

**Report on the Investigation of  
the capsize of the fishing vessel**

***FRAOCH BAN***

**off the coast of the Shetland Islands  
on 15 August 1999**

**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.

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## **GLOSSARY OF ABBREVIATIONS**

|       |   |  |
|-------|---|--|
| EPIRB | - | Emergency position indicating radio beacon |
| HRU   | - | Hydrostatic release unit                   |
| m     | - | metre                                      |
| mm    | - | millimetre                                 |
| MAIB  | - | Marine Accident Investigation Branch       |
| MCA   | - | Maritime and Coastguard Agency             |
| QCM   | - | Qualifying conditions met                  |
| SE    | - | south-east                                 |
| UKFVC | - | United Kingdom Fishing Vessel Certificate  |
| UTC   | - | Universal Co-ordinated Time                |

## **GLOSSARY OF TERMS**

|              |   |   |
|--------------|---|---|
| capsize      | - | a roll to starboard or port caused by a loss of stability which leads to a vessel turning on to its side or inverting. A capsize is normally followed by foundering |
| founder      | - | to fill up with water and sink  |
| free surface | - | the tendency of a fluid to shift with the motion of a vessel. A large free surface can lead to capsize  |
| painter      | - | a length of line attached to a liferaft, which also activates its inflation   |
| pound boards | - | wooden planks which are slotted into stanchions to limit cargo shift, also called locker boards   |



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## SYNOPSIS

At 2135 Universal Co-ordinated Time (UTC) on 15 August 1999, the Marine Accident Investigation Branch (MAIB) was informed that a fishing vessel had capsized off the coast of the Shetland Islands at 1850 that day. An investigation was initiated immediately and was conducted by MAIB inspector, Richard Barwick.

*Fraoch Ban* was fishing for sand eels, which were stowed on board in bulk. The arrangement of the pound boards in the hold did not limit the free surface sufficiently, and as a result the vessel capsized and foundered. The weather at the time was calm and it was daylight. The stability book of the vessel was not approved for the bulk stowage of fish.

As *Fraoch Ban* capsized, the skipper radioed to the fishing vessel *Sarah Joan* for assistance. When the crew abandoned the upturned hull of *Fraoch Ban*, they had to swim to the liferaft, which had floated away because it had been stowed incorrectly. One of the crew became unconscious during the swim and needed to be hauled to the liferaft; the other crew members successfully resuscitated him and he later made a full recovery.

The MAIB has made safety recommendations regarding stability, securing liferafts, and certification of skippers on board fishing vessels.

## SECTION 1 - FACTUAL INFORMATION

### 1.1 PARTICULARS OF VESSEL AND INCIDENT (all times are UTC)

|                            |   |  |
|----------------------------|---|--|
| Name                       | : | <i>FRAOCH BAN ex Crystal Sea</i>                                   |
| Type                       | : | Fishing vessel   |
| Port of registry           | : | Lerwick, Shetland Islands, UK                                      |
| Fishing number             | : | LK966  |
| Official number            | : | A12295   |
| Owner                      | : | Mr Brian Robb<br>Vosetter, East Voe, Scalloway, ZE1 0US            |
| Built                      | : | 1978 Buckie  |
| Material of construction   | : | Steel  |
| Length                     | : | 15.12m (Registered)  |
| Breadth                    | : | 5.67m  |
| Depth                      | : | 1.73m  |
| Gross tonnage              | : | 23.66  |
| Fishing Vessel Certificate | : | Issued by the MCA on 21 June 1999<br>Valid until 30 September 1999 |
| Position of accident       | : | 60° 07' N 001° 02' W   |
| Time and date              | : | About 1850 on 15 August 1999                                       |
| Injury                     | : | A crewman became unconscious but recovered after resuscitation.    |

A general view of *Fraoch Ban* is shown in **(Figure 1)**, and a sketch of the general arrangement is shown in **(Figure 2)**.

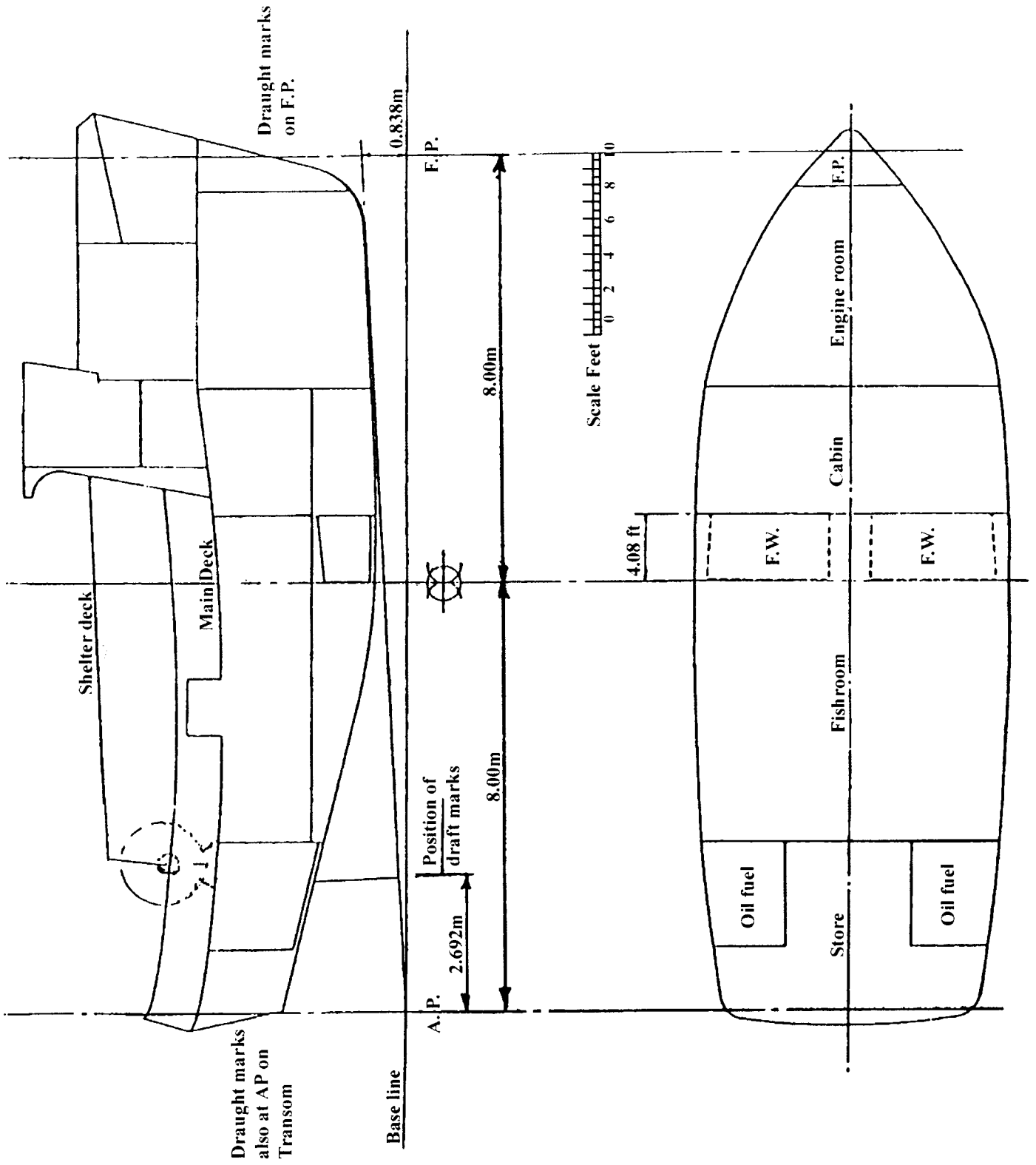
Figure 1



*Fraoch Ban*



Profile and Plan



## 1.2 CREW

*Fraoch Ban* had a crew of four:

Brian Robb, the 35 year old skipper. An experienced fisherman with a Certificate of Competency - Second Hand - Full and Special, now referred to as a Class 2 Fishing Vessel Certificate. At the time the qualifying conditions were met (QCM) on 8 July 1985, the required syllabus did not contain any training on fishing vessel stability. A deck officer Certificate of Competency is currently required on fishing vessels over 16.5m in length; *Fraoch Ban* was 15.12m in length. The Certificate of Competency included training in first-aid; he also had been trained in basic survival at sea and basic fire fighting and prevention. He was the owner of *Fraoch Ban*.

James Robb, aged 59, the skipper's father, an experienced fisherman with a Certificate of Competency - Second Hand - Full and Special, QCM 1 April 1975. A skipper for 25 years, he had been retired for about a year. On this trip he was not in command, and in this report he is referred to as deckhand 1.

Richard Young, 28 year old deckhand. Training received in basic survival at sea, basic fire fighting and prevention, and basic first-aid. He had been a fisherman for six years. He is referred to as deckhand 2.

John Umphray, 17 year old deckhand. Training received in basic survival at sea, basic fire fighting and prevention, and basic first-aid. He had been fishing since he left school nearly two years before the accident, and had worked on *Fraoch Ban* for about three months. This was his first trip fishing for sand eels. He is referred to as deckhand 3.

*Fraoch Ban* normally had a crew of three, but as this was the first trip fishing for sand eels this season, James Robb had joined the others, because he was experienced and skilled in handling the delicate sand eel net. Normally, during the hauling operation, one crewman operated the derrick on the shelter deck, another handled the loading next to the fish hold hatch on the main deck, and the third moved between these two positions; helping as required. As there were four crew members, Brian Robb operated the derrick with John Umphray assisting, and James Robb handled the loading with Richard Young assisting.

## 1.3 WEATHER

Wind SE force 1 to 2, sea and swell slight, visibility good.

## 1.4 HISTORY

The skipper had owned *Fraoch Ban* since April 1997. His recollection is that they had fished for sand eels many times during the 1998 season using a similar stowing method, often in much rougher weather. On one occasion the fishing was so good that the hold was filled to the top with a catch of about 44 tonnes. The vessel performed satisfactorily during this time. The fittings in the fish hold, ie stanchions and pound boards, were acquired with the vessel.

## 1.5 NARRATIVE

*Fraoch Ban* left Lerwick at about 0600 on 15 August 1999. At about 0830 she returned to Lerwick for a replacement piece of gear for the trawl; she left again at about 0900, and headed for the south-east side of Bressay Island where fishing began at about 1000. After about five tows, approximately 25 tonnes of sand eels had been caught. The last tow was hauled around 1850, and roughly half had been loaded when the vessel started to list to port. The derrick was not being used when the list was first noticed, ie no weight was suspended from the derrick.

When the angle of heel became alarming the skipper went to the wheelhouse and called the fishing vessel *Sarah Joan* by radio, requesting assistance. The crew then assembled on the shelter deck. *Fraoch Ban* continued to heel slowly to port until she was on her side, and the crew released the liferaft. The vessel eventually turned right over. The capsize was slow, so three of the crew were able to walk from the shelter deck onto the starboard side, but deckhand 1 had to be helped over the deck edge. As the vessel continued to roll, all the crew walked onto the bottom. The capsize took about five minutes from the first sign of a significant angle of heel, to when the vessel was fully inverted. From that position *Fraoch Ban* took a further ten minutes to sink.

The crew intended to wait on the upturned hull for *Sarah Joan* to arrive, but when diesel oil started to come to the surface they decided to leave; if the boat was going to sink they did not want to swim through diesel oil. The crew had forgotten to make fast the painter of the liferaft and it had drifted away, hence they had to swim. They removed their boots and oilskins before entering the water. Deckhands 2 and 3 swam to the liferaft and were able to inflate it by pulling on the painter. Deckhand 1 became unconscious in the water, and the skipper had to haul him to the liferaft. The unconscious crewman was pulled into the liferaft; he was not breathing. Deckhand 2 performed mouth to mouth resuscitation, while the skipper performed heart massage.

*Sarah Joan* had called the coastguard at 1858 UTC, shortly after she had received the radio message from *Fraoch Ban*. The coastguard helicopter reached the liferaft at 1914 UTC and *Sarah Joan* arrived at about the same time. Deckhand 1 who was breathing again, was transferred to *Sarah Joan*, and the rest of the crew followed. Deckhand 1 was then airlifted to hospital. *Sarah Joan* proceeded towards Lerwick, but after a short while *Fraoch Ban*'s remaining crew were transferred to the lifeboat, which then took them to Lerwick. They too went to hospital for a check-up as they were suffering the initial effects of hypothermia, but there were no injuries. Deckhand 1 made a full recovery, although he remembered nothing from when he passed out in the water, until he woke up in hospital. He was discharged from hospital on 17 August 1999.

The vessel has not been recovered.

## 1.6 LOADING OPERATION

*Fraoch Ban* used a stern trawl to catch sand eels. At the end of a tow, the net was brought to the surface and then along the starboard side. The gilson was hauled with about 1 tonne of

sand eels in the cod end. This part of the catch was hauled up and over the centre of the vessel. It was then lowered through the fish hatch in the shelter deck which placed it over the fish hatch in the main deck where the cod end was released and the sand eels were allowed to spill into the fish hold. The net was emptied about 1 tonne at a time in this way.

## 1.7 FISH HOLD

The fish hold is large enough for a load of sand eels to provide enough free surface to capsize the vessel. *Fraoch Ban* carried pound boards, which, if fitted correctly, would reduce the free surface.

It is not known exactly how the sand eels were stowed in the fish hold, but the most likely arrangement is shown in **(Figure 3)**. Pound boards divided the hold into six rows athwartships and seven longitudinally, making 42 squares. The two aft corners, comprising four squares each, were blocked off with pound boards fitted from the deck to just below the deckhead, so that those parts of the hold were not used, although it was intended to open them up later in the season. Pound boards were fitted elsewhere in the fish hold, but pieces of wood slotted into the stanchions prevented the pound boards from reaching the deck, leaving a substantial gap. This allowed the fish to be stowed more easily, because when the sand eels were dropped through the hatch they were able to spread through most of the space.

Deckhand 2 remembers looking down into the fish hold to try to see if the cargo was shifting as *Fraoch Ban* was listing. The port outer longitudinal row of pound boards, which were fitted up to about chest height, could not be seen by deckhand 2 and the sand eels were spilling to the extreme port side of the hold.

The pound boards were about 32-38mm (1.25"-1.5") thick, and about 230mm (9") wide. The length was suitable to fit between the stanchions **(Figure 3)**. About 200 pound boards were carried.

Stanchions were fitted on 13 August; pound boards were also tested and a number fitted in preparation for the first sand eel trip on 15 August 1999.

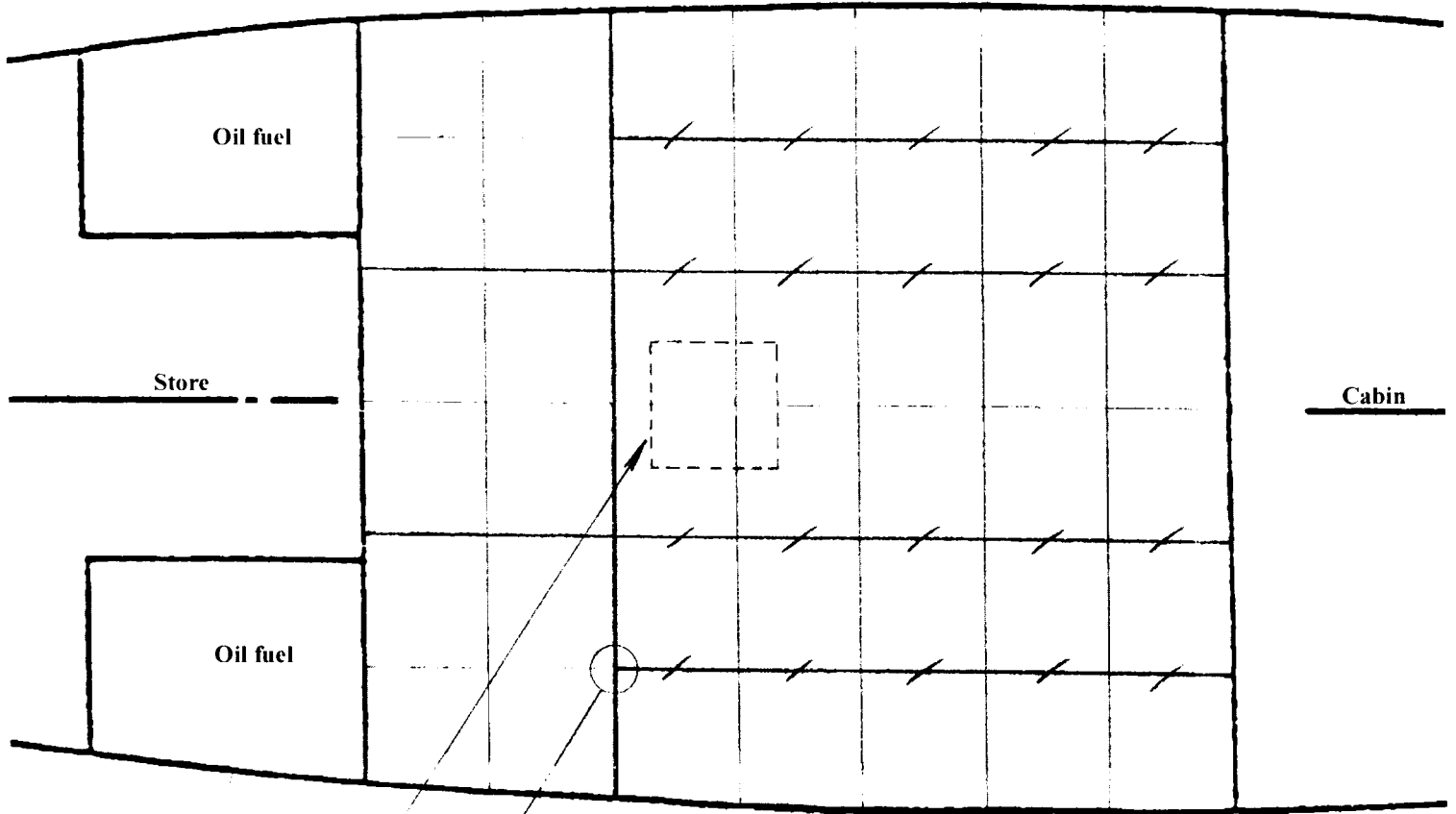
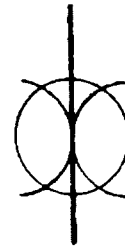
The bilges under the fish hold were pumped after every catch. Bilge alarms were fitted in the fish hold and the engine room. The bilge alarms did not activate before the accident. The bilge alarm in the fish hold was accidentally activated the day before the accident due to a piece of ice coming into contact with the float switch.

## 1.8 TANKS

The free surface effect in the individual fuel tanks was small. It is believed that the pipe between the tanks was fitted with non-return valves so that cross-flooding should not have taken place. The cross-connecting pipe was about 38mm (1.5") in diameter. The fuel tanks were filled individually.

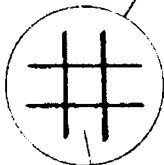
On the morning of the accident the fresh water tanks were filled before leaving harbour. Because only a couple of kettles of water were used before the accident, there was no

### Layout of pound boards in fish hold



Fish hold hatch over

Typical stanchion

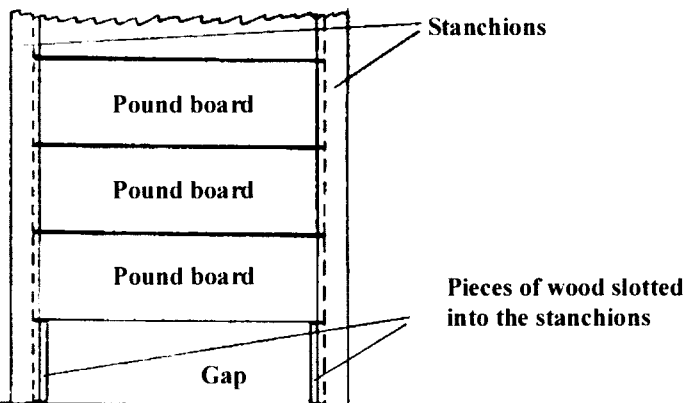


Slots for pound boards

--- Possible position for pound board but none fitted at the time of the capsizing

— Pound boards fitted deck to deckhead

—/— Pound boards fitted with a gap at the top and bottom



significant free surface in these tanks. The water tanks were cross-connected; they were normally filled from one side, ie as one tank was filled, water crossed to the other tank as well. The cross-connecting pipe was about 38mm (1.5") in diameter.

## 1.9 STABILITY

The stability book was approved on 25 July 1996. An inclining test which was conducted on 4 May 1999 showed that the weight and centre of gravity of *Fraoch Ban* had not changed significantly, and the MCA did not require the stability book to be updated.

In all of the conditions where a load of boxed fish was carried, compliance with the stability criteria was met.

The stability book showed conditions for a cargo of boxed fish, and in the Working Instructions, Note 6 states:

*BULK CATCH            No conditions are given for bulk catch and, should bulk loading be envisaged additional conditions must be submitted.*

The current owner had not signed the form FV10 at the back of the stability book.

While sand eels were loaded, *Fraoch Ban* became progressively more unstable due to the increasing free surface. When the catch stowed in the fish hold reached 25 tonnes this was enough to cause the vessel to capsize.

## 1.10 LIFERAFT

A fishing vessel of *Fraoch Ban*'s size must carry a liferaft; she complied with this requirement.

The liferaft on board had been borrowed from West Side Fishermen while *Fraoch Ban*'s own liferaft was being serviced. The liferaft had not been stowed properly; the painter had not been made fast to the weak link via the HRU to the structure of the vessel. The liferaft was located on the shelter deck just aft of the wheelhouse.

As the vessel heeled over, the liferaft was released manually by using the senhouse slip, which held the canister in its cradle, but because the painter was not made fast, it floated away. When the crew decided to abandon *Fraoch Ban* it was 50-100m away. Deckhands 2 and 3 managed to swim to the liferaft, but when they reached it, about 20m of painter had to be pulled out of the canister, which took some time. After considerable difficulty, deckhand 2 succeeded in inflating the liferaft, by placing his feet on the end of the canister while pulling the painter which activated the inflation mechanism.

Once the two deckhands boarded the liferaft, they tried to paddle with their hands towards the other two crew members who were swimming. However, they did not make any significant headway, so they searched for the paddles. When these were located, the two crew in the water were close to the liferaft, so the paddles were used only briefly.

The unconscious crewman was not very heavy, so he was hauled into the liferaft fairly easily.

Once the liferaft was inflated, it functioned satisfactorily and was later recovered by *Sarah Joan* and taken to Lerwick. It was inspected by the MAIB on 18 August 1999.

### **1.11 LIFEJACKETS AND EPIRB**

*Fraoch Ban* complied with the requirements for a fishing vessel of her size, carried lifejackets for each person on board, and was equipped with an EPIRB.

The lifejackets were stowed in the cabin below the main deck. As the capsizing developed, the crew thought that *Fraoch Ban* might turn over at any time, so it was considered too dangerous to try and retrieve them.

The EPIRB had been correctly stowed, because the HRU released the unit when *Fraoch Ban* capsized. The EPIRB started transmitting on 406MHz, and the coastguard received this distress message shortly after the message from *Sarah Joan*. The EPIRB was recovered by the helicopter and switched off.

## SECTION 2 - ANALYSIS

### 2.1 FREE SURFACE AND STABILITY

There are three possible causes for the capsize:

#### 2.1.1 Free surface in the fish hold because of broken pound boards

The crew thought that some of the pound boards on the port side might have broken, but this is considered to be unlikely, as these wooden boards were strong, and when the vessel was upright were under no load. Before the accident, *Fraoch Ban* was upright most of the time as the weather was calm, and there would have been little rolling.

It is considered that the pound boards did not break. The crew thought that this may have been the reason for the excessive free surface, but this was caused by the gaps at the bottom.

#### 2.1.2 Free surface in the fish hold, plus cross-flooding of the tanks

The pound boards may have been fitted more judiciously than as shown in **(Figure 3)**, such that the free surface was more limited. If this was the case, some other factor must have contributed to the de-stabilisation; the most likely being the cross-flooding of liquid in the tanks.

If the water tanks were nearly full, little transfer would have taken place through the cross-connecting pipe, but if the tanks contained less than the crew had thought, significant cross-flooding might have occurred.

It is possible that the port side non-return valve, in the pipe which cross-connected the fuel tanks, became stuck open, allowing liquid to cross-flood from the starboard tank to the port tank, and increasing any heel to port. *Fraoch Ban* capsized to port.

The free surface effect would have been increased significantly if fluid could cross-flood. This applies to both the water tanks and the fuel tanks. The diameter of the cross-connecting pipe was about 38mm (1.5") for both sets of tanks. This small bore would have meant that the cross-flooding was slow. *Fraoch Ban* took about five minutes to capsize.

#### 2.1.3 Free surface of sand eels in the fish hold

The pound board arrangement of the fish hold **(Figure 3)** with a load of 25 tonnes of sand eels, provided enough free surface to capsize *Fraoch Ban*. The arrangement of the divisions in the main part of the fish hold did not break up the free surface satisfactorily, because the catch could move from one section to another through the gaps under the pound boards. A bulk cargo of sand eels is more viscous than sea water; it would shift with the vessel movement, but more slowly than a pure liquid. Sand eels are small fish with a slippery skin surface, and will readily slide over one another, especially just after being caught.



As noted above there might have been cross-flooding between the tanks. However, the incorrect use of the pound boards (**Figure 3**), particularly with gaps under them, produced a large free surface. This is considered to be the most likely reason the vessel capsized.

The crew believe that *Fraoch Ban* was loaded similarly in 1998; but the pound boards must have been more judiciously fitted then for the vessel not to have capsized.

The recollections of the crew vary, so the arrangement of the pound boards in the fish hold is not known for certain. However, it is clear that the sand eels were being stowed in bulk. In this respect the requirements of the stability book were not complied with. A note in the early part of the book stated that bulk fishing was not to be undertaken without first compiling stability conditions to show that it could be conducted safely. The vessel met the required stability criteria while carrying boxed fish, but the margin was very small. Therefore *Fraoch Ban* did not meet the criteria when loaded with a bulk catch with a large free surface.

The crew had intended using the aft corners of the fish hold later in 1999; this would have only increased the free surface effect and would have further adversely affected stability.

The skipper had not registered his acceptance of the stability book. When stability books are approved the current owner must sign the form FV10. When a vessel changes ownership the stability book is passed on, but there is no mechanism to ensure that the new skipper reads it. The skipper of *Fraoch Ban* bought the vessel in April 1997 and, although the stability book was transferred during this change of ownership, form FV10 was not updated nor was it signed by the new skipper.

The bilges were pumped after each trawl. The bilge alarms did not activate during the capsizing. The inadvertent setting-off of the bilge alarm in the fish hold the day before the accident, indicates that the unit was operating properly. The free surface effect due to bilge water is therefore considered to be negligible.

## 2.2 TRAINING

The skipper had looked briefly through the stability book, but it did not make much sense to him; he remembered doing some work on stability during his training, although at that time it was not in the syllabus for a Certificate of Competency - Second Hand - Full and Special.

Since 1 January 1987, the syllabus for a Class 2 Fishing Vessel Certificate has included “A general understanding of the principles of ship stability as applied in the stability book carried on board”. Skippers who have recently obtained this qualification should have a better understanding of this subject. At present a skipper of a fishing vessel less than 16.5m in length (*Fraoch Ban* was 15.12m) is not required to hold a Certificate of Competency, and it is recommended that a serious consideration is given to increasing certificate requirements to cover all fishing vessels down to 12m in length.

*Fraoch Ban*'s skipper should undertake the training in stability as required in the current syllabus for a Class 2 Fishing Vessel Certificate.

Deckhand 1 also held a Certificate of Competency - Second Hand - Full and Special, but, like the skipper, when the qualification was obtained, training in stability was not required in the syllabus.

If Note 6 (see section 1.9) in the stability book had been read and complied with, this accident would not have happened. It is essential that the stability book is read and understood by all skippers.

### **2.3 EVACUATION AND RESCUE**

The skipper is commended for his prompt action in summoning help. The crew of the fishing vessel *Sarah Joan* also showed good seamanship in alerting the coastguard and quickly going to *Fraoch Ban*'s assistance.

The evacuation would have been quicker if the liferaft had been correctly stowed. Stowing a liferaft appears to be a simple task, but actually requires some thought to get right.

Manufacturers of HRUs provide a diagram on correct installation; having this to hand and following it, is the best way to ensure that the correct method is used. MGN 104, published by the MCA, also gives guidance on this subject. Deckhand 1 almost lost his life because the liferaft was not made fast properly. On the positive side, the benefits of carrying a liferaft were demonstrated in this case.

There would have been less risk to the crew's lives had lifejackets been readily to hand. M Notice 1414 recommends that additional lifejackets should be stowed in the wheelhouse for this reason. However, approved self-inflating lifejackets are available, and it is recommended that fishermen wear these whenever they are working on deck. This type of lifejacket is compact, and does not significantly hinder their work.

The skipper and deckhand 2 are commended for resuscitating deckhand 1, who had stopped breathing. The training in first-aid proved its worth.

## SECTION 3 - CONCLUSIONS

### 3.1 FINDINGS

1. The large free surface in the fish hold was the main cause of the accident. The incorrect use of the pound boards, particularly the gaps under them did little to lessen the free surface, which was enough to capsize the vessel. [2.1]
2. *Fraoch Ban*'s stability book only showed conditions for the carriage of boxed fish; at the time of the accident the fish were being stowed in bulk, a condition which had not been approved. [2.1]
3. The skipper had not registered his acceptance of the stability book, using form FV10. [2.1]
4. The skipper had looked briefly through the stability book, but it did not make much sense to him. [2.2]
5. When the skipper and deckhand 1 obtained their deck officer fishing vessel qualifications, training in stability was not part of the syllabus. [2.2]
6. Fishing vessels of *Fraoch Ban*'s size are not required to carry a skipper who has been trained in stability. [2.2]
7. The liferaft had not been correctly stowed. [2.3]
8. Lifejackets were not donned, because they were stowed below deck in the cabin and were not readily to hand. [2.3]
9. The training in first-aid, received by the skipper and deckhand 1, proved its worth. [2.3]

### 3.2 CAUSES

#### Fundamental cause

*Fraoch Ban* had a catch of sand eels stowed in bulk on board, which produced a free surface effect large enough to capsize her.

#### Underlying causes

The non-compliance with the requirements of the stability book as far as bulk fish stowage was concerned.

The inadequate training that the skipper had received in fishing vessel stability.

## SECTION 4 - RECOMMENDATIONS

***Fraoch Ban***'s owner, **Mr Brian Robb**, is recommended to:

1. Undertake training in stability as specified in the current syllabus for a Class 2 Fishing Vessel Certificate. [2.2, 3.1.4]
2. Thoroughly read the stability book of any fishing vessel that he is operating. If he does not understand any aspect of the book, he should revise the subject and seek professional advice. [2.2, 3.1.4]
3. Make sure that the liferaft is correctly stowed on any vessel that he is operating. [2.3, 3.1.7]

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

4. Review the application of the form FV10, to ensure that when there is a change of ownership the form is filled in again. [2.1, 3.1.3]
5. Consider requiring certification of skippers of any fishing vessel required to hold a UKFVC. [2.2, 3.1.5]