost with the vessel.

Sarah Jayne capsized because in her loaded state she had an insufficient reserve of stability to withstand the sudden flooding and its associated free-surface effect. The flooding of the fish hold and water entrained on deck following the swamping is concluded to be the only likely cause of flooding that contributed to the vessel's loss.

Sarah Jayne's stability information booklet, approved in 1995, specified that catch should be limited to 17.08 tonnes, though modification to the vessel after 2007 would have reduced this limit. Routine landing of catches of this quantity without incident would have reinforced a belief that it was safe for *Sarah Jayne* to carry such loads. However, when heavily laden, *Sarah Jayne* had a low freeboard aft, which increased the risk that waves might wash over the deck. As the weight of catch in the hold increased, so did the risk of downflooding should a wave wash over the deck while fish were being loaded into the fish hold through the open fish deck scuttle, and with the fish hold hatch cover also open.

The liferaft failed to surface and inflate, probably as a result of its being obstructed by the wheelhouse roof overhang when it was released from its stowed position on the aft external bulkhead. Although a definitive reason for an EPIRB transmission not being received following the accident cannot be determined, the carriage of an EPIRB remains an important safety precaution for fishing vessels.

The MAIB has previously made recommendations to the Maritime and Coastguard Agency (MCA) regarding loading, freeboard and future stability standards for small fishing vessels (MAIB Report 2/2013 on the capsize and foundering of FV *Heather Anne*). As part of its intended development of new standards for small fishing vessels, the MCA is additionally recommended to review and include additional design and operational requirements as necessary to ensure that a vessel engaged in bulk fishing remains seaworthy when loading the catch into the fish hold at sea.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *FV SARAH JAYNE* AND ACCIDENT

SHIP PARTICULARS

Vessel's name	Sarah Jayne
Flag	UK
Classification society	Not applicable – not subject to survey
IMO number/fishing numbers	BM 249
Type	Fishing vessel
Registered owner	Privately owned
Manager(s)	Privately managed
Construction	Steel
Length overall	14.94m
Registered length	14.48m
Gross tonnage	23.62
Minimum safe manning	Not applicable
Authorised cargo	Not applicable

VOYAGE PARTICULARS

Port of departure	Exmouth
Port of arrival	Exmouth (intended)
Type of voyage	Coastal
Cargo information	Sprats
Manning	3

MARINE CASUALTY INFORMATION

Date and time	11 September 2012 at 1121 BST
Type of marine casualty or incident	Very Serious Marine Casualty
Location of incident	50º 23.075N, 003º 19.553W, 6nm east of Berry Head, near Brixham
Place on board	Not applicable
Injuries/fatalities	1 fatality
Damage/environmental impact	Minimal pollution
Ship operation	Loading catch
Voyage segment	Mid-water
External & internal environment	West-south-west force 3 to 5 wind; moderate sea; good visibility
Persons on board	3

1.2 FISHING ROUTINE

Sarah Jayne **(Figure 1)** was based in Exmouth. She was used primarily for scallop dredging but also carried out stern trawling, particularly for sprats between August and January. The start and length of the sprat season depended on fish stocks. At the time of the accident, sprat stocks were abundant and local fishing vessels were landing large catches.

Sarah Jayne's crew began their sprat fishing season on 22 August 2012, following a period of vessel maintenance. Up until the vessel's loss, they had managed to fish for 8 days, including the 2 days immediately prior to the accident.

The skipper's normal routine was to fish during the day and return to port each night. When sprat fishing, the crew worked 6 days a week, Sunday to Friday.

1.3 ENVIRONMENTAL CONDITIONS

The weather on the day of the accident was broadly as forecast. The wind was force 3 to 5 from the west-south-west and the sea conditions deteriorated from slight to moderate during the morning. Visibility was generally good to moderate. It was 3 days after neap tides. At the time of the accident, the predicted tidal stream was about 0.5 knot in a south-westerly direction.

1.4 NARRATIVE

1.4.1 Events prior to the accident

Sarah Jayne sailed from Exmouth at 0515 on 11 September 2012, with the skipper, mate and crewman on board. The mate took charge of the watch for the passage to Brixham while the skipper rested. They arrived at Brixham at 0715 and loaded 1 tonne (te) of ice in the aft centre pound of the fish hold.

Fishing vessels *Constant Friend* and *Girl Rona*, with which *Sarah Jayne* often fished, were already heading towards the fishing grounds in Torbay. At about 0740, *Sarah Jayne* departed Brixham and a course was set for the fishing grounds. During the passage to the fishing grounds the mate rested, but he was called to assist with shooting the gear, which occurred around 0830-0845. The skipper started his tow in a south-easterly direction with 90 fathoms of wire deployed. Later, another 20 fathoms of trawl wire length was veered as the shoal of fish the vessel was tracking had swum deeper. At about 1000, the skipper decided to haul the net. **Figure 2** shows *Sarah Jayne*'s track from AIS and the Succorfish GPS tracking system.

The deck was prepared for loading the fish on board: the flush deck scuttle within the deck pound was removed, the two starboard freeing ports within the pound were closed, and the fish hold hatch cover was lifted off and placed on the port side of the deck **(Figure 3)**. The trawl wires were hauled, with the mate operating the main winch and the crewman tending the net sensor cable. The deck wash was continuously running, powered by the engine-driven bilge/deck wash pump that was drawing its suction from the sea. Once the trawl wire had been hauled in to the 10-fathom mark, the skipper moved from the wheelhouse to the winch controls so that the mate could join the crewman in securing the trawl doors. Once the net

Figure 1: *Sarah Jayne*, rigged for stern trawling

Reproduced from Admiralty Chart BA 3315 by permission of the Controller of HMSO and the UK Hydrographic Office

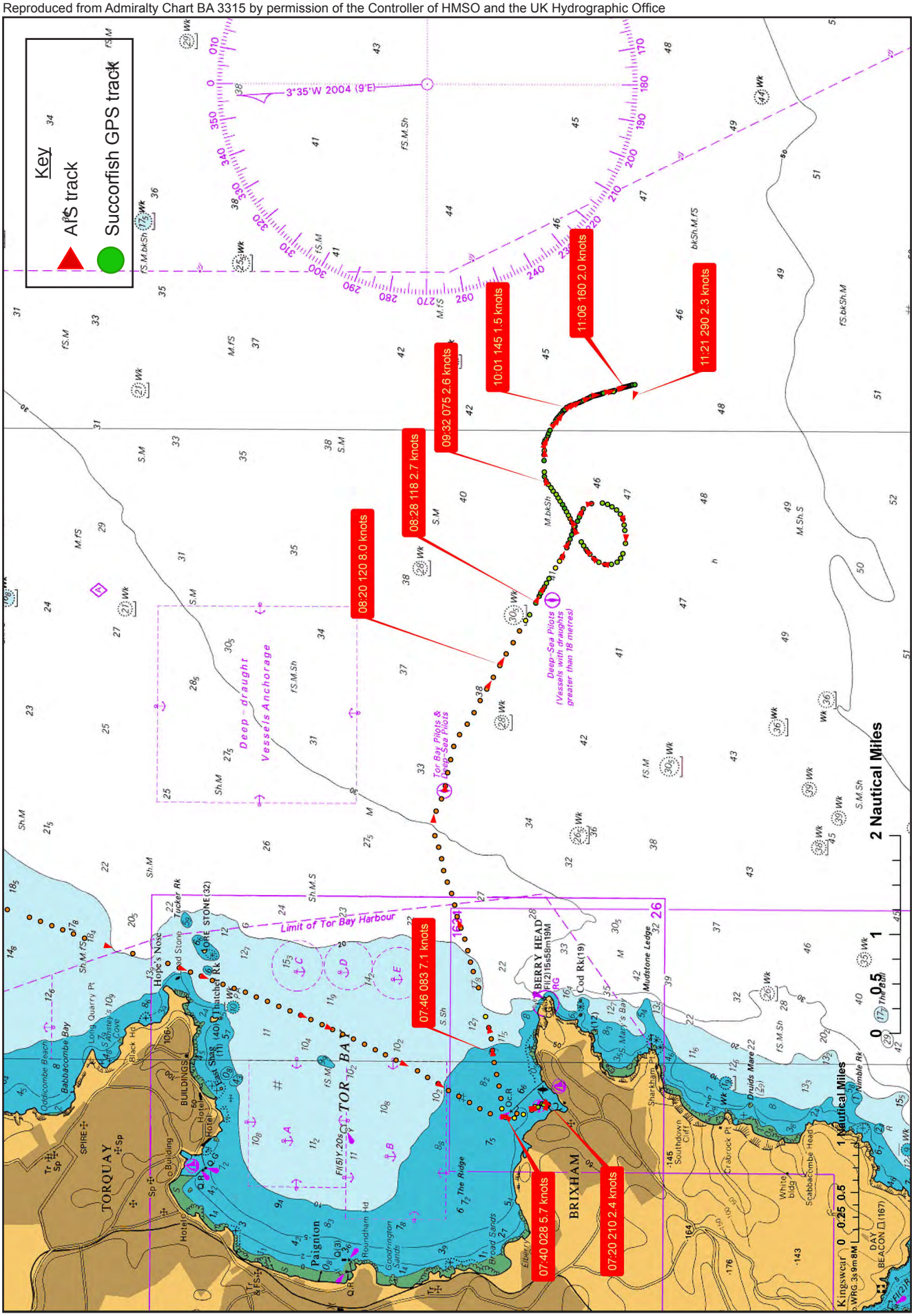


Figure 2: *Sarah Jayne*'s track from AIS and Succorfish GPS tracking system

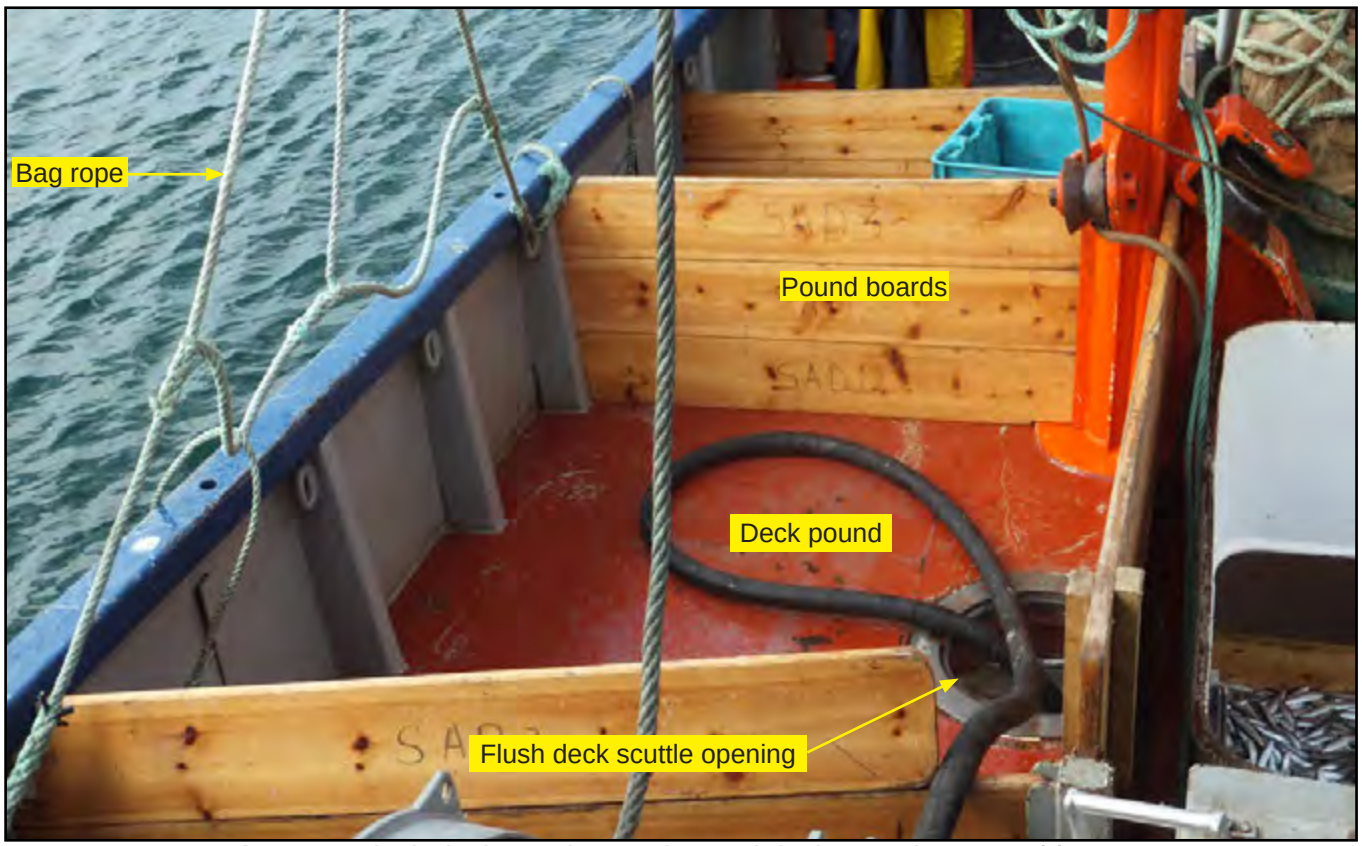


Figure 3: Flush deck scuttle opening and deck pound on FV *Girl Rona*

had been secured on the net drum and partially hauled, the crewman removed the sensor from the headline of the net. He then went down into the aft centre pound of the fish hold to prepare for loading the fish.

After hauling the net sufficiently to retrieve the dog rope, the skipper returned to the wheelhouse, took the engine out of gear and allowed the vessel to drift with the starboard beam to the wind. This enabled the net to be brought round on to the starboard quarter and secured alongside with a rope. The lifting becket[1] was hauled and the cod-end **(Figure 4)** lifted over the rail and held against the bag rope **(Figure 3)**. The cod-end was released into the fish hold through the flush deck scuttle opening. The cod-end was then re-secured and dropped back into the water, the lifting becket was released allowing fish to fill the cod-end again, and the lifting procedure was repeated. Each time the cod-end was lifted on board it contained about 1te of fish.

The crewman in the fish hold inserted pound boards to enable the port side to be filled with fish first via a metal chute connected to the flush deck scuttle opening. As normal with a large catch, this resulted in the vessel listing heavily to port, with the port side main deck awash. The fish hold centre and starboard pounds were then filled with the intention of returning the vessel to an upright condition. The crewman climbed out of the fish hold after about 10-12te of fish had been loaded, leaving the centre and starboard pounds filling with fish. During loading, the skipper briefly entered the engine room to redirect the bilge pump suction to the fish hold, so that the water entrained in the catch, which had filtered down into the bilge, was pumped overboard. He later returned the bilge pump suction to draw from the sea, as the water seen emitting from the deck wash hose had significantly reduced.

[1] Besides providing a lifting point, the lifting becket also tightened around the cod-end, so that only the fish between the becket and the opening in the end of the cod-end were released onto deck.

Figure 4: Cod-end

1.4.2 Swamping and capsize

After approximately 20 lifts, and as the cod-end was next being lifted, creating a starboard list, a wave broke over *Sarah Jayne*'s starboard quarter, causing water to flood down through the fish hold hatch and flush deck scuttle opening. The mate and crewman quickly replaced the fish hold hatch cover. The starboard side of the hatch cover was secured by being jammed against the pound boards, while one clip on the port side was screwed down. The skipper lowered the net back into the water and then re-entered the engine room to again redirect the bilge pump suction to the fish hold. While he was below, a second wave swamped the starboard quarter, causing further flooding and resulting in the vessel listing further to starboard with the deck awash up to the side of the fish hold hatch coaming, and the starboard bulwark rail underwater.

The mate released the rope securing the net to the starboard side, and the skipper steered the vessel slowly to starboard to bring her head into the wind. Meanwhile, the mate and crewman retrieved the pound boards that were floating freely around the deck and stowed them on the port side.

The skipper made a brief very high frequency (VHF) radio call to the crew of *Girl Rona,* whom he knew were nearby; he said that he had a problem and asked if the vessel could stand-by. *Girl Rona*'s crew had just finished loading their own catch of sprats. They located *Sarah Jayne* on radar 3-4nm away and proceeded towards her.

A few minutes later, at about 1121, *Sarah Jayne*'s skipper made another call saying that he thought he was 'losing it', to which *Girl Rona*'s skipper responded 'get out'. At this point, *Sarah Jayne* rolled slowly to starboard and capsized to the inverted position. The mate and crewman managed to get clear but the last sighting of the skipper was of him entering the wheelhouse. *Girl Rona*'s crew saw *Sarah Jayne* capsize and sent a 'Mayday Relay' message on VHF radio Channel 16. Brixham Coastguard responded immediately, and the Portland Coastguard rescue helicopter and local lifeboats were tasked.

The mate and crewman managed to grab hold of a lifebuoy, some pound boards and two fenders to aid their flotation, as they swam away from the vessel. They shouted for the skipper, but there was no sign of him. *Sarah Jayne* sank at approximately 1129.

1.4.3 Rescue and wreck location

At 1141, *Sarah Jayne*'s mate and crewman were rescued by the crew of *Girl Rona*. Other vessels had responded to the 'Mayday Relay' and a search for the missing skipper was co-ordinated by Brixham Coastguard.

The two rescued crew changed into dry clothes and were given a warm drink before they were collected by a fast rescue craft from RFA *Wave Knight*. They were checked by a medic on board before the Portland Coastguard rescue helicopter transported them to Torbay Hospital. They were released from hospital later the same day, with no serious injuries.

The wreck of *Sarah Jayne* was located on the seabed, in 50m water depth, shortly after the accident. Following the unsuccessful surface search for the missing skipper, his body was subsequently retrieved from inside the vessel by volunteer divers on 20 September 2012. The subsequent postmortem examination determined the cause of death to be drowning.

1.5 CREW

1.5.1 Owner/skipper

The skipper, Geoff Ingram, had also been the vessel's owner for the previous 14 years. He was 51 years old and had fished since 1976. He was a well-respected, experienced and successful fisherman.

He had completed all the mandatory fishermen's basic safety training courses in 1989 and the safety awareness training course in 2002, and had refreshed his first-aid training in 2005. He had also been involved in several fishing safety initiatives during his career. He held a Royal Yachting Association (RYA) Coastal Skipper and Yachtmaster Offshore Shorebased Certificate, which he obtained in 1998. There was no record of him having attended the voluntary 1-day Seafish intermediate stability awareness course.

As well as fishing, he served with the Exmouth lifeboat for 18½ years and had retired from the Royal National Lifeboat Institution (RNLI) as the deputy coxswain. During his service, he received a commendation for bravery.

1.5.2 Mate

The mate was 33 years old and had fished all his life, starting on his father's angling boat. At the age of 16 he started an RYA Yachtmaster Theory course, but did not complete it. He started work as a crewman on *Sarah Jayne* in 2000. He became mate in 2005/2006 and had acted as relief skipper on several occasions when the owner was away. He had attended three of the mandatory fishermen's basic safety training courses in July 2001 and the safety awareness training course in November 2002, and had refreshed his first-aid training in 2005.

1.5.3 Crewman

The crewman, who was 29 years old, had fished for 6 years, and had acted as crewman on three other boats operating from Exmouth. He had worked on *Sarah Jayne* for 3 years. He had attended the mandatory fishermen's basic safety training courses in 2009, including the 1-day health and safety (safe working practices) training course.

1.6 VESSEL BACKGROUND

1.6.1 Design

Sarah Jayne was built in 1979 by W. Visick & Sons Ltd, Truro. She was a multi-purpose fishing vessel, capable of being used for scallop dredging as well as beam and stern trawling **(Figure 5)**. However, the owner had never used the vessel for beam trawling and had not sought a licence to do so.

Sarah Jayne was built as the second in a series of three similar sister vessels all developed by the same designer. The first, *Gerry Ann C* (TH 257), was constructed in 1975 and the third, *Girl Rona* (TH 117) **(Figure 6)**, was completed in 1980. All three vessels operated in the Torbay and Lyme Bay area.

The previous owner of *Sarah Jayne* had sold the vessel to Geoff Ingram in July 1998 as he took ownership of a new vessel, *Constant Friend* (BM 484), the same year. This vessel was a development of the earlier design with the accommodation under the wheelhouse removed to provide space for a larger capacity fish hold (30 tons compared to 25 tons in the original design). *Constant Friend* operated in the same area as *Sarah Jayne* and, along with *Girl Rona,* was involved in the search after the accident.

1.6.2 Main engine and deck machinery

Sarah Jayne was fitted with a Cummins NTA855-M main engine, permanently de-rated to 221kW, which provided propulsion and electrical power, and drove the hydraulic pumps and a bilge/deck wash pump.

A North Sea Winch GF-80 provided a mid-drum pull of 4te. An hydraulic main net drum, which was used when stern trawling, and a smaller net drum fitted above the main net drum to assist with net repair, were also fitted. The latter was empty at the time of the accident.

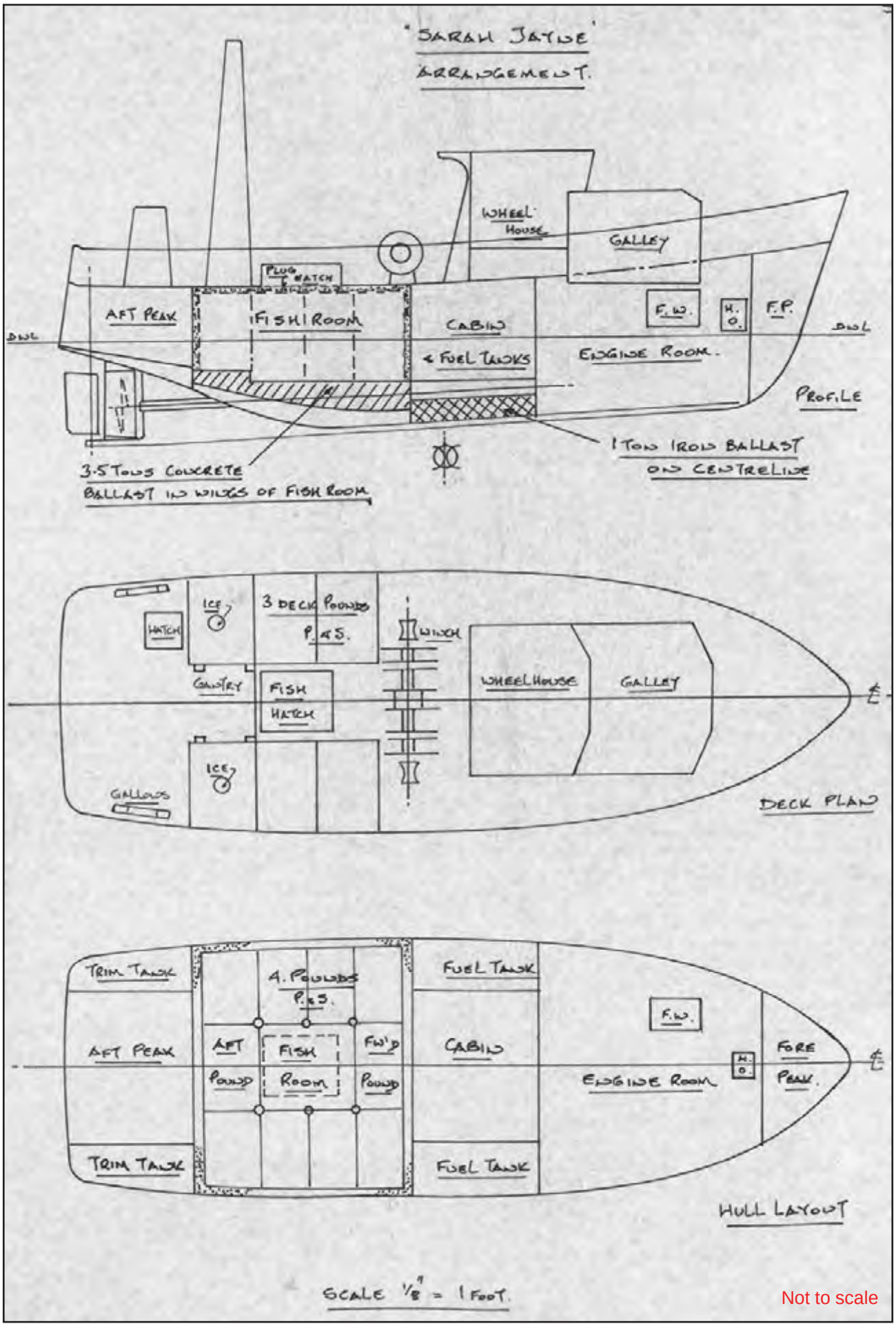


Figure 5: *Sarah Jayne* general arrangement

Figure 6: FV *Girl Rona*

1.6.3 Maintenance

Sarah Jayne underwent a refit each summer. She was slipped in June 2012 for shot blasting, antifouling and repair to her bulwarks and freeing ports. In August 2012, the vessel was lifted out for further work, including painting of her topsides and replacement of the main sea-chest. Some new electronic equipment was also fitted.

1.6.4 Ballast tanks, bilge pumping and bilge alarms

Sarah Jayne was originally fitted with three ballast tanks: a fore peak tank with a capacity of 4te, and 2 aft trim tanks each with a capacity of 2te. If required, the tanks were filled using the deck wash hose from the main deck. The aft tanks were emptied using the bilge system. A goose neck vent, which rose to the underside of the bulwark rail, and had a section of flexible hose attached to its end, provided ventilation for each of the three ballast tanks.

At the time of the accident, the starboard aft trim tank was used as a store, with access provided from the aft peak. The port aft trim tank was used only occasionally to provide an initial port list to help the loading of bulk fish. The fore peak tank was never used.

The engine-driven bilge/deck wash pump ran constantly, ejecting water via the deck wash hose. The pump took its suction either directly from the sea or from an internal compartment by opening the relevant valve on the sea-chest in the engine room. Bilge suctions were situated in the engine room, accommodation, aft peak, aft trim tanks and the fish hold. All the bilge suction lines were fitted with non-return valves to prevent back-flooding. The fish hold suction line was of a larger bore

than the others to facilitate more rapid pumping. To enable the fore peak tank to be emptied, a valve was fitted to allow the tank's contents to be drained into the engine room.

Sarah Jayne had originally been fitted with a back-up manual bilge and fire-fighting pump system, but this had been removed and a petrol-driven salvage pump was carried instead.

All sea inlets and overboard discharges were situated in the engine room with the exception of a redundant sea inlet valve in the accommodation that had been previously used to supply the manual bilge and fire-fighting pump system.

A bilge alarm system was fitted with sensors in the aft peak, accommodation and engine room. A sensor was not fitted in the fish hold owing to the regular need to have water in the fish hold during bulk fishing. The bilge alarm was audible on the main deck and was not heard prior to or during the accident. The engine room sensor was last tested prior to the refit in August.

1.6.5 Freeing ports

Sarah Jayne was fitted with five freeing ports on either side to allow shipped water to be shed from the deck. The aftermost pair were fitted with a grillage and had no closures. The other four on each side were fitted with steel shutters that could be closed. The freeing ports varied in size slightly but the majority were 0.14m^2, providing in total a greater capacity than that required under The Fishing Vessels (Safety Provisions) Rules 1975.

1.6.6 Liferaft

In accordance with The Fishing Vessels Code of Practice for the Safety of Small Fishing Vessels, the vessel was fitted with a 4-man Seasafe ISO9650-1 standard liferaft, mounted vertically on the external aft bulkhead of the wheelhouse. The liferaft, manufactured in January 2012, was on hire and had been fitted by the owner in August 2012 to replace his own liferaft **(Figure 7)**, which was due its periodic service. The owner had intended to fit the latter on the wheelhouse roof as a spare.

On hiring the new liferaft, the owner fitted a new liferaft cradle and, in accordance with best practice, a new 'green' Hammar Hydrostatic Release Unit (HRU). The 'green' HRU was intended for non-SOLAS vessels and was designed to release before reaching 4m water depth.

Marine Guidance Note (MGN) 343 (F) Hydrostatic Release Units (HRU) – Stowage and Float Free Arrangements for Inflatable Liferafts provides generic guidance on securing, stowing and launching of liferafts. The guidance includes the following key points on liferaft stowage:

- 'stow containers with drain holes at the bottom;
- stow longitudinally in horizontally fixed cradle;
- stow to give protection from weather, smoke, soot, oil, flooding and accidental damage;

- ensure liferaft can be manually released easily in an emergency by operating the senhouse slip or other release mechanism, and does not need tools or a knife';

and not to:

- 'lash in cradles;
- stow under overhanging decks or awnings'.

Image courtesy of Bill Whateley

Figure 7: *Sarah Jayne* (liferaft and EPIRB positions)

1.6.7 EPIRB

A McMurdo E3 EPIRB was purchased and registered to *Sarah Jayne* in September 2005. This replaced a previous emergency beacon that had been fitted in 2001. The EPIRB was fitted in a float-free canister mounted on the aft port side of the wheelhouse roof **(Figure 7)**. The EPIRB was serviced in September 2010 and a new 'Break-thru' HRU was listed on the service invoice.

No transmission was received from the EPIRB following the vessel's capsize and foundering.

1.6.8 Other safety equipment

Two Perrybuoy lifebuoys were carried, one on each of the port and starboard sides of *Sarah Jayne*'s wheelhouse. The port lifebuoy was fitted with a lanyard attached to a smoke and light float.

Four solid foam lifejackets were stowed in the wheelhouse, and three constant wear personal flotation devices (PFD) were kept in the galley/mess area. PFDs were not routinely worn by the crew and neither the PFDs nor the lifejackets were donned prior to, or during, the accident.

A digital selective calling (DSC) VHF radio was fitted in the wheelhouse. No radio distress alert or message was received from *Sarah Jayne*. An AIS unit and a Succorfish GPS tracking system were fitted on board, enabling *Sarah Jayne's* position, speed and course over the ground to be monitored.

1.7 WRECK SURVEY

Three remotely operated vehicle (ROV) surveys were conducted on the wreck of *Sarah Jayne*. These, together with reported observations from the volunteer divers, identified the following:

- The wreck was upright on the seabed with the net, still significantly full with fish, attached to the vessel **(Figure 8)**.
- The Seasafe liferaft was on the seabed to the port side of the vessel with the painter leading up and over the bulwark rail **(Figures 9** and **10)**.
- The fish hold hatch cover was on the starboard side of the main deck with the access hatch open and a securing lug damaged **(Figure 11)**.
- At least two of the freeing ports on the starboard side appeared to be closed.
- The engine room escape hatch cover and starboard side door to the galley/ mess were closed.
- The wheelhouse door was open.
- The trawl doors were in their stowed position although the port trawl door was not lying vertically.
- The port lifebuoy was floating in the vicinity of the engine exhaust.

Given the poor underwater conditions, it was not possible to determine:

- which two of the freeing ports on the starboard side appeared to be closed;
- whether or not the EPIRB and its float-free housing were on the wheelhouse roof; and
- if the flush deck scuttle was open or closed.

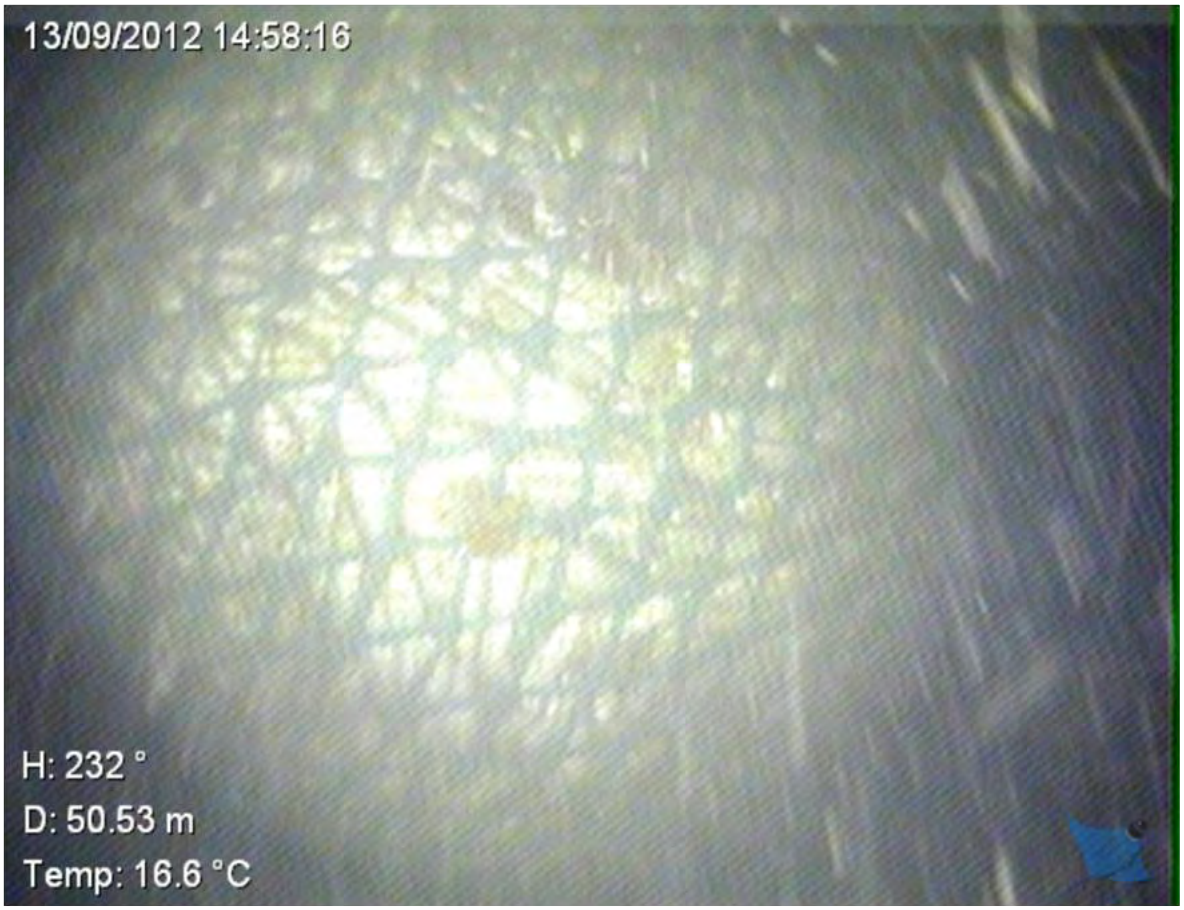


Figure 8: *Sarah Jayne*'s net

Figure 9: Liferaft on seabed with painter

Figure 10: Liferaft on seabed

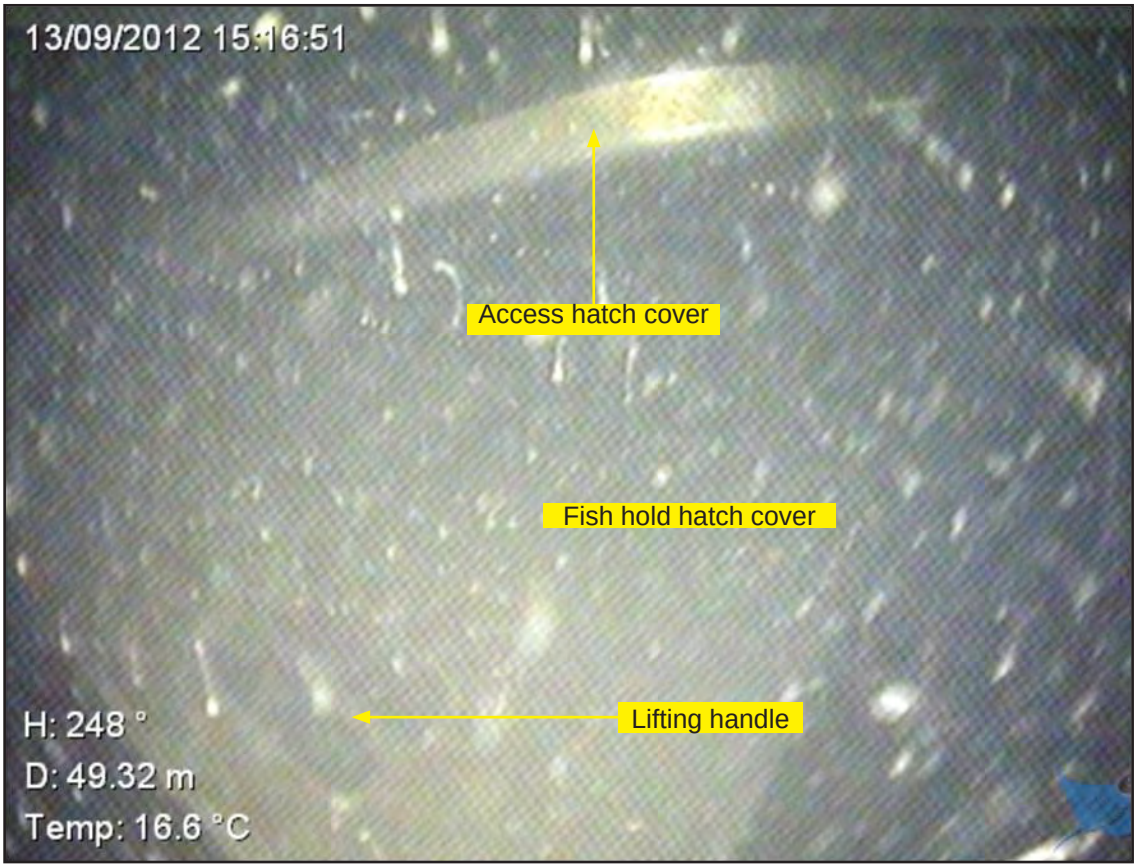


Figure 11: Fish hold hatch cover

1.8 SAFETY LEGISLATION AND SURVEY REGIME

1.8.1 The Fishing Vessels (Safety Provisions) Rules 1975

Sarah Jayne was constructed in accordance with The Fishing Vessels (Safety Provisions) Rules 1975. These required a stability information booklet (SIB) demonstrating that the vessel complied with specific stability criteria. The SIB was approved by the Maritime and Coastguard Agency (MCA), and a lightship check was required at renewal surveys, every 4 years, to ensure the SIB remained valid. The Rules also required an inspection of the vessel 2 years prior to certificate renewal.

The vessel was required to comply with the following in respect of freeboard:

> 'Every vessel of 12 metres in length and over to which these Rules apply shall be so designed, constructed and operated as to ensure that in all foreseeable operating conditions the freeboard will be adequate to provide:-
>
> (a) compliance with the stability criteria set out in Rule 16 of these Rules;
>
> (b) reasonable safety for men working on deck;
>
> (c) reasonable safety to the vessel from the entry of water into enclosed spaces having regard to the closing appliances fitted.'

Merchant Shipping Notice (MSN) 975 Freeboards of Fishing Vessels expanded upon this requirement in 1981 by providing minimum freeboard values. It stated:

> *'It has been observed that many vessels engaged primarily in bulk fishing are frequently loaded such that the reserves of stability and 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.'*

1.8.2 Survey under the 1975 Rules

Sarah Jayne was last surveyed by the MCA under the 1975 Rules survey regime in 2001 and was issued a fishing vessel safety certificate valid until 31 August 2005. As part of the survey a hull thickness report was compiled and a lightship check was conducted. A few minor items were raised and rectification action was taken. The surveyor concluded in his report:

> *'The vessel is a credit to the owner-skipper and is kept in a good state of repair and maintenance.'*

1.8.3 The Fishing Vessels (Code of Practice for the Safety of Small Fishing Vessels) Regulations 2001 (as amended)

In April 2001 The Fishing Vessels (Code of Practice for the Safety of Small Fishing Vessels) Regulations 2001 came into force. They applied to all fishing vessels under 12m registered length. The Code, in essence, required owners of small fishing vessels to:

- adhere to a basic checklist of safety equipment;

- carry out a risk assessment to ensure satisfactory precautions were taken;
- conduct annual self-certification inspections; and
- present the vessel for inspection to the MCA at least every 5 years.

The Code did not include any specific stability or freeboard requirements. The Regulations were amended in 2002 to include all fishing vessels under 15m length overall. *Sarah Jayne* was, therefore, no longer legally required to meet any stability or freeboard requirements.

The Code was revised in 2007, published as MSN 1813 (F), and stated that stability requirements would be reintroduced for fishing vessels between 12m registered length and 15m length overall. However, as the underpinning legislation was not in place, this category of vessel was only recommended to meet the stability requirements. Annex 4 of the Code expanded upon the stability information that should be provided. The Code also recommended owners to arrange a lightship check at intervals not exceeding 5 years from the last lightship check to verify that the stability information provided remained valid.

In December 2010, the MCA published MGN 427 (F) Stability Guidance for Fishing Vessels of Under 15m Overall Length **(Annex A)**. It reiterated that full stability requirements would be reintroduced for fishing vessels 12m and over registered length but less than 15m length overall. It also re-emphasised the legal obligations of owners and skippers under The Fishing Vessel (Health and Safety at Work) Regulations 1997 to provide a safe working environment. In the absence of statutory stability requirements, it offered several methods for owners and skippers to assess stability to support this aim. Three of the proposed methods, including the Wolfson Guidance Mark, employ a freeboard mark to provide loading guidance to the operator.

At the time of the accident, the intended legislation to reintroduce stability requirements for fishing vessels 12m and over registered length to 15m length overall had not been introduced, primarily owing to government initiatives to reduce regulation. Therefore, compliance with stability requirements remained a recommendation.

1.8.4 Inspections under the Code of Practice for the Safety of Small Fishing Vessels

Since 2002, *Sarah Jayne* had been inspected four times: in 2006, 2008 and twice in 2010. Only minor deficiencies were identified. At the last inspection in April 2010, the liferaft HRU was found to be out-of-date and the first-aid kit required replacement.

1.9 STABILITY AND LOADING

1.9.1 Original stability information

The designer of *Sarah Jayne* completed stability calculations when the vessel was constructed and, following the initial inclining experiment to determine the vessel's lightship displacement and centre of gravity, the SIB was approved by the MCA in 1981. **Annex B** contains relevant extracts from the 1981 SIB. In particular, the SIB stated:

> *'The capacity of the fish room is 25 tons which is the maximum capacity of the vessel to meet the stability requirements and freeboard rule.'*

1.9.2 Lightship check and new SIB

Following a lightship check, another inclining experiment was conducted in February 1994. The vessel was found to have increased in weight by 6.924 tons (7.03te) to 55.534 tons (56.42te). The vertical centre of gravity (VCG) had remained virtually the same at 7.568 feet (2.31m). A new SIB was produced, which was approved by the MCA on 21 April 1995. This was signed by the owner at the time and placed on board the vessel. **Annex C** contains relevant extracts of the 1995 SIB.

The increase in lightship displacement led to a reduction in the maximum loading permitted for the vessel to 16.81 tons (17.08te). Whereas the original SIB had suggested the ballast tanks should be used to maintain the design trim, the 'Notes to the Skipper' in the 1995 SIB stated:

> *'On returning to port with a full load of Sprats the forward trim tank should be filled to 100% capacity. This tank should be "pressed up" to avoid any "free surface effect".'*

It also stated:

> *'The loading of fish and in particular Sprats, is restricted to the forward pounds of the fish room. The after pounds, aft of the fish room hatch, should not be used to carry fish. This will reduce the after trim of the vessel and maintain the freeboard requirements…..*
>
> *The maximum capacity of the fish room loaded as above is 16.81 tons, which is the maximum capacity of the vessel to maintain the freeboard and stability requirements.'*

Sarah Jayne's lightship was checked in 1997, with little change. Therefore, the 1995 approved SIB remained valid and this was the information that was provided with the vessel to Geoff Ingram when he took ownership. During his ownership, the vessel's lightship was checked again on 30 July 2001 and the results indicated no further weight growth had taken place. The 1995 SIB and conditions contained within it remained valid.

1.9.3 Modifications since 2001

There are no records of lightship checks or inclining experiments having been conducted since 2001. However, several major modifications were completed during this period. These included:

- Replacement of the original Gardner 8L3B engine (dry weight 3.2te) with a new Cummins NTA 855-M engine (dry weight 1.45te).
- Replacement of the original trawl winch (weight unknown) in 2006 with a North Sea Winch GF-80 **(Figure 12)**.
- Installation of a small net drum (estimated weight 0.25te), approximately 3m above the main deck.

It is unknown if the owner had manually corrected the SIB to account for these alterations as the SIB was lost with the vessel. However, he had sought advice from a consultant naval architect in May 2005 prior to fitting the additional net drum. After some preliminary calculations, it was concluded that the net drum could be fitted but that it would reduce the vessel's stability. No further calculations or amendments to the SIB were requested.

Both MSN 1813 (F) and MGN 427 (F) emphasise the importance of ensuring stability has not been degraded by vessel modifications.

Figure 12: *Sarah Jayne*'s new trawl winch and fish hold hatch cover in 2006

1.9.4 Vessel loading

At the time of the accident, it was estimated that there were 20te of fish in the fish hold. The landing records for *Sarah Jayne* confirm the greatest landing weights coincided with sprat fishing. Since August 2010, the following sprat landings were recorded:

Year	Catch<10te	10te<Catch<17.08te	17.08te<Catch<20te	Catch>20te
2010	41	30	8	5
2011	13	10	0	0
2012	4	1	1	2

Table 1- Sprat landings since August 2010

These figures do not include by-catch or poor quality fish that was landed.

1.9.5 Use of hatches and flush deck scuttles while loading

The method of loading bulk fish on board *Sarah Jayne* was common to other vessels engaged in the same trade, and it necessitated using a flush deck scuttle to allow the fish to enter the fish hold quickly and easily. *Sarah Jayne* had three flush deck scuttles when she was built but, at the time of the accident, only one remained, positioned between the fish hatch and the starboard bulwark.

The 1975 Rules provided requirements for watertight integrity. Hatch coamings for a vessel of *Sarah Jayne*'s dimensions were required to be a minimum height of 380mm, and hatch covers were required to be secured with suitable gasket and clamping arrangements to ensure the hatch could be sealed weathertight. Flush deck scuttles and manholes (eg access hatches) were also permitted as follows:

> *'In every vessel of 12 metres in length and over to which these Rules apply, flush deck scuttles of the screw, bayonet or equivalent type and manholes may be fitted where these are essential for fishing operations and shall be capable of being closed watertight and shall be permanently attached to the structure, provided that such scuttles and manholes may be effectively weathertight only when closed if their design, size and disposition is such that no danger is likely to result from the absence of complete watertightness.'*

Seafish Construction Standards, published in September 2012, impose enhanced requirements for new-build fishing vessels less than 15m length overall. Hatch coamings are required to be a minimum height of 300mm, and hatch covers should preferably be secured by hinges on the forward side or otherwise permanently attached to the structure. Flush deck scuttles are to be permanently attached to the structure with a notice in close proximity stating:

> *'HATCH TO BE KEPT CLOSED AT SEA'*

The Standards also recommend that access, loading and discharge hatches that are likely to be opened at sea, should be positioned on the centreline where practicable.

1.10 STABILITY AWARENESS

1.10.1 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 4,500 fishermen.

The course uses a series of visual animations and a specially designed model boat to explain key aspects of stability and to provide fishing vessel 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 simulated 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 fishermen the importance of maintaining adequate stability, specific MAIB accident investigations are highlighted. An end-of-course assessment requires a pass mark of 60%.

1.10.2 Guidance available

There are several sources of guidance available to fishermen, some of which have already been discussed. In 2008, the MCA provided a copy of its 'Fishermen's Safety Guide' (MCA/034) to every UK fishing vessel certificate holder. The guide provides basic information on a variety of topics including stability, freeboard, loading and free-surface effect **(Annex D)**.

Additionally, MGN 415 (F) Fishing Vessels: The Hazards Associated with Trawling, including Beam Trawling and Scallop Dredging provides useful reminders on the closure of hatches, the importance of keeping freeing ports clear and the danger of trapped water on deck.

At the time of writing, the RNLI, the Fishing Industry Safety Group (FISG) and the MCA were planning to work together to produce a short film for fishermen, highlighting the various aspects of stability.

1.11 PREVIOUS ACCIDENTS

The following accidents, although dissimilar in many respects to the loss of *Sarah Jayne*, have particular aspects that are relevant to the findings of this investigation.

1.11.1 FV *Heather Anne*

In 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, but not before the crewman had drowned. Neither the skipper nor the crewman was wearing a lifejacket.

A subsequent stability assessment, after the vessel was salvaged, indicated that the vessel had been operating with a low reserve of stability. *Heather Anne* had been significantly modified since her construction in 1971. As a consequence, her lightship displacement had increased by over 50% and, with an estimated catch of 10.5te on board at the time of capsize, her freeboard had been reduced to only a few centimetres.

The MAIB safety investigation identified the MCA's intention to harmonise fishing vessel standards for new vessels with those applicable to small commercial vessels by 2016. The report also acknowledged the introduction of minimum design freeboard in the Seafish Construction Standards, which came into force on 1 January 2013.

Recommendations were made 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 was made to the MCA, which was designed to provide support for ongoing efforts that seek to ensure fishermen wear PFDs when working on the open deck.

1.11.2 FV *Girl Rona*

In January 2012 *Sarah Jayne's* 'sister vessel' *Girl Rona* capsized while entering her home port of Teignmouth with a catch of herring in her fish hold. The liferaft was deployed but all five crew managed to abandon the vessel to the local RNLI lifeboat.

The tide and wind had resulted in rough sea conditions at the entrance to the harbour. As *Girl Rona* negotiated the sand bar present at the harbour entrance, the vessel took a sheer to starboard and listed to port, probably resulting in some of the 18te of herring in the fish hold spilling over the pound boards. The list increased as the vessel became broadside on to the waves and she capsized in the shallow water, resulting in her port side resting on the seabed.

The vessel was subsequently salvaged and repaired. She had been back at sea about a month before she was involved in the search and rescue operation following the loss of *Sarah Jayne*.

1.11.3 Other cases

From 1992 to May 2013, 108 fishing vessels under 15m length overall were recorded in MAIB's accident database as having capsized. In the same period, 17 fishing vessels of 15m or more length overall were recorded as having capsized. These figures include capsizes caused by swamping, snagging of fishing gear, excessive loading, shift of cargo and heavy weather.

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 MECHANISM OF VESSEL LOSS

2.2.1 Cause of capsize

Sarah Jayne capsized because, in her loaded condition, she had an insufficient reserve of stability to withstand the sudden flooding and its associated free-surface effect. There were several contributing events that led to the loss:

- A catch of approximately 20te was loaded into the fish hold, reducing the vessel's freeboard.
- The significant catch remaining in the net in the water had the effect of damping the ability of *Sarah Jayne*'s stern to rise or roll to port as waves approached the stern.
- Two waves swamped the vessel's starboard quarter as a result of her low aft freeboard.
- The flush deck scuttle and fish hold hatch cover were open/removed, enabling water to enter the fish hold.
- Two freeing ports on the starboard side were closed, restricting the ability of the entrained water to drain off the deck.

2.2.2 Likely cause of flooding

The two waves that swamped the stern of the vessel would have led to a considerable amount of water entering the fish hold, through the fish hold hatch and, in particular, the flush deck scuttle opening. The possibility of other flooding contributing to the vessel's loss was considered and is discussed below.

Assuming that the bilge alarm system was functioning, the fact that no alarm was heard at any stage up to the capsize suggests that the aft peak, accommodation and engine room were free of floodwater. Additionally, these three spaces had been visited on the morning of the accident as follows:

- The aft peak had been entered by the crew while in Brixham to retrieve some spare gear. It was found to be dry and the deck hatch cover was secured after exiting the compartment.
- The accommodation was dry when the mate left the space before shooting the net at around 0830-0845.
- The skipper visited the engine room at least 2-3 times during the morning and raised no concerns with the crew.

The engine room was the most likely compartment to have suffered any flooding as virtually all sea water inlets and overboard discharges were situated there.

The port aft trim tank was not in use at the time of the accident although it is feasible that some water might have entered the tank via the deck vent when the vessel listed to port during the fish-loading process. However, the vent was fitted with a piece of flexible hose that should have prevented back-flooding if submerged. It is unlikely the starboard aft trim tank was flooded as it would have overflowed into the aft peak due to its manhole cover having been removed.

It is unlikely that a non-return valve failure led to back-flooding through the bilge pumping system because:

- The bilge alarm would have sounded if the engine room, aft peak or accommodation had flooded.
- The vessel would have taken an initial port list if the aft port trim tank had flooded.
- Prior to loading the fish there was no evidence of water having back-flooded into the fish hold.
- The system had functioned correctly since testing after the refit in August.

It is concluded that the only likely cause of flooding was the ingress of sea water through the fish hold hatch and flush deck scuttle opening.

2.3 STABILITY AND FREEBOARD

2.3.1 Loading limit

Although they were recommended, *Sarah Jayne* was no longer legally required to comply with any stability or freeboard requirements following the 2002 amendment to The Fishing Vessels (Code of Practice for the Safety of Small Fishing Vessels) Regulations 2001. However, the instructions provided in her SIB remained valid.

The fish hold was physically capable of carrying 25 tons of fish and this limit for sprat fishing was included in the vessel's original SIB. However, the amended SIB, approved in 1995 by the MCA, stated that the maximum catch of sprats to be carried was 16.81tons (17.08te) to ensure the vessel complied with the stability and freeboard requirements.

The stability and freeboard requirements are intended to ensure that a vessel has a sufficient stability margin to survive external loads such as those from swamping, flooding, snagging of nets and heavy weather. Loading beyond the calculated limit for a vessel erodes her reserve of stability, placing the vessel and her crew at increased risk.

Since August 2010, catches of greater than 17.08te were landed from *Sarah Jayne* on 16 occasions, 7 of which were over 20te. Routine landing of catches of this quantity without incident would have reinforced a belief that it was safe for *Sarah Jayne* to carry such loads. A common misconception by fishermen is that they can feel the stability of a vessel when on board and can judge when it is safe.

Unfortunately, stability cannot be instantly assessed in this manner, given the many variables involved. Predicting precisely when a vessel will capsize is virtually impossible, which is why a vessel's stability needs to be assessed against standard criteria to provide an adequate safety margin. By way of a comparison, it is possible to lift loads in excess of a sling's safe working load numerous times, but at some stage the sling may suddenly break without warning. Safety margins exist to provide a cushion for the unknown and unexpected; those who operate within these margins are exposing themselves to an increased and unnecessary risk.

2.3.2 Lightship checks and vessel modifications

Since 2001, although *Sarah Jayne* was regularly maintained, there were no recorded lightship checks even though significant weight changes had been made to the vessel.

The new main engine was approximately 1.75te lighter than the original engine. Removing this weight from low down in the vessel would have raised the vessel's VCG and, consequently, degraded her stability. The fitting of the additional net drum 3m above the main deck, although only an estimated 0.25te, would also have raised the vessel's VCG. The difference in weight between the original and replacement trawl winches could not be determined and so its effect on the vessel's VCG is unknown.

Without conducting a lightship check and/or an inclining experiment, the extent of the degradation to the stability of *Sarah Jayne* was unknown. Given the modifications undertaken, it was highly likely the loading limit would have had to be further reduced for the vessel to continue to meet stability and freeboard requirements.

The skipper sought professional advice regarding the fitting of the additional net drum. Although he might have sought advice when replacing the main engine and trawl winch, there is no evidence to confirm this.

2.3.3 Freeboard

Low freeboard was a major contributing factor in this accident and was inexorably linked to the vessel's stability. The 1995 SIB required, when the vessel was loaded with sprats, that the fore peak tank should be pressed full, equating to approximately 4te of ballast, and that the aft pounds in the fish hold should be left empty. Complying with these instructions would have ensured that *Sarah Jayne*'s forward trim moment was maximised to increase the aft freeboard, thereby satisfying the minimum freeboard requirements of MSN 975. The guidance of MSN 975, although introduced in 1981, remains relevant today. It emphasises that adequate freeboard is an important feature of a fishing vessel's safe operation. It is understood that the above SIB instructions were not routinely followed prior to the accident.

The modifications to *Sarah Jayne* would have also had a detrimental effect on her trim. The replacement of the main engine with a lighter one reduced the forward trim moment. The addition of the small net drum above the main net drum increased the aft trim moment. Both modifications had the effect of decreasing the aft freeboard which, in turn, would have reduced her stability and increased the risk of her stern being swamped.

Minimum freeboard is employed as a safety measure throughout the shipping industry as a means to prevent vessel overloading and provide a margin of safety. The small fishing vessel sector has remained unique for many years in that minimum freeboard is not an explicit mandatory requirement. As highlighted in the MAIB *Heather Anne* report[2], the MCA intends to harmonise small fishing vessel standards with those of small commercial vessels by 2016. This would involve the inclusion of a minimum freeboard. Additionally, the report refers to the Seafish Construction Standards for new fishing vessels having introduced a minimum design freeboard of 300mm for certain vessels. While this covers the future, the problem remains for existing vessels, prompting the need for greater stability awareness and more informed loading guidance.

2.3.4 Stability awareness and loading guidance

Stability awareness among fishermen has been a concern for many years, especially in respect of operators of fishing vessels under 15m length overall, for which no mandatory stability and freeboard requirements exist. To address this, the voluntary 1-day intermediate stability awareness course was developed by Seafish and has been well received by many of the participants. As far as can be established, *Sarah Jayne's* skipper had not attended this course. However, he had access to the Fishermen's Safety Guide **(Annex D)**, which contains guidance on stability, particularly with regard to a vessel's VCG and the effect of free-surface.

Generic stability awareness alone is insufficient for skippers to operate their vessels safely. They also need to be able to refer to vessel-specific operating criteria to meet acceptable stability and freeboard standards. Following several research projects, in December 2010 the MCA published MGN 427 (F). This reiterated the MCA's intention that full stability requirements would be reintroduced for fishing vessels of 12m and over registered length to 15m length overall. It also stated that skippers and crews should attend the Seafish 1-day intermediate stability awareness course.

Although providing some useful guidance, the five methods detailed in MGN 427 (F) for fishermen to assess their vessel's stability varied considerably in their approach, complexity, cost, and the margins of safety they afforded. The methods were reviewed in the MAIB's *Heather Anne* report. The report concluded that MGN 427 (F) fell short of providing meaningful practical guidance, and a recommendation was made to the MCA to revise the MGN as a result.

2.4 WATERTIGHT INTEGRITY AND FREEING ARRANGEMENTS

2.4.1 Loading procedure

Ensuring a vessel remains watertight is fundamental to her staying afloat. This is reflected in the guidance provided in MGN 415 (F) and MGN 427 (F) to the effect that hatch covers and other weathertight openings should be kept closed at sea and freeing ports should be kept clear. However, fishing vessels of a similar design and which adopt a similar loading procedure for bulk fishing to that of *Sarah Jayne* routinely violate this basic principle by necessarily opening weathertight closures and shutting freeing ports.

[2] MAIB Report 2/2013: http://www.maib.gov.uk/publications/investigation_reports/2013/heather_anne.cfm

The investigation considered how the dangers associated with opening the fish hold hatch cover and flush deck scuttle, and closing freeing ports while loading fish, could be reduced. However, the fact that weathertight closures need to be opened, and the loss of fish through freeing ports needs to be minimised, to facilitate the loading procedure, inevitably impacts on a vessel's seaworthiness.

2.4.2 Deck hatches

'Lift-off' hatch covers, such as that fitted to *Sarah Jayne*'s fish hold hatch, were permitted under the 1975 Rules, which did not specify that the cover should be permanently attached to the vessel. It appears that this did not cause undue delay in the mate and crewman replacing the cover. However, the 2012 Seafish Construction Standards require the hatch covers of new vessels to be secured by hinges on the forward side or otherwise permanently attached to the structure. This will ensure that any delay in closing the hatch is kept to a minimum.

The 1975 Rules required the cover to be secured with suitable gasket and clamping arrangements to ensure the hatch could be sealed weathertight. This was not possible on *Sarah Jayne* owing to the pound board arrangement, which prevented the starboard side securing clips from being used. It would have been possible to secure the hatch cover properly had the clips been located on the fore and aft sides of the hatch.

Crew access to the fish hold could have been made through the smaller access hatch set into the fish hold hatch cover. The access hatch was permitted under the 1975 Rules and was fitted specifically for this purpose. This would have negated the need to remove the fish hold hatch cover during the loading procedure and would have significantly reduced the quantity of floodwater entering the fish hold from the initial wave.

2.4.3 Freeing ports

The freeing ports provided on *Sarah Jayne* were of a greater total area than that required by the 1975 Rules. They were recently maintained, providing every opportunity for water to be shed from the deck. However, this was only the case when the freeing ports were open.

When loading bulk fish on deck, it is common practice within the industry to reduce the loss of fish overboard by closing the adjacent freeing ports. However, as detailed in MGN 425 (F) and the Fishermen's Safety Guide, as soon as a freeing port is closed, the ability of a vessel to drain water off her deck is reduced, leading to water becoming trapped between the bulwarks. This water adds not only top-weight, but also a significant free-surface effect, which can lead to capsize unless a vessel has an adequate stability reserve. Careful consideration must be given to reducing the adverse effect of deck pound arrangements and to the use of perforated closures to maximise the ability of water to drain safely off a vessel's deck.

2.4.4 Safe operation and the use of flush deck scuttles

Sarah Jayne would have been at her most vulnerable when bringing her catch on board. During this operation: the vessel would have been stopped in the water, beam to sea and swell; the net alongside would have limited or precluded use of her engine; and the act of lifting the cod-end inboard – effectively suspending a

heavy weight from the derrick head – would have reduced her stability. However, in this accident a number of additional hazards had been introduced. Firstly, by not complying with the advice in the SIB to ballast the fore peak tank, limit the quantity of fish carried, and restrict the stowage of fish to the forward part of the fish room, the vessel was operating with significantly reduced freeboard aft – thereby increasing the risk of a wave swamping the stern. Secondly, by closing the two freeing ports and opening both the flush deck scuttle and the fish hold hatch, two further hazards had been introduced: the risk of water either entrained in the catch or from swamping being kept on deck and unable to run off quickly; and, most significantly, this water being easily able to flood into the fish hold. On this occasion, this combination of hazards combined to facilitate a catastrophic accident.

Although the practice of opening the flush deck scuttle at sea cannot be condoned, should it be considered necessary to facilitate the rapid loading of bulk catch into the fish hold then all possible steps should be taken to reduce the hazard as far as reasonably practicable. In this case, besides adhering to the advice in the SIB, such measures could have included: using mesh instead of blanks in the freeing ports to allow water on deck to run away; modifying the flush deck scuttle to facilitate rapid closing in the event of an emergency; and, minimising the fish hold opening by keeping the main hatch cover in place and instead using the smaller access hatch. The risk of flooding could have been further minimised by closing the flush deck scuttle between lifts.

In the future, there is a need to more closely align construction standards with fishing methods. The 2012 Seafish guidance for new build vessels is clear: through-deck scuttles should not be opened at sea. Consideration therefore needs to be given to developing mechanisms whereby the fishing vessel can conduct its primary purpose – fishing – without becoming vulnerable to catastrophic accidents during the process.

2.5 USE OF LIFESAVING EQUIPMENT

2.5.1 Liferaft release

The wreck survey revealed that the liferaft released from its cradle when *Sarah Jayne* foundered. However, it did not rise to the surface and inflate as intended. Given the liferaft was new, it is unlikely it was defective. A more likely explanation is as follows.

When the vessel initially capsized, the depth of the liferaft might not have been sufficient to cause the HRU to activate. Even if the HRU had activated, the liferaft would have only floated up to the main deck as the vessel was upside down. As the vessel sank and turned the right way up, given the likely stern attitude, the liferaft might have floated up and become trapped under the lip of the wheelhouse roof. All the time the liferaft was submerged, its drain holes would have allowed water to fill the canister. Once on the seabed, the buoyancy of the canister would eventually have reduced to the point at which it was neutrally buoyant and then, with the assistance of tidal current, it would have drifted over the port side and then onto the seabed, where it was located during the underwater inspections.

Although MGN 343 (M+F) provides some useful guidance on the positioning of liferafts, it is impossible to position a liferaft so as to guarantee an easy and successful deployment for all loss scenarios. The position of the liferaft on the aft external bulkhead of the wheelhouse of *Sarah Jayne* did enable easy access to

manually deploy the liferaft and it was protected from the elements. However, this position was not clear of obstructions as the wheelhouse roof overhang was directly above. Fitting the liferaft on the wheelhouse roof, as was intended for the spare liferaft, might have increased the chance of the liferaft deploying, but this would have made it more difficult to deploy manually and it would have been more exposed to the weather.

Making the decision to abandon a vessel will almost always be a tough one, as most crews' inclination is to persevere with trying to resolve the emergency situation. At the time of his second VHF radio call to *Girl Rona*, *Sarah Jayne*'s skipper realised that his vessel was likely to founder. However, given that the liferaft was ideally positioned to facilitate its manual deployment, it would have been a sensible precaution for the crew to prepare it for launching during the short period between the skipper's first and second VHF radio calls.

2.5.2 EPIRB

Although the Code of Practice for the Safety of Small Fishing Vessels only recommends that vessels carry an EPIRB, *Sarah Jayne*'s owner had fitted one to his vessel. In accordance with best practice, he had also ensured the EPIRB was serviced and had fitted it within a float-free housing, with an HRU, to maximise the opportunity of the EPIRB being released in an emergency.

The wreck survey was inconclusive with regard to whether or not the EPIRB and its float-free housing were on the wheelhouse roof.

Although a definitive reason for an EPIRB transmission not being received following the accident cannot be determined, the carriage of an EPIRB remains an important safety precaution for fishing vessels. As demonstrated by this accident, fishing vessels are often lost suddenly, giving little time to raise the alarm. A float-free EPIRB should ensure that emergency services are alerted quickly to maximise the chance of rescue.

2.5.3 Use of lifejackets and PFDs

Lifejackets and PFDs were carried on board *Sarah Jayne* but were not routinely worn by the crew. It would have been a sensible precaution to don lifejackets or PFDs, particularly after the second wave had swamped the deck. It was very fortunate that, in this case, *Girl Rona* was able to rescue the mate and crewman from the water quickly. If the alarm had not been raised, the ability of the two men to stay afloat awaiting rescue, without wearing lifejackets or PFDs, would have been severely hampered.

The MAIB made its first recommendation regarding the compulsory wearing of lifejackets in 2000. Since then, the industry has been slow to embrace the need to wear this lifesaving device. The MAIB *Heather Anne* report raised this same issue following the drowning of one of the crew after the vessel capsized. Fortunately initiatives are now underway, primarily led by the fishing federations, to provide UK fishermen, for little or no cost, with a PFD they can wear safely while working on deck. It is hoped that this step will facilitate a culture change among fishermen that leads to PFDs becoming routine wear when on deck. If such a culture change does not occur, steps should be taken to mandate the wearing of this fundamental item of personal protective equipment when conditions warrant it.

SECTION 3 - CONCLUSIONS

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

1. The flush deck scuttle on *Sarah Jayne* was permitted under The Fishing Vessels (Safety Provisions) Rules 1975 and was fundamental to the method adopted on board for loading bulk fish. [2.4]

2. Fishing vessels of a similar design and which adopt a similar loading procedure for bulk fishing to that of *Sarah Jayne* routinely violate the basic principle of ensuring a vessel remains watertight, by necessarily opening weathertight closures and shutting freeing ports. [2.4]

3. The fact that weathertight closures need to be opened, and the loss of fish through freeing ports needs to be minimised, to facilitate the loading procedure for bulk fishing, inevitably impacts on a vessel's seaworthiness. [2.4]

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

1. The capsize occurred as *Sarah Jayne*, with an approximate 20te catch in her fish hold, had an insufficient reserve of stability to withstand the sudden flooding and its associated free-surface effect. [2.2]

2. Routine landing of catches in excess of 17.08te, the limit specified in the SIB approved in 1995, without incident, would have reinforced a belief that it was safe to do so. [2.3]

3. Although recommended, *Sarah Jayne* was no longer legally required to meet any stability or freeboard requirements following the 2002 amendment to The Fishing Vessels (Code of Practice for the Safety of Small Fishing Vessels) Regulations 2001. [2.3]

4. Since 2001, there were no recorded checks on *Sarah Jayne*'s stability even though significant weight changes had been made to the vessel. [2.3]

5. Given the modifications undertaken since 2001, it was highly likely the loading limit of *Sarah Jayne* would have had to be further reduced for the vessel to continue to meet stability and freeboard requirements. [2.3]

6. The owner sought professional advice regarding the fitting of the additional net drum. Although he might have sought advice when replacing the main engine and trawl winch, there is no evidence to confirm this. [2.3]

7. It is understood that ballasting instructions, contained in the 1995 SIB to increase the aft freeboard when the vessel was loaded with sprats, were not routinely followed prior to the accident. [2.3]

8. The low freeboard aft would not only have affected *Sarah Jayne*'s stability performance but also increased the risk of her stern being swamped. [2.3]

9. Existing fishing vessels do not have an explicit mandatory minimum freeboard requirement, prompting the need for greater stability awareness and more informed loading guidance. [2.3]

10. As far as can be established, the skipper had not attended the voluntary Seafish 1-day intermediate stability awareness course. [2.3]

11. Generic stability awareness alone is insufficient for skippers to operate their vessels safely. They also need to be able to refer to vessel-specific operating criteria to meet acceptable stability and freeboard standards. [2.3]

12. If the fish hold hatch cover had been secured prior to loading the catch, the quantity of floodwater entering the fish hold from the initial wave would have been significantly reduced. [2.4]

13. The closure of any freeing ports will restrict the ability of a vessel to shed water from her deck after being swamped. [2.4]

14. The use of through deck scuttles to load fish from the deck to the fish hold creates a significant down-flooding hazard. [2.4]

15. The liferaft, although in service and fitted with an HRU, failed to surface and inflate, probably as a result of it being obstructed when released from its stowed position on the aft external bulkhead, and directly below the roof overhang of the wheelhouse. [2.5]

16. Although a definitive reason for an EPIRB transmission not being received following the accident cannot be determined, the carriage of an EPIRB remains an important safety precaution for fishing vessels. [2.5]

17. The wearing of lifejackets or PFDs would have been a sensible precaution when working on deck. It was very fortunate that, in this case, the mate and crewman, who were not wearing lifejackets or PFDs, were rescued quickly. [2.5]

SECTION 4 - ACTION TAKEN

4.1 MARINE ACCIDENT INVESTIGATION BRANCH

In its investigation report of the capsize and foundering of the fishing vessel *Heather Anne* (FY126) on 20 December 2011 (Report 2/2013, published 13 January 2013), the **Marine Accident Investigation Branch** has:

Made recommendations (2013/106, 2013/107 and 2013/108) to the **Maritime and Coastguard Agency** *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.

SECTION 5 - RECOMMENDATIONS

Given the recommendations already made to the MCA regarding loading, freeboard and future stability standards for small fishing vessels following MAIB Report 2/2013 on the capsize and foundering of FV *Heather Anne*, only one recommendation has been made.

The **Maritime and Coastguard Agency**, in consultation with the Sea Fish Industry Authority, is recommended to:

2013/213 As part of its intended development of new standards for small fishing vessels, review and include additional design and operational requirements as necessary to ensure that a vessel engaged in bulk fishing remains seaworthy throughout its intended loading procedure. Specific hazards that should be addressed include:

- The increased risk of capsize from swamping if freeing ports are closed.
- The risk of downflooding if flush deck scuttles and fish hold hatch covers are opened at sea.

Marine Accident Investigation Branch
June 2013

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

Annex A

Extract from MGN 427 (F)

Maritime and Coastguard Agency

MARINE GUIDANCE NOTE

MGN 427 (F)

Stability Guidance for Fishing Vessels of under 15m Overall Length

Notice to all Shipyards, Boatbuilders, Fishing Vessel Operators, Skippers, Fishermen, Designers and Consultants

PLEASE NOTE:-
Where this document provides guidance on the law it should not be regarded as definitive. The way the law applies to any particular case can vary according to circumstances - for example, from vessel to vessel and you should consider seeking independent legal advice if you are unsure of your own legal position.

Summary

This Notice:

- Provides guidance for stability assessment to help fishermen make decisions.
- Strongly recommends owners and skippers to commission and purchase new vessels which have had a stability assessment and stability information supplied.
- Re-iterates that full stability requirements for the 12m registered length – 15m overall length fishing vessels will be re-introduced in the near future.
- Indicates that at the present time there is no intention to introduce compulsory stability criteria to fishing vessels under 12m registered length.
- Vessels over 12m registered length which have historically been roll tested may continue to do so.
- Skippers and owners are reminded that beam trawlers have a 20% uplift with the full stability criteria and their own formula for a roll test (only applicable to existing vessels which have previously been on a roll test).

1. Introduction

1.1 Vessels under 15 metres LOA are not currently required to have approved stability that is compliant with statutory requirements. There is presently no intention to introduce statutory requirements for vessels under 12 metres registered length.

1.2 Any vessel must be stable for its intended purpose and it is reasonable to expect that naval architectural skills will be employed during the design and construction process to ensure that the vessel is safe for use. MCA recommends that all purchasers ask for stability information from builders.

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

1.4 Unfortunately it is not possible to make an assessment of stability and hence the safety of the vessel by simple inspection; however, various tools and assessment methods can be used to provide a degree of confidence and assurance.

2. Legal Responsibilities

2.1 While no specific statutory requirements currently exist for the stability of small fishing vessels, the owner, skipper and others do have legal responsibilities as detailed under the Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997.

For example their duties include ensuring, as far as is reasonably practicable:

- Systems of work that are, so far as reasonably practicable, safe and without risk to health,
- Safe arrangements for the use, handling, and stowage and transportation of articles and substances,
- there is provision of information, instruction, training and supervision necessary to ensure health and safety of workers and other persons.

2.2 In the absence of specific statutory requirements for stability and its subsequent approval of stability, owners may use other methods to assess stability and support skippers and fishermen to meet their health and safety general duties and responsibilities. It is not acceptable to do nothing and assume the vessel's stability is satisfactory. It is always better to assess the situation or obtain professional advice and this notice helps by providing additional information for this process. In short, MCA is providing a number of methods you may find helpful. MCA Fishing Vessel Surveyors cannot decide which method of stability assessment is best for your vessel (that is for owners/ skippers and crews to decide), but they are available to discuss the pros and cons of each method and may be able to identify specific risks/ similar vessels/ fishing methods which may assist owners/skippers and crews in coming to a decision on which stability assessment method best fits their vessel.

3. Some factors to consider and some myths

3.1 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 movable 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 the catch is not stored on deck, it should be stored as low as possible in the vessel as soon as is practicable.

4 Available Stability Methods

4.1 The following methods are considered:

- Full stability information, inclining experiment and calculation.
- Small Commercial Vessel Code standard.
- A modified small passenger vessel standard.
- IMO Roll Period Approximation.
- Wolfson Guidance.

5 Full Stability Method

5.1 This requirement will apply to all vessels over 12 metres and is widely used.

5.2 The method requires the lightship weight and centres of gravity both vertical and longitudinal to be ascertained (e.g. inclining experiment) and that the stability for a series of loading conditions be calculated.

5.3 The properties of the GZ Curves are then compared with the criteria reproduced here at Annex 1 and Appendix 1 to that Annex.

5.4 Many Naval Architects consider that the established criteria are good for vessels above 7m registered length.

5.5 Vessels which have previously been on a roll test, if they have had no structural modifications, may continue on the roll test until modified. Should they have been modified or wish to modify they must contact the MCA and prepare for hull stability assessment.

6 Small Commercial Vessel Code Standard (heel test)

6.1 This method requires checking the heel, resultant from the application of the maximum load on the maindeck at the maximum outboard position, is within 7°, together with sufficient freeboard.

6.2 The method may only be used for vessels carrying up to 1000 kg of cargo, in this case fish, and may not be most suited for cockle/mussel dredgers bagging the catch.

6.3 This method has distances from port as limits of operation.

6.4 For further details see Annex 2.

7 Small Passenger Vessel Heel Test

7.1 As an alternative to the Small Commercial Vessel Code heel test standard, an equivalent test can be used to that on small passenger vessels, which allows for weights in excess of 1000 kg.

7.2 It considers a shift in passenger, or in this case landed fish weight, with an assumed distribution of 2/3 : 1/3 on each side of the vessel. This gives a simple formula of WB/12 (see Annex 3, paragraph 6.0) as a heeling moment which when applied should not exceed a vessel heel of 7^{o}, plus a minimum freeboard requirement.

7.3 This method can be repeated to check for changes over time.

7.4 For further details see Annex 3.

8 Roll period Approximation (IMO)

8.1 This is an operational comparative method to determine whether the vessel is stiff or tender.

8.2 Because of its simplicity it can be used operationally by the skipper.

8.3 This method is particularly useful to assess changes which can affect stability during the life of the vessel (if the roll period increases the vessel is becoming less stable).

8.4 Refer to Annex 4 for further information.

9 Wolfson Guidance

9.1 Overview

9.1.1 During 2003 to 2006, the Maritime & Coastguard Agency in response to the Marine Accident Investigation Branch (MAIB) Recommendations, sponsored a number of initiatives aimed at reducing the number of stability associated accidents onboard United Kingdom fishing vessels.

9.1.2 These initiatives included earlier work on identifying the use of a stability model for increasing “stability awareness” and the commissioning of research into a system which would inform the skipper concerning his management of stability.

9.1.3 The research was conducted by the Wolfson Unit of the University of Southampton.

9.2 Deliverable

9.2.1 Deliverables from the research included;

9.2.2 To produce a “traffic light” system which would inform the user of the level of risk associated with a particular operation, and;

9.2.3 to provide a baseline which could be used over time to recognise degradation of stability due to the acquisition of lightship by growth or the retention of equipment, stores or supplies.

9.3 Research Results

9.3.1 The research results have been published and are available on the Wolfson website, at www.wumtia.soton.ac.uk .

9.3.2 The Method has been publicised during recent United Kingdom “FISHING” Exhibitions and presented academically.

9.4 Making the Method available

9.4.1 The FISG Stability Sub Group decided that the Document, “Preparation of Guidance Information for Fishing Vessels – Instructions for Consultants”, prepared by the Wolfson Unit should be published for information and guidance. This is attached at Annex 4.

9.4.2 Fishing vessels load their cargo at sea. It should always be remembered that no matter how inherently stable the vessel may be, that if the net snags on an obstruction,

the vessel may be overwhelmed. Due regard should always ensure that the towing point is as low as possible. To save the ship, the fishing gear may have to be buoyed and jettisoned to recover later, possibly using a bigger vessel.

9.4.3 The attachment of fishing wire to the trawl winches should always be arranged for quick removal. The rope type of attachment is most effective and allows the wire to be parted from the winch drum quickly.

10 Notes on Maintaining Stability

10.1 A notice containing simple and effective methods for maintaining stability should be posted on the vessel in a prominent position, where crew members will see it.

10.2 The notice should include notes entitled “Simple Efforts for Maintaining Stability” or similar. These notes should be relevant to the vessel, its gear and catch handling arrangements and the fishing method. Suggestions for notes follow, and relevant ones might be selected from, or based on, this list but it is not intended to be exclusive.

- To maintain the approved stability, ensure that external doors and hatches are not left open at sea. (Those assumed to be closed in preparation of the Notice should be identified clearly here).
- Ensure that scuppers and freeing ports are open and clear of obstructions to allow water to drain quickly from the deck.
- Before attempting a heavy lift, or freeing snagging gear, inform the coastguard, bring the warp as far inboard and as low as possible, close all the doors and hatches and ensure that all crew are on deck, wearing lifejackets.
- If the maximum recommended lift from the vessel’s side is exceeded, abandon the lift immediately. The position of the gear should be marked for retrieval by a larger vessel.
- The vessel may become unsafe if heavy items are moved up, heavier gear is fitted or lifting points are moved.
- Secure all gear and the catch against shifting.

11 Training

11.1 Skippers and crew should attend the Seafish 1-day Intermediate Stability Awareness course. Contact your nearest Seafish Approved Training Provider for details or call Seafish on 01472 252302. See MGN 411 for further details on fishermen's training.

More Information

Vessel Policy Branch
Maritime and Coastguard Agency
Bay 2/30
Spring Place
105 Commercial Road
Southampton
SO15 1EG

Tel : +44 (0) 23 8032 9139
Fax : +44 (0) 23 8032 9104
e-mail: Fishing@mcga.gov.uk

General Inquiries: infoline@mcga.gov.uk

MCA Website Address: www.mcga.gov.uk

File Ref: MS 88/1/677

Published: December 2010
Please note that all addresses and
telephone numbers are correct at time of publishing

An executive agency of the Department for Transport

Safer Lives, Safer Ships, Cleaner Seas

When printed by the MCA the material used contains a minimum 75% post-consumer waste paper

Annex B

Extracts from *Sarah Jayne* SIB, approved in 1981

50FT. TRAWLER "SARAH JAYNE"

STABILITY BOOK

OFFICE COPY.

DEPARTMENT OF TRADE

[redacted]

Date ..... 18 SEP 1981 ...

File No. CM ..45120/31/04.....

38 SHEETS

[redacted]

DOFT LETTER 21-7-80
MODIFIED 16-3-80

Department of Trade

BULK FISHING DANGERS

Safety checklist

DO **check** from stability information the MAXIMUM CATCH that can be carried.

DO **ensure** that the hold pumping system works properly.

DO **check** that fish-hold bilge strums and slushwell grids are clear before starting to load.

DO **fit** longitudinal pounds complete from the bottom of fish-hold to deckhead as the catch is stowed, to prevent overspilling.

DO **ensure** that hatches, doors and side scuttles not actually in use are securely closed.

DO **check** holds and engine-room bilges regularly and pump clear.

DO **take special care** when using flush scuttles to load bulk fish: **ensure** that such scuttles are securely fitted in place when not in use.

DO NOT block **freeing ports** or obstruct the passage of water from the deck to them.

DO NOT overload: this can drastically reduce the vessel's resistance to capsizing and may also cause back-flooding through submerged discharges.

DO NOT continue to **haul gear** or **load** bulk fish when there is a significant amount of unwanted water in the hold.

DO NOT add or transfer **water ballast** to level the catch across the hold.

DO NOT attempt excessively **heavy lifts.**

DO NOT ignore the **weather** conditions.

INDEX.

M.F.V. SARAH JAYNE

INCLINING EXPERIMENT

DATE 28th. MARCH 1980

LOCATION BRIXHAM HARBOUR – CONDITIONS FAIR – VESSEL MOORED HEAD TO WIND – FREE TO MOVE.

CONDITION VESSEL COMPLETE IN A SEA GOING STATE

FUEL 95% FULL – FREE SURFACE PRESENT (1·27) } F.S. MOMENT
F.W. 60 GALLONS. " " " (0·018) } 1·318
OIL 30 " " " " (0·03) }

BILGES PUMPED DRY BUT SMALL AMOUNT OF WATER REMAINED AFT BALLAST TANKS PUMPED DRY.

TRAWL & DOORS RIGGED, SPARE TRAWL ON DECK.

150 BOXES IN FISH ROOM PLUS 2½ TONS ICE.

DRAFTS DRAFTS READ WITH NO ONE ON BOARD & ½ TON WEIGHTS ON DECK.

AFT 7'-2½" – 220CM.
FOR'D. 5'-0" – 152 CM
MEAN DRAFT AMIDSHIPS 186CM.

DENSITY OF SEA WATER ASSUMED AT 1·026

TRIM NEGLIGIBLE.

DISPLACEMENT TO MARKS 60·5 TONS.
+ ·25 TONS PERSONNEL

WEIGHTS. 224lb. SHIFTS THROUGH A DISTANCE OF 16'-1".

8CWT USED FOR 8 SHIFTS.

2CWT USED TO COUNTERACT SLIGHT LIST CAUSED BY TRAWL VESSEL FLOATING ON EVEN TRIM.

PENDULUMS. 2 USED – ONE IN FISHROOM LENGTH 2076 mm.
ONE IN WHEELHOUSE " 1635 mm.

DEFLECTIONS RECORDED			FISHROOM		WHEELHOUSE
1st. SHIFT	224lbs.	P. to S.	25 mm		25 mm
2nd. "	"	"	24 "		14 "
3rd. "	"	S. to P.	24 "		18 "
4th. "	"	"	25 "	ZERO CHECKED	23 "
5th. "	"	"	29 "		21 "
6th. "	"	"	30 "		25 "
7th. "	"	P. to S.	31 "		24 "
8th. "	"	"	28 "	ZERO CHECKED	22 "
		TOTAL DEFLECTION	216 "		172 "
		AVERAGE "	27 "		21·5 "

INCLINING EXPERIMENT CONT'D

TANGENT OF DEFLECTED ANGLE IN WHEELHOUSE $= \frac{21.5}{1635} = 0.013$

TANGENT OF DEFLECTED ANGLE IN FISHROOM $= \frac{27}{2076} = 0.013$

INCLINING PARTY CONSISTED OF 4 PERSONS WITH MR. R.L. JONES REPRESENTING THE DEPT. OF TRADE.

POSITION OF CENTRE OF GRAVITY

$$GM = \frac{w \times d}{W \tan\theta}$$

$w = 224$ lbs
$d = 16'-1" = 16.083'$
$W = 60.5 + 4$ MEN $(.25)$
$\tan\theta = 0.013$

$$= \frac{224 \times 16.083 \times 12}{60.75 \times 0.013 \times 2240}$$

$= 24.44"$ FLUID $= 2.04$ FT. (FLUID) AS INCLINED
$= 0.62$ METRES (FLUID).

THIS HAS TO BE CORRECTED FOR FREE SURFACE EFFECT AND TO OBTAIN LIGHT SHIP CONDITION (1)

CENTRE OF GRAVITY AS INCLINED

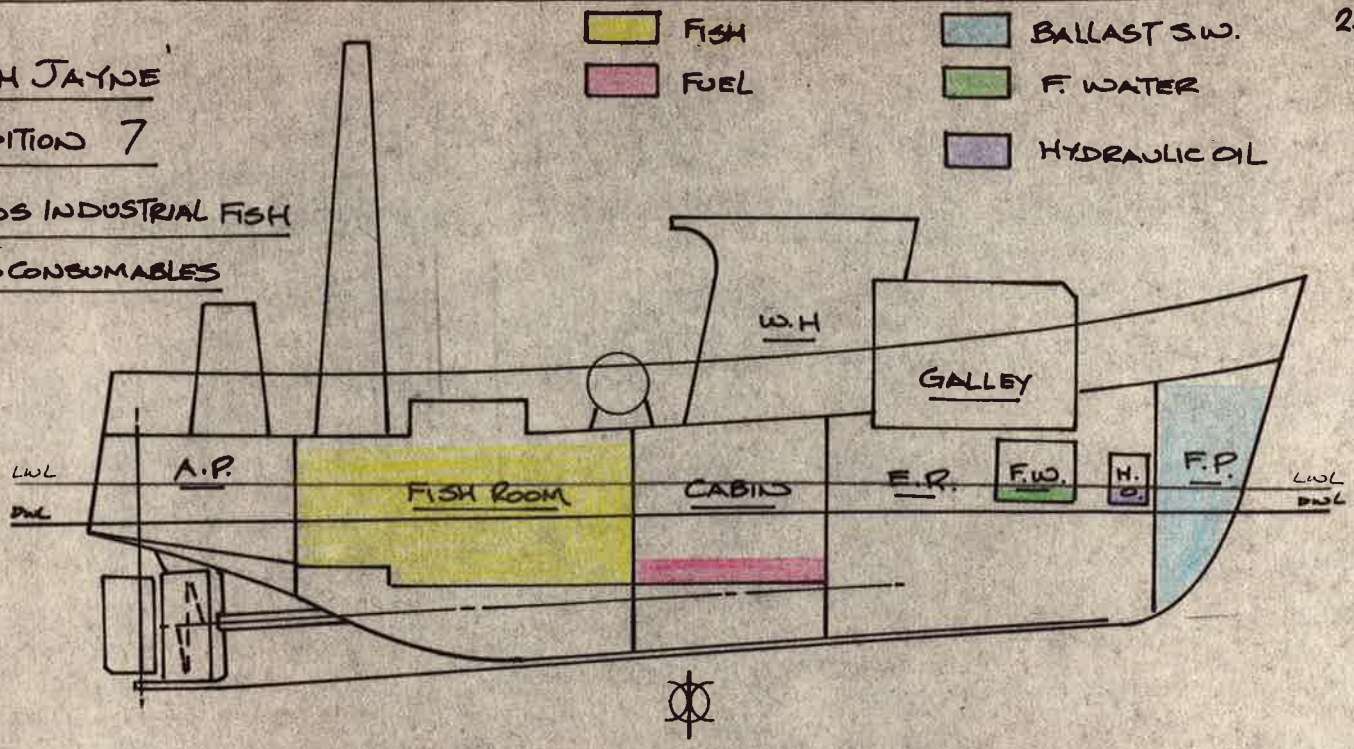
VIRTUAL CG ABOVE K $=$ KMT $-$ GM
$= 9.42 - 2.04 = 7.38$ FT. ABOVE K. (FLUID)
SOLID KG $= 7.36'$
AND ABOVE LCB AT 1.3 FT. AFT OF AMIDSHIPS.

'SARAH JAYNE'

CONDITION 7

25 TONS INDUSTRIAL FISH

10% CONSUMABLES



ITEM	TONS	ABOVE K		AFT ℄		FOR'D ℄		FREE
		Lever	Moment	Lever	Moment	Lever	Moment	SURFACE MT.
LIGHT SHIP	48·61	7·52	365·55	0·15	7·29	—	—	—
3 MEN	0·20	13·0	2·6	—	—	—	—	—
TRAWL & DOORS	0·65	11·5	7·48	21	13·65	—	—	—
FISH IN ROOM.	25·0	6·0	150·00	8·5	212·50	—	—	11·36
FUEL 200 GALLS.	0·77	3·0	2·31	—	—	1	0·77	1·30
F.W. 10 GALLS	0·04	6·5	0·26	—	—	11	0·44	0·02
HYD. OIL 10 GALLS	0·04	6·5	0·26	—	—	18	0·72	0·03
STORES	0·08	6·0	0·48	—	—	—	—	—
1/1 FORE PEAK BALLAST	2·0	8·0	16·00	—	—	21·5	43·0	0·62
TOTALS	77·39		544·94		233·44		44·93	13·33
					44·93			
					188·51			

DISPLACEMENT 77·39 TONS

C.G. IS 7·04 FT. ABOVE K (SOLID) FREE SURFACE CORR^{N} 0·172'

∴ CG IS 7·212 FT. ABOVE K (FLUID) & 2·43 FT. AFT OF ℄

HYDROSTATIC PARTICULARS

DISPLACEMENT	77·39 TONS.	GM (FLUID)	1·918'
MEAN DRAFT	213 CM. 6·98'	LCB	1·75' AFT ℄
TPI	1·57	LCF	3·2' AFT ℄
MCT 1"	4·16	TRIM	10·97" 28 CM AFT.
VCB	4·55'	DRAFT FOR'D	5·39' 164 CM.
BML	35·9'	DRAFT AFT	8·43' 257 CM.
BMT	4·58'	FREE BOARD AFT ℄	2·41 FT.
KMT	9·13'	FREE BOARD RULE MIN.	5% LWL 2·38 FT.
GM (SOLID)	2·09'		
FREE SURFACE CORR^{N}	0·172'		

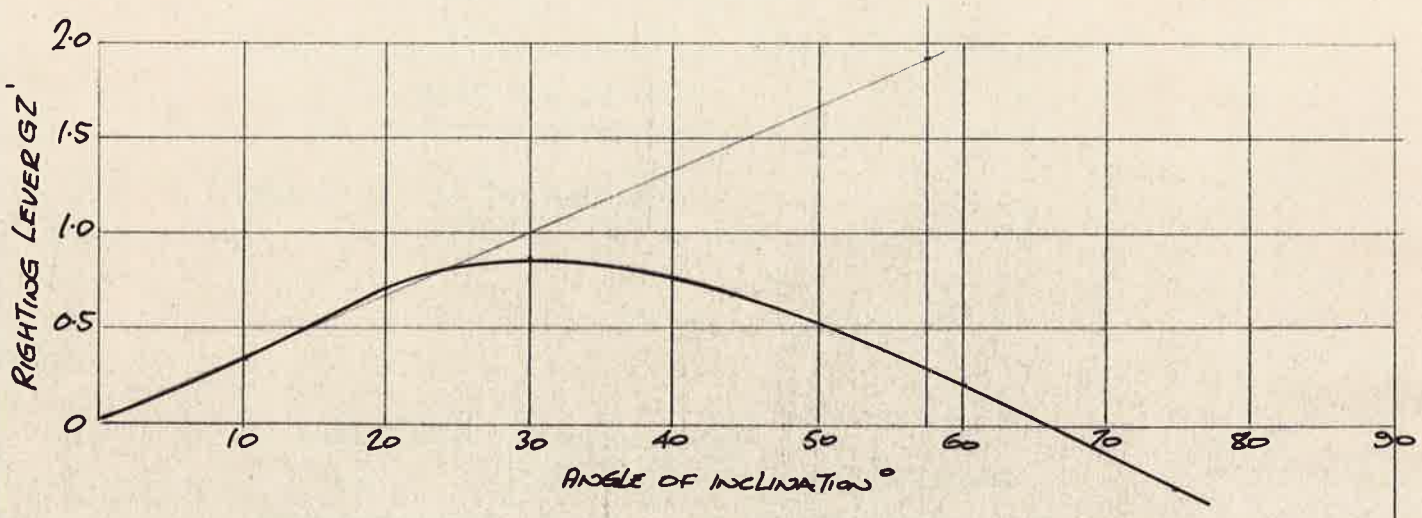
CONDITION 7

STATICAL STABILITY

77.39 Tons DISPLACEMENT

$$GZ = KN - KG \sin\theta$$

ANGLE OF HEEL	KN	KG Sinθ	GZ'
10°	1.58	7.21 × 0.1736 = 1.25	0.33
20°	3.17	7.21 × 0.342 = 2.46	0.71
30°	4.46	7.21 × 0.500 = 3.60	0.86
45°	5.76	7.21 × 0.7071 = 5.09	0.67
60°	6.46	7.21 × 0.866 = 6.24	0.22
75°	6.63	7.21 × 0.9659 = 6.96	-0.33
90°	6.32	7.21 × 1.000 = 7.21	-0.89.



	SUMMARY	RESULTS	METRIC	MINIMUM CRITERIA
1	INITIAL GM 1.918 FT	1.918'	0.58 M.	0.35 M.
2	AREA UNDER GZ CURVE UP TO 30°	14.92 FT°	0.079 M. RADS.	0.055 M. RADS.
3	AREA UNDER GZ CURVE UP TO 40°	23.13 FT°	0.123 M. RADS.	0.090 M. RADS.
4	AREA UNDER GZ CURVE BETWEEN 30° & 40°	8.21 FT°	0.044 M. RADS.	0.030 M. RADS.
5	MAXIMUM GZ IS 0.86' & OCCURS AT 30°	0.86' @ 30°	30°	MAX. GZ AT NOT LESS THAN 25°
6	GZ AT 30°	0.86'	0.262 M.	0.20 M. @ 30°

IN THIS CONDITION THE VESSEL MEETS THE REQUIRED CRITERIA.

IT SHOULD BE NOTED THAT THE FREEBOARD IS AT RULE MINIMUM.

SPECIAL NOTES TO THE SKIPPER

1). FOR THE PURPOSE OF THE CALCULATIONS IT HAS BEEN ASSUMED THAT THE VESSEL WILL OPERATE ON SHORT VOYAGES AS PLANNED. MAINLY DAY WORK RETURNING TO PORT EACH EVENING OR AT MOST TO BE AT SEA FOR ONLY A FEW DAYS OR OVERNIGHT.

2). FUEL THE LEVEL OF FUEL IN THE MAIN TANKS HAS A BEARING ON THE STABILITY OF THE VESSEL IN SO FAR AS TO FILL THE TANKS TO 100% CAPACITY AT 1060 GALLONS EACH TANK WOULD CAUSE SOME OVER LOADING FORWARD & SLIGHTLY RAISE THE CENTRE OF GRAVITY OF THE VESSEL. IT IS THEREFORE RECOMMENDED THAT THE TANKS BE FILLED TO A MAXIMUM OF 800 GALLONS IN EACH TANK WITH AN OPERATIONAL RANGE DOWN TO ABOUT 400 GALLONS IN EACH TANK. THIS SHOULD GIVE AMPLE FUEL CAPACITY AND WITH THE TANKS ABOUT 1/3 FULL THIS WOULD ADD LOWER WEIGHT & SLIGHTLY IMPROVE THE STABILITY. THE STABILITY BOOK HAS BEEN COMPILED SHOWING FUEL CAPACITIES RANGING FROM 1600 GALLS TO 200 GALLS.

3). BALLAST & TRIM THE EFFECT OF TRIM HAS NOT BEEN TAKEN INTO ACCOUNT. IT IS EXPECTED THAT EXCESSIVE TRIM WILL REDUCE THE STABILITY AND THIS MUST BE AVOIDED BY THE LOADING OR DISCHARGE OF WATER BALLAST IN THE FORWARD OR AFTER TANKS SO AS TO MAINTAIN AS FAR AS PRACTICAL THE DESIGN TRIM.

4). LOADING INDUSTRIAL FISH. THE FREE SURFACE CORRECTION APPLIED TO THE LOADING OF FISH IN THE FISH ROOM HAS BEEN RESTRICTED TO THAT APPROPIATE TO HAVING 2 LONGITUDINAL DIVISIONS IN THE FISH ROOM. THE DIVISIONS MUST BE THEREFORE BE FITTED INTACT TO THE DECK-HEAD TO PREVENT SPILLOVER. IF ERECTION OF PARTING BOARDS PROCEEDS WITH FISH LOADING A SUITABLE HEIGHT OF THE BOARDS ABOVE THE LEVEL OF FISH MUST BE MAINTAINED.
IT IS RECOMMENDED THAT THE LOADING SEQUENCE BE TO FILL THE FORWARD SIDE BAYS OF THE FISH ROOM FIRST, THEN THE CENTRE SIDE BAYS FOLLOWED BY THE AFT SIDE BAYS & LASTLY THE CENTRE SECTION.

REGULAR PUMPING OF THE HOLD SHOULD BE MADE TO PREVENT A BUILD UP OF WATER.

THE CAPACITY OF THE FISH ROOM IS 25 TONS WHICH IS THE MAXIMUM CAPACITY OF THE VESSEL TO MEET THE SAFETY REQUIREMENTS AND THE FREE BOARD RULE.

SPECIAL NOTES TO THE SKIPPER CONT'D.

4) CONT'D.

THE STOWAGE OF FISH IN DECK POUNDS SHOULD BE AVOIDED WHILST THERE IS ROOM IN THE FISH ROOM AND FISH SHOULD NOT BE STOWED ON DECK AFTER THE FISH ROOM IS FULL AS THIS WOULD OVERLOAD THE VESSEL.

5) ICING.

ICING MAY OCCUR BETWEEN 1ST NOVEMBER & 30th. APRIL IN THE FOLLOWING AREAS.

(i). NORTH OF LATITUDE 61°N.

(ii) NORTH OF LATITUDE 45°N. & WEST OF LONGITUDE 28°W.

THE VESSEL SHOULD NOT OPERATE IN SUCH AREAS IN WINTER UNLESS ADDITIONAL LOADING CONDITIONS ARE FIRST CALCULATED SHOWING THE VESSEL CAN WITHSTAND THE ICING TO BE EXPECTED.

CHANGE OF USE OF VESSEL

THE STABILITY BOOK HAS BEEN PREPARED TO GIVE AS FULL A RANG OF CONDITIONS AS MAY BE MET IN THE INTENDED SERVICE. IF ANY MODIFICATIONS CONCERNING WEIGHT OR THE VESSEL IS PUT TO A DIFFERENT USE THE DESIGNER SHOULD BE CONSULTED TO SEE IF THE STABILITY IS ADVERSELY AFFECTE

Annex C

Extracts from *Sarah Jayne* SIB, approved in 1995

50 FT. TRAWLER

"SARAH JAYNE"

BM 249

STABILITY BOOK

[redacted]

No addition or amendment is to be made to this document without prior approval of the Department.

No. of pages 44

[redacted]

1ST. ISSUE 30-3.95

CONTENTS

Page.

Voyage Cycle - Beam Trawling

Background Information.

General Particulars.

Offical Number	Measured under Pt. IV		
Name	"Sarah Jayne"		
Type	Stern Trawler ~ Scalloper.		
Dimensions	Length O.A.	50'-9"	15.47m.
	Length Reg'd.	48'-8"	14.83m.
	Beam Mld.	17'-0"	5.18m.
	Depth Mld.	9'-0"	2.74m.
	Draft Aft	7'-0"	2.13m. (D.W.L.)
Tonnage	24.9 Tons Pt. IV		
Owner	[redacted]		
Regd. No	BM 249 (Brixham)		
Built	1979 by W. Visick & Sons Ltd. - Truro.		
Completed	By owner in March 1980.		
Displacement	Ranges from 55.534 Tons Light Ship To 82.321 Tons Loaded Ship.		
Fuel Capacity	2120 Gallons		
Fresh Water	60 Gallons.		

STATEMENT BY THE OWNER

"SARAH JAYNE" BM 249

The operating conditions set out in this book in conjunction with the Working Instructions are based on the worst foreseeable service conditions in respect of the weights and disposition of fish carried in the hold, ice in the hold, fuel, water and other consumeables.

[redacted]

Notes.

1. The Skipper is obliged to ensure that his operation of the vessel does not render the above statement invalid.

2. Should any alteration be made to the vessel's permanent structure or equipment so as to affect its watertight or weathertight integrity, or in the amount or disposition of the weight of the vessel the Marine Safety Agency should be notified and the alteration recorded on the page provided in this book.

Notes to the Skipper of "SARAH JAYNE"

For the purpose of this stability book it has been assumed that the vessel will operate on short voyages as planned.
Sailing from the home port of Brixham on mainly day work and returning to port each night or at the most on a thirty six hour cycle.

Fuel.
The level of fuel in the main tanks has a bearing on the stability of the vessel in so much that to fill the tanks to 98% capacity would cause some over loading and give a forward trim to the vessel. It would also slightly raise the centre of gravity of the vessel.
It is therefore recommended that the tanks be filled to a maximum capacity of 85% which is 900 gallons in each tank and would provide more than adequate fuel for the intended duties. It would also be beneficial to the stability, although not strictly necessary, to have a residue of fuel remaining in the tanks of about 200 gallons total on return to harbour.

Trim Tanks.
The trim ballast tanks are provided to regulate the trim of the vessel. These tanks are not intended to improve the stability of the vessel other than maintaining a regular trim and in the case of bulk fishing to help improve the freeboard aft.

The Condition sheets show ;
On leaving port with full fuel tanks the after trim tanks should be 50% full to give a slight after trim. This should only be necessary in the Sprat fishing and Scalloping modes.
On returning to port with a full load of Sprats the forward trim tank should be filled to 100% capacity. This tank should be "pressed up" to avoid any "free surface effect".
Otherwise it should not be necessary to use the trim tanks at sea.

The after trim tanks may be filled whilst in harbour to achieve a list to the vessel whilst laying alongside a drying out quay. After using the trim tanks they should be pumped dry to avoid any build up of free surface water in the tanks.

Loading

The loading of fish and in particular Sprats, is restricted to the forward pounds of the fish room.
The after pounds, aft of the fish room hatch, should not be used to carry fish. This will reduce the after trim of the vessel and maintain the freeboard requirements.

The fish room has three longitudinal divisions made by pound boards. These boards must be taken up to the deck head to avoid any possibility of the spilling over of fish whilst at sea.

Regular pumping of the fish room must be made when loading fish to avoid any build up water which can give a "free surface effect" to the catch.
An ullage of twelve inches (space between the stowed fish and deck head) has been allowed in the calculations for Sprat fishing loading. This ullage applies to the forward wings and centreline section forward of the fish hatch. The fish hatch section may be filled up to the level of the underside of the plug hatch.

The maximum capacity of the fish room loaded as above is 16.81 tons, which is the maximum capacity of the vessel to maintain the freeboard and stability requirements.

Fish or scallops should not be carried on deck and should be stowed below as soon as is practical.

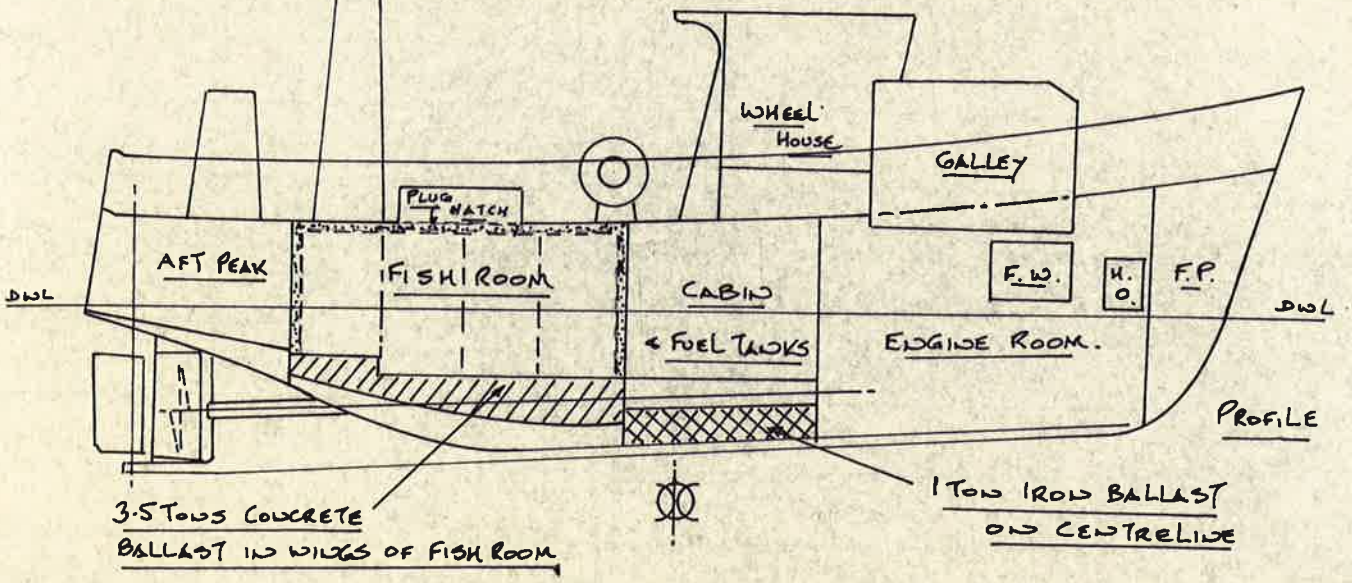
The net drum should be removed when Scalloping or Beam Trawling.

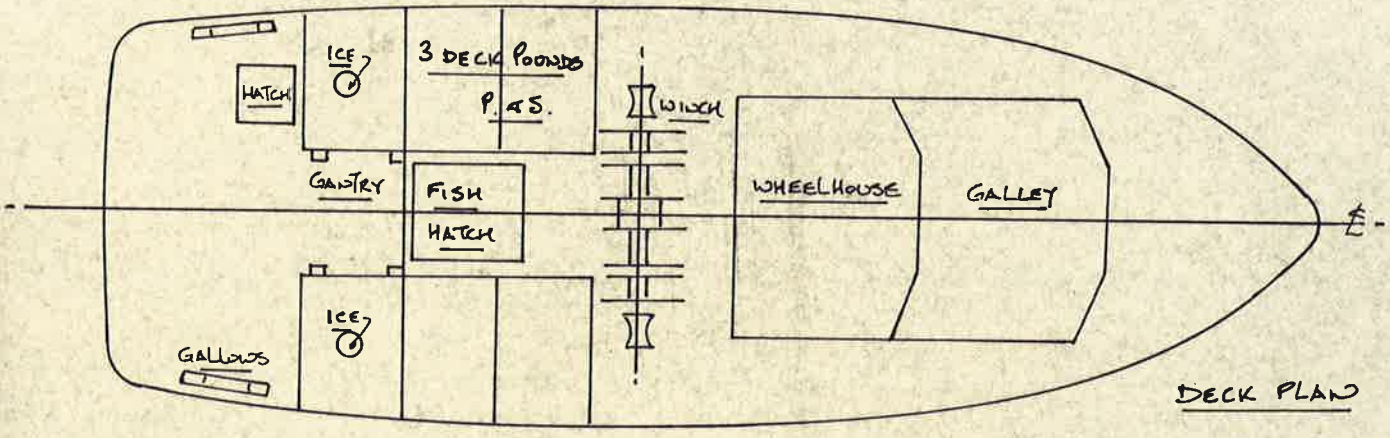
Fish whilst Beaming should be stowed in 40 Kg. boxes with a total capacity of 100 boxes.

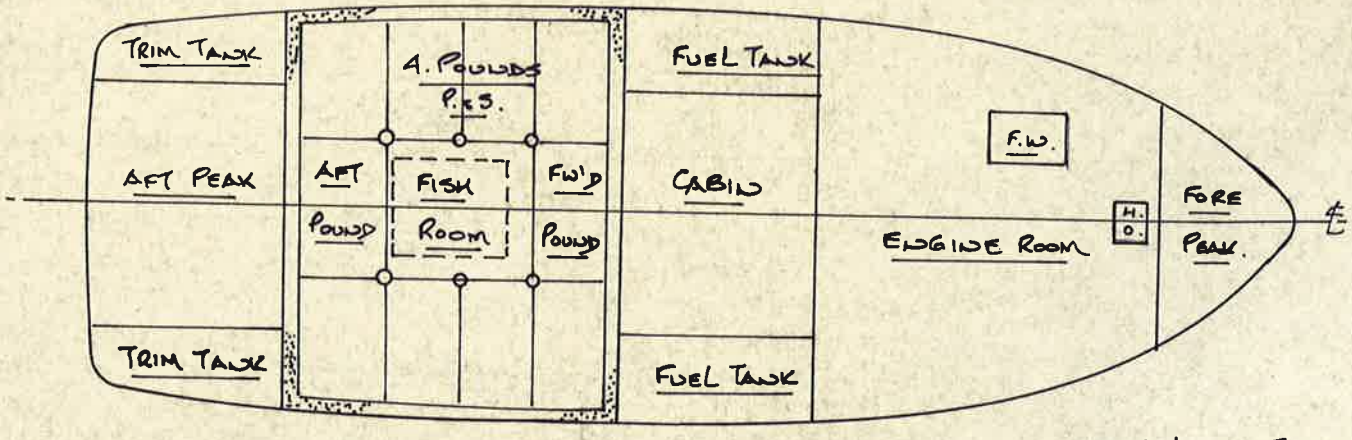
Ice carried whilst Scalloping is 1 ton and 3 tons whilst Beaming. The ice is to be stored in the after sections of the fish room. A small allowance has been made in the calculations for loss of ice due to melting and wastage. This has been assumed as small due to the short length of the fishing cycles.

An allowance for the carrying of fishing gear such as spare nets, tooth bars, shackles and weights, ropes, etc., has been made in the calculations. This gear to be stowed low down in the after section of the fish room.

"SARAH JAYNE"
ARRANGEMENT.







SCALE 1/8" = 1 FOOT.

'SARAH JAYNE'

TANK CAPACITIES

ITEM	CAPACITY %	CAPACITY GALLS.	S.G.	TONS WEIGHT	VCG Above 'K'	L.C.G. About ⊗	F.S.Mt.
FUEL TANKS (P.&S.)	100	2120	0.87	8.23	6.60	1.00 F.	NIL
	98	2077	"	8.07	6.59	"	1.30
	85	1800	"	6.99	6.20	"	1.27
	70	1480	"	5.76	5.30	"	1.10
	30	636	"	2.47	3.60	"	0.79
	10	212	"	0.78	3.00	"	0.57
FRESH WATER (1)	100	60	1.00	0.27	7.90	11.00 F.	NIL
	98	59	"	0.26	7.88	"	0.018
	70	42	"	0.188	7.20	"	"
	30	18	"	0.08	6.50	"	"
	10	6	"	0.03	6.40	"	"
HYD. OIL (1)	98	30	0.89	0.12	7.30	18.00 F.	0.03
	50	15	"	0.06	6.30	"	"
F.P. TRIM TANK (1)	100	890	1.025	4.07	8.61	21.00 F.	NIL
	50	445	"	2.04	6.00	20.05 F.	0.60
	15	134	"	0.61	4.80	20.00 F.	0.20
A.P. TRIM TANKS (P.&S.)	100	872	"	4.00	7.25	20.00 A.	NIL
	50	436	"	2.00	6.50	"	0.29
	30	260	"	1.19	6.30	19.80 A.	0.28
	25	218	"	1.00	6.20	19.50 A.	0.26

NOTES ON THE USE OF FREE SURFACE MOMENTS.

PROVIDED A TANK IS COMPLETELY FILLED WITH LIQUID. NO MOVEMENT OF THE LIQUID IS POSSIBLE AND THE EFFECT ON THE SHIPS STABILITY IS PRECISELY THE SAME AS IF THE TANK CONTAINED SOLID MATERIAL.

IMMEDIATELY A QUANTITY OF LIQUID IS WITHDRAWN FROM THE TANK THE SITUATION CHANGES AND THE STABILITY OF THE SHIP IS ADVERSELY AFFECTED BY WHAT IS KNOWN AS THE "FREE SURFACE EFFECT". THIS ADVERSE EFFECT ON THE STABILITY IS REFERRED TO AS A "LOSS IN GM" OR AS A "VIRTUAL RISE IN V.C.G." AND IS CALCULATED AS FOLLOWS.

FREE SURFACE MOMENT IN TONS FEET

$$= \frac{i\ ft^4 \times \text{SPECIFIC GRAVITY OF LIQUID}}{35\ ft^3/\text{TON} \times 1.025}$$

LOSS OF GM DUE TO FREE SURFACE

$$= \frac{\text{FREE SURFACE MOMENT tons.ft.}}{\text{DISPLACEMENT tons.}}$$

FOR TANKS WHICH ARE RECTANGULAR IN PLAN VIEW

i IS CALCULATED AS $\dfrac{\text{LENGTH OF TANK} \times \text{BREADTH}^3}{12}$

THE CALCULATION IS MADE AT LEVEL OF LIQUID IN THE TANK.

"SARAH JAYNE"

FISH ROOM CAPACITIES.

SECTION	100% Vol ft^3	VCG Above 'K'	LCG Aft ⊗
FWD. SECTION WINGS (P. & S.)	542	6.0'	8.0'
" " ℄	100	6.0	5.0
HATCH SECTION ℄	167	6.0	9.75
	(809)		
AFT SECTION (3 BAYS)	239	6.5	14.60
100% CAPACITY.	1048		

SPRAT STOWAGE RATES (BULK FISHING)

SECTION	STOWED Vol. FT^3	TONS WEIGHT	VCG Above 'K'	VERTICAL MOMENT	LCG Aft ⊗	LONG'L MOMENT
FWD. SECTION WINGS (P.&S.)	450	10.71	5.60'	59.98	8.0	85.68
" " ℄	88	2.10	5.60	11.76	5.0	10.50
HATCH SECTION ℄ (TO U.S. PLUG HATCH)	167	4.00	6.00	24.00	9.75	39.00
TOTALS	795	16.81	5.70	95.74	8.04	135.18

MAXIMUM CAPACITY - SPRAT FISHING IS 16.81 TONS WITH A VCG 5.70' ABOVE 'K' AND LCG 8.04' AFT OF ⊗.

SPRATS STOWED AT A RATE OF 42 FT^3 PER TON.

THE AFTER 3 BAYS OF THE FISH ROOM ARE NOT TO BE USED.

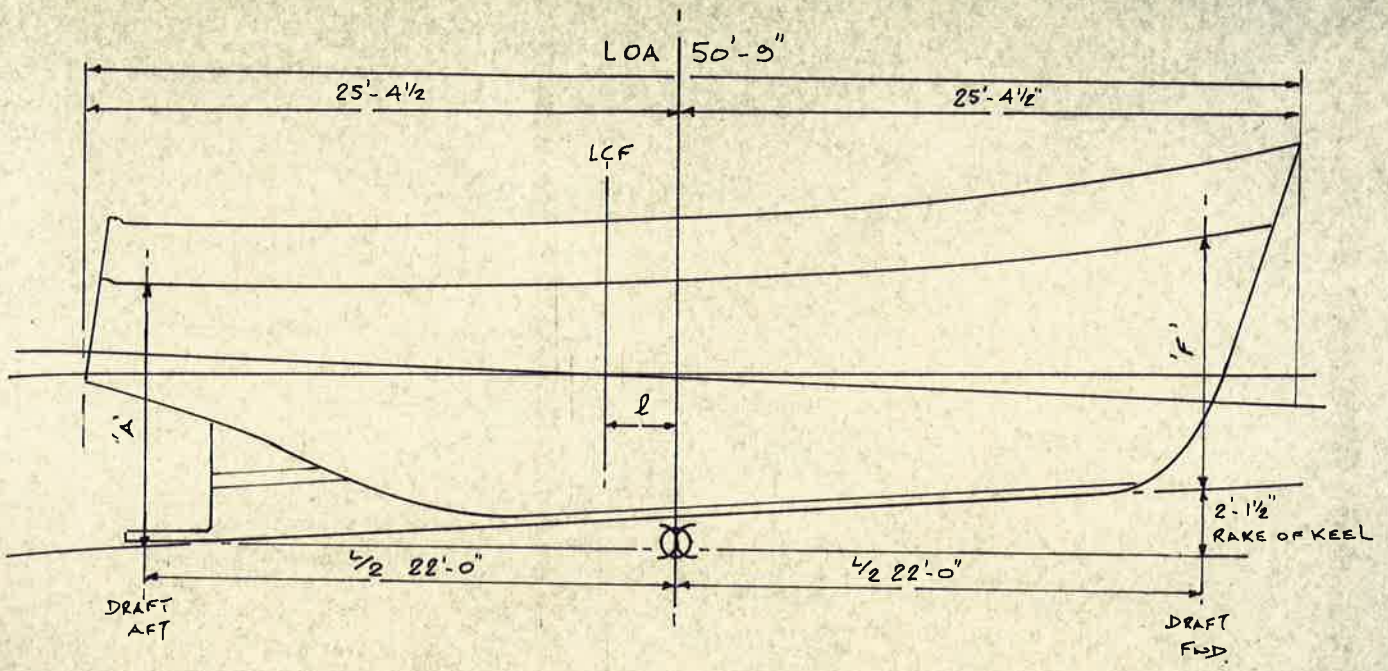
ALL SECTIONS OF FISHROOM TO BE BOARDED UP TO DECK HEAD TO AVOID SPILLAGE.

AN ULLAGE (SPACE BETWEEN DECK HEAD AND FISH) HAS BEEN TAKEN AT 12 INCHES FOR THE FWD. SECTION WINGS & FWD. SECTION ℄ COMPARTMENTS. THE HATCH SECTION ℄ FILLED TO UNDERSIDE PLUG HATCH.

THE FISH ROOM IS TO BE KEPT PUMPED DRY DURING LOADING OF FISH TO AVOID ANY BUILD UP OF WATER.

"SARAH JAYNE"

DRAFTS – TRIM MOMENTS & FREEBOARDS.



TRIM OF THE VESSEL

IF LCG IS AFT OF LCB – SHIP TRIMS AFT.

IF LCG IS FOR'D OF LCB – SHIP TRIMS FOR'D.

TRIM LEVER IS DIFFERENCE IN POSITION OF LCG FROM LCB.

TRIM MOMENT IS TRIM LEVER × DISPLACEMENT.

CHANGE OF TRIM FROM THE DESIGN TRIM IS $\frac{\text{TRIM MOMENT}}{\text{MCT 1"}}$

THE AMOUNT OF TRIM IS PROPORTIONED BETWEEN FOR'D & AFT AS THE VESSEL PIVOTS ABOUT THE LCF.

IN THE CASE OF A VESSEL THAT TRIMS AFT FROM THE DESIGNED TRIM

DRAFT AFT = MEAN DRAFT + CHANGE OF TRIM $\left[\frac{L/2 - l}{L}\right]$ + $\frac{\text{RAKE OF KEEL}}{2}$

DRAFT FOR'D = MEAN DRAFT – CHANGE OF TRIM $\left[\frac{L/2 + l}{L}\right]$ – $\frac{\text{RAKE OF KEEL}}{2}$

IN THE CASE OF A VESSEL THAT TRIMS FORWARD FROM THE DESIGNED TRIM

DRAFT AFT = MEAN DRAFT – CHANGE OF TRIM $\left[\frac{L/2 - l}{L}\right]$ + $\frac{\text{RAKE OF KEEL}}{2}$

DRAFT FOR'D = MEAN DRAFT + CHANGE OF TRIM $\left[\frac{L/2 + l}{L}\right]$ – $\frac{\text{RAKE OF KEEL}}{2}$

FREEBOARDS

M 975 FREEBOARD RULE REQUIREMENT

"SARAH JAYNE" "L" = 46·24' = 14·09M. ∴ FREEBOARD AFT NOT LESS THAN 773MM.

& FREEBOARD FW'D NOT LESS THAN 1213 MM.

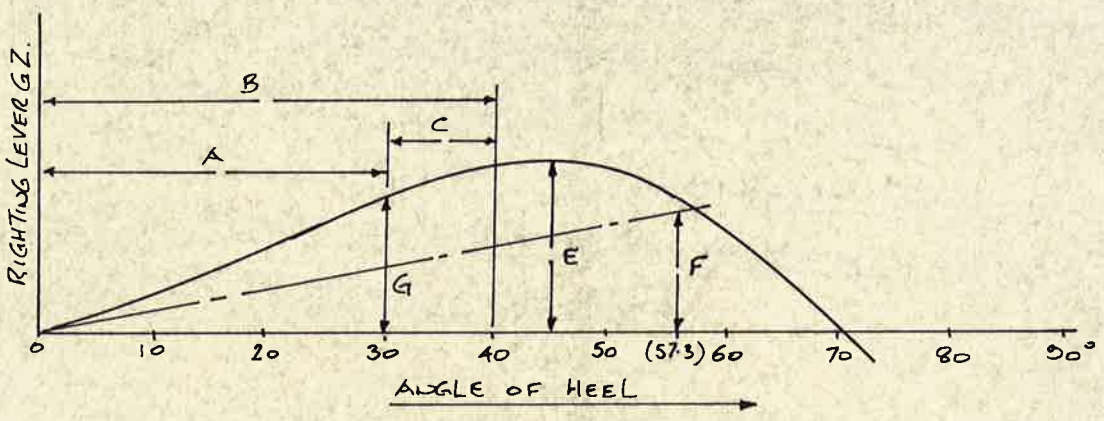
HULL DEPTH AT 'A' = 3300MM HULL DEPTH AT 'F' = 3450MM.

CORRESPONDING FREEBOARDS AT TRIMMED WATERLINE IS OBTAINED BY SUBTRACTING DRAFTS OBTAINED FROM 'A' & 'F'

SPECIAL NOTES REGARDING THE STABILITY OF THE VESSEL

THE VESSEL HAS TO COMPLY WITH THE 1975 FISHING VESSEL SAFETY PROVISIONS RULES. IT IS THEREFORE MOST IMPORTANT THAT IN ANY SAILING CONDITION THE STABILITY COMPLIES WITH THE FOLLOWING MINIMUM CRITERIA.

STATICAL STABILITY CURVE



A. – AREA UNDER GZ CURVE UP TO 30° SHALL BE NOT LESS THAN 0.055 METRE RADIANS.

B. – AREA UNDER GZ CURVE UP TO 40° SHALL BE NOT LESS THAN 0.090 METRE RADIANS. OR SUCH LESS ANGLE OF HEEL AT WHICH THE LOWER EDGES OF ANY OPENINGS IN THE HULL, SUPERSTRUCTURE OR DECKHOUSES OR COMPANIONWAYS, BEING OPENINGS THAT CANNOT BE CLOSED WEATHERTIGHT ARE IMMERSED.

C – AREA UNDER GZ CURVE BETWEEN 30° AND 40° OR SUCH LESSER ANGLE AS DEFINED ABOVE TO BE NOT LESS THAN 0.030 METRE RADIANS.

E – MAXIMUM RIGHTING LEVER GZ SHALL OCCUR AT AN ANGLE OF HEEL NOT LESS THAN 25°

F – IN THE UPRIGHT POSITION THE TRANSVERSE METACENTRIC HEIGHT GM SHALL BE NOT LESS THAN 0.35 METRES.

G. – THE RIGHTING LEVER GZ SHALL BE AT LEAST 0.20 METRES AT AN ANGLE OF HEEL EQUAL TO OR GREATER THAN 30°

H – FREEBOARD HEIGHTS SHALL CONFORM TO THE REQUIREMENTS OF NOTICE M.375.

FOR VESSELS ENGAGED IN SINGLE OR TWIN BOOM FISHING THE VALUES OF A, B, C, F & G. SHALL BE INCREASED BY 20%.

ie A = 0.066 METRE RADIANS.
B. = 0.108 METRE RADIANS.
C. = 0.036 METRE RADIANS.
F. = 0.420 METRES.
G. = 0.240 METRES.

General Stability Precautions

Compliance with the stability criteria does not ensure immunity against capsizing regardless of the circumstances or absolve the skipper of his responsibilities. Skippers should therefore exercise prudence and good seamanship having regard to the season of the year, weather forecasts, the navigational zone and should take the appropriate action as to speed and course warranted by the prevailing conditions.

Care should be taken to ensure that the cargo (fish) is properly stowed so that compliance with the criteria can be achieved. Loose equipment should be stowed or lashed in position so as to minimise the possibility of both longitudinal or lateral shifting whilst at sea.

Cross connection ballast, fuel and other tank pipelines should be closed at the valves to avoid any transference of liquid from one side to the other whilst at sea or if the vessel is unattended to prevent any increase in list.

Bilges should be pumped dry whilst loading or stowing fish to avoid any build up of water affecting the stowage of fish whilst bulk fishing.
Bilges should be kept dry at all times and a method of monitoring the bilge level throughout the vessel, in particular whilst at sea, should be made.

INCLINING EXPERIMENT

TRAWLER "SARAH JAYNE" BM 249 — 23 FEBRUARY 1994

LOCATION — BRIXHAM INNER HARBOUR

CONDITIONS — SMOOTH WATER - LIGHT WIND
VESSEL MOORED BOW & STERN TO QUAY
AND FREE TO MOVE.

VESSEL — COMPLETE & IN A SEA GOING STATE EQUIPED FOR MID WATER TRAWLING. NET ON NET DRUM, LANDING & BOARDING DERRICKS RIGGED.

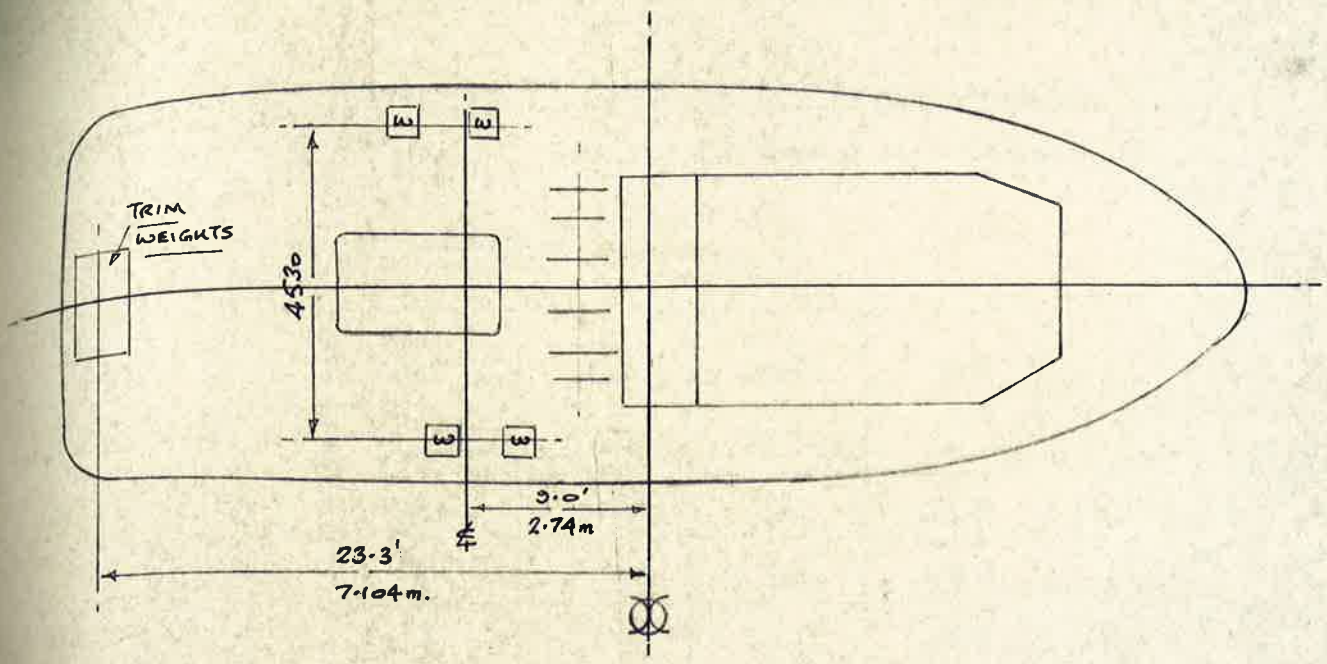
TANKS. — FUEL TANKS P. & S. TOPPED UP FULL TO DECK LEVEL.
FRESH WATER TANK EMPTY.
HYDRAULIC OIL TANK FULL.
LUB. OIL CARRIED IN 4 x 25Lt. DRUMS IN ENG. ROOM.
BALLAST TANKS.
FORWARD — DRY
AFT PORT - 2" SOUNDING - AS PUMPED DRY.
AFT STAR'D. - 4¾" SOUNDING - AS PUMPED DRY.

BILGES. — ENGINE ROOM 5" SOUNDING IN 2 BAYS - AS PUMPED DRY.
CABIN 2" SOUNDING - AS PUMPED DRY.
FISH ROOM 5" SOUNDING IN 2 BAYS - AS PUMPED DRY.
AFT PEAK. BAILED OUT DRY.

POUNDS — DECK & FISH ROOM POUND BOARDS ALL FITTED.
FISH ROOM EMPTY OF BOXES OR GEAR.

[redacted]

DISPOSITION OF INCLINE WEIGHTS



INCLINE WEIGHTS W 6 × 20Kg = 120Kg MOVED ACROSS 4.530 M.

C.G. OF WEIGHTS 205mm ABOVE DECK. (AT SIDE)

TRIM WEIGHTS 26 × 20Kg PLACED ON DECK AFT = 520Kg.

C.G. OF WEIGHTS 130 mm ABOVE DECK (ON ℄)

DRAFT MARKS

WITH ONE MAN ON BOARD THE DRAFT MARKS READ

FORWARD	167 CM.
AFT	229 CM.
MEAN DRAFT	198 CM.

DISPLACEMENT TO MARKS IN S.W. READING 1.025 S.G.

68 TONS. = 69.088 TONNES.

DISPLACEMENT ON TEST 69.088 PLUS 2 MEN (0.15)

= 69.238 TONNES (68.148 TONS)

PENDULUMS & DEFLECTIONS.

ONE AFT PENDULUM RIGGED IN FISHROOM LENGTH 1930 mm.

ONE FW'D PENDULUM RIGGED IN ENG. ROOM LENGTH 3410 mm.

DEFLECTIONS RECORDED

SHIFT	WEIGHT	MOVE	A.P.	F.P.
1	120 KG.	S. to P.	27.5 mm.	61 mm
2	120	S. to P.	30	63.5
3	120	P. to S.	30	63.5
4	120	P. to S.	27.5	63.5
5	120	P. to S.	26.5	61
6	120	P. to S.	32	65
7	120	S. to P.	32	63.5
8	120	S. to P.	26.5	65
		TOTALS	232	506
		MEAN	29	63.25

TANGENT OF DEFLECTED ANGLE AT A.P. = $\frac{29}{1930}$ = 0.0150

AT F.P. = $\frac{63.25}{3410}$ = 0.0185

MEAN TAN θ = 0.01675

POSITION OF CENTRE OF GRAVITY

$$GM\ (\text{AS INCLINED}) = \frac{w \times d}{W \tan\theta}$$

$w = 0.12t.$
$d = 4.53m.$
$W = 69.238t.$
$\tan\theta = 0.01675$

$$= \frac{0.12 \times 4.53}{69.238 \times 0.01675}$$

$= 0.4687$ Metres $= 1.537$ FT.

CENTRE OF GRAVITY (AS INCLINED)

VIRTUAL CG ABOVE 'K' = KMT − GM
= 9.30' − 1.537'
= 7.763 FT. ABOVE 'K'

NO ALLOWANCE MADE FOR FREE SURFACE

LONGITUDINAL POSITION OF C.G.

TRIM MEASURED OFF DWL ON LINES PLAN
= 0.43 − 0.16 = 0.27FT. FORWARD

$$\text{TRIM} = \frac{\text{LEVER BG} \times \Delta^{lt.}}{\text{MCT 1"} \times 12}$$

$$\text{TRIM LEVER BG.} = \frac{0.27 \times 4 \times 12}{68.15} = 0.19' \text{ FWD.}$$

LCB IS 1.45' AFT OF AMIDSHIPS

∴ LCG IS 1.45 − 0.19 = 1.26 FT. AFT OF AMIDSHIPS.

CORRECTIONS TO GIVE LIGHT SHIP-CONDITION

ITEM	TONS	ABOVE K		AFT ℄		FOR'D ℄		FREE SURFACE Mt.
		Lever	Moment	Lever	Moment	Lever	Moment	
INCLINED VESSEL	68.15	7.763	529.05	1.26	85.87	—	—	—
LESS								
1 MAN W.HOUSE	0.074	11.3	0.84	—	—	2.0	0.15	—
1 MAN ENG. ROOM	0.074	5.9	0.44	—	—	10.0	0.74	—
1 MAN FISH ROOM	0.074	5.3	0.39	9.5	0.70	—	—	—
INCLINE WEIGHTS	0.472	10.15	4.79	9.0	4.25	—	—	—
TRIM WEIGHTS	0.512	10.45	5.35	23.30	11.93	—	—	—
FUEL TANKS P.&S. 100%	8.23	6.6	54.32	—	—	1.0	8.23	IGNORED
HYD. OIL	0.12	9.5	1.14	—	—	18.0	2.16	NEGLIBLE.
LUB OIL - IN DRUMS	0.08	4.4	0.35	—	—	9.0	0.72	"
PROVISIONS / STORES	0.10	12.0	1.20	—	—	12.0	1.20	—
SPRAT TRAWL	0.133	14.5	1.93	15.5	2.06	—	—	—
BRIDLES - SET	0.219	14.5	3.18	15.5	3.39	—	—	—
200 FATH. TRAWL WARPS	0.383	11.8	4.52	3.0	1.15	—	—	—
1 PAIR TRAWL DOORS	0.395	12.5	4.94	20.0	7.90	—	—	—
NET DRUM	1.75	14.5	25.38	15.5	27.13	—	—	—
	(12.616)	(8.62)	(108.77)		(58.51)		(13.20)	—
					13.20			
					45.31			
TOTALS	55.534	7.568	420.28	0.730	40.56			—

LIGHT SHIP DISPLACEMENT 55.534 TONS

CG IS 7.568 FT. ABOVE 'K' AND 0.73 FT. AFT OF AMIDSHIPS

(ABOVE WEIGHT INCLUDES SONAR, BOARDING DERRICK, LANDING BOOM. AND HEADLINE TRANSDUCER DRUM.)

HYDROSTATIC PARTICULARS

DISPLACEMENT	55.534 T	BMT	5.75'	TRIM	0.473' FWD.
MEAN DRAFT AT MARKS	176 cm.	KMT	9.54'	DRAFT AFT	6.88 FT
T.P.I.	1.43 T.	GM SOLID	1.972'	DRAFT FWD.	4.78 FT.
MCT 1"	3.6	LCB AFT ℄	1.07'		
VCB	3.78'	LCF AFT ℄	3.06'		
BML	44.47'				

CONDITION 1

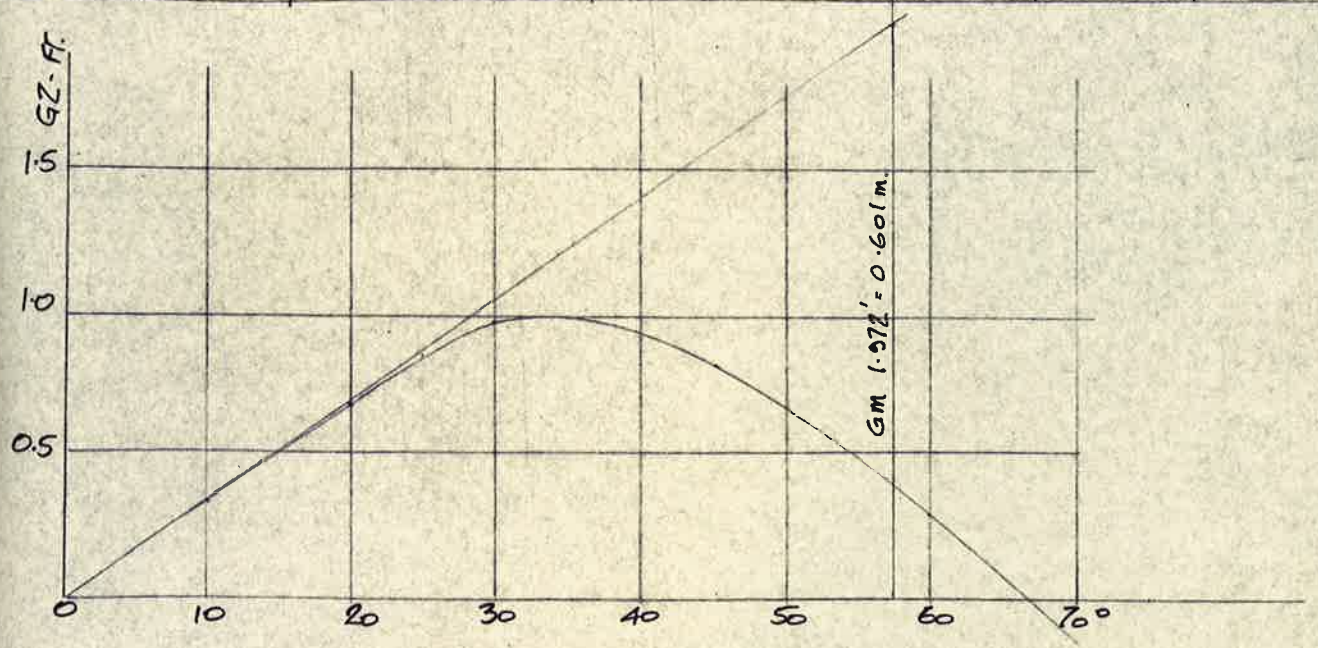
LIGHT SHIP

CURVE OF STATICAL STABILITY

$$GZ = KN - KG \sin\theta$$

DISPLACEMENT 55.534 TONS KG = 7.568 FT.

θ	10°	20°	30°	45°	50°	60°	75°
Sin θ	0.174	0.342	0.500	0.707	0766	0.866	0.966
KN	1.63	3.25	4.69	6.15		6.83	6.92
KG Sin θ	1.317	2.588	3.784	5.351		6.55	7.31
GZ	0.313	0.662	0.906	0.799		0.28	- 0.39



θ°	GZ	SM	F(AREA)
0	0	1	0
10	0.313	3	0.939
20	0.662	3	1.986
30	0.906	1	0.906

AREA TO 30° = 3/8 × 10° × 3.831 = 14.37 FT° = 0.076 m.R.

AREA 30°-40° = 0.050 m.RAD.

GZ AT 30° = 0.906 FT. = 0.276 m.

θ°	GZ	SM	F(AREA)
0	0	1	0
10	0.313	4	1.252
20	0.662	2	1.324
30	0.906	4	3.624
40	0.923	1	0.923

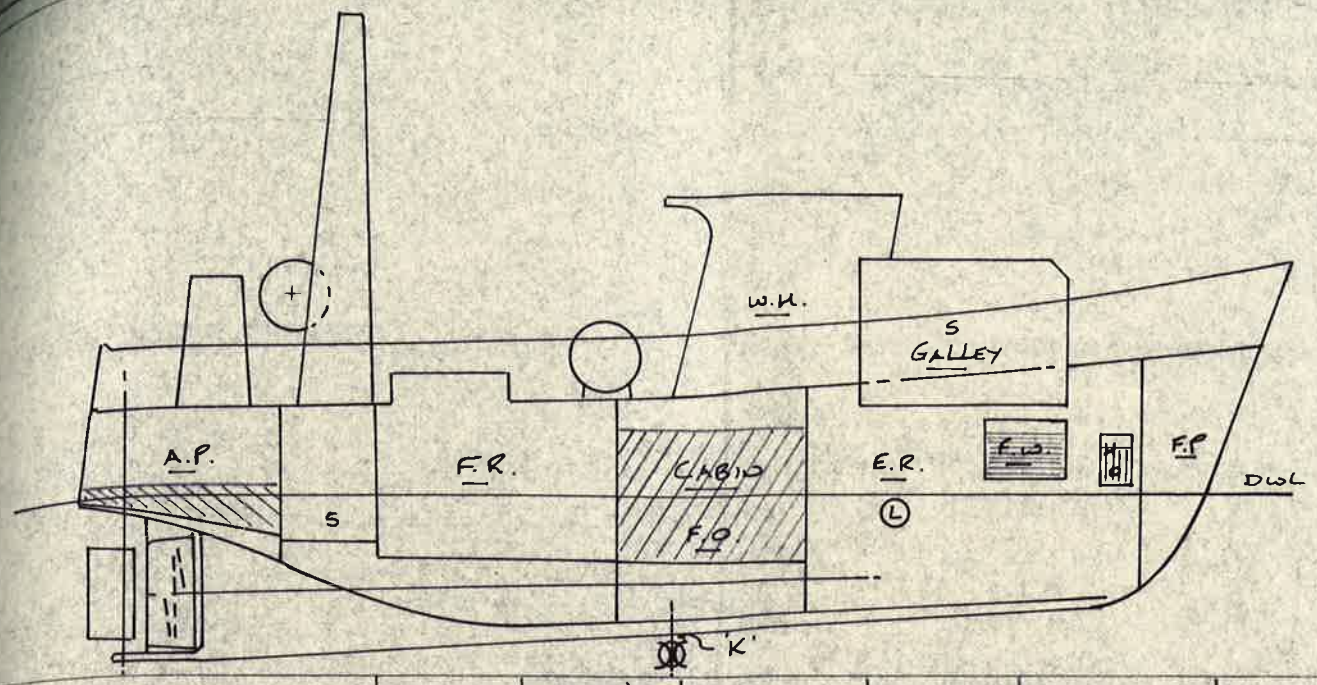
AREA TO 40° = 1/3 × 10° × 7.123 = 23.74 FT° = 0.126 m.R.

"SARAH JAYNE"

VOYAGE CYCLE - SPRAT FISHING

SPRAT FISHING CONDITION 3

ARRIVAL AT FISHING GROUNDS - 70% CONSUMEABLES.



CODE	DEADWEIGHT	TONS
	FUEL	5.76
	FRESH WATER	0.188
	HYDRAULIC OIL	0.08
(L)	LUB OIL (DRUMS)	0.06
S.	SPARE GEAR & STORES	0.31
	S.W. BALLAST	1.19

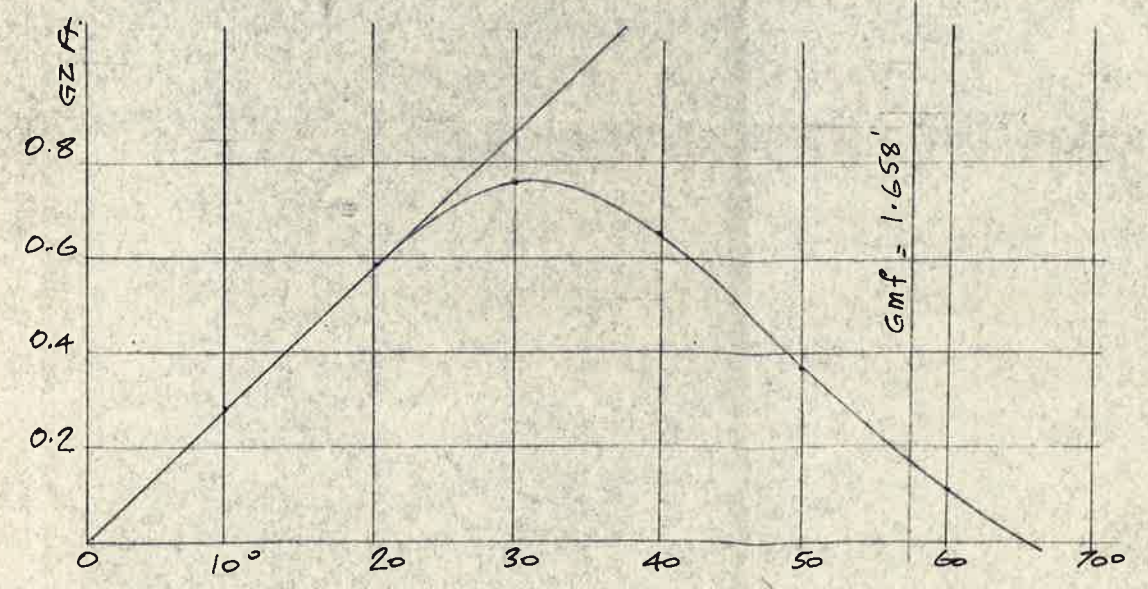
CALCULATION FOR GM	Feet
FREE SURFACE CORRECTION 1.428 / 66.229	0.022
KG	7.630
KG CORRECTED	7.652
KMT	9.310
GM FLUID	1.658

ITEM OF DEADWEIGHT		TONS	ABOVE 'K' VCG	VERTICAL MOMENT	ABAFT ♮ LCG	LONG'L MOMENT	F.S.M.
FUEL (P. & S.)	70%	5.76	5.30	30.53	1.00 F.	5.76 F.	1.100
F.W.	70%	0.188	7.20	1.35	11.00 F.	2.07 F.	0.018
HYDRAULIC OIL	70%	0.08	6.30	0.55	18.00 F	1.44 F.	0.030
LUB. OIL DRUMS		0.06	4.40	0.26	9.00 F.	0.54 F.	NEG.
PROVISIONS / STORES		0.08	12.00	0.96	12.00 F.	0.96 F.	—
CREW	3 MEN	0.222	12.70	2.82	—	—	—
MID WATER TRAWL ON WETDRM		2.102	14.50	30.48	15.50 A.	32.58 A.	—
200 f. TRAWL WARPS		0.383	11.80	4.52	3.00 A.	1.15 A.	—
1 PR. TRAWL DOORS		0.400	12.50	5.00	20.00 A.	8.00 A.	—
SPARE TRAWL & F.GEAR	AFT FISH Rm.	0.230	4.75	1.09	14.90 A.	3.43 A.	—
		(9.505)	(8.16)	(77.56)	(3.62 A.)	(34.39 A.)	(1.148)
F.P. TANK	DRY	—	—	—	—	—	—
A.P. TANKS (P. & S.)	(30%)	1.19	6.30	7.50	19.80 A.	23.56 A.	0.28
LIGHT SHIP		55.534	7.586	420.28	0.73 A.	40.56 A.	—
DISPLACEMENT		66.229	7.630	505.34	1.43 A.	98.51 A.	1.428

MEAN DRAFT AT MARKS	195 cm.	L.C.B.	= 1.40 A.
L.C.F. AFT ♮	3.30 FT.	TRIM LEVER BG.	= 0.09 FT. AFT.
L.C.B. AFT ♮	1.40 FT	TRIM OVER L.B.P.	$\frac{0.09 \times 66.229}{4.97 \times 12}$ = 0.100 FT. AFT
MCT 1"	4.97 T/FT.		
T.P.I. IMMERSION	1.5 T.		
V.C.B. ABOVE 'K'	4.15 FT.		
DRAFT AT AFT MARKS = 7.505'	= 229 cm.	HULL DEPTH AFT 330 cm.	FREEBOARD AFT 101 cm.
DRAFT AT FWD. MARKS = 5.28'	= 161 cm.	HULL DEPTH FWD. 345 cm.	FREEBOARD FWD. 184 cm.

KN VALUES TAKEN AT LEVEL TRIM - 66.229T. DISPLACEMENT (TRIM NEGILIBLE)

θ	10°	20°	30°	40°	50°	60°
Sin θ	0.174	0.342	0.500	0.643	0.766	0.866
KN	1.610	3.200	4.580	5.560	6.225	6.730
KG Sin θ	1.331	2.617	3.826	4.920	5.861	6.627
GZ	0.279	0.583	0.754	0.640	0.364	0.103



θ°	GZ	SM	F (AREA)
0	0	1	0
10	0.279	3	0.837
20	0.583	3	1.749
30	0.754	1	0.754

AREA TO 30° = 3/8 × 10° × 3.340 = 12.525 FT° = 0.066 m.R.

θ°	GZ	SM	F (AREA)
0	0	1	0
10	0.279	4	1.116
20	0.583	2	1.166
30	0.754	4	3.016
40	0.640	1	0.640

AREA 30° - 40° = 0.039 m.RAD. AREA TO 40° = 1/3 × 10° × 5.938 = 19.79 FT° = 0.105 m.R

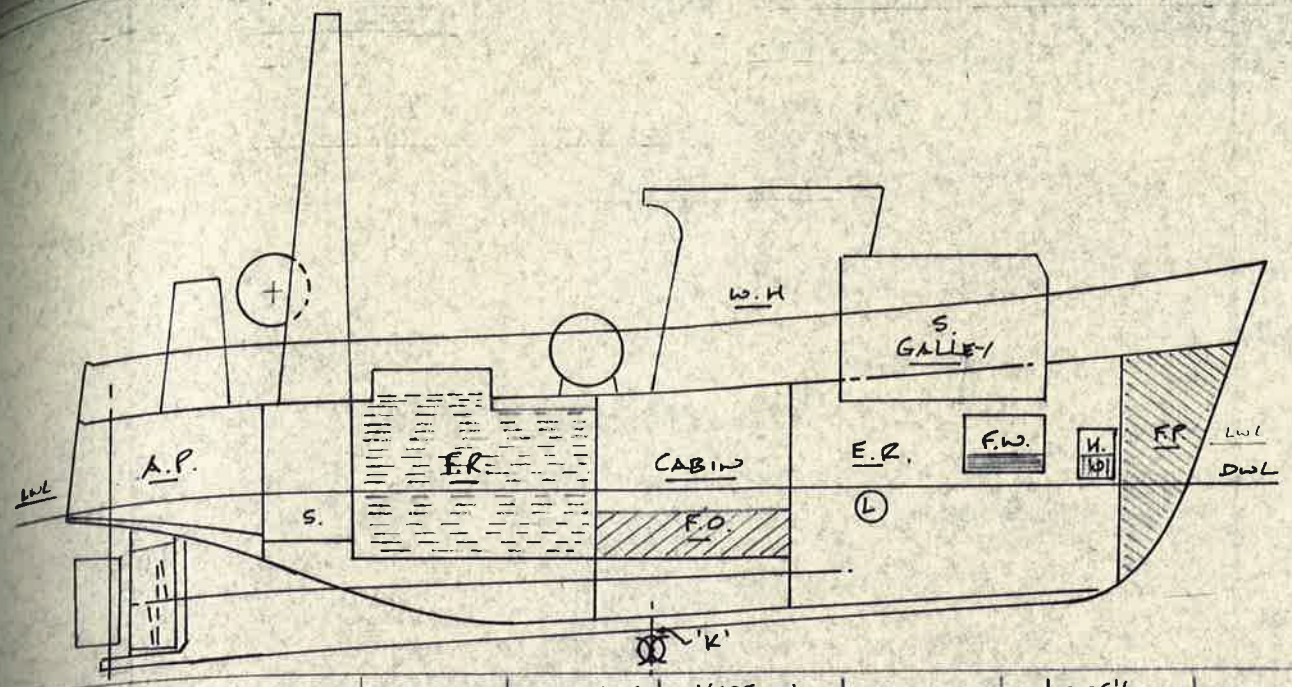
GZ AT 30° = 0.754 FT. = 0.23 m.

IN THIS CONDITION VESSEL MEETS REQUIRED CRITERIA.

SPRAT FISHING — CONDITION 4

LEAVE FISHING GROUNDS - MAXIMUM CATCH

30% CONSUMEABLES.



CODE	DEADWEIGHT	TONS
	FUEL	2.47
	F.W.	0.08
	HYDRAULIC OIL	0.06
L	LUB. OIL (DRUMS)	0.03
S.	SPARE GEAR & STORES	0.16
	S.W. BALLAST	4.07
	FISH - SPRATS	16.81

CALCULATION FOR GM	feet
FREE SURFACE CORRECTION $\frac{0.838}{82.321}$	0.010
KG	7.348
KG CORRECTED	7.358
KMT CORRECTED FOR TRIM 0.273' FWD	9.080
GM FLUID.	1.722

ITEM OF DEADWEIGHT		TONS	ABOVE 'K' VCG	VERTICAL MOMENT	ABOUT ⊗ LCG	LONG'L MOMENT	F.S.m.
FUEL (P.&S.)	30%	2.47	3.60	8.892	1.00 F.	2.47 F.	0.79
F.W.	30%	0.08	6.50	0.520	11.00 F.	0.88 F.	0.018
HYD. OIL	50%	0.06	6.30	0.378	18.00 F.	1.08 F.	0.03
LUB. OIL (DRUMS)		0.03	4.40	0.132	9.00 F.	0.27 F.	NEG.
PROVISIONS/STORES		0.03	12.00	0.360	12.00 F.	0.36 F.	—
CREW	3 MEN	0.222	12.7	2.820	—	—	—
MID WATER TRAWL ON NET DRUM		2.102	14.50	30.480	15.50 A.	32.58 A.	—
200 f. TRAWL WARPS		0.383	11.80	4.520	3.00 A.	1.15 A.	—
1PR. TRAWL DOORS		0.400	12.50	5.000	20.00 A.	8.00 A.	—
SPARE TRAWL + FISH GEAR AFT	(FISH ROOM)	0.130	4.75	0.618	14.50 A.	1.94 A.	—
SPRATS : MAX CATCH F.R.		16.81	5.70	95.817	8.04 A.	135.15 A.	—
		(22.717)	(6.583)	(149.537)	(7.65 A.)	(173.76 A.)	(0.838)
F.P. TANK	100%	4.07	8.61	35.043	21.00 F.	85.47 F.	NIL
A.P. TANKS (P.&S.)	0%	—	—	—	—	—	—
LIGHT SHIP		55.534	7.568	420.28	0.73 A.	40.56 A.	—
DISPLACEMENT		82.321	7.348	604.86	1.565 A.	128.85 A.	0.838

MEAN DRAFT AT MARKS	221 cm.
L.C.F. AFT ⊗	3.15 FT.
L.C.B. AFT ⊗	1.77 FT.
M.C.T. 1"	5.16 T/FT.
T.P.I. IMMERSION	1.57 T.
VCB ABOVE 'K'	4.66 FT.
DRAFT AT AFT MARKS 8.156' =	249 cm.
DRAFT AT FWD. MARKS 6.304' =	192 cm.

L.C.B. = 1.77 A

TRIM LEVER BG. = 0.205 FT. FWD.

TRIM OVER L.B.P. $\frac{0.205 \times 82.321}{5.16 \times 12} = 0.273'_{FWD}$

HULL DEPTH AFT	330 cm.	FREEBOARD AFT	81 cm.
HULL DEPTH FWD	345 cm.	FREEBOARD FWD.	153 cm.

KN VALUES INTERPOLATED FOR 82.321 TONS Δ^t AT 0.273 FT. FWD. TRIM.

Θ	10°	20°	30°	40°	50°	60°
Sin Θ	0.174	0.342	0.500	0.643	0.766	0.866
KN	1.5826	3.1498	4.3780	5.3226	6.0656	6.6160
KG Sin Θ	1.2803	2.5164	3.6790	4.7312	5.6362	6.3720
GZ	0.3023	0.6334	0.6990	0.5914	0.4294	0.244

Θ°	GZ	SM	F (AREA)
0	0	1	0
10	0.3023	3	0.9069
20	0.6334	3	1.9002
30	0.6990	1	0.6990

AREA TO 30° = 3/8 × 10° × 3.5061 = 13.148 FT° = 0.070 m.R.

Θ°	GZ	SM	F (AREA)
0	0	1	0
10	0.3023	4	1.2092
20	0.6334	2	1.2668
30	0.6990	4	2.7960
40	0.5914	1	0.5914

AREA TO 40° = 1/3 × 10° × 5.8634 = 19.54 FT° = 0.104 m.R.

AREA 30° - 40° = 0.034 m.RAD.

GZ AT 30° = 0.6990 FT. = 0.213 m.

IN THIS CONDITION VESSEL MEETS REQUIRED CRITERIA.

METRIC CONVERSIONS

Metric Equivalents

MULTIPLY BY	TO CONVERT FROM	TO OBTAIN	—
0.03937	MILLIMETRES	INCHES	25.4
0.3937	CENTIMETRES	INCHES	2.54
3.2808	METRES	FEET	0.3048
2.2046	KILOGRAMMES	POUNDS	0.45359
0.0009842	KILOGRAMMES	TONS (2240lbs)	1016.047
0.9842	METRIC TONS (ie TONNES OF 1000 KILOS.)	TONS (2240 lbs)	1.016
2.4998	METRIC TONS PER CENTIMETRE (of IMMERSION)	TONS PER INCH (IMMERSION)	0.4000
8.2014	MOMENT TO CHANGE TRIM ONE CENTIMETRE (TONNE METRE UNITS)	MOMENT TO CHANGE TRIM ONE INCH (FOOT TON UNITS)	0.122
187.9767	METRE RADIANS	FEET DEGREES	0.0053
—	TO OBTAIN	TO CONVERT FROM	MULTIPLY BY ABOVE

Relation between Weight & Volume

10mm. cubed = 1 cubic centimetre

1 cubic centimetre of fresh water (S.G.1.0) = 1 gramme

1000 " " " " " " = 1 Kilogram (1000 grammes)

1 " metre " " " " = 1 Tonne (1000 kilos)

1 " " " salt water (S.G.1.025) = 1.025 Tonnes.

1 tonne " " " " " = 0.975 Cubic Metres

1 cubic metre = 35.316 cubic feet

1 cubic foot = 0.0283 cubic metres.

RECORD OF MINOR ALTERATIONS TO THE VESSEL.

ALL MINOR ALTERATIONS TO THE VESSEL INCLUDING ALTERATIONS TO THE PERMANENT BALLAST OR FISHING GEAR, SHOULD BE ENTERED HERE. MINOR BEING INTERPRETED AS CAUSING A LOSS IN STABILITY WHICH IS SMALL IN RELATION TO THE MARGIN OVER THE LEGAL MINIMUM, OR WHICH INCREASES STABILITY. MAJOR ALTERATIONS WILL REQUIRE COMPREHENSIVE REVISION OF THE BOOK. THE MARINE SAFETY AGENCY (M.S.A.) SHOULD BE NOTIFIED OF ALL ENTRIES MADE.

ALTERATION DETAIL	WEIGHT TONS	L.C.G.' from AMIDSHIPS	LONG'L. MOMENT TONS/FEET	VCG' Above 'K'	VERTICAL MOMENT TONS/FEET	REMARKS.

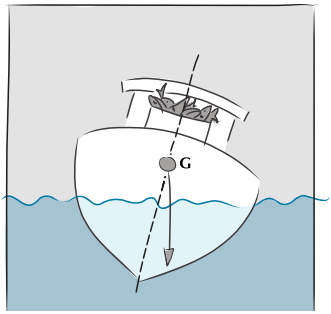
Annex D

Extracts from Fishermen’s Safety Guide

Stability

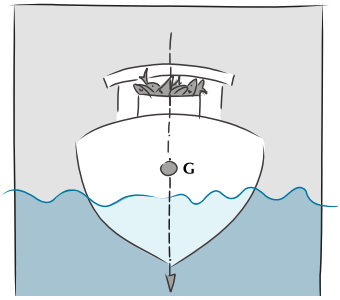
The Stability of a vessel refers to its ability to return to the upright position in the water.

Many different things can affect the stability of a vessel and cause it to capsize. However these things can be controlled. A well designed vessel will not capsize even in the worst conditions – if it is operated properly. Fishing vessel stability is a very complex subject. Some basic rules are outlined below.

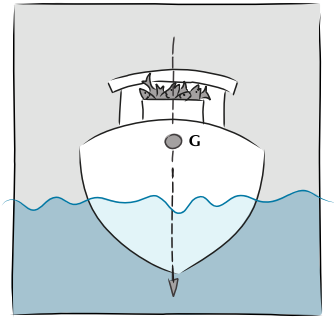


Centre of gravity

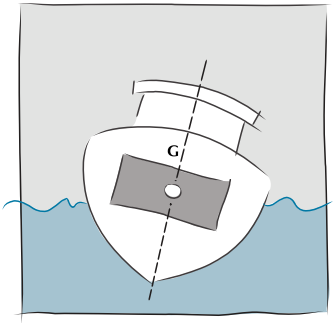
The centre of gravity is the point at which the whole weight of the vessel can be said to act vertically downward. As a general rule, a lower centre of gravity means a more stable vessel.



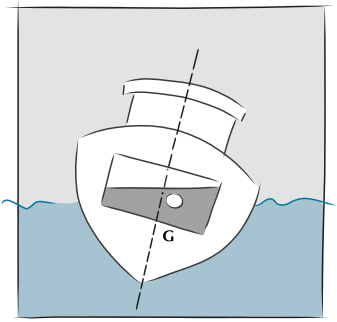
The centre of gravity changes depending upon how weight is distributed in the vessel. For example, a heavy load placed high on deck will produce a higher centre of gravity, and hence less stability, than a load stored below deck.



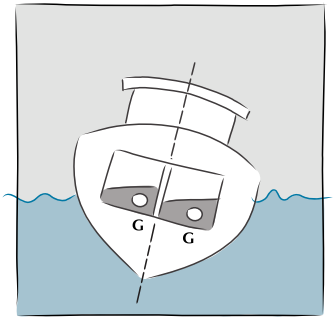
A vessel with a high centre of gravity is 'top heavy'. If it lists or heels to one side, the centre of gravity pushes down in the direction of the list. The danger of capsizing is much greater.



When a vessel with full tanks heels over, the contents of the tank do not shift. The tank's centre of gravity does not change, so it does not affect the vessel's stability.



In a partly filled tank or hold, the contents will shift with the movement of the boat. This 'free surface' effect increases the danger of capsizing.



When a vessel, with partially filled spaces, heels over, the contents of the spaces will shift. The centre of gravity moves over to the side, making the vessel less stable.

You cannot always avoid partly filled spaces. By dividing a tank into two equal parts with a longitudinal baffle, the free surface effect is greatly reduced. Using boards to divide fish wells into compartments will also help.

Loose water or fish on deck

Fish left loose upon the deck have the same effect as water. Fish should be properly stowed in the hold as soon as possible to maintain stability.

When water is shipped on deck and unable to escape, it creates a large free surface. It also adds weight high in the vessel. Freeing ports (scuppers) are vital for removing shipped water and maintaining stability.

Loading and unloading

Loading and unloading operations have a dramatic effect on stability. For example when a heavy load is lifted clear of the water it has the same effect on the vessel's centre of gravity as if the weight were actually at the head of the boom. The vessel will also heel. All such operations should proceed with extreme caution.

Freeboard

A proper freeboard is essential for stability. Freeboard is the distance between the water and the working deck of the vessel. If the deck edge goes under the water when the vessel heels, the danger of capsizing is great.

An overloaded vessel will have too low a freeboard. The deck will submerge with even a slight heel. Overloading is a major cause of fishing vessels capsizing.

Watchkeeping

With the continued development of modern day audio/visual equipment – mobile phones, the iPod and the portable DVD player supplementing the old favourites of domestic radios, CD players and television sets, the number of potential distractions is increasing.

If you have any of these items, or similar, in the wheelhouse of your fishing vessel then **they should never be used to the detriment of navigational duties**. The proper place for these 'distractions' is in the crew accommodation.

Investigations into collisions and groundings involving fishing vessels have shown that poor watchkeeping is a major cause of such incidents. A competent and alert Watchkeeper, keeping a proper all round lookout at all times, is absolutely essential for the safety and wellbeing of the crew and the vessel.

Marine Guidance Note – MGN 313 (F): 'Keeping a Safe Navigational Watch on Fishing Vessels' gives more information and explains why fishing vessels need to maintain a proper navigational watch at all times. Please see page 63 for details of how to obtain this MGN.

Marine Accident Report