Report on the investigation of

the collision between the German container ship

Merkur

and the United Kingdom fishing vessel

Silvery Sea

which then foundered about 35 miles west of Esbjerg, Denmark

with the loss of five lives on 14 June 1998

Marine Accident Investigation Branch
First Floor
Carlton House
Carlton Place
Southampton
SO15 2DZ

Report No 21/2000

Extract from

The Merchant Shipping

(Accident Reporting and Investigation)

Regulations 1999

The fundamental purpose of investigating an accident under these Regulations is to determine its circumstances and the causes with the aim of improving the safety of life at sea and the avoidance of accidents in the future. It is not the purpose to apportion liability, nor, except so far as is necessary to achieve the fundamental purpose, to apportion blame.

CONTENTS

Approximate position of collision
Probable track of Silvery Sea
0800
Track of Merkur
0700
0600
DENMARK
ESBJERG
FANØ
RØMØ
Sylt Outer Reef
Sylt Outer Ground
DENMARK GERMANY
3767
Westerland
Kampen
List
Ammunition Dumping Ground (disused)
Reproduced from Admiralty Chart 1405 by permission of the Controller of HSMO and the UK Hydrographic Office

SYNOPSIS

At 0607 Universal Co-ordinated Time (UTC) on 14 June 1998, the UK registered fishing vessel *Silvery Sea* collided with the German registered container ship *Merkur* about 35 miles west of Esbjerg, Denmark. This caused *Silvery Sea* to founder with the loss of her five-man crew. The Department of the Environment, Transport and the Regions' (DETR) duty officer notified the Marine Accident Investigation Branch (MAIB) of the accident at 0912 that day. Captain P Kavanagh carried out the investigation.

Silvery Sea was on passage from the fishing grounds near the entrance to the Firth of Forth on a true course of 098° and making a speed of about 9.3 knots. She was fully loaded with her catch of sand eels and making for Esbjerg on the west coast of Denmark to land it.

Merkur was on passage from Hamburg to Gothenburg, partly loaded with containers. She was making good a course of 340° and a speed of 15 knots. The chief officer and a seaman were on watch at the time of the incident. The weather was fine with good visibility and it was daylight. There was no other traffic involved in the incident.

Shortly after 0530, *Merkur*'s chief officer saw an echo on the edge of his radar screen. It was on his port bow at a range of about 7 miles. As the bearing of the echo did not change, he assessed that a risk of collision existed. Using his binoculars, he identified the echo as a fully-laden fishing vessel on an easterly heading, probably making for Esbjerg. She was not engaged in fishing. A crossing situation existed, and by the *International Regulations for Preventing Collisions at Sea (Collision Regulations)* it was the fishing vessel's responsibility to keep out of the way of the vessel on her starboard bow, the German container ship. The chief officer, in the stand-on vessel, maintained his course and speed.

There is some doubt as to whether or not the chief officer left the bridge before the collision. However, the evidence indicates that at 0600, he plotted *Merkur*'s position and entered it into the deck logbook. He then returned to the navigation console and saw that the fishing vessel had taken no avoiding action. Realising there was a risk of an imminent collision, he sounded a warning signal on the whistle. The fishing vessel did not respond, and although *Merkur*'s chief officer altered course to starboard, it was too late and the two vessels collided.

The fishing vessel sank very quickly. *Merkur*'s chief officer sounded the general alarm, called the master and made a distress call. It was received by Lyngby Radio and despite an extensive search by a number of vessels and a helicopter, no survivors were found.

Later on, Danish divers retrieved the bodies of all five fishermen from the wreck.

The cause of the collision was twofold. *Silvery Sea* did not keep out of the way of *Merkur*, and *Merkur*'s chief officer did not take avoiding action sufficiently early to prevent a collision.

Silvery Sea foundered because she was holed forward and pushed down in the collision. Water was able to progressively flood the full length of the vessel through open doors in the transverse bulkheads.

Recommendations are made with regard to collision bulkheads in fishing vessels, to the researching of possible increased deadweight of RSW tanks due to the settling and compression of sand eels, and to the review of criteria for commissioning postmortem examinations following an accident.

Merkur [photograph courtesy of Fotoflite]

Silvery Sea

PARTICULARS OF VESSELS AND ACCIDENT

Vessel details

Name	:	*Silvery Sea*	*Merkur*
Registered Owner	:	Mr A J Manson and others	ms "*Merkur*" Reederei G Bertels KG
Port of Registry	:	Oban	Hamburg
Flag	:	United Kingdom	Germany
Classification Society	:	-	Germanischer Lloyd
Built	:	1976 in Holland	1991 in Germany
Construction	:	Steel	Steel (ice strengthened)
Type	:	Purse seiner and trawler	General cargo/container ship
Length Overall	:	38.04m	103.5m
Gross Tonnage	:	265.67	3,815
Engine Power (kW)	:	838	1995
Service Speed	:	approximately 10 knots	14.5 knots

Accident details

People on Board	:	5	10
Casualties	:	5 fatalities	None
Damage	:	Extensive damage to stem causing vessel to flood and founder	Large shell opening in way of No 1 hold and some internal structure fracturing
Location of Incident	:	Latitude 55°25.18′N Longitude 007°27.57′E about 35 miles west of Esbjerg, Denmark	
Date and Time	:	14 June 1998 about 0607 (UTC)	

SECTION 1 - FACTUAL INFORMATION

1.1 NARRATIVE

All times are UTC except as otherwise stated. Local time is UTC + 2. All courses are true.

1.1.1 Events leading up to the collision

Silvery Sea

During June, there is a short season for catching sand eels on the fishing grounds of Wee Bankie, near the entrance to the Firth of Forth. Denmark is one country which processes sand eels into fishmeal/fertiliser.

The fishing vessel *Silvery Sea* was engaged in sand eel fishing and had landed her first catch of the season at Esbjerg on 6 June 1998. She then returned to Wee Bankie to make her second catch and on 12 June, while in contact with his home port of Mallaig, her skipper said that despite a poor start, the day's fishing had been good. He added that he was fully loaded and would be returning to Esbjerg.

In a fax to his wife on 13 June, the skipper said *Silvery Sea* was making 9.3 knots. The course from Wee Bankie to where the accident took place was about 098° and the distance about 317 miles. Had she maintained a speed of 9.3 knots throughout she would have been underway for about 34 hours, and would therefore probably have set sail from the fishing grounds at about 2000 on 12 June.

In a fax to his Danish agent, the skipper gave his estimated time of arrival (ETA) in Esbjerg as 1400 (local time) on 14 June, and said he had approximately 530 tonnes of sand eels on board

During passages across the North Sea, each member of the crew normally expected to take two-hour navigational watches in turn. Watches were allocated randomly.

It is not known who was on watch when the collision occurred at around 0607, and there is no information available to indicate what did, or did not happen on board *Silvery Sea* in the 30 minutes or so that preceded it. As visibility was good, it is assumed that the German cargo ship would have been clearly visible on *Silvery Sea*'s starboard bow during the minutes leading up to the collision.

Merkur

Merkur left Hamburg for Gothenburg at 1900 on 13 June. She was loaded with containers in her holds and with one layer on top of No 2 and No 3 hatches **(see Diagram 1)**. One container was on a second layer directly in front of the accommodation: her maximum load of containers could reach up to four high on the hatches.

The master took the first navigational watch and was relieved at 0006 the next day by the second officer. *Merkur* had, by then, left the Elbe and was on her first course of 342°, to the first waypoint 2.5 miles due west of the Horn Rev west cardinal buoy and some 35 miles west-north-west of Esbjerg.

The chief officer relieved the second officer at 0300, and was joined an hour later by a new watchman who, after drinking a cup of coffee, was employed cleaning the starboard bridge wing.

The chief officer plotted *Merkur*'s position every half hour using the global positioning system (GPS), and entered the hourly positions in the logbook. The radar was on the 6-mile range scale but was off-centred giving a 9-mile range ahead. The bridge watch alarm system was set to sound at 12-minute intervals.

Between 0500 and 0600 *Merkur* made good a course of 340° and a speed of 15 knots. There were no other vessels near by. Between 0500 and 0515, the watchman stopped cleaning the bridge wing and went below for breakfast. This normally took him about 30 minutes. When he returned he resumed his cleaning.

Shortly after plotting the 0530 position, the chief officer saw an echo on the edge of the radar screen and on the port bow at about 7 miles range. Using a pair of binoculars he identified it as a fishing vessel on an easterly heading. She was not engaged in fishing as she was not showing fishing signals and had no fishing gear deployed. Because her amidships freeboard was small he estimated she was fully loaded.

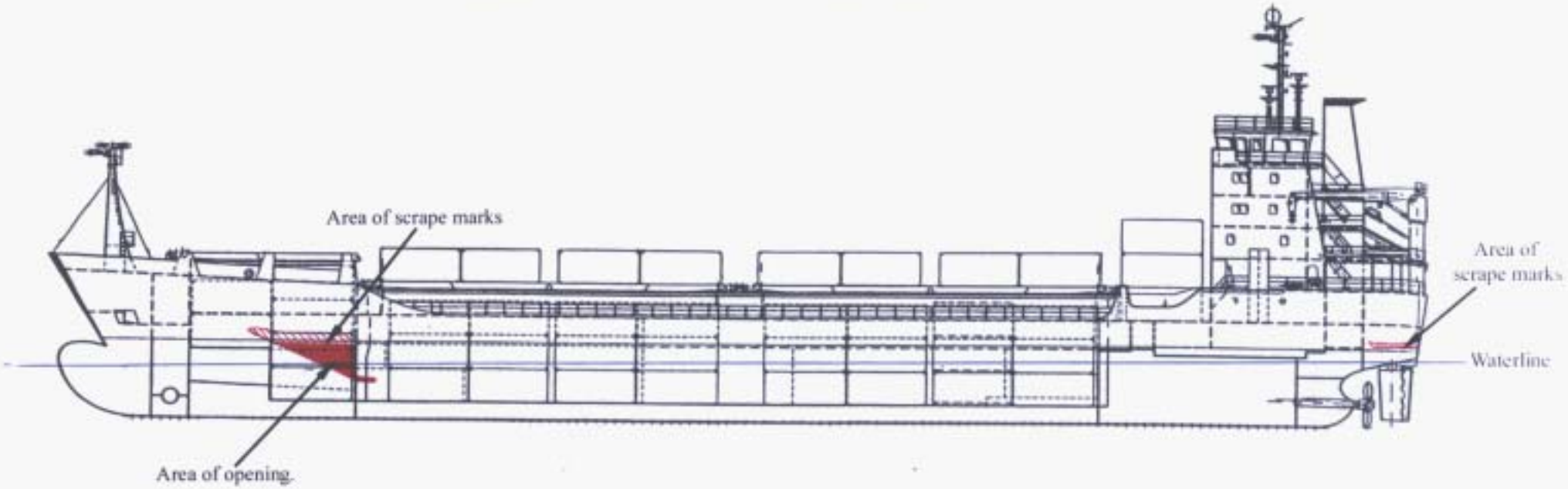
At about 0545, using the electronic bearing marker (EBM) on the radar, the chief officer noted the fishing vessel was on a steady bearing. Because she was on his port bow and therefore the give-way vessel in a crossing situation, he assumed she would obey the *Collision Regulations* and keep out of *Merkur*'s way. He therefore maintained his course and speed.

The chief officer told the watchman to keep a good lookout on the starboard side for fishing vessels outbound from Esbjerg.

There is some doubt as to whether or not the chief officer left the bridge before the collision. However, the evidence indicates that after plotting the 0600 position he looked up from the chart table and saw that the fishing vessel had not given way and, with the range now at about 8 cables was, seemingly, maintaining her original course and speed. The chief officer sounded a warning signal on the whistle. Seeing there was no response from the fishing vessel and that a dangerous close-quarters situation was developing, he put the rudder hard-to-starboard about 1 minute after sounding the whistle. As the ship's head began to turn, the fishing vessel collided with *Merkur* just abaft her port bow. The impact forced the fishing vessel's head to port, and her starboard side made further contact with *Merkur*'s port quarter.

The chief officer sounded the general alarm, called the master and transmitted a "Mayday" on very high frequency (VHF) radio channel 16. Lyngby Radio responded, and the radio operator asked for the ship's position, which was given as Latitude

Diagram 1 - Profile of *Merkur* showing damage on port side



55° 25'.18 N, Longitude 007° 27'.57 E. The master arrived on the bridge to see a fishing vessel on his starboard quarter submerged by the head with her stern out of the water. He saw from the wake of his ship, that *Merkur* was altering course to starboard. As the turn continued the, as yet, unidentified fishing vessel sank. Shortly afterwards two of her inflatable liferafts surfaced.

When *Merkur* had turned full circle and slowed down, the master saw a lifejacket and a lifebuoy rise to the sea surface. *Merkur*'s free-fall lifeboat was then launched to search for survivors.

1.1.2 The search and rescue operations

At 0612, Lyngby Radio received the "Mayday" call from *Merkur* and, at 0615, relayed it to the Maritime Rescue Co-ordination Centre (MRCC) at Åarhus. A rescue helicopter was scrambled, with an ETA of 0700 at the incident scene. At 0622, the Danish authorities received a COSPAS/SARSAT alert from a UK registered electronic position indicating radio beacon (EPIRB). The first strike gave a position about 2.5 miles from the collision position. The beacon number was passed to Great Yarmouth Coastguard to determine the origin of the EPIRB from the UK registry database. At 0630, the MRCC at Bremen offered help to the Danish Coastguard by placing one of the German Coastguard vessels at its disposal.

The crew in *Merkur*'s lifeboat identified the fishing vessel as *Silvery Sea* from the floating lifesaving appliances. This was relayed to the Danish MRCC and then to Great Yarmouth Coastguard. At 0656, Falmouth Coastguard confirmed the EPIRB came from the fishing vessel *Silvery Sea* registered in Oban. Great Yarmouth Coastguard contacted Oban Coastguard and asked it to establish how many people had been on board *Silvery Sea*. Enquiries with the agents in Esbjerg and Mallaig revealed there had been five crew members on board.

Merkur was joined by two Danish lifeboats, a German coastguard cutter and five merchant ships, including the passenger ship *Europa,* which initially assumed the role of on-scene commander. This function was handed over to a German coastguard cutter at 0901.

The helicopter found the fishing vessel's rubber dinghy and two liferafts, only one of which had inflated, although both had been serviced and were up to date. *Silvery Sea*'s EPIRB was recovered by the Esbjerg lifeboat at 1010.

Despite an intensive search, no survivors were found and all search and rescue operations were terminated at 1116.

During the search, the crew of *Merkur*'s lifeboat were able to see the damage to their own ship and told the master that there was a hole in the ship's port side plating at the after end of No 1 hold. Although no flooding was initially reported or noticed, this had changed by the time the search ended. At 1430, the flooding into both Nos 1 and 2 holds was so great that the master declared an emergency and requested pumps. These were forthcoming from a number of vessels during the rest of the day and, by

about 0200 the following morning, the level of water in the holds had stabilised. *Merkur* then made for Esbjerg, where she berthed at 1124 on 15 June.

1.2 ENVIRONMENTAL CONDITIONS

At the time of the collision, the wind was south-east force 5 with good visibility. The seas were slight and there was no swell.

The tide was setting in a north-westerly direction at 0.5 knot.

The altitude of the sun was just over 23° on a bearing of about 082°.

The surface sea water temperature was about 11° C.

1.3 *SILVERY SEA*

1.3.1 Background

Silvery Sea was the largest fishing vessel to sail out of Mallaig and all but one of her crew came from that area. The skipper was held in high regard and imposed exacting standards of discipline, seamanship and working practices on his crew. *Silvery Sea* was known as one of the better-operated vessels in the Scottish fleet.

She was primarily a purse seine netter, but was also equipped with trawl nets.

A current United Kingdom Fishing Vessel Certificate as required *by The Fishing Vessels (Safety Provisions) Rules 1975*, was held by *Silvery Sea* and had been issued on 30 January 1998.

1.3.2 Vessel description

Silvery Sea was built with an overall length of 27.1m and had three refrigerated saltwater (RSW) tanks. Forward of the tanks were a dry fish hold and a conventional whaleback. The accommodation consisted of three decks: the wheelhouse deck, a galley/bathroom/mess deck and two six-man berths below. The skipper's cabin was on the after port side of the wheelhouse.

In 1985, *Silvery Sea* was lengthened with a 10m full-body section (comprising three extra RSW tanks) being inserted amidships. An enclosed steel shelter deck was constructed from the top of the whaleback deck to the forward bulkhead of the wheelhouse. The old RSW tanks were extended upwards to the shelter deck level and fitted with hatches. The accommodation was heightened by 2m by inserting an extra deck between the wheelhouse and the mess deck which then became a recreation room **(see Diagram 2)**.

The shelter space formed part of the buoyancy and was included in the stability calculations. For the converted vessel, this extra buoyancy was necessary to pass the

requirements for stability. For stability purposes, the uppermost deck therefore, moved from the main deck to the shelter deck.

When built the vessel had a collision bulkhead on frame 46, which due to the lengthening became frame 71. Originally, the collision bulkhead extended to the uppermost continuous deck, which was the main deck. No collision bulkhead exemption was necessary, or granted, for the original arrangement.

Rule 2 of *The Fishing Vessels (Safety Provisions) Rules 1975* requires that a collision bulkhead is fitted, but makes no detailed requirements. Had the cargo ship construction regulations been followed, such a bulkhead would have been required to extend up to the shelter deck with no openings.

After *Silvery Sea* was lengthened, the SGO (now the MCA) granted an exemption from the requirement to have a collision bulkhead. The reason for this exemption is unknown.

In the gutting room there was a hatchcover to the dry fish hold. At the forward end of the gutting room a weathertight door, secured by two dogs and on the starboard side at frame 74, gave access to the forward store **(see Photograph 1)**. At the after end were two passageways, which ran aft along both outboard sides of the RSW tanks. The passageways did not have weathertight doors at the forward ends, but they were fitted aft. These gave access to the RSW machinery space. In the transverse bulkhead at the after end of the RSW machinery space, there was one weathertight door, which provided access to the accommodation and engine room spaces. There was also a door on the port side of the bulkhead at the forward end of the gutting room.

A net drum was added at the stern in 1986.

In May 1987, following an engine failure, *Silvery Sea* was re-engined with a more powerful one but, due to the constraints of the propeller blade size, it was restricted to give the same power output as the original.

She had three sonars: one low frequency/long range set, one high frequency/short range set and a back-up set. For navigation she had an Admiralty raster chart service (ARCS) electronic chart system, which had a GPS input, and two radars. She had three VHF radio sets, two medium frequency radiotelephone sets, and a SATCOM type 'C' laptop computer for sending faxes.

There were two bridge chairs, one in the centre and the other on the starboard side of the wheelhouse. The sonars, the electronic chart system, automatic helm, engine controls, watch alarm and other ancillary equipment were arranged, close at hand, around the starboard chair. In front of the centre chair were secondary engine controls.

A watch alarm was fitted in the wheelhouse and located to the right of the starboard wheelhouse chair. The watch alarm was automatically activated when the autopilot was engaged **(see Photograph 2)**. It could not be heard in the lower deck cabins because of the ambient noise from the propeller and onboard machinery. When in

operation, a small light illuminated on the box and a 50db buzzer sounded every 3 minutes. It was cancelled by the watchkeeper pressing a red button (there was a second button over the chart table). If, after a further minute, he failed to do so, a 110db klaxon sounded and could be heard in the skipper's cabin, the recreation room and galley.

1.3.3 The crew

At the time of the accident, five crew members were on board:

Alexander John Manson, the 57 year old skipper and part owner, had been at sea since he was 15 years old. He was issued with a Full Skipper certificate of competency in the early 1960s, and had served at sea as skipper ever since. He had undertaken the basic sea survival course, in addition to the training requirements for a Full Skipper certificate of competency. He had owned a number of fishing vessels:

Silvery Sea, a 20m ring netter, which fished off the west coast of Scotland;

Crystal Sea, a steel purse seiner, which was built in The Netherlands, and which he bought in 1973 after selling *Silvery Sea*; and

Silvery Sea, which he had built in 1976 and modified in 1985.

William Tait was 52 years old and served as deckhand/second engineer. He held both Second Hand Special and Fishing Vessel Second Engineer certificates of competency. He had served on board *Silvery Sea* since the beginning of 1998.

Allan Patrick Paul MacDonald, a 32 year old deckhand, had attended the three mandatory safety courses: sea survival, fire fighting and first-aid. After leaving school, he served 2 to 3 years on board the fishing vessel *Silver Crest*. He had worked on board *Silvery Sea* for about 12 years.

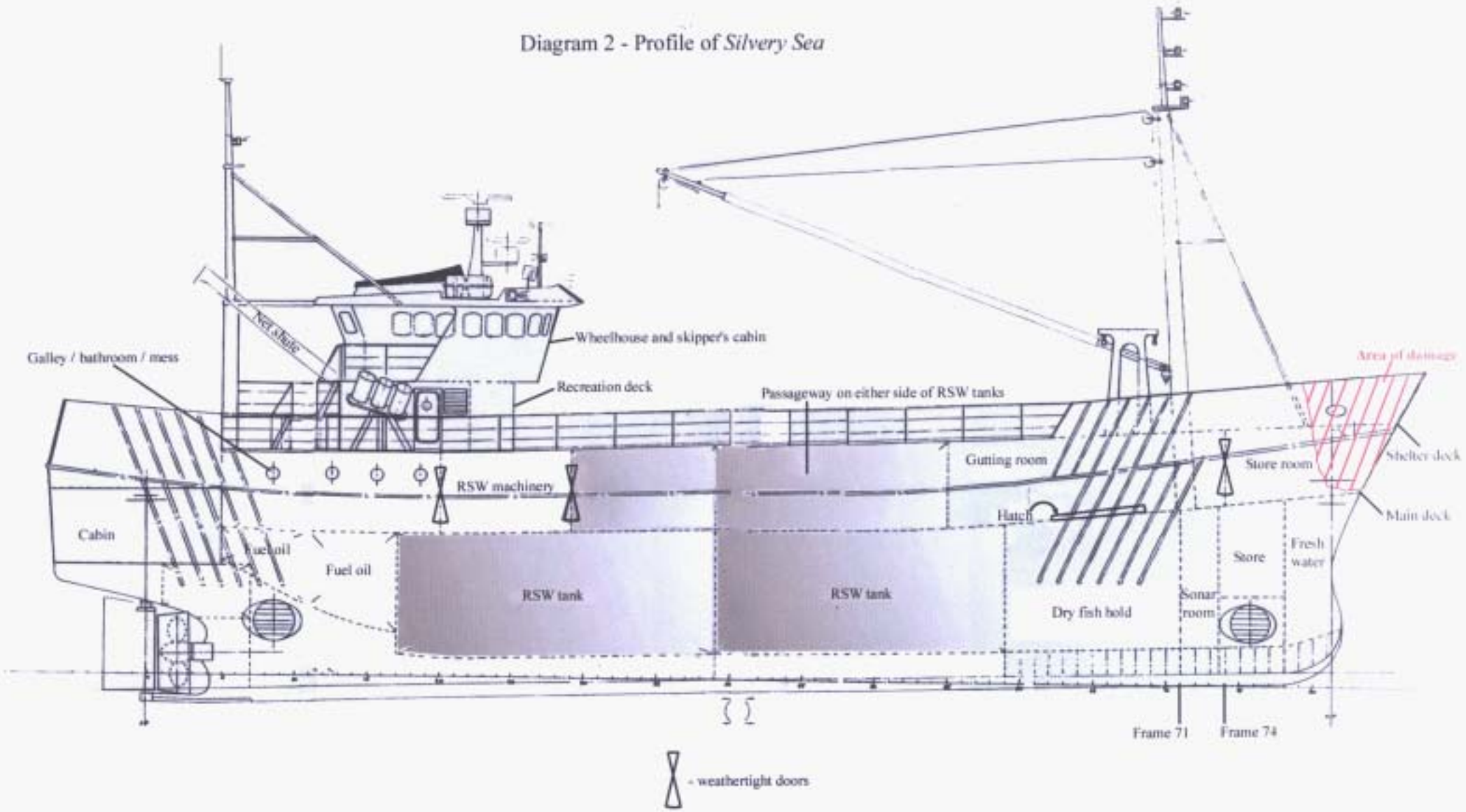
Alexander John MacKenzie, another 32 year old deckhand, had been on fishing vessels since leaving school. He had served on various local boats sailing out of Mallaig before joining *Silvery Sea,* on which he had served 7 to 8 years. He had attended a number of safety courses with the intention of joining the offshore oil industry, but he did not take up employment in this field.

Michael Dyer, a 36 year old deckhand, had previously been employed on fish farms, for which he had a boatmaster's licence, and on the ferry running between Arisaig and Eigg. He had served on board *Silvery Sea* for 9 to 10 years and had attended relevant safety training courses.

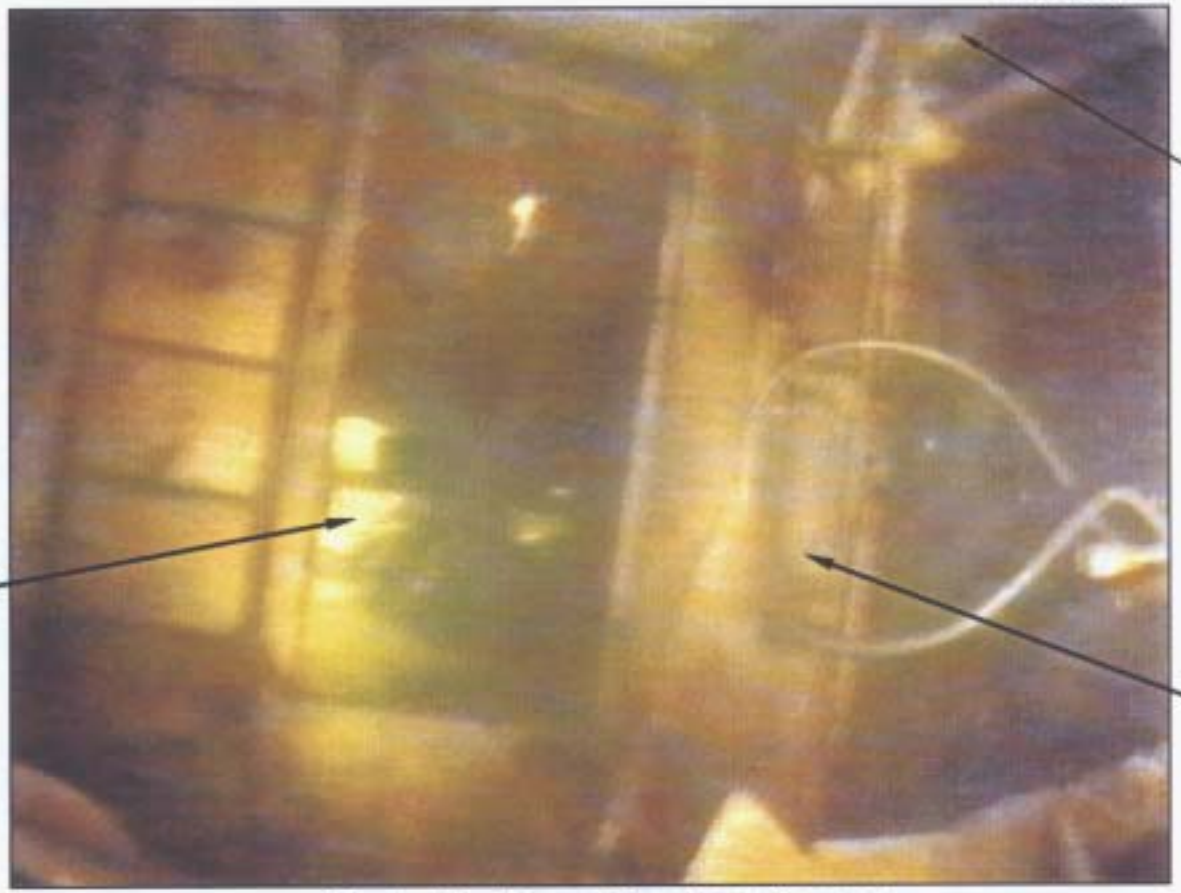
The deck officer certificate requirements for *Silvery Sea* were:

1. either a Deck Officer Certificate of Competency (Fishing Vessel) Class 1 or a full skipper; and

Diagram 2 - Profile of *Silvery Sea*



Photograph 1



View looking forward from the gutting room

2. either a Deck Officer Certificate of Competency (Fishing Vessel) Class 2 or a second hand special.

The engineer officer certificate requirements were:

1. an Engineer Officer Certificate of Competency (Fishing Vessel) Class 1; and

2. an Engineer Officer Certificate of Competency (Fishing Vessel) Class 2.

If the engine room was unmanned at sea, a person with deck and engine certificates, such as those held by Mr Tait, was accepted as both mate and second engineer. However, *Silvery Sea* was deficient because she was not carrying a person holding an Engineer Officer Certificate of Competency (Fishing Vessel) Class 1.

1.3.4 Stability and loading

After the vessel had been modified, a new stability book was produced. It was approved by the SGO (now the MCA) in June 1987. Following the fitting of a fish-pumping system and a ballast keel in 1995, the stability of the vessel was recalculated, but it was not until January 1998 that the MCA approved a new trim and stability book.

The new book gave a number of working instructions, which included the following:

- *The maximum deadweight should be limited to 478.06 tonnes, this corresponding to the vessel's departure from the fishing grounds with 50% oil fuel and 50% fresh water and 100% RSW tanks.*

- *The forward draught should not exceed 5.025m, corresponding to a minimum vertical distance of 2.150m measured from the waterline to the line of the shelter at the side of the forward terminal;*

- *Bulk loading in water is to be conducted using the RSW tanks only; the forward lower fish hold not being designed for this type of stowage.*

- *With all the main RSW tanks in operation, no fish should be loaded into the fish hold.*

- *If, for some operational consideration, it is considered necessary to load bulk fish in the forward hold, it is essential that all pound division boards are secured in position before loading commences.*

On Saturday 13 June 1998, the skipper sent an Inmarsat fax to his agent in Esbjerg saying that *Silvery Sea* had 530 tonnes of fish on board. This was more than usual and exceeded the maximum permitted deadweight. Records of previous landing figures (in tonnes) in Esbjerg were as follows:

03.06.1992	-	407.93
11.06.1992	-	483.58
18.06.1994	-	463.36
24.05.1995	-	443.18
02.06.1995	-	485.68
13.06.1995	-	425.79
02.06.1997	-	510.66
16.06.1997	-	290.35
06.06.1998	-	276.38

1.3.5 Post-accident underwater surveys

On 16 June, two days after the accident, the vessel's insurer Sunderland Marine Mutual Insurance Company Ltd commissioned a Danish diving company to conduct a survey on the wreck of *Silvery Sea*. The first diver found and identified the wreck at a depth of about 30m and attached a bottom line to it.

The second diver took a video recording of the outer hull. He found the starboard wheelhouse door open, but all other outer doors to the accommodation closed and battened down. Looking into the wheelhouse from outside, he saw the engine control levers were on full ahead, and the helm indicator pointing to port. Three of the wheelhouse windows were missing; one facing aft; one facing forward and one on the starboard side. The major damage to the vessel was confined to the stem **(see Section 1.3.7)**. Loose deck equipment was found on the seabed around the wreck.

The third diver entered the lower accommodation and found the first body (Mr Tait) with a half-donned lifejacket at the foot of the stairs leading from the recreation deck to the wheelhouse.

Three other bodies were discovered. Mr Manson was found at the bottom of the wheelhouse stairs at the entrance to the recreation room, while Mr MacDonald and Mr MacKenzie were located immediately outside the two cabins.

Despite searching the rest of the accommodation spaces, the fifth body was not found during this initial dive.

The bodies were taken to the surface and transferred to an awaiting tug. They were conveyed ashore where they were handed over to the Danish authorities in Esbjerg **(see Section 1.3.6)**.

On 21 June, the MAIB commissioned the same company of divers to carry out a further survey of the wreck. They collected as much evidence as possible to try and

establish the status of the vessel at the time of her foundering, and to search for the body of the missing crew member.

Two divers made an initial inspection of the wreck and took video recordings of the major damage to the stem. One of them tried to enter the gutting room through a deck hatch, but was prevented by the size of his air bottles. The shelter deck hatch for the dry fish hold was seen to be closed and battened down, while the hatches for the RSW tanks were all found closed except for the inspection hatch of the after middle tank. The divers entered the wheelhouse and recorded what they found with the video camera **(see Section 1.3.7)**.

After the first two divers had used up their "bottom time", two other divers were sent down and instructed to search for the body of the missing man and to video inside the wreck. One had an umbilical line and the other kept the line free of obstacles. The door between the gutting room and the forward store was found open, and the damage to the stem could be clearly seen **(see Photographs 1 and 3) (see Section 1.3.7)**. The internal hatchcover to the dry fish hold had been pushed aft and upwards probably by the force of the impact **(see Photograph 4)**. Mooring ropes could be seen leading down into the hold and into the starboard passageway.

The wheelhouse and various parts of accommodation spaces were recorded on video. The forward starboard door to the RSW machinery space and the door to the engine room were seen to be open.

On entering the old RSW machinery space on the starboard side of the galley deck, which contained a number of laundry machines, one of the divers found the body of Mr Dyer. It was taken to the surface, conveyed ashore in a tug, and handed over to the Danish authorities in Esbjerg **(see Section 1.3.6)**.

1.3.6 Pathological evidence

During the identification process, the Danish police photographed the bodies.

Neither the Danish nor the Scottish authorities carried out any postmortem examinations.

The Danish police photographs and reports show that:

Alexander Manson was wearing a shirt and jeans;

William Tait was wearing a long sleeved singlet and socks;

Allan MacDonald was wearing a tee shirt;

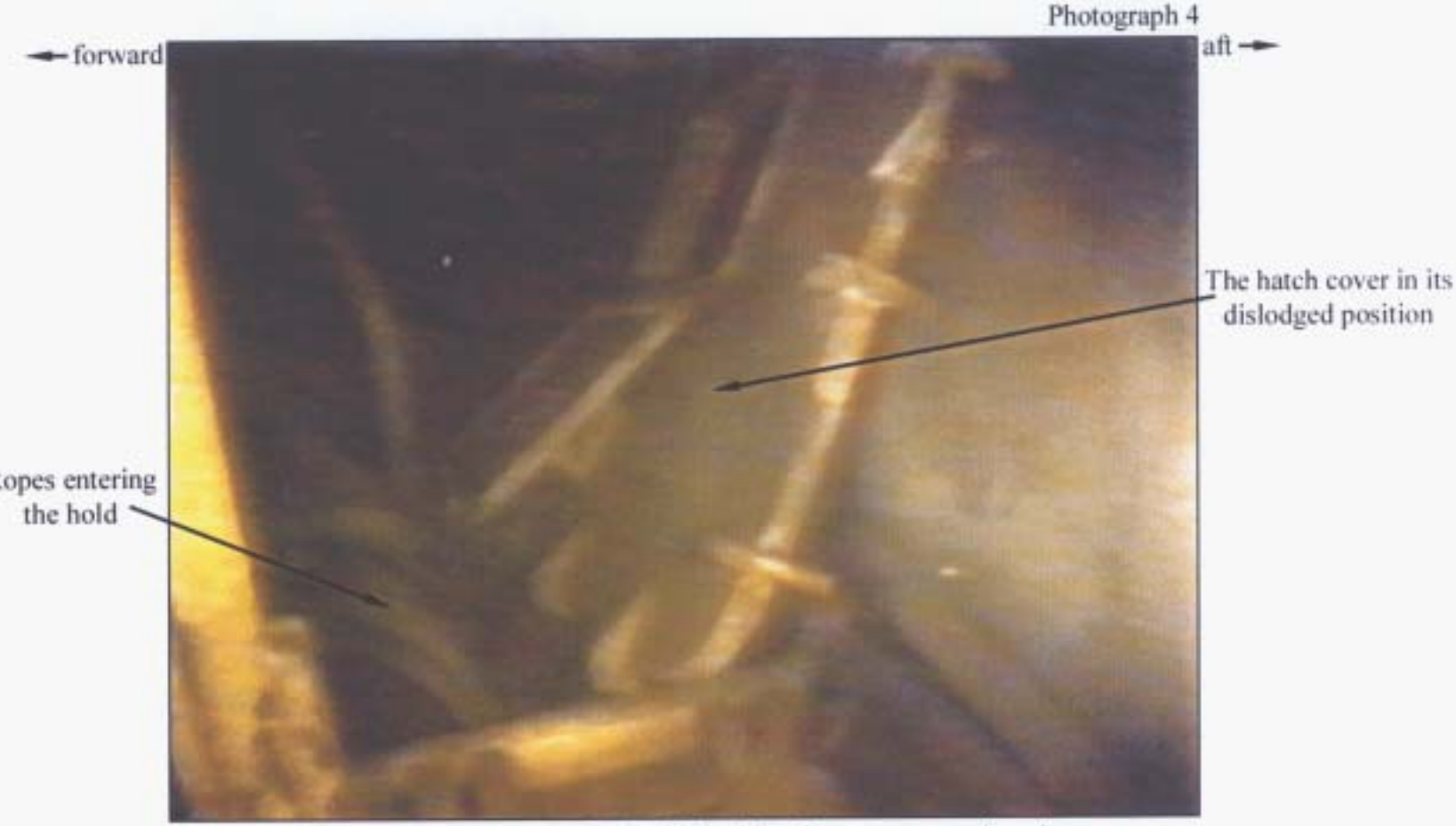
Alexander MacKenzie was wearing a checked shirt and socks; and

Michael Dyer was wearing a tee shirt, jeans with a belt and socks.

Photograph 3

View through doorway showing the opening in the stem and the top foredeck pushed down

Photograph 4



View of the hatch to dry fish hold (looking from port to starboard)

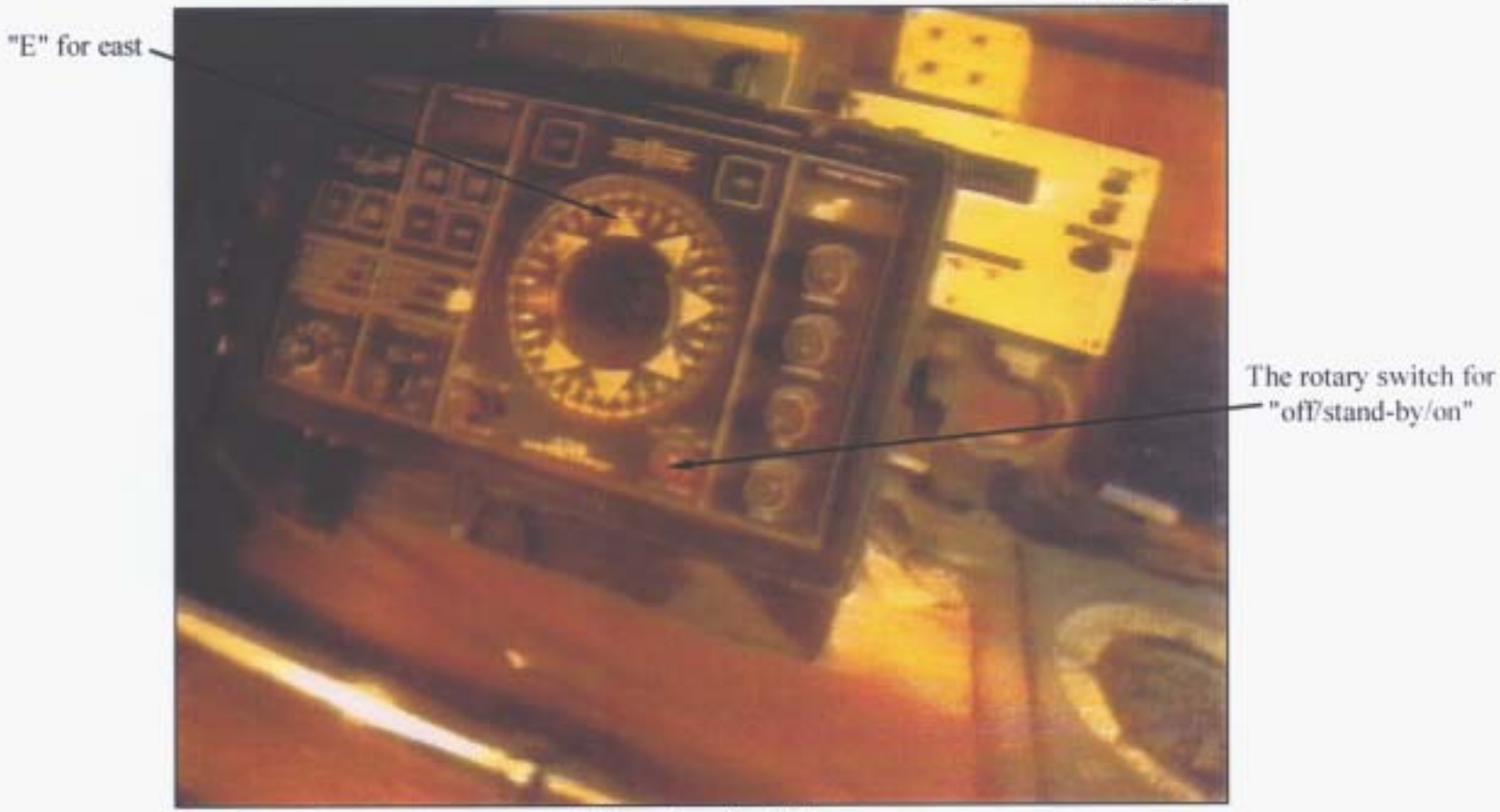
Photograph 5

The bow and stern transverse thrusters
(starboard wheelhouse door to the right of the photograph)

Photograph 6

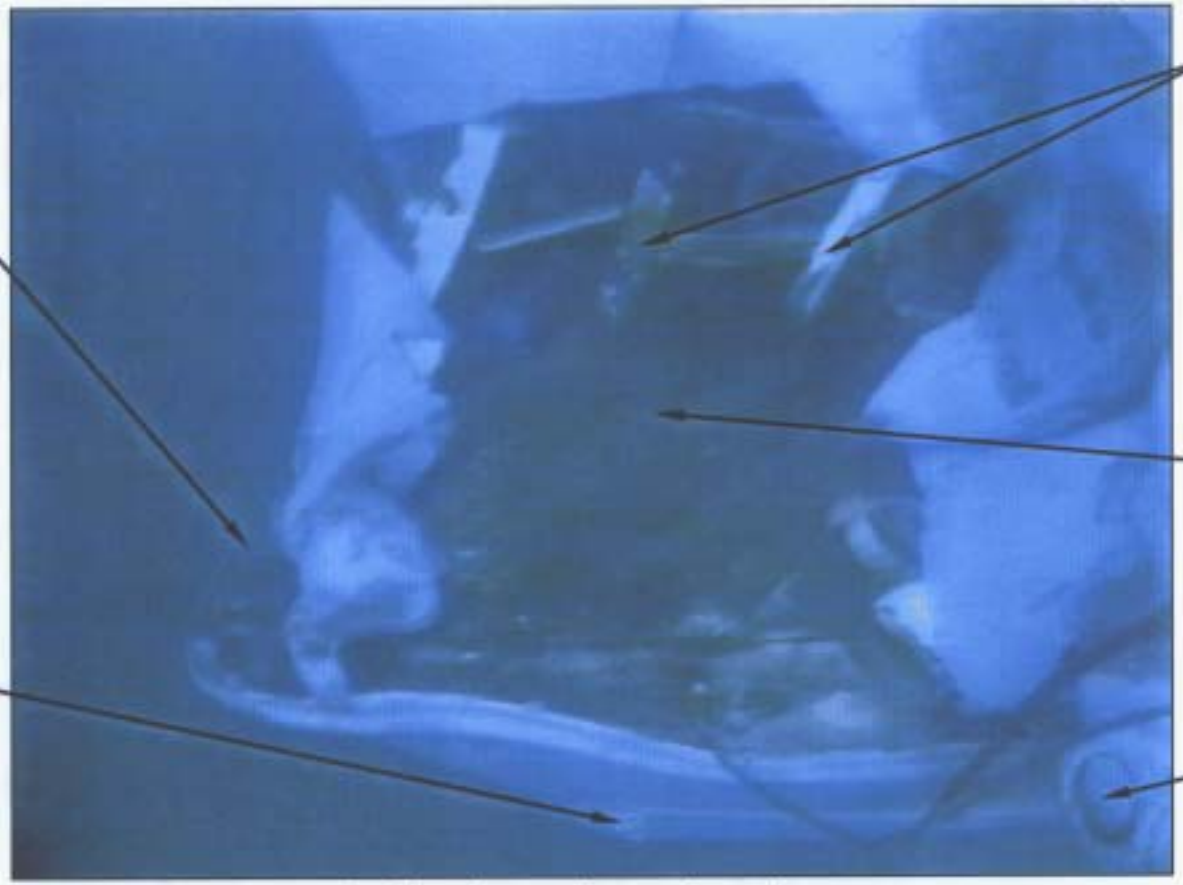
View of engine and pitch controls

Photograph 7



The automatic pilot

Photograph 8



Looking down on the opening to the stem

Photograph 9

View of the forward damage to Merkur

Because no postmortem examinations were carried out, the photographs provided the only source of information on which to make any judgment about the most likely causes of death. The expertise of a pathologist from Southampton General Hospital was sought.

All bodies showed fresh injuries, but it is thought that these were most likely caused by the divers, as they attempted to extract the bodies from the accommodation. This had not been easy. The bodies of Mr MacDonald, Mr Tait and Mr MacKenzie showed suffusion of the face which indicated drowning. Mr Manson's face was pale and clean-shaven, while Mr Dyer's face showed he had suffered a heavy blow to his nose.

The pathologist concluded that all five had possibly drowned, but he was less certain about both Mr Manson and Mr Dyer.

Because of Mr Manson's appearance, the pathologist explained that he could have either sustained a blow to the head, or suffered an acute medical event such as a coronary or cerebral episode. Any of these might have killed him, made him unconscious or rendered him incapable. Had any of these occurred before the collision, he would not have been able to react to an emergency. If he had been incapacitated before the vessel sank, he might have been unconscious at the time, but would have drowned when water entered his lungs.

He went on to explain further that there are a number of reasons why death by drowning does not always cause suffusion of the face. This could have happened by "dry-drowning", which occurs when a person is suddenly immersed in cold water, causing shock and the mouth to open involuntarily. The person imbibes cold water causing the airways to close. This stimulates the vagus nerve, which makes the heart slow down. Another reason is that the sudden immersion in cold water may provoke cardiac shock, especially when the person is middle-aged or over.

The pathologist stated that postmortem examinations would have been the only way to clarify the causes of death.

1.3.7 Description of the wheelhouse from the divers' video and findings

The divers entered the wheelhouse through the starboard side door and videoed the space as they found it.

On the starboard bulkhead, the control levers for the forward and aft athwartship thrusters were horizontal and pointing forward. The controls were electrical actuators for hydraulic proportional valves, and the neutral position for the levers was upright. Therefore, both levers were apparently on the full-to-port thrust position. However, they were probably pushed forward by the ingress of water through the starboard door close by **(see Photograph 5)**.

The engine speed and the propeller pitch control levers were set forward by similar amounts, indicating the engine was engaged and that the propeller pitch was on number 6 (out of 10) in the ahead position **(see Photograph 6)**. The setting on the

engine revolution counter was between 800 and 900. The helm indicator showed 23° to starboard. (The rudder was actually about 10° to 15° to port.)

The gyrocompass heading was 126° on the autopilot, the heading selector dial was between 100° and 103° and the "off/standby/on" rotary switch indicator was pointing to "on" **(see Photograph 7)**.

The divers noted that:

- there were three VHF radio sets on board: one set was on P5 (a private channel), one set was on channel 12, but it was not possible to determine on which channel the third set was. This was because the channel number selectors were touch pad buttons and the channel frequency digital display was electronic;
- the clock above the chart table had stopped at 0709;
- the magnetic compass was on a heading of between 120° and 130°;
- the emergency alarm lever was in the upright "off" position;
- the engine and pitch control levers on the amidships console were full back. (However, these levers were for the old engine and were redundant).

1.3.8 Damage

The major impact damage was to the stem of the fishing vessel. In this area, above the main deck, the structure was crumpled and had been pushed back by about 2.5m, or as far as the forestays of the foremast. The uppermost deck had been pushed down and the forward end of the store space had been opened up. There was no damage below the main deck or evidence of pressure damage to the hull **(see Diagram 2 and Photograph 8)**.

1.4 *MERKUR*

1.4.1 Description

Merkur was a container ship with three hatches for two holds and a capacity to carry a maximum of 374 twenty-foot equivalent units (teus). The bridge, accommodation and engine room spaces were all located aft. There was a controllable pitch propeller and a bow thruster.

The bridge had a central "U" shaped navigation and control console, which incorporated two seats and a radar in front of each of them. At sea one of the radars was kept on stand-by. Between the two seats there was a gyrocompass and an autopilot, one of three VHF radio sets and a tiller. There was an uninterrupted view forward from the seats. The chart table, from which there was a large angle of view

forward and aft, was on the after starboard side of the bridge. The communication station was on the after port side of the bridge. There was a gyro repeater on each bridge wing. There were two GPS sets for position fixing, and the other navigational equipment included a magnetic compass and an echo sounder.

1.4.2 The crew

The chief officer, a German national, was 48 years old at the time of the accident. He had joined an East German shipping company in 1968 as an apprentice. He gained his first licence in 1976 and his master's licence for medium range voyages in 1977. During his time with the company, he progressed from third officer to chief officer, serving on various types of ships trading on medium and long-range voyages. In 1989, he served on board a ship trading in the Mediterranean for six months, after which he joined the Bartels shipping company. Until her sale in 1995, he served as chief officer on board *Gisela Bartels*. After 1995, he had served exclusively on *Merkur*. He had a German licence, issued at Kiel in September 1992 which allowed him to serve as:

- master and chief officer on:
  - coastal passenger ships up to 4,000gt;
  - cargo ships, in any trading area, up to 8,000gt; and

- second officer on:
  - coastal passenger ships up to 4,000gt
  - cargo ships of any size in any trading area.

At the German Board of Inquiry following the accident, **(see Section 1.5)** the master testified that in the two years that he had sailed with the chief officer, he had found the latter reliable; he had not been involved in any incidents, and only drank alcohol on social occasions. There was no alcohol on board *Merkur*.

The master, a German national, was 49 years old at the time of the accident. He first went to sea in 1964 as a deckhand on deep-sea ships. Between 1981 and 1983, he studied at a nautical college and was given his first command in 1984. He joined the Bartels shipping company in 1991, initially as a building inspector for *Merkur*. When the building was finished, he served on *Merkur* as chief officer for the first two months, after which he was appointed master. Apart from leave periods, he had been in command of the ship ever since. He held a German licence which was issued at Kiel in January 1992, and had the same limits as the chief officer's. However, his licence was endorsed in 1997 so that he could serve as master on cargo ships up to 12,000gt in any trading area.

The remaining crew members consisted of an Egyptian second officer, a German chief engineer, and six Lithuanian crew members, which included an engine room rating, four able seamen and an able seaman/cook.

Merkur's Safe Manning Certificate required her to have a designated cook, but because one rating acted as both able seaman and the cook, she was short of one able seaman.

1.4.3 Damage

Silvery Sea's bow made a large hole measuring about 2.5m high by about 3m long on the port side at the after end of *Merkur*'s No 1 hold. There were a number of scrape marks forward and above the damage. The opening stopped at the transverse bulkhead dividing numbers 1 and 2 holds. This bulkhead was split. There were further smaller and lower gashes, which ran aft of the transverse bulkhead for about 2.5m. There were also longitudinal scrape marks on the port quarter **(see Diagram 1 and Photograph 9)**.

1.5 THE GERMAN BOARD OF INQUIRY

MAIB inspectors did not have access to *Merkur*'s crew during the investigation, but the statements made by the master, chief officer and the watchman were forwarded to the Branch. These prompted the MAIB to raise a number of questions regarding the account of, and the background to, the events. These were submitted to the German authorities for answering at their Board of Inquiry hearing which was convened on 30 September 1999 in Hamburg. The MAIB investigation could not be satisfactorily completed until this Board had completed its Inquiry which two MAIB inspectors and their interpreter attended.

The Inquiry panel, which consisted of five members, questioned the master, chief officer and watchman of *Merkur*, and two German border policemen.

The two policemen had been helping with the pumping operations on board *Merkur* after the collision. In each of their reports, which were made several days later, they had noted separately, from conversations on board, that it had been said the chief officer had left the bridge during the events leading up to the collision. The panel closely questioned them on this allegation.

While working on deck, the first policeman had been talking to someone he had not identified, who told him that there was no one on the bridge just before the collision. The panel questioned him as to whether this statement referred to either the master and/or the chief officer of *Merkur* or to *Silvery Sea*. The policeman was positive that this conversation was with the chief officer of *Merkur*, who was referring to himself with the words, "I was on watch but not on the bridge."

The second policeman had gone to *Merkur*'s bridge to change his wet clothing. While there he talked to the master about the damaged hold and during the conversation was also told there had been no one on the bridge. The panel questioned him on whether this referred to the master, the chief officer or the fishing vessel's skipper, and in what context the statement was made. The policeman could not explain how the conversation led to this statement, but he was sure that it referred to the chief officer.

A legal advisor representing the master, chief officer, watchman and the Bartels shipping company, referred to the police evidence. He said that his clients had been under enormous stress at the time and conclusive statements could not have been made. He believed the allegation that the chief officer was not on the bridge, was

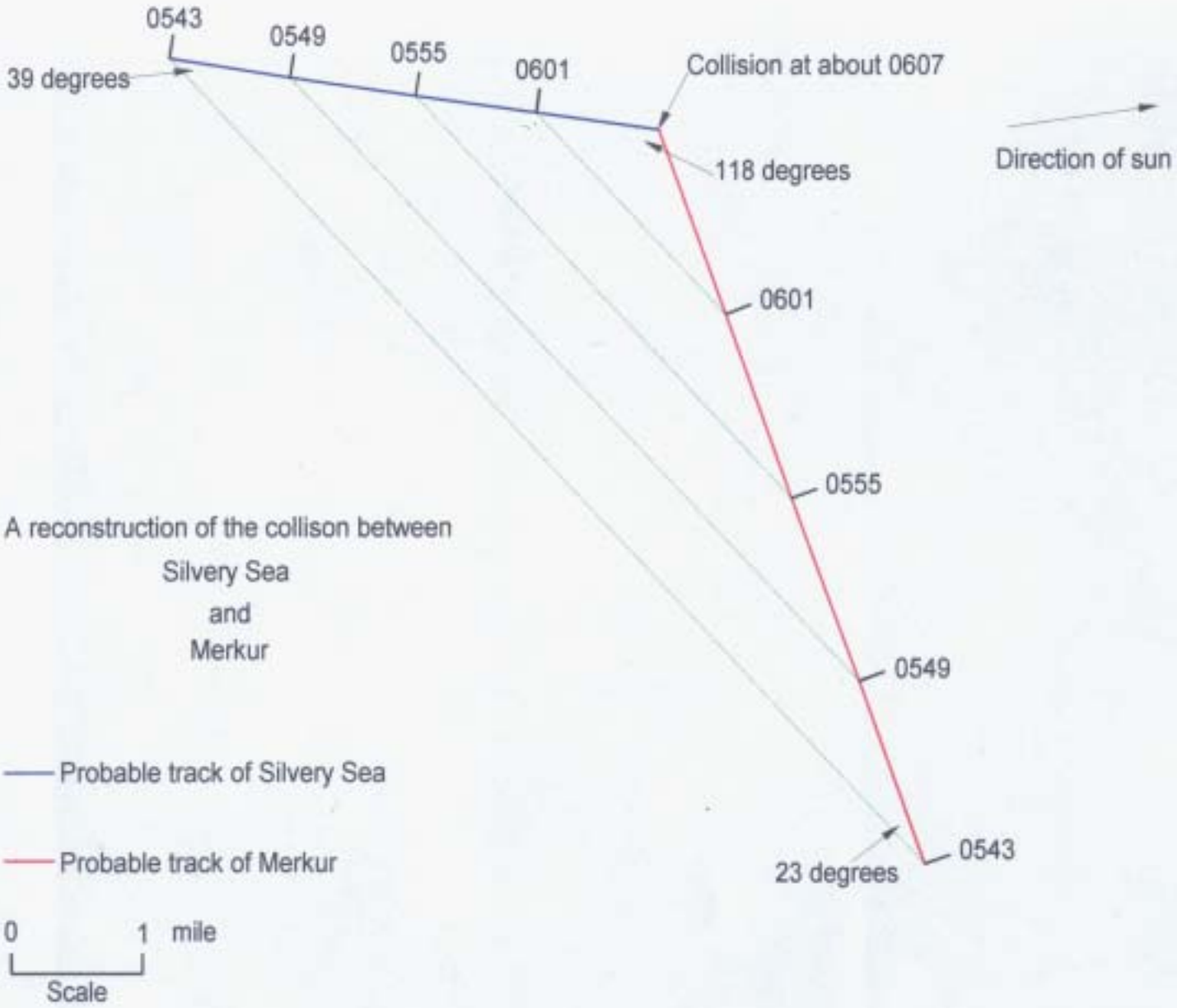

0543
0549
0555
0601
39 degrees
Collision at about 0607
118 degrees
Direction of sun
0601
0555
0549
0543
23 degrees
A reconstruction of the collison between
Silvery Sea
and
Merkur
Probable track of Silvery Sea
Probable track of Merkur
0 1 mile
Scale

Diagram 3

made. He believed the allegation that the chief officer was not on the bridge, was unsubstantiated, and that the police had made mistakes through wrong association and statements made out of context.

The determination of the Board, which was made the same day, was as follows (translated from German):

> *At about 0808 hours on 14.06.1998 the independent trawler "Silvery Sea" travelling on a course of approximately 102° about 36 sea miles west of Esbjerg/Denmark collided with the MC "Merkur" which was steering a course of approximately 342°.*
>
> *The truwler sank immediately and all five members of the crew were drowned. The MS "Merkur" suffered severe damage to the front of the ship on the port side and took in water, but was able to stay afloat with the help of several ships and their crews which gave assistance so that it was able to reach Esbjerg.*
>
> *The accident is attributed to the facts that:*
>
> - *the trawler did not give-way as specified in rule 15 KVR* (Collision Avoidance .Regulations) for reasons which cannot now be explained,*
> - *the watchkeeping officer on the MS "Merkur"*
>
> *did not use the radar which was in operation in such a way that he had sufficient information about the movement when the collision was to be expected*
> - *temporarily left the bridge without being properly relieved*
> - *consequently carried out rule 17b) KVR* too late.*
>
> *Because of this he (acted incorrectly.*
>
> *The captain and the shipping line acted incorrectly in that the ship was not crewed in accordance with the current shipping certificate. A deck assistant was missing. This did not contribute to the cause of the accident.*

A longer report was produced at a later date.

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the cause, contributory causes and circumstances of the accident as a basis for making recommendations, if any, with the aim of preventing similar accidents occurring again.

This section will firstly examine how these two vessels collided in good visibility and weather, and secondly, why *Silvery Sea* foundered so quickly that none of the crew was able to escape

2.2 THE COLLISION

2.2.1 *Silvery Sea*

Silvery Sea was not engaged in fishing within the meaning of Rule 3(d) of the *International Regulations for Preventing Collisions at Sea* (Collision Regulations), and her manoeuvrability was not restricted. She was on passage from the fishing grounds off the Firth of Forth to her landing port of Esbjerg, making a course of about 098° and a speed of about 9.3 knots **(see Diagram 3 overleaf).** The autopilot dial indicated the course being steered was between 100° and 103°.

Merkur was about 38° or 3½ points on *Silvery Sea*'s starboard bow. As events evolved, and from the chief officer's evidence, the bearings of each vessel from one another would not have changed appreciably, indicating they were on a collision course. This was a crossing situation as defined by Rule 15 of the Collision Regulations. The rule states that "*the vessel which has the other vessel on her own starboard side shall keep out of the way and shall, if the circumstances of the case permit, avoid crossing ahead of the other vessel.*" In practical terms this means that the give-way vessel can either reduce speed and allow the stand-on vessel to cross ahead, or, more usually, alter course to starboard and pass round the stern of the other vessel. Rule 16, of the Collision Regulations, states that "*the give-way vessel should take, so far as possible, early and substantial action to keep well clear.*" *Silvery Sea* had plenty of sea room in which to manoeuvre.

The evidence from the underwater survey indicates that when she collided with *Merkur*, *Silvery Sea* was on a steady course, and on full economical speed.

It is concluded that whoever was on watch on *Silvery Sea* was not, in the period leading up to the collision, keeping a proper lookout in accordance with Rule 5 of the Collision Regulations, and had failed to take any action to avoid collision. There is no obvious reason why.

The question arises as to how a well-run vessel, fitted with a working watch alarm, could collide with another ship without, apparently, any action being taken to prevent it.

Several theories have been examined. Fatigue is a common cause of accidents in fishing vessels when either fishing or on passage to land. *Silvery Sea*'s crew should have been well rested in the 34 hours since they had left the fishing grounds, so there was no apparent reason why any of them would have been suffering from undue tiredness or sleep deprivation. Furthermore, as each member of the crew normally kept only one two-hour watch in every ten, fatigue is unlikely to have been the reason why nobody was keeping a proper lookout. Even if someone had been in the wheelhouse and asleep, it is unlikely he would have slept through the loud watch alarm.

The person on watch may have left the bridge for some reason and stayed below for several minutes. Had he done so the 110db watch alarm klaxon would have sounded after 4 minutes. This is not only audible on the wheelhouse, but also in the recreation room and galley. The crew members, who were probably on the lower decks, would not have heard it due to the noise of the propeller, ventilation and engine. Had the skipper been in his cabin and conscious he would have heard the klaxon. Although it is assumed the watch alarm was functioning normally, it is possible it was not.

Whatever the reason, the watch alarm failed to alert the crew to the fact that nobody was maintaining a watch in the period before the collision.

There is no evidence to show that the sound signals from *Merkur*, when the range had closed to about 8 cables, did anything to alert *Silvery Sea* to the risk of collision.

It is also feasible the watchkeeper had been taken ill in the wheelhouse, and either remained there or had left the bridge unattended to recover. In either situation the alarm would have sounded, and the same considerations would have applied.

Because of the random nature of the roster system, it is impossible to determine who was, or should have been, on watch just before the collision.

The investigation also considered whether there was any physical or other reason to prevent the keeping of a good lookout. The visibility was good, there is no evidence to indicate there was any other shipping to distract the watchkeeper's attention, and so far as it is possible to judge, the bridge equipment was in working order. There were no adverse environmental conditions, such as glare from the early morning sun reflecting on the surface of the sea. The difference in bearing between the sun as it was rising on the port bow and the bearing of *Merkur* on the starboard bow was about 55°. Any glare would have had minimal effect.

The positions in which the bodies were found give no indication as to whether the bridge was manned at the time of the collision or where people were when it happened. There would have been an enormous shudder at the moment of impact, which would have woken anyone who was asleep. Even allowing for momentary disorientation, it is probable that some or all of the crew attempted to move from wherever they were to either find out what had happened, or to escape once it was known how serious the situation was. It is also likely that the inrush of water swept them to where they were found.

Mr Dyer's body was found on the lower deck. His facial injuries indicated that he might have been knocked unconscious, either from the sudden jolt of the collision or from the large ingress of water. He did not have suffusion of the face, which is the usual sign of drowning.

Mr Tait was found with a lifejacket at the foot of the stairs to the wheelhouse. He was known to keep his lifejacket near his bunk, but lifejackets were also stored in the wheelhouse.

It is impossible to reconstruct precisely what happened during the short time between collision and sinking. The only certainty about the entire incident is that *Silvery Sea* sank very soon after the collision.

The skipper's body was found at the bottom of the wheelhouse stairs at the entrance to the recreation room. Like Mr Dyer, he did not have suffusion of the face. The pathologist gave a number of reasons for the possible causes of the skipper's death, but none were conclusive. No postmortem was carried out and without this crucial input, it has not proved possible to establish the cause of death.

The Danish Police authorities carried out formal identification procedures of all the bodies, giving the cause of death of each fisherman as drowning. These conclusions were made without the benefit of postmortem examinations. The Scottish authorities did not carry out any autopsies on the deceased fishermen and, because the accident happened outside Scottish territorial waters, the *Fatal Accident and Sudden Death Inquiry (Scotland) Act* of 1976 does not provide for a Fatal Accident Inquiry to be convened.

The lack of any postmortems on the deceased prevented the investigation from establishing whether any of them died from causes other than drowning.

The investigation has been unable to establish why a proper lookout was not kept onboard *Silvery Sea* in the minutes before, and at the time of, the collision with *Merkur*.

Silvery Sea's wheelhouse battery-powered clock stopped at 0709 (UTC+1), which probably occurred when it was immersed in water as the vessel foundered. The vessel foundered several minutes after the collision, which is estimated as having occurred at 0607 (UTC). As the distress message from *Merkur* was received at 0612, the estimated collision time is a reasonable deduction.

2.2.2 *Merkur*

On board *Merkur*, shortly after 0530, the chief officer first saw the echo of a fishing vessel on his port bow on the edge of his off-centred radar screen and at a range of 7 miles. However, with the radar on the 6-mile range scale, the off-centred setting extended the range ahead to 9 miles. It has been calculated that the actual range of the echo at the time of sighting would have been about 7.6 miles. On reconstruction, the first sighting on the radar would therefore have been at about 0546, so the echo was first seen on radar some 21 minutes before the collision.

He knew from the EBM that the vessel was on a steady bearing and therefore on a collision course. The evidence is inconclusive about how carefully he monitored the approach of the fishing vessel, but all the indications show that he was in no doubt that a risk of collision existed from when he first started to monitor it. Furthermore, he recognised *Silvery Sea* was not engaged in fishing. He knew he had a crossing situation and the fishing vessel was, by Rule 15 of the Collision Regulations, the give-way vessel.

Merkur's chief officer soon assessed he was the stand-on vessel and therefore obliged to observe Rule 17 of the Collision Regulations. The rule includes the following:

> *(a) (i) Where one of two vessels is to keep out of the way the other shall keep her course and speed.*
> *(ii) The latter vessel may however take action to avoid collision by her manoeuvre alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action in compliance with these rules.*
> *(b) When, from any cause, the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way alone, she shall take such action as will best aid to avoid collision.*

It is evident from the available information that, from the time it was ascertained that a risk of collision existed until apparently the range had closed to about 8 cables, very little monitoring of the fishing vessel was being undertaken. There is some suggestion to indicate the chief officer may not even have been on the bridge for some of this time, and the watchman had been directed to keep a lookout for vessels approaching from the opposite, starboard, side. During the few minutes preceding the collision the evidence suggests that the chief officer was occupied with plotting and logging the ship's position. Whatever actually happened, the indications are that it was not until the range had closed to about 8 cables that he realised the fishing vessel was not taking appropriate action to keep out of the way.

Under Rule 34 (d) of the Collision Regulations, the chief officer gave a warning signal on the ship's whistle to show his doubt as to whether sufficient action was being taken by the fishing vessel to avoid collision.

> Rule 34(d). *"When vessels in sight of one another are approaching each other and from any cause either vessel fails to understand the intentions or actions of the other, or is in doubt whether sufficient action is being taken by the other to avoid collision, the vessel in doubt shall immediately indicate such doubt by giving at least five short and rapid blasts on the whistle. ....."*

The chief officer made the sound signal after he had plotted and logged the 0600 position and when he estimated that the fishing vessel was about 8 cables away.

The range was then very close indeed. From the reconstruction, a distance apart of only 8 cables equates to about 2 minutes steaming time to the point of impact. The chief officer might have chosen to use the VHF radio to call the fishing vessel but did

not do so because he could not see her name. He thought that if he called the fishing vessel without giving her name, another vessel might have answered, which would have caused confusion and wasted time in avoiding her. There is no disagreement with this decision, but he should have been alert to his responsibility under Rule 2(a) of the Collision Regulations, which states:

> *"Nothing in these Rules shall exonerate any vessel, or the owner, master or crew thereof, from the consequences of any neglect to comply with these Rules or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case."*

Although the chief officer chose not to take action in accordance with Rule 17(a)(ii), he effectively had a responsibility under Rule 2(a) to take avoiding action before a point had been reached where a collision could not be avoided by the combined actions of both vessels. If he had delayed taking action until a collision could not be avoided by the action of the other vessel alone, in accordance with Rule 17(b), a collision would probably still have resulted.

Merkur had plenty of sea room in which to manoeuvre, but not the luxury of time. The chief officer waited a further minute before altering course to hard-to-starboard. The ship's data shows that, with one steering motor, it takes 32 seconds for the rudder to be moved hard over to 45°, and a further minute for the ship to turn through 90°. The chief officer should have sounded the whistle much sooner and, having seen no reaction from the fishing vessel, altered course much earlier. His actions were too late and, therefore, inadequate to avoid collision.

When the master arrived on the bridge, he could see from the wake that his ship was turning to starboard and that the still floating fishing vessel was on the starboard quarter.

The damage to *Silvery Sea* shows a bias to the port bow while the scrape marks on *Merkur* indicate that the fishing vessel impacted at an angle in excess of 90°. If *Merkur* had altered course to starboard earlier, the angle between them would have been less. Therefore, *Merkur* must have only just started to turn when the collision occurred.

The question arises as to why an experienced officer left it so late before taking any action to avoid a collision. There are two possible reasons:

Firstly, he might not have been on the bridge in the minutes preceding the collision. In their testimonies, the police officers stated, separately, that different people had told them that there was nobody on the bridge. Despite lengthy and detailed questioning by the German Board of Inquiry panel, the policemen stood by their testimony **(see Section 1.5)**. The inquiry concluded that the chief officer temporarily left the bridge. If this was so, why did he leave the bridge when he knew that a fishing vessel was approaching on a collision course?

The chief officer said that he had not left the bridge, and the watchman corroborated this. It can only be speculated as to why he would want to leave the bridge, and this

at about 0545, after which the chief officer could have left him alone on watch while he went for a quick breakfast before returning to take the 0600 position. Normally he would have been relieved at 0600 but, because he was not being relieved until 0700 that day, he might have missed breakfast. He may, alternatively, have left the bridge to visit the toilet, but he denied this at the Inquiry.

The second reason follows from the chief officer's own explanation as to why he did not alter course until the fishing vessel was so close. He said he had assumed the fishing vessel would alter course and saw no reason why she would not do so. With his experience of coastal trading, and under the circumstances in which he found himself, the tolerance threshold for the distance he expected fishing vessels to alter course for his ship was much less than for merchant ships. He knew that fishing vessels could, when on passage, alter course quickly and do so at close range. He made this assumption on the basis that the fishing vessel watchkeeper would be keeping a proper lookout. It is a dangerous assumption and no officer of the watch should ever make such assumptions. He should always be alert to the possibility that such a watch might not be kept, should keep watching the give-way vessel with care and, if necessary, judge the timing of his avoiding actions accordingly.

There is a conflict of evidence between that of the policemen and that of the master, chief officer and the watchman. It is impossible to draw a definite conclusion as whether or not the chief officer had left the bridge at any time, or whether this was even a contributory cause of the collision. It was unfortunate that MAIB inspectors were unable to interview the crew of *Merkur* after the incident.

2.3 THE FOUNDERING OF *SILVERY SEA*

Why did this large well-founded but heavily laden fishing vessel sink so quickly that none of the crew were able to escape? The answer to this question lies mainly in two aspects - the loaded condition of the vessel and her internal watertight integrity.

2.3.1 The loaded condition

The stability book showed that the total capacity of the RSW tanks was 433.1 tonnes. On examination it was found that this capacity was calculated with a sea water density (or specific gravity - SG) of 0.976. This was wrong and should have been 1.025*, changing the capacity to 454.84 tonnes. Condition 4 of the stability book relates to departure from the fishing grounds with 100% full RSW tanks, 50% fuel and 50% fresh water. The waterline for this condition has been drawn on **Diagram 4**.

(* Note: *The density of sand eels in RSW tanks has been taken to be the same as sea water.*)

The MAIB re-defined the hull of *Silvery Sea* to undertake trim and stability calculations, and confirmed the assessment given above.

In the skipper's fax to his agent **(see Section 1.1.1),** he said that there were 530 tonnes of (sand eels) on board. It is generally agreed that this was probably an over-

estimation for remuneration reasons. However, she had landed 510 tonnes at Esbjerg on a previous occasion and this could have been the approximate quantity she was carrying at the time of the accident. With a total capacity of 455 tonnes in the RSW tanks but loaded with 510 tonnes, there would have been an excess of 55 tonnes. Apart from the skipper's fax and the statement by *Merkur*'s chief officer that the fishing vessel was "fully laden" there is no other evidence to indicate her exact load.

During the fishing operations, the skipper would have progressively filled the RSW tanks with sand eels and, over time, the contents may have settled and become compressed and increased in density. Therefore, he may have been able to load more sand eels than the approved capacity of 455 tonnes. Alternatively, he may have placed the excess catch in the forward fish hold, which would have been the worst condition scenario. Any of the above options is possible; none can be proved.

Diagram 4 opposite shows waterlines for various loaded conditions:

the green waterline represents condition 4 of the stability book;

the blue waterline represents the worst condition that the vessel could have been in before the accident with 55 tonnes in the fish hold; and

the red waterline represents the same condition as the previous one, but with the bow damaged and the forward store room flooded.

2.3.2 Internal watertight integrity

If, before the collision, the vessel had been in the deepest loaded condition (4) approved in the stability book, the damage would very largely have been confined to an area above the (green) waterline. As the waterline was only about 200mm below the sill of the starboard door at frame 74, assuming a normal sill height of 380mm, incoming water would have risen to a height just below the sill. Had the door been shut in this condition, the flooding would have been contained. The effect of *Silvery Sea* being pushed down in the collision, meant that any residual bow wave and any form of sea state would have allowed water to flow over the sill. The open door would have done nothing to stop it. The flooding would have been progressive but possibly at a slower rate in condition 4 than in that represented by the blue waterline in **Diagram 4**.

The video footage shows that the starboard door at frame 74 was open and resting against a deckhead pipe running fore and aft **(see Photograph 1)**. The two dogs and the securing wedges on the port side frame of the opening do not appear to be damaged or displaced. Furthermore, examination of the underwater video indicates that the door appears to be tied back. Therefore, it is concluded that before the collision the starboard door at frame 74 was open, and at the time of impact was unable to restrain the flooding from forward.

The video footage, taken from outside the wreck and from inside the gutting space, shows that the major damage to the fishing vessel was to the bow area, above the main deck and forward of the bulkhead at frame 74 **(see Section 1.3.8)**. The compression

The video footage, taken from outside the wreck and from inside the gutting space, shows that the major damage to the fishing vessel was to the bow area, above the main deck and forward of the bulkhead at frame 74 **(see Section 1.3.8)**. The compression of *Silvery* Sea's foredeck and the configuration of the damage to *Merkur*, suggests that the bow of the fishing vessel was pushed downwards. Combined with the low freeboard in the heavily laden condition, and the residual bow wave from the ahead motion, flooding would have occurred through the damaged bow and open door at frame 74. The carriage of an extra 55 tonnes of fish would have made a significant difference to the waterline, lowered the freeboard and placed the door sill below the waterline.

Floodwater would have passed through the door into the gutting room and then into the passageways on either side of the RSW tanks. The hatchcover to the dry fish hold was found dislodged and this would have allowed water into this space. Therefore, most of the spaces forward of the accommodation would have filled rapidly and increased the vessel's draught forward so that she would have trimmed very quickly by the head. When *Merkur*'s master arrived on the bridge, the only part of *Silvery Sea* still visible was her stern. The rest of the hull was underwater. As she started to go down, the engine room would have flooded. Its door was found open which would have increased the rate of sinking.

The main outer doors to the accommodation were closed, but those at the after end of the passageways remained open. Had they been closed, the after spaces might not have flooded so quickly and the crew might have had more time to escape.

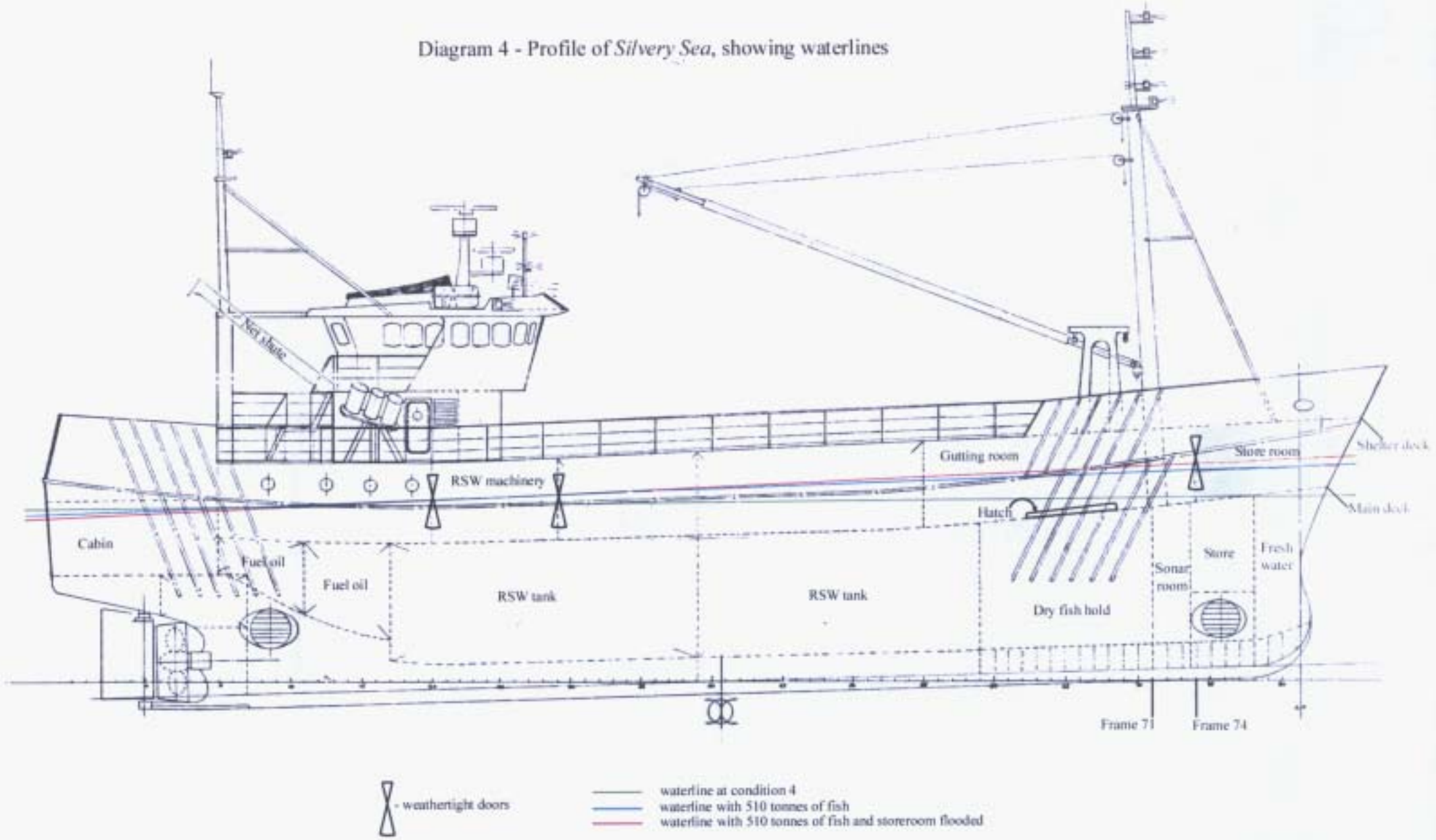
With internal doors open, and especially the starboard door at frame 74, the fishing vessel had no effective subdivision and was unable to remain afloat given the progressive flooding. Sinking was inevitable.

Had there been no opening at all in the bulkhead at frame 74, or if its door had been closed and secured, flooding would probably have been confined to the forward store. Loss of buoyancy would have been small and the vessel should have survived. A door secured by dogs, would probably have withstood the pressure head, as it was high up in the vessel. This means the vessel would probably not have foundered had the door been properly shut and clipped. There was no statutory requirement for the door to be shut and there may have been an operational reason for it to be open. However, good operational practice would have ensured the door was kept shut when not in use, to enhance the survivability of the vessel in the event of a collision.

It is concluded that the speed with which *Silvery Sea* sank was because she was badly holed forward and pushed down by the head in the collision, and her freeboard had been reduced sufficiently to accelerate flooding. The starboard door at frame 74 was one means of containing flooding internally. Although it might have been open for operational reasons it was neither shut nor secured.

After the lengthening, an effective collision bulkhead would have extended up to the shelter deck. This could have been achieved by using the bulkhead at frame 74. The extended collision bulkhead would then have comprised the bulkhead at frame 71 below the main deck, the main deck between frame 71 and frame 74, and the bulkhead

Diagram 4 - Profile of *Silvery Sea*, showing waterlines



at frame 74 above the main deck. The problem with this solution is that it would have required the removal or welding up of the doors in frame 74. The removal of these doors would have caused practical difficulties in accessing the forward spaces.

If *Silvery Sea* had been fitted with a collision bulkhead up to the shelter deck she would have survived.

SECTION 3 - CONCLUSIONS

3.1 FINDINGS

3.1.1 General

1. A collision occurred between the UK fishing vessel *Silvery Sea* and the German container ship *Merkur* at about 0607 UTC on 14 June 1998, in a position approximately 35 miles west of Esbjerg, Denmark. [1.1.1]

2. No environmental conditions contributed to the accident. [2.2.1]

3. There was no other traffic in the area, which had a bearing on the collision. [1.1.1]

4. Both vessels had plenty of sea room in which to manoeuvre. [2.2.1, 2.2.2]

5. Postmortem examinations on the deceased fishermen, by either the Danish or Scottish authorities, would have been of assistance in investigating the cause of the collision. [2.2.1]

6. There was no known technical or material deficiency on either vessel that contributed to the cause of the collision. [2.2.1, 2.2.2]

3.1.2 *Silvery Sea*

1. The fishing vessel was on passage from the fishing grounds of Wee Bankie, near the entrance to the Firth of Forth, to her landing port of Esbjerg. [1.1.1]

2. The skipper sent a fax to his agent in Esbjerg stating that he had 530 tonnes of fish on board. This would have been an overloaded condition. [1.3.4]

3. On a previous occasion, *Silvery Sea* had landed a maximum load of fish at Esbjerg of 510 tonnes, which was also an overloaded condition. [1.3.4]

4. There is uncertainty over the SG of compressed sand eels within RSW tanks. [2.3.1]

5. From the fishing grounds to the collision position, the course was 098° and she had reported that she had been making 9.3 knots. [1.1.1]

6. The fishing vessel had been on passage for about 34 hours up to the time of the collision. [1.1.1]

7. Having taken a roster system of two-hour navigational watches for each crew member since leaving the fishing grounds, it is probable that the five fishermen on board would not have been suffering from fatigue. [1.1.1]

8. Due to the random nature of the roster system of watches it is not known who was on watch at the time of the immediate events leading up to the accident. [1.1.1]

9. There was a watch alarm system, which was activated when the autopilot was engaged. [1.3.2]

10. The loud klaxon for the watch alarm sounded only in the wheelhouse but was also audible in the skipper's cabin, the recreation room and galley. It could not be heard in the crew's cabins. [1.3.2]

11. The fishing vessel foundered so quickly that all five crew members on board were unable to escape from within the vessel, and lost their lives. [1.1.2, 1.3.5]

12. Both of the liferafts were released automatically from the sunken vessel, but one failed to inflate although both were serviced and up to date. [1.1.2]

13. The EPIRB was automatically released and the Danish authorities received its alert signal at 0622. [1.1.2]

14. Two days after the accident, Danish divers went to the wreck and found that except for the starboard wheelhouse door, all the outside weathertight doors to the accommodation were closed, and all hatches on deck, except one, were closed. [1.3.5]

15. The divers found that the major damage to the vessel was confined to the stem and there was a large opening in the bow. [1.3.5, 1.3.8]

16. The divers recovered the bodies of the skipper and an engineer from the first deck below the wheelhouse, and of two deckhands, from outside the cabins on a deck further down in the accommodation. [1.3.5]

17. The divers returned to the wreck to survey the wheelhouse and found that the engine controls were on full economic speed ahead and that the automatic pilot was engaged on a heading of between 100° and 103°. [1.3.5]

18. The divers found in the forward space that the starboard door at frame 74 between the gutting room and the forward storeroom was open and the hatch to the dry fish hold had been pushed up. [1.3.5]

19. The divers found the body of the fifth fisherman on the second deck down from the wheelhouse. [1.3.5]

20. The manning scale was short of a chief engineer, but this was irrelevant to the accident. [1.3.2]

3.1.3 *Merkur*

1. The container ship was on passage from Hamburg to Gothenburg steering 342° but making good a course of 340° over the ground, with a speed of 15 knots. [1.1.1]

2. The chief officer took charge of the navigational watch at 0300 and a new watchman was posted at 0400. [1.1.1]

3. The chief officer had had an adequate rest period before taking the watch, and would probably not have been suffering from fatigue. [2.2.1]

4. There is no evidence that the chief officer was under the influence of drugs or alcohol. [1.4.2]

5. The chief officer was plotting the position of the ship every 30 minutes, and entered it in the deck logbook every hour. [1.1.1]

6. The bridge watch alarm was set at 12-minute intervals. [1.1.1]

7. The radar was on the 6-mile range scale but was off-centred to give a 9-mile view ahead. [1.1.1]

8. The chief officer observed an echo on the radar screen on his port bow at a range of about 7 miles. [1.1.1]

9. By using the electronic bearing marker he found that the bearing of the echo was not appreciably changing. [1.1.1]

10. He saw that the echo was that of a fully laden fishing vessel, on passage and on an easterly course heading for Esbjerg. [1.1.1]

11. He determined that this was a crossing situation, and that the fishing vessel was the give-way vessel. He maintained his course and speed as the stand-on vessel. [1.1.1, 2.2.2]

12. There is some doubt as to whether or not the chief officer left the bridge before the collision. However, the evidence indicates that at 0600 he plotted the ship's position and entered it into the logbook. [1.1.1]

13. When the fishing vessel was 8 cables away, the chief officer saw she was still on her original course and speed. [1.1.1]

14. He sounded a warning signal to the fishing vessel to which he received no response. [1.1.1]

15. The chief officer then put the helm to hard-to-starboard but his action was too late and the fishing vessel ran stem-on into *Merkur*'s port bow. [1.1.1]

16. *Merkur* launched her lifeboat to search for survivors. [1.1.1]

17. *Merkur* began to take water into her holds and she sought Esbjerg as a port of refuge. [1.1.2]

3.2 CAUSES

3.2.1 The collision

1. *Silvery Sea* did not meet her obligation under the Collision Regulations to keep out of the way of *Merkur*. [2.2.1]

2. The chief officer of *Merkur* did not take appropriate action early enough to best avoid a collision when it became apparent to him that *Silvery Sea*'s action alone would not avoid a collision. [2.2.2]

3.2.2 The foundering

The large ingress of water through the damage in *Silvery Sea*'s bow was able to flow from forward to aft through open doors in transverse bulkheads, thereby depleting her reserve buoyancy and causing the vessel to sink rapidly. [2.3]

3.3 CONTRIBUTORY CAUSES

1. The reason why whoever was on watch in *Silvery Sea* failed to take action to avoid a collision cannot be established because all crew members lost their lives. [2.2.1]

2. It can only be assumed that the watchkeeper on *Silvery Sea* had become incapacitated, or left the wheelhouse and allowed the vessel to continue in automatic helm. [2.2.1]

3. The probable failure of the watch alarm to alert the crew that nobody had cancelled it and, by inference, that there was no-one keeping an effective watch. [2.2.1]

4. The chief officer on *Merkur* made a wrong assumption that *Silvery Sea* was keeping a proper lookout and that she would keep out of the way of *Merkur*, and so did not take avoiding action until it was too late. [2.2.2]

5. Had he used the radar to determine the time of nearest approach of the fishing vessel, the chief officer might not have taken the 0600 position and concentrated more on the fishing vessel. [2.2.2]

6. The bow of the heavily laden fishing vessel was damaged and pushed down in the collision, allowing seawater to enter the hull and flood progressively through the open starboard door at frame 74. [2.3]

7. With internal doors open, and especially the starboard door at frame 74, the fishing vessel had no effective subdivision and was unable to remain afloat after the hull had been opened to the sea. [2.3]

8. A positive conclusion cannot be made as to whether or not the chief officer left the bridge or whether this allegation was a contributory factor. [2.2.2]

3.4 OTHER FINDINGS

1. If the starboard door at frame 74 had been properly secured closed by the dogs, the vessel would have probably survived. [2.3]

2. Had the vessel been in the deepest condition approved by the stability book, the waterline after the collision would have been just below the sill of the starboard door at frame 74. The vessel's movement caused by the collision and in the seaway would have led to progressive flooding over the sill of the door opening. [2.3]

3. If *Silvery Sea* had been fitted with a collision bulkhead up to the shelter deck she would have survived. [2.3]

SECTION 4 - RECOMMENDATIONS

The Maritime and Coastguard Agency is recommended to:

1. Examine any instance where an exemption for a collision bulkhead has been granted in the past to a fishing vessel which has been lengthened, and reassess the effect of granting that exemption.

2. Amend *The Fishing Vessels (Safety Provisions) Rules 1975* to include detailed requirements for collision bulkheads. These should state that the collision bulkhead is extended to the uppermost continuous weather deck and no doors or other openings are to be fitted in it.

3. Conduct research into whether it is possible to exceed the approved deadweight of RSW tanks because of a resultant SG in excess of 1.025, due to the settling and compression of sand eels.

The Director of the Logistics and Maritime Transport Directorate of the DETR is recommended to:

4. Draw the attention of the Crown Office to the problems created by the failure to carry out postmortems for the victims of *Silvery Sea* and recommend the criteria for commissioning postmortem examinations following an accident be reviewed.

Marine Accident Investigation Branch
July 2000