MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

ACCIDENT REPORT

VERY SERIOUS MARINE CASUALTY | REPORT NO 3/2021 | APRIL 2021

Flooding and foundering of the fishing vessel *Ocean Quest* (FR 375) 70 miles north-east of Fraserburgh on 18 August 2019

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SUMMARY

At 0917 on 18 August 2019, the UK-registered fishing vessel *Ocean Quest* foundered 70 nautical miles north-east of Fraserburgh. *Ocean Quest*'s crew were all rescued uninjured by a coastguard helicopter; there was no pollution.

Ocean Quest was lost after flooding in the engine room. The source of the flooding has not been determined, but was almost certainly the result of a shell plating or hull weld failure beneath the main engine. Although every effort was made by the crew to bring the flood under control, the onboard pumping effort was not fully optimised as the sea water suctions had been left partly open after pumping started, which allowed the pumps to continue drawing in sea water while they were trying to drain the engine room bilge. It was also unfortunate that none of the three additional portable pumps passed across by other fishing vessels could be made to work.

Ocean Quest's crew were well prepared for the abandonment having routinely practised for such an emergency. The alarm was raised in good time and the subsequent rescue ensured everyone was safely transferred ashore. No recommendations have been made in this report; however, this accident highlights the importance of readiness to respond to emergency situations.

Ocean Quest (FR 375)

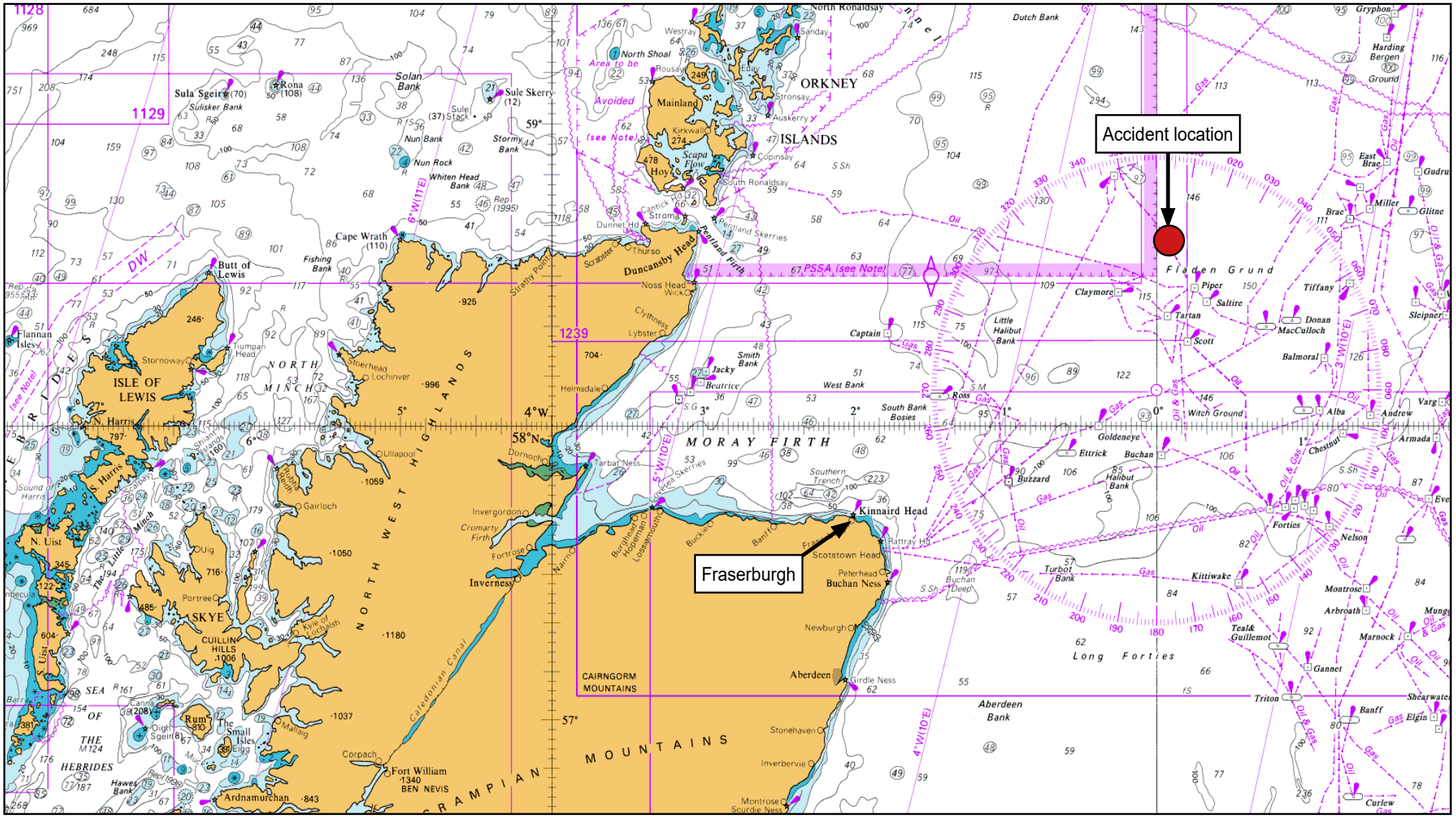

Figure 1: Chart showing Fraserburgh and the location of the accident

FACTUAL INFORMATION

Narrative

Ocean Quest departed from Fraserburgh on 16 August 2019 and headed north-east to its North Sea fishing grounds **(Figure 1)**. Throughout the following day, the crew trawled for prawns, processing the catch after each haul, then drifted overnight with a lookout in the wheelhouse and other crew resting. At 0445 on 18 August, one of the deckhands woke the rest of the crew and preparations commenced for the day's trawling.

Just before 0500, the skipper started the main engine, selected ahead gear and increased to 1000 revolutions per minute. Soon after engaging gear, the engine room bilge alarm sounded in the wheelhouse; the skipper then went on deck and told one of the deckhands[1] to go the engine room and investigate the alarm. When the deckhand arrived in the engine room, he saw a significant amount of water in the bilges. Knowing that the starboard general service pump was already set up to draw from the engine room bilge, the deckhand part opened the sea suction to prime the system, then started the pump. Assessing the water ingress was serious, the deckhand shouted to alert the skipper and to ask him to come to the engine room.

When the skipper arrived in the engine room, he saw the water in the bilges and also observed that it was welling up underneath the main engine. The skipper knew that a serious situation was developing and instructed the deckhand to set up the port general service pump to draw from the engine room bilge, and to start the pump. The skipper also took a short video of the flooding on his mobile phone **(Figure 2)**.

Figure 2: Water welling up under the main engine (image retrieved from the skipper's mobile phone)

The skipper then instructed other crew members to rig the vessel's portable electric submersible pump into the engine room, and to prepare for abandonment by collecting lifejackets and immersion suits and placing them at the muster station. The skipper then looked over the port and starboard sides to check that water was discharging from both sea water system hull outlets before going to the wheelhouse to raise the alarm. The skipper raised the alarm with the coastguard by transmitting a "Mayday" call on both very high frequency (VHF) and medium frequency radios; he also pressed the VHF digital selective calling distress button, and manually activated the emergency position indicating radio beacon. On receipt of the "Mayday" call the coastguard tasked a rescue helicopter and lifeboat to proceed immediately to the scene.

Using VHF radio, *Ocean Quest*'s skipper discussed the situation with the skipper of the fishing vessel *Lynden II*, which was nearby. *Ocean Quest*'s skipper confirmed

[1] The deckhand who went to the engine room had no formal engineering qualifications but was referred to on board by other crew as the 'engineer' because the vessel's full-time engineer was ashore at the time of the accident.

that all available pumps were being used in an attempt to stem the flood; *Lynden II* then headed over to assist. Two other fishing vessels that were in the area, *Odyssey* and *Fruitful Bough*, became aware of the incident and also proceeded to assist.

The floodwater continued to rise in the engine room and the skipper stopped the main engine when the water started splashing around the compartment from contact with the flywheel. At 0625, *Ocean Quest*'s skipper informed the coastguard that the flooding had not been brought under control and that the water level was halfway up the side of the engine and rising **(Figure 3)**. The starboard auxiliary engine, which was supplying electrical power, stopped when it became flooded by the rising water. The skipper then started the port auxiliary engine and connected its generator to the vessel's switchboard to supply electrical power to the general service pumps.

Figure 3: CCTV image showing floodwater about halfway up the main engine (image retrieved from the skipper's mobile phone)

When *Odyssey* arrived, a petrol-engine driven portable salvage pump was passed across, but *Ocean Quest*'s crew were not familiar with the pump's controls and could not start it. When *Lynden II* arrived, an electric submersible pump was passed across, but it could not be used as there was no compatible discharge hose to extract the floodwater. The third fishing vessel that came to *Ocean Quest*'s aid, *Fruitful Bough*, transferred a petrol-engine driven portable salvage pump, but this was immersed in sea water during the transfer, rendering it inoperable.

As the situation deteriorated, *Ocean Quest*'s crew prepared for abandonment by dressing in immersion suits, donning lifejackets and launching the liferaft. When the rising floodwater covered the port auxiliary engine, it stopped and all electrical power was lost except for 24-volt battery-powered emergency supplies.

When the coastguard rescue helicopter arrived, the winchman was lowered with a portable salvage pump. Two of *Ocean Quest*'s crew were then winched up into the helicopter **(Figure 4)**. Although the helicopter's salvage pump was working effectively, it was apparent to the skipper and helicopter winchman that it was having little effect. By this time, floodwater had entered the cabin space and *Ocean Quest* had developed a significant list to starboard **(Figure 5)**.

At 0750, the skipper, winchman and two remaining deckhands were hoisted off *Ocean Quest* and the helicopter flew to Inverness. The nearby fishing boats continued to monitor the situation and *Ocean Quest* was observed to sink at 0917.

Figure 4: Crew being winched up to the rescue helicopter

Figure 5: *Ocean Quest* listing heavily to starboard prior to foundering

Ocean Quest

Ocean Quest was a steel-hulled, twin-rigged trawler built in 1982 in compliance with *The Fishing Vessels (Safety Provisions) Rules 1975*, and comprised three main internal compartments: a fish hold, engine room and accommodation area **(Figure 6)**. The bulkheads separating these three main compartments were required to be watertight. Under the 1975 Rules, the vessel was required to have two powered general service pumps, capable of draining bilges, with a total capacity of not less than 27.3 cubic metres per hour (m^3/hr).

Since the change of ownership in 2007, *Ocean Quest* had undergone several significant hull and machinery upgrades, including the replacement of the main engine, both auxiliary engines and the fitting of two electrically driven general service pumps. The electrical and hydraulic systems had also been extensively upgraded, a shelter deck had been added aft, and an ice machine installed in the fish room.

Crew

Ocean Quest's skipper was a 37-year-old UK national who had been a fisherman all his working life; he had co-owned *Ocean Quest* with his father, who was the relief skipper, since 2007. The skipper held a Maritime and Coastguard Agency (MCA) fishing vessel class 2 Certificate of Competency.

The other four crew were Filipino nationals who were familiar with *Ocean Quest* as they were regular crew; one of them had been working on board the vessel for over 11 years. All the crew had completed the mandatory Seafish[2] training courses. Although he held no formal engineering qualifications, one of the deckhands was referred to by the other crew as the 'engineer' as the vessel's full-time engineer was ashore for this trip. The crew had completed regular training drills including for abandonment.

Hull valves and sea water pipework

There were four sea water valves in *Ocean Quest*'s engine room. On the starboard side there were two sea water valves providing cooling water for the main and starboard auxiliary engines, and another providing a sea water supply to the starboard general service pump for deck washing. On the port side of the engine room, there was a single sea water valve providing a supply to the port general service pump and cooling water for the port auxiliary engine.

Pipework below the engine room lower floor plates was restricted to the sea water valves and risers; the remaining sea water pipework was above the lower floor plate level. All the sea water valves were open at the time of the accident. Sea water for the general service pumps entered via the sea water valves, then a sea water suction that was part of a system valve block on the port and starboard sides. A simplified schematic diagram of the sea water system is at **Figure 7**.

In August 2019, *Ocean Quest* was lifted out of the water for maintenance and painting. All the sea water valves were removed for cleaning and no evidence of wastage of the pipework or hull fittings was found.

Bilge pumping and alarms

Ocean Quest was fitted with two electric motor driven self-priming general service pumps capable of draining bilges and providing pressurised sea water for deck washing. Both pumps had a rated capacity of 25m^3/hr. There was also a 240V electric powered portable submersible pump, rated at 8m^3/hr. In the engine room, there were two bilge level float switches that activated an alarm in the wheelhouse.

The starboard general service pump was located at the engine room's intermediate level adjacent to the starboard auxiliary engine and was primarily used by the crew for bilge pumping. The port general service pump was located at the lower plate level adjacent to the main engine, and the crew used it primarily for deck washing. Each pump had a dedicated bilge suction line drawing water from the engine room's aft bilge well and the fish room. The port pump also had a suction line from the forward engine room bilge well **(Figure 7)**. Each suction line was fitted with a strainer.

[2] Seafish – the Sea Fish Industry Authority works across all sectors of the UK seafood industry to promote good quality and sustainable seafood, and to improve the safety and standards of training for fishermen.

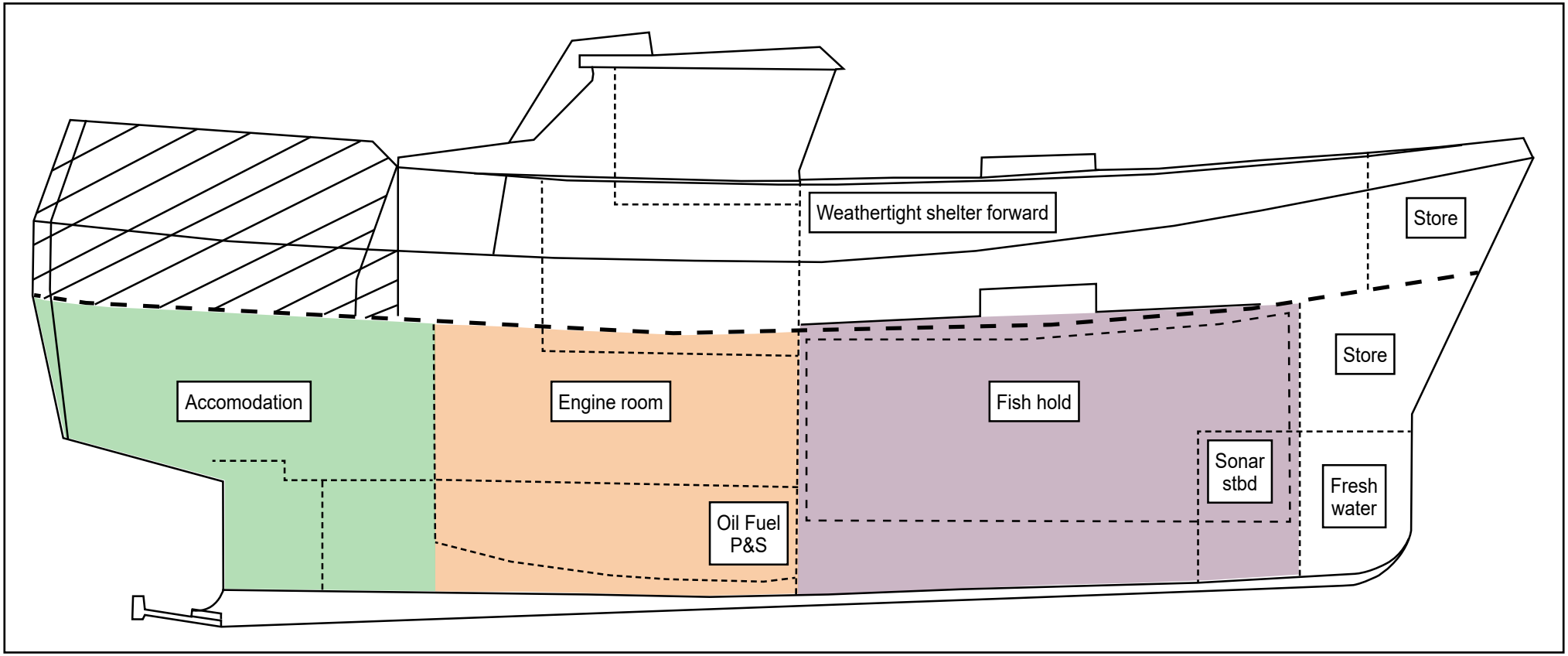

Figure 6: Vessel layout showing watertight divisions

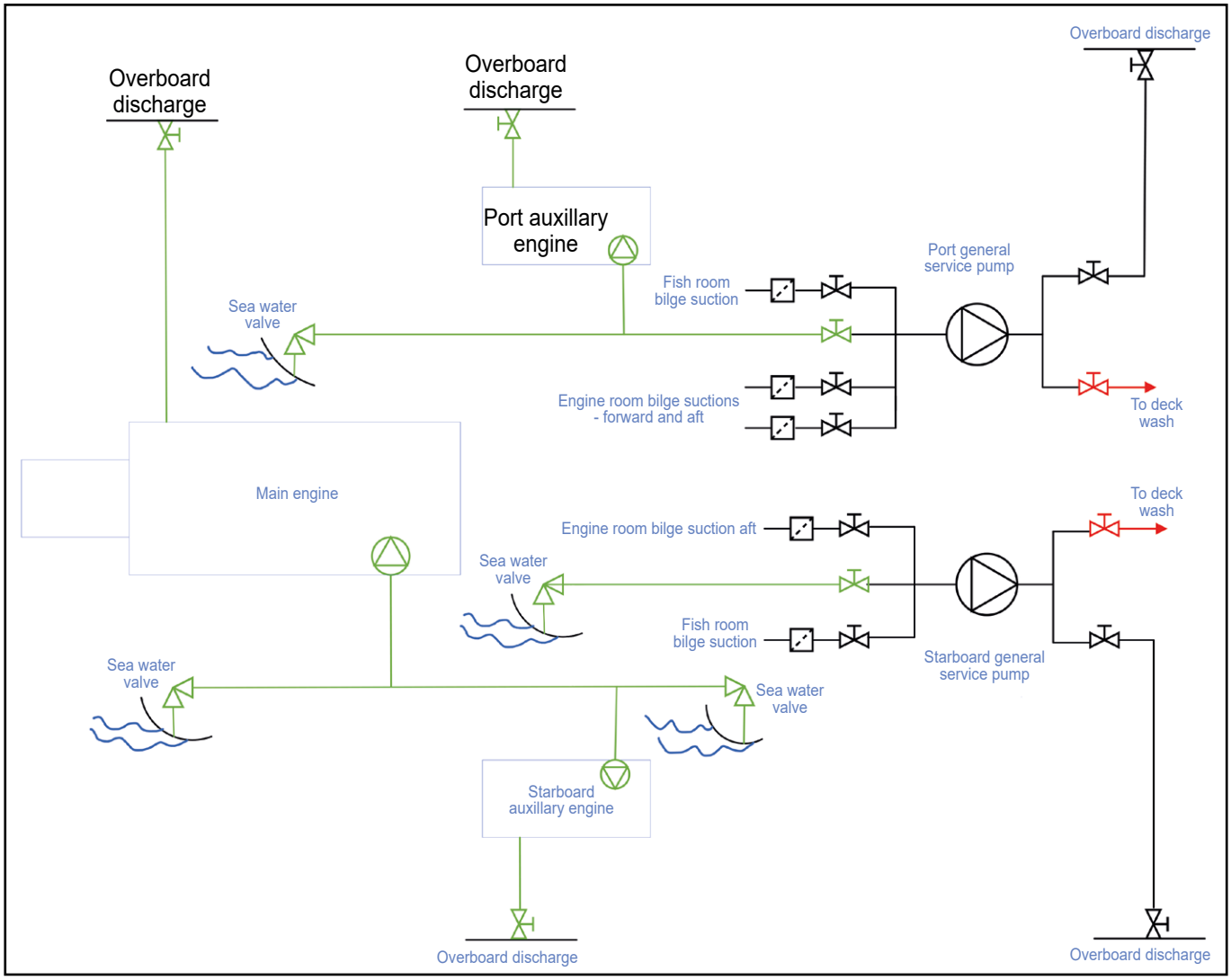

Figure 7: Simplified sea water and bilge system

Bilges were pumped on a daily basis when at sea to remove the water from ice melt in the fish room and any water that had accumulated in the engine room bilges. The normal practice on board when pumping bilges was to partially open the sea suction valve prior to starting the pump to prime the system, then leave it open while the pump was running. The crew did this to protect the pump and system from running dry when pumping out relatively small volumes of water from the bilges. The starboard pump's aft engine room bilge well suction valve was routinely left open when the pump was not in use.

Survey and certification

In December 2017, *Ocean Quest* was subject to a hull thickness determination survey in preparation for its forthcoming 5-yearly MCA survey. Hull thickness surveys used ultrasonic equipment to identify any areas of hull erosion; it is a sampling process and does not provide a 100% coverage of the hull. In older fishing vessel designs, the area where the hull meets the keel can also be inaccessible and difficult to measure. *Ocean Quest*'s 2017 survey revealed areas of hull plating wastage of over 50% in the fish room slush well and forward engine room bilge well. The affected areas of eroded hull were cut out and replaced.

On 1 February 2018, an MCA surveyor attended *Ocean Quest* to conduct the 5-yearly survey and, as a result, a UK fishing vessel certificate (UKFVC), valid until 31 January 2023, was issued. The UKFVC stated that *Ocean Quest* had been surveyed and found to be in compliance with the *Code of Safe Working Practice*[3] *for the Construction and Use of Fishing Vessels of 15m length overall to less than*

[3] Issued by the MCA in October 2017 under cover of Merchant Shipping Notice (MSN) 1872 (F)

24m registered length (the Code of Practice). An intermediate MCA survey was conducted on 17 April 2019; the survey report identified 11 issues requiring attention, none of which directly impacted on *Ocean Quest*'s seaworthiness.

Guidance for flooding

The MCA's Marine Guidance Notice (MGN) 165(F) *Fishing vessels: The Risk of Flooding*, provided advice on preventing flooding, and actions to take in the event of a flooding emergency. For reducing the risk of flooding, advice in MGN 165 (F) included, inter alia:

- *'Always investigate immediately the cause of high bilge alarms.*
- *Regularly (at least weekly) test the bilge pumps and bilge system.*
- *Test bilge alarms daily.*
- *Keep sea water valves closed when not in use.*
- *Ensure crew members are familiar with sea water side valves and bilge systems. As a reminder, keep a plan at the engine room entrance, identifying the position of sea inlet valves.'*

For effective use of the bilge pumping system, MGN 165(F) offered the following guidance:

- *'Close the sea suction after any priming of bilge pumps.*
- *Stop the bilge pump when pumping bilges is finished.*
- *Close all bilge valves when not in use.'*

In the event of a flooding emergency, MGN 165(F) recommended:

- *'Immediately try to find the cause of the flooding and shut the right sea valve. If in doubt, close all sea valves until the flooding stops.*
- *Start pumping the bilge as soon as possible.*
- *Do not concentrate on other matters, such as recovering the fishing gear. Deal with the flooding first.'*

Similar accidents and updated guidance

In the 10 years prior to this accident, the MAIB's records show that there were 181 reported accidents involving flooding on board UK-registered fishing vessels, of which 69 resulted in the loss of the vessel. These statistics include accidents where the flooding source was not identified.

On 21 January 2016, the 16m potter *Majestic* foundered as a result of unidentified flooding in its engine room. The MAIB investigation report stated that the loss was probably caused by a breach of the sea water system, and that the engine room had been flooding for about an hour before the crew were alerted.

On 3 March 2017, the 23m trawler *Ocean Way* foundered after uncontrolled flooding in the aft compartment. The MAIB's report into this accident made a recommendation to the MCA to update guidance for fishermen on the actions to take in the event of a flooding emergency. As a result, the MCA published an updated version of the *Fishermen's Safety Guide* that included an additional section on actions to take in the event of a flooding emergency. The six-step actions listed were: sound the alarm, find the flood, inform the coastguard, fight the flood, prepare lifesaving equipment and consider abandonment. Further detail on each of these steps was included in the Guide.

ANALYSIS

Cause of flooding

The cause of the flooding into *Ocean Quest*'s engine room has not been determined; however, it is almost certain that this ingress was a failure of the shell plating or welds under the main engine.

The main engine continued to run without overheating for at least an hour after the initial bilge alarm sounded. This strongly suggests that the flooding was not a result of failure of pipework associated with the main engine cooling. All other sea water cooled machinery also ran without overheating until submerged by floodwater. Additionally, most of the sea water pipework was above the level of the lower floor plates and was not observed to be breached when the skipper and crewman went to the engine room in the early stages of the emergency. The detachment or failure of a sea water valve below the lower floor plates cannot be discounted; however, this would have been unlikely to result in the upwelling of water seen under the main engine, which was not an area adjacent to any of the sea water valves. Moreover, all the engine room sea water valves had been removed, cleaned and replaced as part of a maintenance package just prior to the accident. As a result, it is unlikely that the source of the floodwater was from sea water systems.

Hull thickness surveys provide an indication of shell plating erosion, but it is only a sampling process, and some hull areas can also be awkward to survey with the possibility of weaknesses going undetected. As a 37-year-old vessel, it is not unreasonable that *Ocean Quest* had required replacement of shell plating that had eroded with time or had become corroded. Indeed, several areas of the hull had been replaced after the hull thickness survey in December 2017.

The bilge alarm sounded soon after the main engine had been started and ahead gear selected, suggesting that the ingress coincided with the engine start. Main engine vibration was transmitted directly to the hull through the engine's bedplate, and it is possible that this event triggered a hull plating fracture.

Given the evidence available, especially the observation of water welling up underneath the main engine, it is almost certain that the flood was a shell plating or weld failure beneath the main engine.

Emergency response

Flooding emergencies present an immediate risk to fishing vessels and should be attacked with all available systems to bring the situation under control. Flooding remains a consistent cause of fishing vessel losses, with hull corrosion and loss of containment of sea water systems as common causes of ingress.

In the first instance, every effort should be made to isolate the leak, including closing all sea water valves if necessary. However, on this occasion the skipper had no evidence to suggest that a sea water system failure was the source. As a result, the skipper made a reasonable judgment to leave the sea water valves open in order to sustain cooling water for the auxiliary engines, maintaining power for the bilge pumping effort.

Although the skipper had checked that both bilge pumps were working by sighting the discharges over the vessel's side, their effectiveness would have been reduced from their maximum capacity because the sea suctions were left partially open. Under normal circumstances, the onboard practice was to open the sea suction as well as the bilge suction when pumping bilges. The purpose of this was to protect the pump and system from running dry when pumping out relatively small volumes of water. However, this could lead to a situation whereby the bilge pump was simply pumping sea water and not bilge water. On this occasion, once the bilge pump was running, shutting the sea suction would have ensured maximum emergency pumping capacity.

When faced with the critical situation of a rapidly flooding engine room, the crew's reaction was to set up the bilge pumps in the way it was always done when routinely removing accumulated bilge water from the engine room. It is, therefore, critical to distinguish between routine pumping of bilges and dealing with an emergency, when the most effective means of pumping must be employed; in this case, that would mean closing the sea suction valves that were routinely partly opened while pumping the bilges.

It is possible that even if both general service pumps' sea suctions had been closed after starting the pumps, allowing 100% of the pumps' capacity to draw water from the bilges, the rate of ingress of water was greater than the combined pumping capacity.

MGN 165(F) also recommends closing all bilge valves when not in use, primarily to prevent backflooding, so it was not appropriate to leave the starboard sea water system with valves open when the pump was not in use.

In the course of the emergency, three other fishing vessels passed portable pumps across to assist *Ocean Quest*'s crew. For different reasons, none of these additional pumps could be made to work. It was not until the helicopter arrived that there was an additional pumping effort. It is unreasonable to assume that additional pumps from other vessels will be available. Fishing vessel crews should therefore maintain all their own equipment in good working order for use in the event of a flood. Nevertheless, it was unfortunate that none of the additional pumps could be utilised.

Abandonment

The skipper's decision to raise the alarm by all available means as soon as the situation deteriorated ensured that lifesaving assets were alerted and despatched as soon as possible. This resulted in an orderly and effective evacuation of all the crew, safely to shore, wearing immersion suits and lifejackets. *Ocean Quest*'s crew had conducted abandonment drills regularly and were familiar with their safety equipment, so they were well prepared for the abandonment.

CONCLUSIONS

- *Ocean Quest* flooded and foundered because of engine room flooding that could not be brought under control. It is almost certain that the cause of the flood was a failure of shell plating or welds beneath the main engine.
- *Ocean Quest* had been subject to repairs where hull thickness surveys had previously detected shell plating erosion. Given the vessel's age and that hull thickness surveys are only a sampling process, it is possible that shell or weld weaknesses went undetected.
- The effectiveness of the general service pumps to remove the floodwater would have been degraded by leaving the sea suction valves partly open; a common practice on board for routine draining of bilges, but not appropriate during a flooding emergency.
- It was unfortunate that all three additional pumps provided by other fishing vessels could not be used.
- Prompt notification to the coastguard and familiarity with safety equipment resulted in a safe, timely, and orderly abandonment of the vessel when the situation became untenable.

ACTIONS TAKEN

The MAIB has issued a safety flyer to the fishing industry highlighting the safety issues identified in this report.

RECOMMENDATIONS

Although no recommendations are made in this report, it nevertheless should serve as a reminder to fishing vessel crews to be prepared for flooding emergencies.

SHIP PARTICULARS	
Vessel's name	*Ocean Quest*
Flag	United Kingdom
Classification society	Not applicable
IMO number/fishing numbers	8126628 / FR 375
Type	Fishing vessel
Registered owner	Privately owned
Manager(s)	Not applicable
Year of build	1982
Construction	Steel
Length overall	21.28 metres
Registered length	19.91 metres
Gross tonnage	138.00
Minimum safe manning	Not applicable
Authorised cargo	Not applicable

VOYAGE PARTICULARS	
Port of departure	Fraserburgh
Port of arrival	Not applicable
Type of voyage	Coastal
Cargo information	Not applicable
Manning	5

MARINE CASUALTY INFORMATION	
Date and time	18 August 2019 at 0500
Type of marine casualty or incident	Very Serious Marine Casualty
Location of incident	58°20.56'N 000°11.50W
Place on board	Ship/engine room
Injuries/fatalities	None
Damage/environmental impact	Total loss, no significant pollution
Ship operation	Fishing
Voyage segment	Midwater
External & internal environment	Southerly Force 5
Persons on board	5