ACCIDENT REPORT

Report on the investigation of

the foundering of the fishing vessel

Purbeck Isle

9 miles south of Portland Bill, England

on 17 May 2012

resulting in the loss of her three crew

MAIB
MARINE ACCIDENT INVESTIGATION BRANCH

VERY SERIOUS MARINE CASUALTY REPORT NO 7/2013 MAY 2013

Extract from

The United Kingdom Merchant Shipping

(Accident Reporting and Investigation)

Regulations 2012 – Regulation 5:

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

NOTE

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

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ºC	-	Degrees Celsius
DSC	-	Digital selective calling
EPIRB	-	Emergency position indicating radio beacon
EU	-	European Union
FAI	-	Fatal accident inquiry
GRP	-	Glass reinforced plastic
Hammar	-	CM Hammar AB
HRU	-	Hydrostatic release unit
IMO	-	International Maritime Organization
ISO	-	International Organization for Standardization
kg	-	kilogram
kN	-	kilonewton
kW	-	kilowatt
LSA	-	Life-saving appliances
LSA Code	-	International Life-Saving Appliances Code
m	-	metre
MCA	-	Maritime and Coastguard Agency
MHz	-	megahertz
mm	-	millimetre
MMO	-	Marine Management Organisation
N	-	newton
PFD	-	Personal flotation device
PPE	-	Personal protective equipment
RNLI	-	Royal National Lifeboat Institution
ROV	-	Remotely operated vehicle
rpm	-	revolutions per minute

Seago	-	Seago Yachting Ltd
SFV Code	-	Code of Practice for the Safety of Small Fishing Vessels
SOLAS	-	The International Convention for the Safety of Life at Sea (SOLAS) 1974
Survitec	-	Survitec Group Ltd
t	-	tonne
UK	-	United Kingdom
UTC	-	Universal time, co-ordinated
VHF	-	Very high frequency
Workboat Code	-	The Code of Practice for the Safety of Small Workboats and pilot boats

TIMES: All times in this report are UTC+1 unless otherwise stated

SYNOPSIS

At about 1000 on 17 May 2012, the 11.64m wooden potting vessel *Purbeck Isle* foundered with the loss of her skipper and his two crewmen in the English Channel about 9 miles south of Portland Bill. They had been moving their whelk pots from their winter grounds in Lyme Bay to their summer grounds in deeper water south of Portland Bill. *Purbeck Isle* went down so suddenly that the skipper and his crew were unable to raise the alarm, collect their lifejackets or manually release and inflate the vessel's liferaft. Due to the environmental conditions it is likely that all three fishermen had perished by the time the coastguard was informed that *Purbeck Isle* was overdue.

Purbeck Isle probably sank as a result of rapid flooding following the catastrophic failure of her hull fastenings. She was in a poor material condition and was heavily loaded when she sank. It is likely that the racking stresses acting on the vessel's hull caused her hull fastenings to loosen, allowing the seams between one or more of her hull planks to open up.

The skipper and his crew were lost because they were unable to raise the alarm before entering the water, and their liferaft did not deploy because it had been lashed to the wheelhouse roof in a manner that prevented it from floating free. The alarm was not raised because the vessel sank suddenly and an automatic radio distress signalling device was not carried. Even had the liferaft been rigged correctly and the alarm raised, the chances of all three fishermen surviving would have been significantly reduced because they were not wearing personal flotation devices.

The inspection regime stipulated in the Small Fishing Vessels Code proved to be ineffective; the owner's annual self certification obligations were not met; and, the Maritime and Coastguard Agency's periodic and targeted inspections did not identify and address many of the contributory factors highlighted in this report.

Three recommendations have been made to the Maritime and Coastguard Agency: the first, urging the immediate implementation of previously issued recommendations to ensure that fishing vessels' health and safety legislation applies to all fishermen regardless of their employment status, and that EPIRBS are carried on all fishing vessels under 15m in length; the second, to introduce a more robust inspection regime for such fishing vessels; and the third, to mandate a minimum standard for the liferafts they are required to carry. Actions have been taken by Seago Yachting Ltd to improve the design and performance of its budget liferaft, and by Survitec Group Ltd to ensure that adequate advice is given to the owners of small commercial vessels to ensure they are provided with an appropriate type of liferaft.

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *PURBECK ISLE* AND ACCIDENT

SHIP PARTICULARS

Vessel's name	*Purbeck Isle*
Flag	United Kingdom (UK)
Fishing vessel number	DH 104
Type	Fishing vessel (potter)
Registered owner	Maverick (Weymouth) Ltd
Year of build	1960
Construction	Wood
Length overall	11.64m
Registered length	11.64m
Gross tonnage	5.5

VOYAGE PARTICULARS

Port of departure	Weymouth, England
Type of voyage	Normal (fishing)
Type of catch	Whelks
Manning	3

MARINE CASUALTY INFORMATION

Date and time	17 May 2012 at about 1000
Type of marine casualty or incident	Very Serious Marine Casualty
Location of incident	9 miles south of Portland Bill, England
Place on board	Whole vessel
Fatalities	3
Damage	Loss of vessel
Ship operation	Potting for whelks
Voyage segment	Transit
External environment	Cloudy: air temperature 11ºC, sea temperature 11.3ºC. Visibility: 15 miles. Wind: moderate, east-south-easterly. Sea state: slight swell 2m. Tidal stream: 0.6 knot in a south-westerly direction.

Purbeck Isle

1.2 BACKGROUND

Purbeck Isle was being operated commercially as a whelk potter from her home port of Weymouth, England, by her skipper, David McFarlane. In addition to the skipper, the vessel was crewed by two local fishermen, Jack Craig and Robert Prowse.

Each working day, the skipper and his crew hauled, emptied, re-baited and then re-shot all of *Purbeck Isle*'s pots, one string at a time. They usually put to sea in the early hours of the morning, between 0400 and 0430, and returned to port in the afternoon, between 1600 and 1700. The skipper preferred to work his pots every day but would leave them if he considered the weather conditions to be too rough.

During the winter of 2011/2012, *Purbeck Isle* and a second Weymouth-based boat, *Amanda Jane*, potted for whelks in the same fishing grounds **(Figure 1)** off Chesil Beach in Lyme Bay. The skippers of *Purbeck Isle* and *Amanda Jane* were close friends and had worked together on board both vessels in the past.

The whelks landed in Weymouth were sold to a company based in Exmouth, and were collected daily from the harbour's fish landing quay. The same company supplied and delivered the bait used by the local potting vessels. The buyer's agent typically called the skippers on their mobile phones each morning to check if they were fishing that day, and to find out what time they expected to return and how much bait they required for the following day.

On 14 and 15 May 2012, the skipper was unable to work his pots due to poor weather conditions. Calmer conditions were forecast for 16 May, when he planned to start relocating his pots to deeper grounds about 9 miles south of Portland Bill **(Figure 1)**, where bigger catches could be had during the summer months.

1.3 NARRATIVE

At 0440 on 16 May 2012, David McFarlane took *Purbeck Isle* out of Weymouth harbour, with two crew members, Jack Craig and Robert Prowse. They motored south and rounded Portland Bill **(Figure 1)** on passage to the skipper's winter fishing grounds in Lyme Bay. When they arrived at the grounds, they began to work their pots. Over the course of the morning, they recovered several strings of pots and stacked them on the deck. The skipper then steamed about 20 miles south to his summer grounds and re-shot his pots. Once all the pots had been shot, they returned north, loaded another set of strings and then repeated the procedure.

During the afternoon, the skipper phoned his buyer's agent and informed him that he would not be back in time to land his catch but required 13 bags of bait to be delivered for the following day.

At about 1730, the buyer's agent collected the catches landed by the other fishing boats in Weymouth harbour and left the bait ordered for *Purbeck Isle* on the quay.

At 2103, *Purbeck Isle* arrived back in Weymouth and was secured to her quayside berth. Once alongside, Jack Craig went home for a change of clothes and to eat dinner, and the skipper went ashore for dinner and a drink at a local public house with the skipper of another potting vessel, *Royal Escape*. During their meal, the skippers discussed their intentions for the following day. As *Royal Escape*'s skipper intended to head west towards his home port of Teignmouth, he decided to leave the

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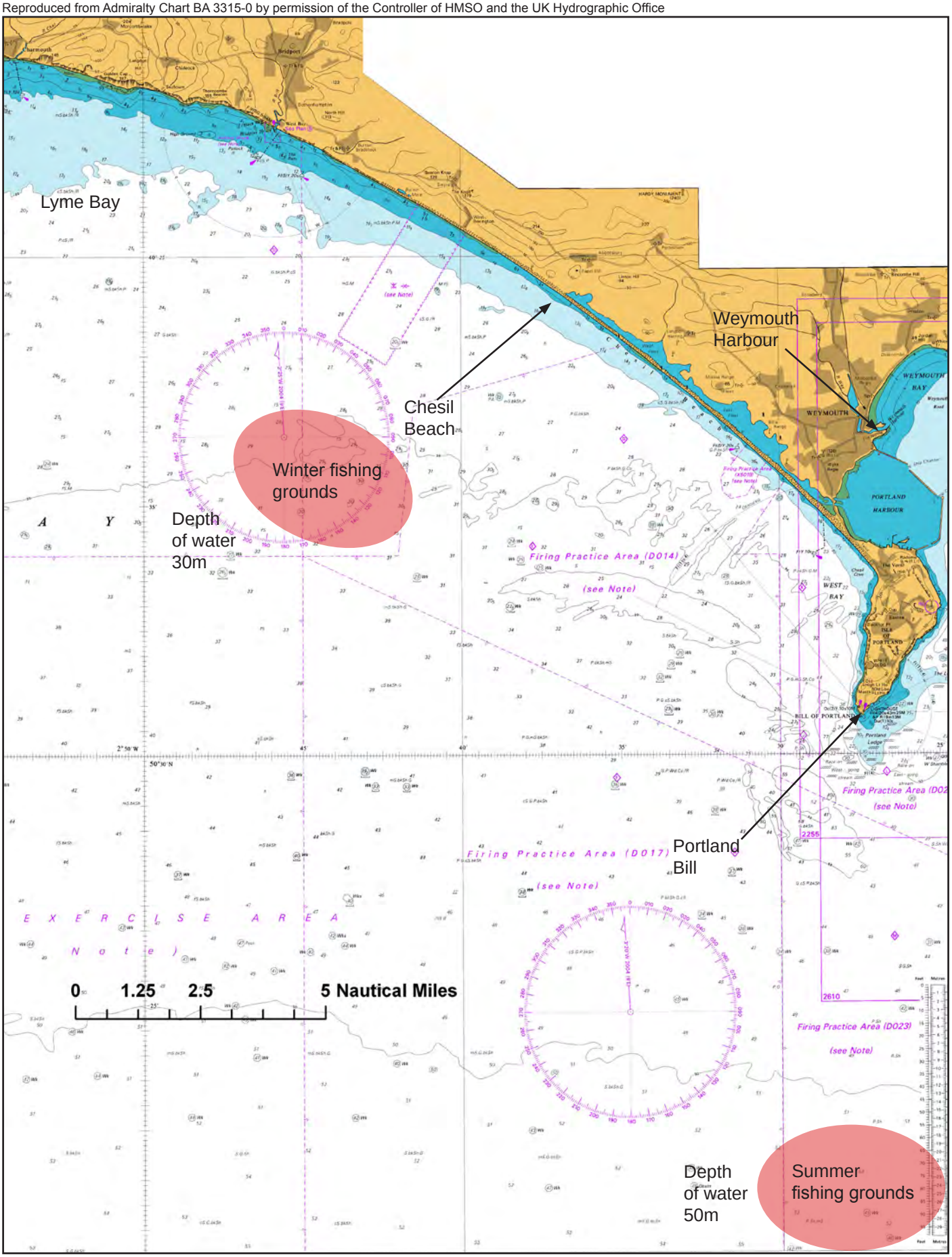

Figure 1: *Purbeck Isle*'s fishing grounds

harbour in the morning with *Purbeck Isle* and follow her round Portland Bill. After his meal, David McFarlane went home for the night and his friend returned to his vessel which was berthed on the fish landing quay. Due to their late return to port and the planned early departure, Jack Craig and Robert Prowse decided to sleep on board *Purbeck Isle* overnight.

At about 0400 on 17 May, the skipper joined his crew on board *Purbeck Isle* and prepared her for sea. The crew let go the mooring ropes and the skipper manoeuvred her downriver to the fish landing quay **(Figure 2)**. When she arrived at the quay, *Royal Escape* was moved forward by her skipper to allow room for

0412: *Purbeck Isle* holding position off the quay while *Royal Escape* is moved forward

0419: *Purbeck Isle's* skipper stood on the quay talking to *Royal Escape's* skipper while his crew load bait

0427: *Purbeck Isle* heading out of the harbour closely followed by *Royal Escape*

Figure 2: *Purbeck Isle* on the fish landing quay, Weymouth Harbour

Purbeck Isle to get alongside. At 0412, she was made fast and her crew began to load the bait while the skipper stood on the quay and spoke to his friend on board *Royal Escape*.

At 0427, *Purbeck Isle*, closely followed by *Royal Escape*, was manoeuvred off the fish landing quay and out of the harbour. During their passage south, the skippers chatted to each other on their mobile phones and on channel 77 of their very high frequency (VHF) radios. At 0527, *Purbeck Isle* was recorded heading west past Portland Bill lighthouse, by Portland Coastal Watch Station's closed circuit television camera **(Figure 3)**. *Purbeck Isle* then headed north-west towards her winter fishing grounds while *Royal Escape* continued west across Lyme Bay.

At 0653, *Amanda Jane*'s skipper, who did not go to sea that day, spoke to David McFarlane on his mobile phone. At that time, the crew were working *Purbeck Isle*'s pots in the winter grounds off Chesil Beach. Similar to the previous day, the crew hauled in several strings of pots, stacked them on the deck and headed south **(Figure 3)**.

At 0958, the buyer's agent sent a text message to *Purbeck Isle*'s skipper, but received no reply. The agent then tried to call him three times between 1029 and 1158, but again he did not answer. The agent then called *Amanda Jane*'s skipper and told him he had not been able to make contact with David McFarlane, and he asked for Jack and Robert's mobile phone numbers.

Having tried and failed to contact anybody on board *Purbeck Isle* during the afternoon, the agent instructed his lorry driver to take enough bait to satisfy the vessel's normal requirements and wait for her arrival on the quay. At about 1725, the lorry driver called the agent and told him that *Purbeck Isle* had still not returned to port.

The agent then called *Amanda Jane*'s skipper and told him that his friend's vessel had not returned to port and asked if he could contact him using his VHF radio.

*Amanda Jane'*s skipper, having been told earlier by his friend that he planned to be back in by 1630, immediately became concerned. He rang *Royal Escape*'s skipper and asked him to try to contact the overdue vessel on VHF channels 77 and 16. At 1735, after *Royal Escape*'s skipper had also failed to make contact with *Purbeck Isle*, *Amanda Jane'*s skipper telephoned the Portland and Weymouth Coastguard and informed them that *Purbeck Isle* was overdue. He explained that their buyer's agent had been trying to make contact with the vessel throughout the day and he was very concerned because he had expected her to be back at 1630.

Initially, it was unclear where *Purbeck Isle* had been working during the day, so the coastguard put out a general broadcast to all vessels operating in the area, requesting them to report any sightings of the overdue vessel. Following a report of a possible sighting in Lyme Bay, the coastguard tasked one of its coastal response teams to go to Portland's Coastal Watch Station and carry out a visual search of the Chesil Beach coastline.

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Figure 3: *Purbeck Isle*'s approximate track on the day of the accident

As further information was gathered, the search effort began to focus on *Purbeck Isle*'s summer grounds. At about 1925, the coxswain of the Weymouth all-weather lifeboat was instructed to head to a search area south of Portland Bill. The Portland coastguard helicopter (CG106) was also scrambled and tasked to carry out an aerial search of this area.

By 2000, several local fishing boats, along with other commercial vessels and warships operating in the area, had joined the search. At about 2100, a cluster of marker buoys belonging to *Purbeck Isle* was spotted floating on the surface 9 miles south of Portland Bill in position N50º 21.6', W002º 29.35' **(Figure 4)**. The lifeboat proceeded to the scene and identified that there was an object on the seabed 52m below the marker buoys. The search efforts continued throughout the night and into the next day.

On 18 May 2012, *Odyssey Explorer*, a deep water survey vessel operating in the area, joined the search. Her technical team used the vessel's side-scan sonar to confirm that the object on the seabed was a small wreck. The vessel's owners then offered to keep *Odyssey Explorer* in the area and volunteered the use of her underwater remotely operated vehicle (ROV) to help positively identify the wreck.

At about 1500, the skipper of a leisure yacht reported seeing two life rings that he thought were from *Purbeck Isle* floating together on the surface about 18 miles west of the cluster of marker buoys. About an hour and 25 minutes later, the crew of the coastguard helicopter tasked to investigate the sighting found David McFarlane's body entangled with the ropes attached to *Purbeck Isle*'s two lifebuoys. He was wearing a tee shirt and jogging bottoms. At about 2330, *Odyssey Explorer'*s ROV located the wreck and confirmed that it was *Purbeck Isle* **(Figure 5)**.

The search and rescue operation terminated on 19 May 2012. On 9 August 2012, Jack Craig's body was recovered from the seabed in Lyme Bay by a trawler. At the time of the publication of this report, Robert Prowse was still missing and presumed lost at sea.

1.4 ENVIRONMENTAL CONDITIONS

On the day of the accident the weather had been forecast to worsen during the morning and into the afternoon. Between 0800 and 1200, there was a moderate 11 to 16 knots east-south-easterly breeze. The sea state 9 miles south of Portland Bill was slight and there was a moderate 2m swell. The air temperature was 11ºC, it was cloudy and the visibility was about 15 miles. The sea temperature was 11.3ºC. The predicted tidal stream at 1000 was 0.6 knot in a south-westerly direction.

1.5 CREW

David McFarlane was 35 years old and had been a fisherman for nearly 20 years. He was a popular character within the local fishing community and had a reputation among his fellow fishermen for being a hard worker who took a fearless approach to his fishing activities. Immediately prior to taking over the operation of *Purbeck Isle*, he had skippered the vessel for her registered owner. Before this, he had served as skipper and crewman on board several other local potting vessels, including *Amanda Jane* and *Royal Escape*. In addition to running *Purbeck Isle*, he often worked as skipper for another local boat owner who fished commercially for bass.

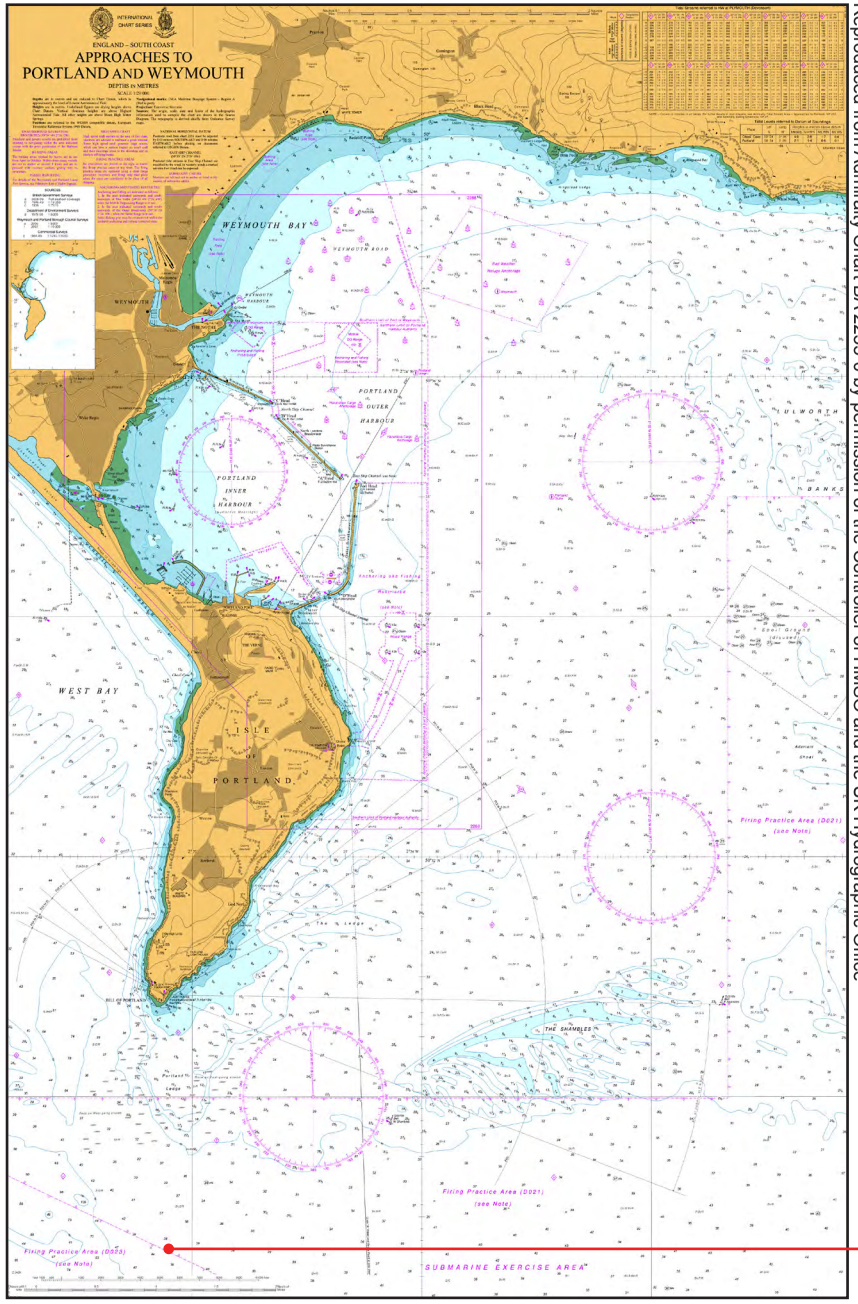

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Figure 4: Cluster of marker buoys from *Purbeck Isle* spotted 9 miles south of Portland Bill

Figure 5: *Purbeck Isle* located on the seabed by *Odyssey Explorer*'s ROV

He had attended three of the four mandatory fishing industry safety training courses: sea survival, fire-fighting and first-aid. However, he had not attended the Health and Safety Awareness Course.

During the 18-month period prior to the accident, David McFarlane had employed several different crews from the Weymouth and Portland area. Most were experienced fishermen, but some were novices. His crew were normally paid a share of the profit but, occasionally, short-term crew were paid a fixed daily rate. Jack Craig and Robert Prowse were working as share fishermen and received a share of the vessel's weekly operating profits.

Jack Craig was 21 years old. He had been working on board *Purbeck Isle* for about 1 month and had occasionally skippered the vessel in David McFarlane's absence. When he left school at 16 years of age, he attended the Whitby and District Fishing Industry Training School. He went on to work on fishing vessels in Scotland and in the Channel Islands before returning home to fish out of Weymouth. He held an unrestricted under 16.5m fishing vessel skippers' certificate and had completed the mandated sea survival, fire-fighting, first-aid and health and safety awareness courses. He had also completed a 2-day Navigation and Intermediate Stability Awareness course, a Diesel Engine Maintenance course and a Radio Operator's course.

Robert Prowse was 20 years old and had been working on board *Purbeck Isle* for about 2 weeks. He had left school when he was 15 years old to pursue his childhood ambition to be a fisherman. He had worked on several local fishing boats over the previous 4 years but was keen to work on board deep sea fishing vessels. He held a short range VHF radio certificate and had completed the mandated sea survival, fire-fighting, and first-aid courses. He also held a level two national powerboat certificate.

1.6 CAUSE OF DEATH

Dorset County Hospital's autopsy report for David McFarlane was not able to conclude categorically that drowning was the cause of death, and stated that hypothermia remained a possibility.

Due to the length of time Jack Craig had been in the water, it was not possible to ascertain his cause of death.

1.7 *PURBECK ISLE*

1.7.1 Ownership

The registered owner of *Purbeck Isle* was Maverick (Weymouth) Ltd, a private limited company wholly owned by one person. The owner of Maverick (Weymouth) Ltd purchased *Purbeck Isle* in 1998 and had used her to work his crab pots. By 2010, he had begun to reduce his crabbing activities and was using the vessel mainly to transport people around the sheltered waters of Weymouth harbour.

Towards the end of 2010, David McFarlane expressed an interest in buying *Purbeck Isle* but did not have the funds required to purchase the boat and her owner's fishing licence. As her owner was keen to sell, he offered David McFarlane the opportunity to operate the vessel and buy both it and his licence in instalments over a 2 to 3 year period. They shook hands on the deal and David McFarlane began to use *Purbeck Isle* to pot for whelks.

In accordance with their verbal agreement, David McFarlane met all the operating costs of the vessel, including fuel, maintenance and crew wages. He also made fixed monthly payments to the registered owner to cover insurance, berthing and liferaft hire costs. The two men had not agreed a set monthly payment for the purchase of the vessel and fishing licence but regular payments had been made, the size of which were dependent on the vessel's operating profit. At the time of the accident, David McFarlane had paid about 75% of the value put on the vessel and fishing licence by the registered owner.

1.7.2 Vessel construction

Purbeck Isle was built in 1960 by J.Hinks and Son at its boatyard in Appledore, England. Her length overall, breadth and depth (unladen) were 11.64m, 3.62m, and 0.88m respectively. Her hull was of carvel[1] construction and her hull strakes[2] were made up from planks of larch. Sawn sections of oak were used to assemble her

[1] Carvel construction – solid wood planks, butted together and fastened to frames with flexible caulking material inserted between the planks.

[2] Strake – a horizontal strip of planking on the exterior hull of a wooden vessel, running longitudinally along the vessel from stem to stern.

internal transverse double frames[3]. Iron nails were used to fasten the hull planks to the oak frames. An outboard section of her hull, on the starboard side directly below the hauling winch, was protected by a wooden planked pot pad[4] **(Figure 6)**. The pot pad itself was covered by a heavy duty plastic sheet. A zinc sacrificial anode was also attached on the outside of the hull beneath the waterline.

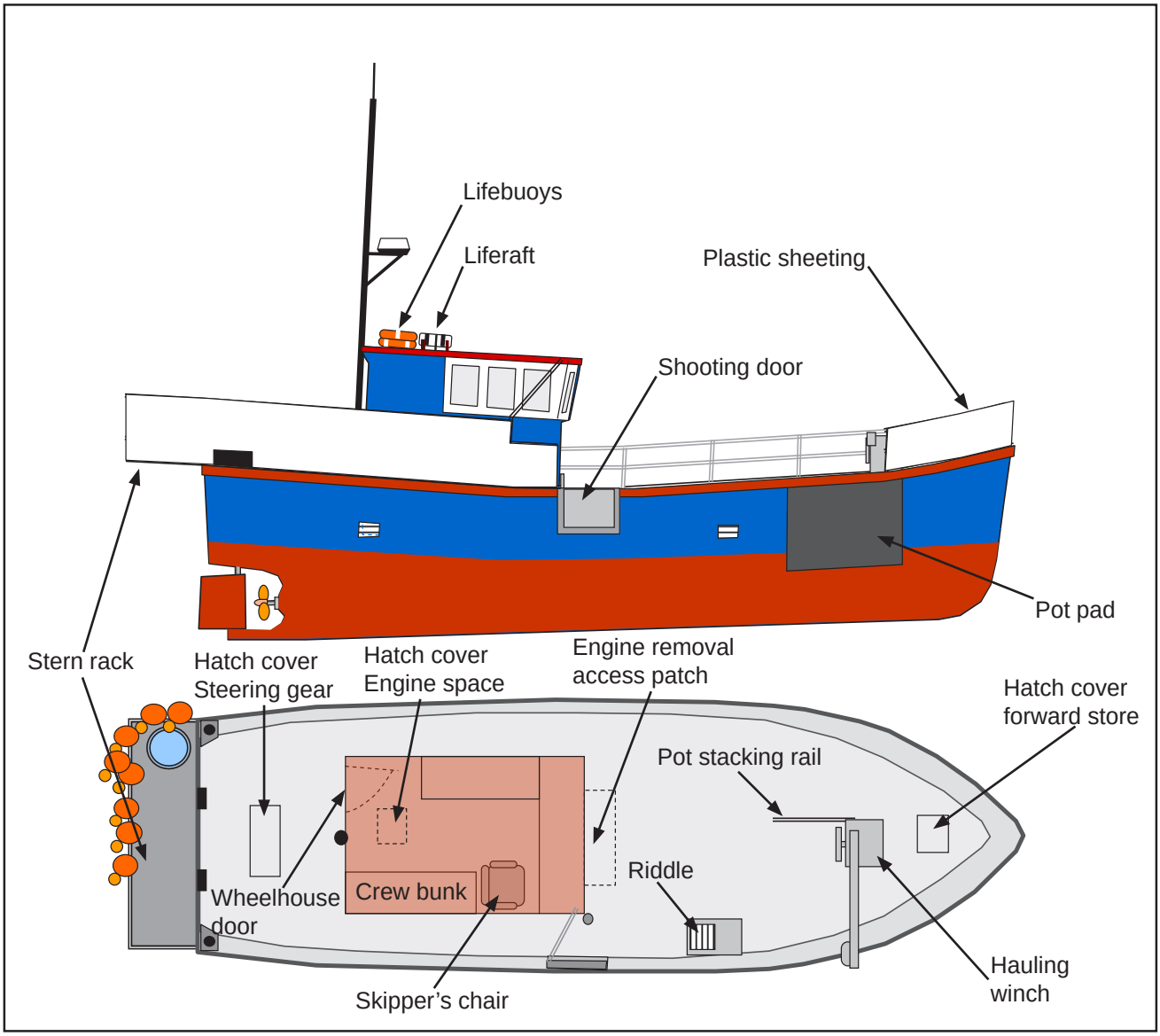


Figure 6: *Purbeck Isle* general layout

Purbeck Isle's single deck consisted of larch planking laid forward to aft on a base of plywood boards. The seams between the deck planks were caulked[5] and topped with bitumen. The exposed surface of the deck had been covered over with heavy duty plastic sheeting.

Below the deck was a machinery compartment and a forward store **(Figure 7)**. Access to the machinery space was via a deck hatch in the wheelhouse, and access to the forward store was via a deck hatch in the bow. A non-watertight

[3] Frames – athwartships members (ribs) of a wooden boat's framework.

[4] Pot pad – a section of additional wooden planks fitted to the hull of a potting vessel in the area of the hauling winch to provide protection for the exterior hull from repeated contact with the pots during hauling operations.

[5] Caulking – forcing material (often cotton) into the seams of the planks in a boat's hull or deck to make them watertight.

plywood bulkhead segregated the machinery space from the forward store. There was also a maintenance hatch on the after deck behind the wheelhouse for access to the steering gear **(Figure 6)**.

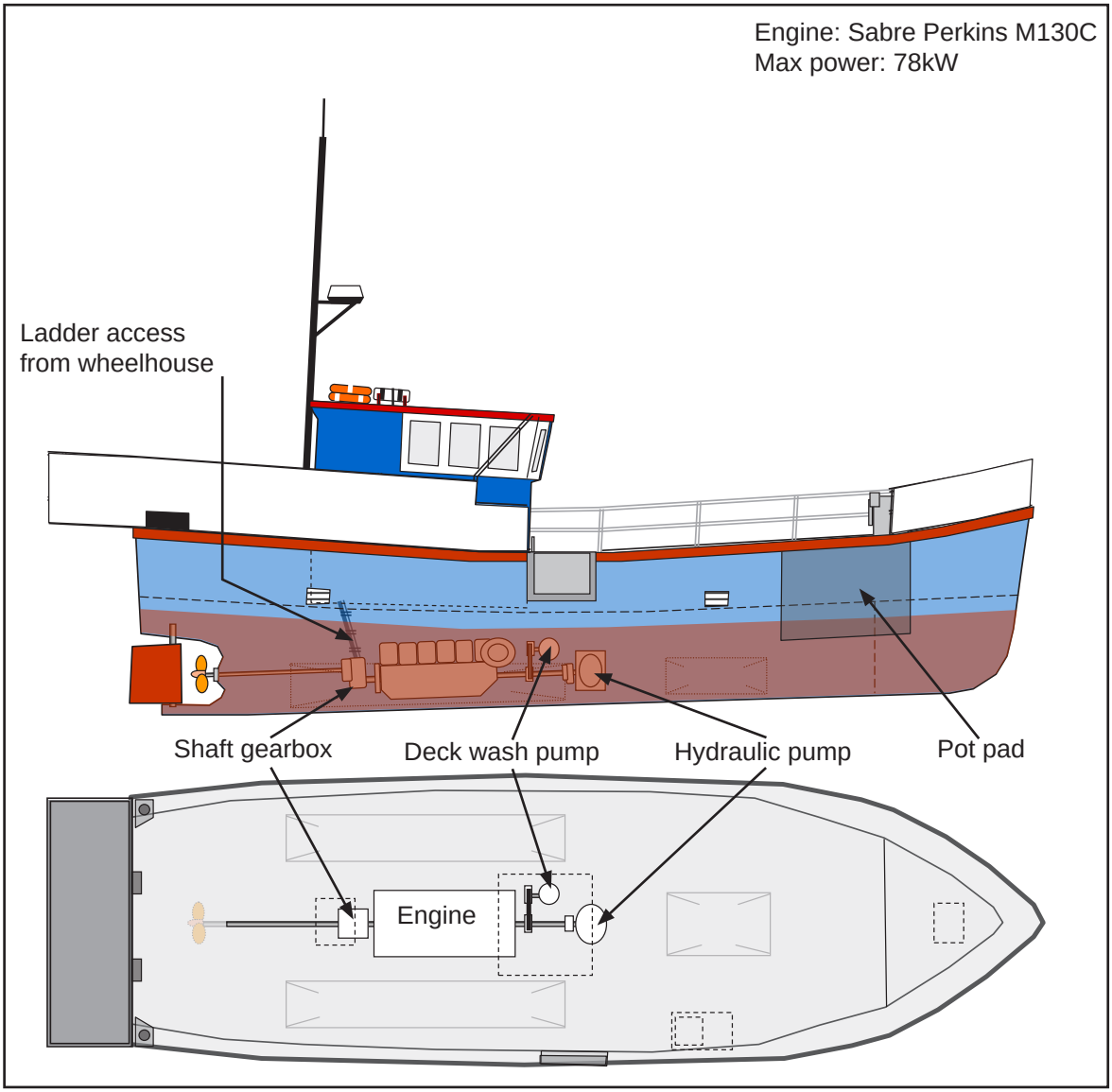


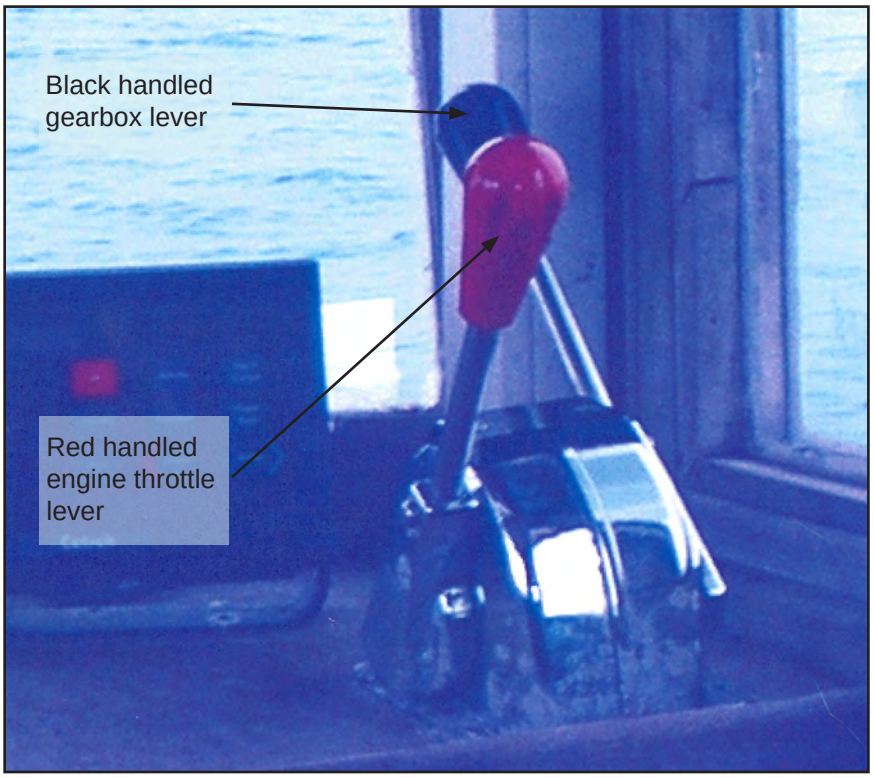
Figure 7: *Purbeck Isle* below deck layout

1.7.3 Propulsion machinery

Purbeck Isle was fitted with a 78kW Perkins Sabre M130C diesel engine, which drove a single fixed pitch propeller via a reversible shaft gearbox. The engine had a maximum speed of 2,500 revolutions per minute (rpm) and was capable of propelling the vessel through the water at between 8 and 9 knots.

The vessel's main engine throttle and gearbox control levers **(Figure 8)** were positioned on the starboard side of the wheelhouse console in front of the skipper's chair. A second set of control levers, used to control the vessel while hauling gear, was fitted on top of the hauling winch casing **(Figure 8)**. Typically, the skipper set the wheelhouse throttle control lever to run the engine at about 1,800rpm when on passage, giving a typical steaming speed of about 6 to 7 knots. Depending on

environmental conditions and individual skipper's preference, the throttle was set to between 1,200rpm and 1,800rpm to provide speeds of between 5 and 7 knots when shooting gear.



Main propulsion control levers on the starboard side of the wheelhouse console

Propulsion control levers on top of the hauling winch

Figure 8: Propulsion control levers

1.7.4 Vessel modification, maintenance and repair history

A review of *Purbeck Isle*'s known maintenance and repair history identified that several structural modifications and upgrades had been made to the vessel over the 21-year period prior to the accident **(Figure 9)**. During a major refit at a local Portland boatyard in 1991, her deck and wheelhouse were completely renewed, and a steel whaleback[6] and steel guardrails were bolted to the top of her gunwale[7].

Figure 9: *Purbeck Isle* construction alterations and modifications

[6] Whaleback – an arched structure over the bow of a boat designed to provide shelter from the prevailing seas.

[7] Gunwale – upper edge or top most planking of the side of a wooden boat.

When Maverick (Weymouth) Ltd bought the vessel, its owner fabricated and fitted a steel stern rack. At that time, the vessel was rigged to shoot its pots over the gunwale via a steel shooting ramp **(Figure 9)** located on the starboard side of the deck.

In 1998, the owner removed the vessel's original engine and fitted the Perkins Sabre engine. In order to do this, the wheelhouse was raised several centimetres off the deck and the engine's original access hatch and its deck coaming[8] were removed. The hole left in the deck in front of the wheelhouse by the removal of the access hatch was covered by an aluminium plate **(Figure 6)**. The aluminium plate was bolted flush to the deck and sealed using a silicon-based marine sealant.

In 1999, the majority of *Purbeck Isle*'s deck planking was renewed, but the deck's plywood base and the outer edge of its planking were not. The following year, a hole was cut into the bulwark[9] on the starboard side of the deck just in front of the wheelhouse to allow a steel shooting door to be fitted **(Figure 6** and **Figure 9)**. In 2008, the steel whaleback and the stern rack were removed, and a new hauling winch was fitted.

When David McFarlane took over the operation of *Purbeck Isle* in 2010 a short section of damaged hull planking behind the pot pad was cut away and replaced. On 3 January 2011, the repair failed at sea when this short length of plank sprung, causing the vessel to flood. *Purbeck Isle* was taken out of the water and the plank was re-fastened and its seams were re-caulked and stopped with a silicon-based marine sealant **(Figure 10)**.

In the spring of 2011, the skipper had a new set of steel guardrails and a stern rack bolted on to the top of the vessel's gunwale. In order to provide some protection from the prevailing environmental conditions for the crew on deck, white plastic sheeting was attached to the outside of the guardrails **(Figure 9)**. A steel rail was also fitted to the deck adjacent to the hauling winch to allow the crew to tightly stack the pots on the port side of the winch, to prevent them sliding about the open deck.

On 5 October 2011, *Purbeck Isle* was taken out of the water at Portland Marina for end of season maintenance. Her hull was sand blasted below the waterline to remove old layers of paint and anti-fouling, and a local self-employed boat maintenance engineer was asked to carry out general repairs to the hull. However, the skipper dismissed this engineer following concerns over the quality his workmanship, and contracted a locally established boat repair yard to complete the work.

The repair yard raked out the silicon-based sealant that had been injected between the seams of the hull planking by the previous contractor, hammered home any hull fastenings found to be loose and re-compacted the old caulking material. A small amount of caulking was renewed before red lead and putty were used to re-stop about 80% of the seams between the planks below the waterline **(Figure 11)**. A patch repair was also carried out to a small section of deck close to the hauling winch.

[8] Coaming – raised rim or border around an opening on a boat designed to deflect or prevent the entry of water.

[9] Bulwark – the sides of a boat above the upper deck.

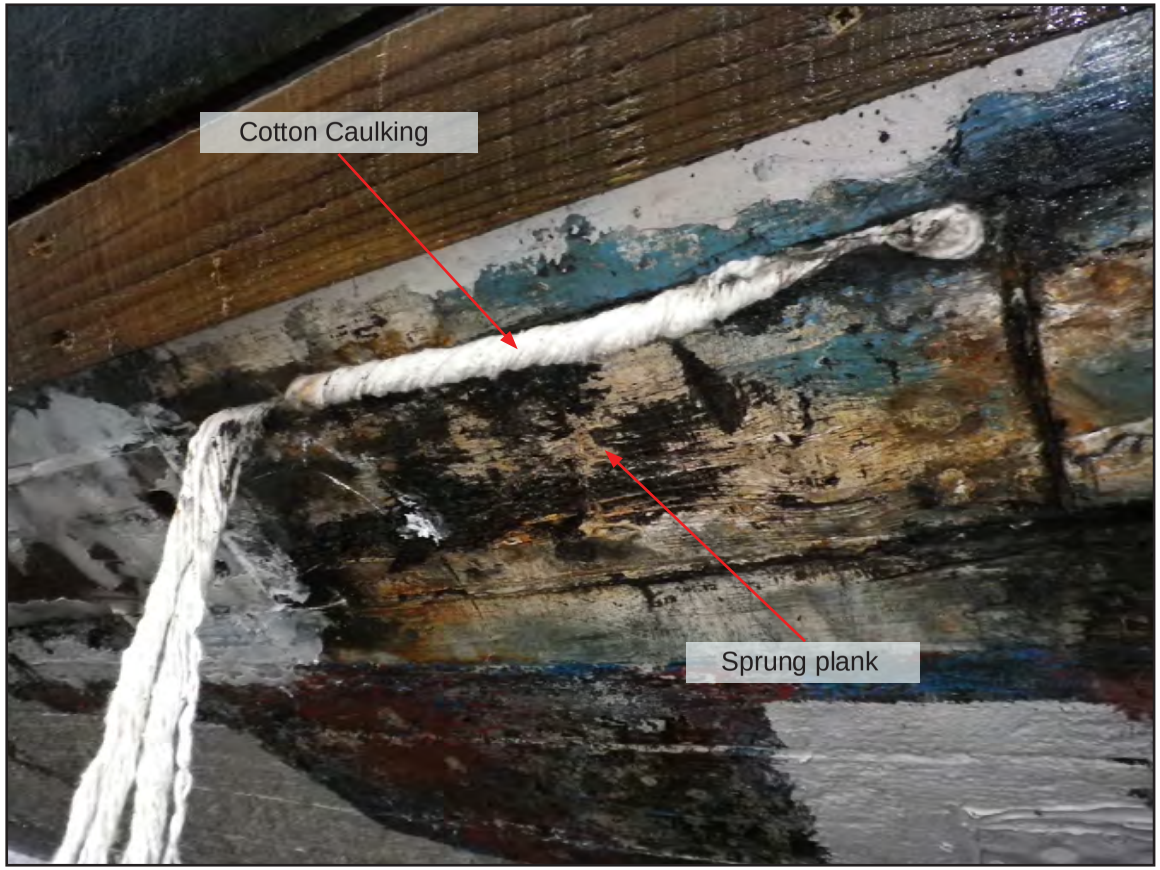


Figure 10: Repair carried out following flooding incident on 3 January 2011

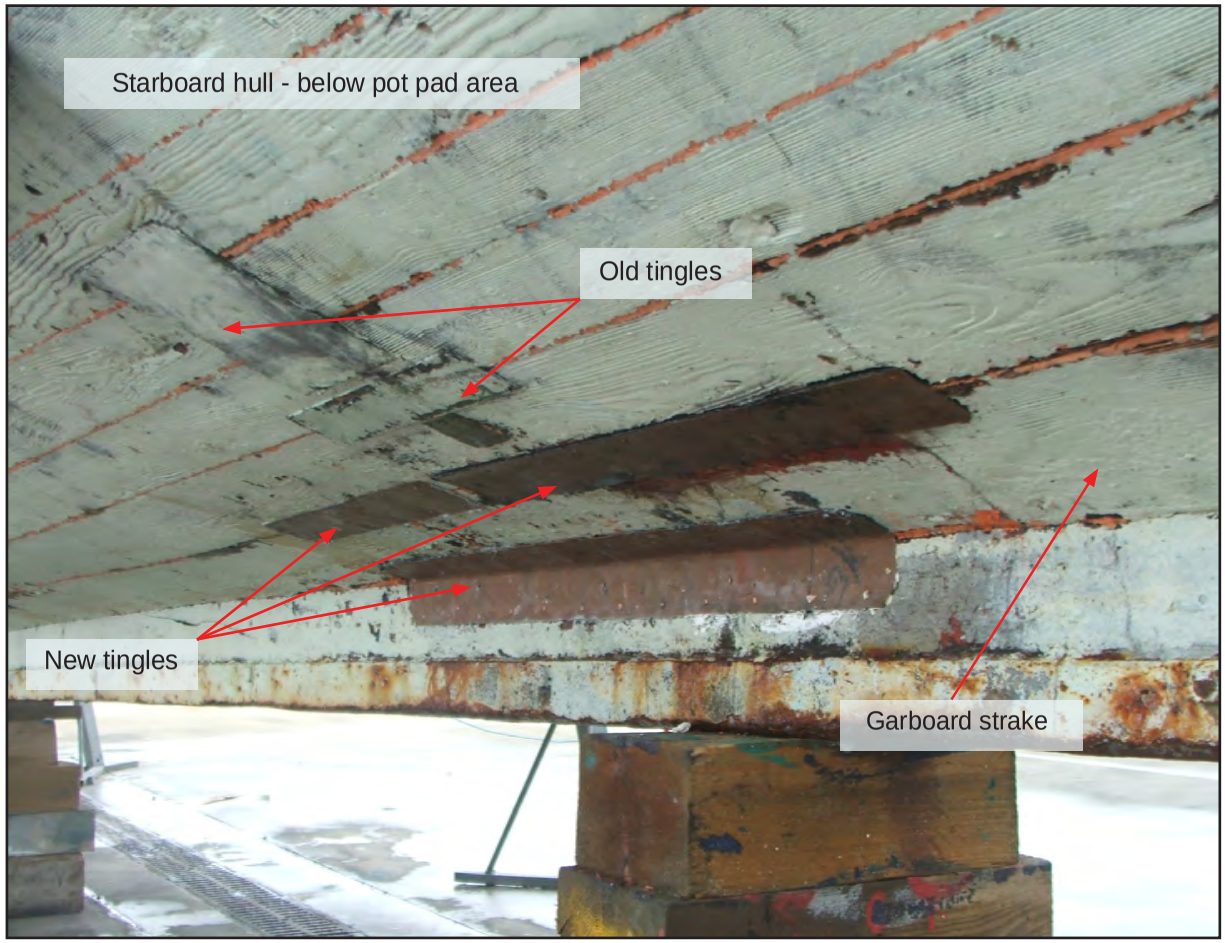


Figure 11: Hull condition in October 2011

It was noted during the maintenance period that some small areas of planking, mainly behind the pot pad, had been attacked by gribble worm[10]. It was also evident from the photographs taken at the time that a significant number of tingles[11] **(Figure 11)** had been fitted over the exterior seams between the hull planking. Many of these were fitted below the pot pad and around the garboard[12] strakes. Several of the old tingles, which had been removed by the previous contractor, were renewed.

Prior to refloating the vessel, the skipper and a previous crew member painted the hull and fitted two bunks in the wheelhouse. When *Purbeck Isle* was refloated, a large amount of water entered the engine room through the hull on the starboard side in the area of the pot pad. When the boat was lifted back out of the water the boatyard discovered that the water had entered through a gap between the butted ends of two planks located behind the bottom aft quarter of the pot pad. On closer inspection, it was apparent that the short length of plank that had been originally inserted by the skipper, and subsequently repaired in January 2011 **(Figure 10)**, was 10mm to 20mm too short, and had not been properly fastened at its after end.

The boatyard recommended that the affected planks be removed and replaced with a new one of adequate length. As this would have taken 2 days to do, the skipper instructed the boatyard to carry out a temporary repair. As instructed, the boatyard sealed the gap between the planks by fastening 6 layers of 4mm thick plywood board over the affected area **(Figure 12)**. The plywood boards were laminated and cold moulded in situ. The plywood repair spanned three planks vertically and a strong back was fitted internally to add further strength. In order to do this a section of the pot pad had to be cut away. The boatyard's invoice **(Annex A)** listed the work it had carried out and included a recommendation to remove the temporary repair and fit a new plank at a later date.

Following the maintenance period, *Purbeck Isle* was taken out of the water on at least three other occasions to allow urgent repairs to be carried out to her hull below the waterline:

- On 12 December 2011, about 6 weeks after her maintenance period, another plank sprung behind her pot pad and she had to be returned onto Weymouth harbour's drying grid[13] so that the plank could be re-fastened.

- Eleven days later, the vessel started to take on water again through the same part of the hull while operating in choppy seas; once more, she was placed on the drying grid for emergency repairs.

- On 22 February 2012, *Purbeck Isle* was taken out of the water at Portland Marina after she started taking on water through her garboard strakes. The seams were re-caulked and additional tingles were fitted. While out of the water, a heavy duty plastic protective sheet was fitted on the outside of the pot pad.

[10] Gribble worm – generic name for a group of marine species that bore into wood.

[11] Tingle – a temporary patch repairing a hole in the hull

[12] Garboard strake – the planks which lie adjacent to the keel on each side.

[13] Drying grid – a concrete hard standing adjacent to the quay which was submerged at high tide and out of the water at low tide.

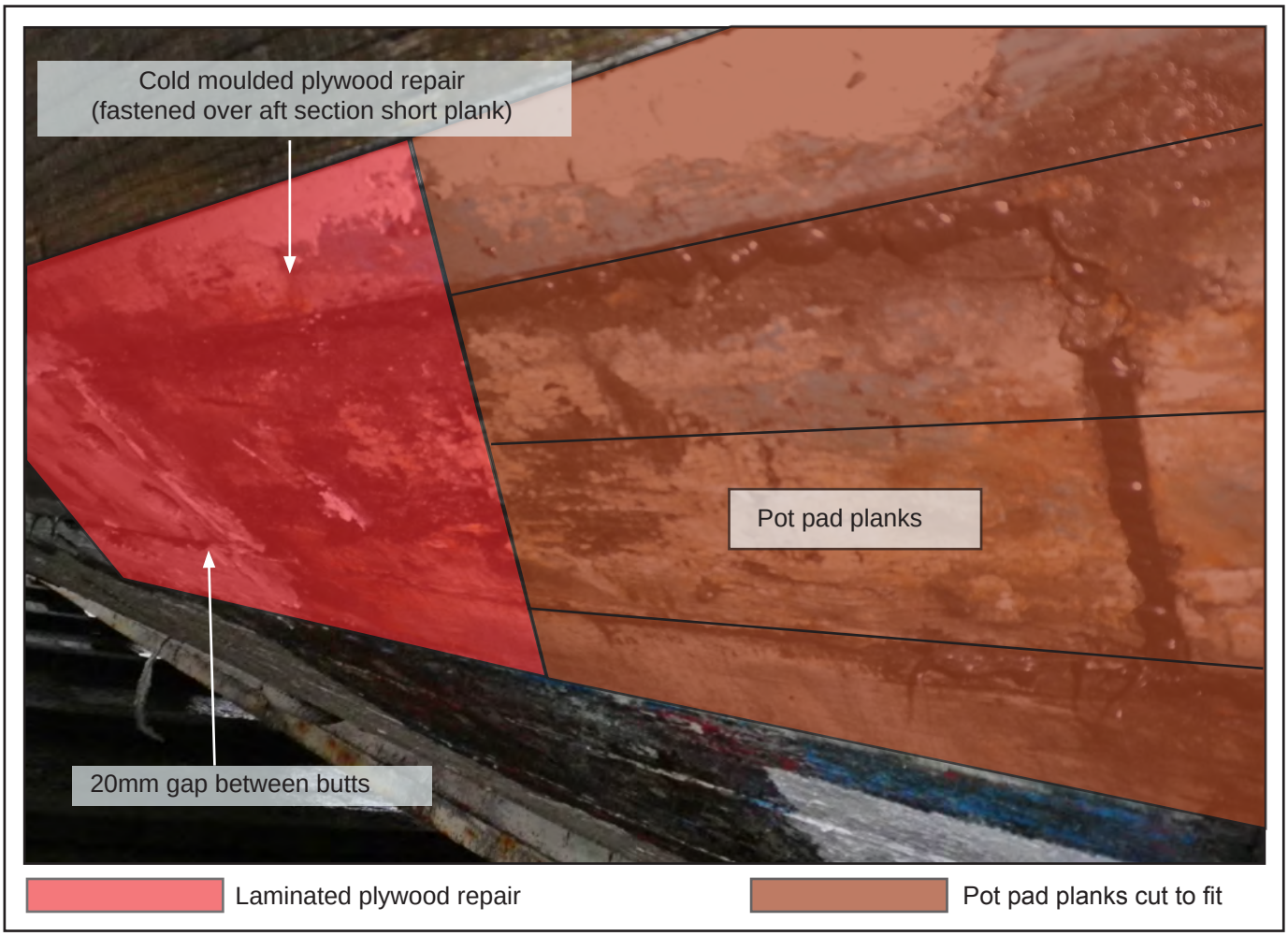


Figure 12: Temporary repair to short section plank behind pot pad

1.7.5 Bilge pumping and alarm system

Purbeck Isle had three electric bilge pumps and one hand-operated emergency bilge pump **(Figure 13)**. A float-activated high level bilge sensor connected to an audible alarm and warning lamp located in the wheelhouse was fitted in the machinery space. The electric bilge pumps were each capable of removing about 5t of water from the machinery compartment per hour and could be started manually from the wheelhouse. One of the pumps was electrically connected to a float switch, allowing for automatic operation. This bilge pump was normally left in its automatic mode at all times, even when the vessel was berthed alongside overnight. The hand-operated emergency bilge pump was fitted to the aft bulkhead of the wheelhouse. It had not been operable for some time as its suction pipework had been disconnected.

Purbeck Isle also had an engine-driven deck wash pump that could be re-configured to pump the bilges overboard in an emergency. In order to do this, a crewman was required to enter the machinery compartment and go to the forward end of the engine to turn the pump's sea suction valve to its bilge suction position. As a result of the failure of the electric bilge pumps, often due to a build-up of sand and silt in the bilges, or because of the amount of water ingress, it had been necessary for previous crew members to wade through high levels of bilge water to change the deck wash pump's suction valve to bilge suction on several occasions during the 18-month period prior to the accident.

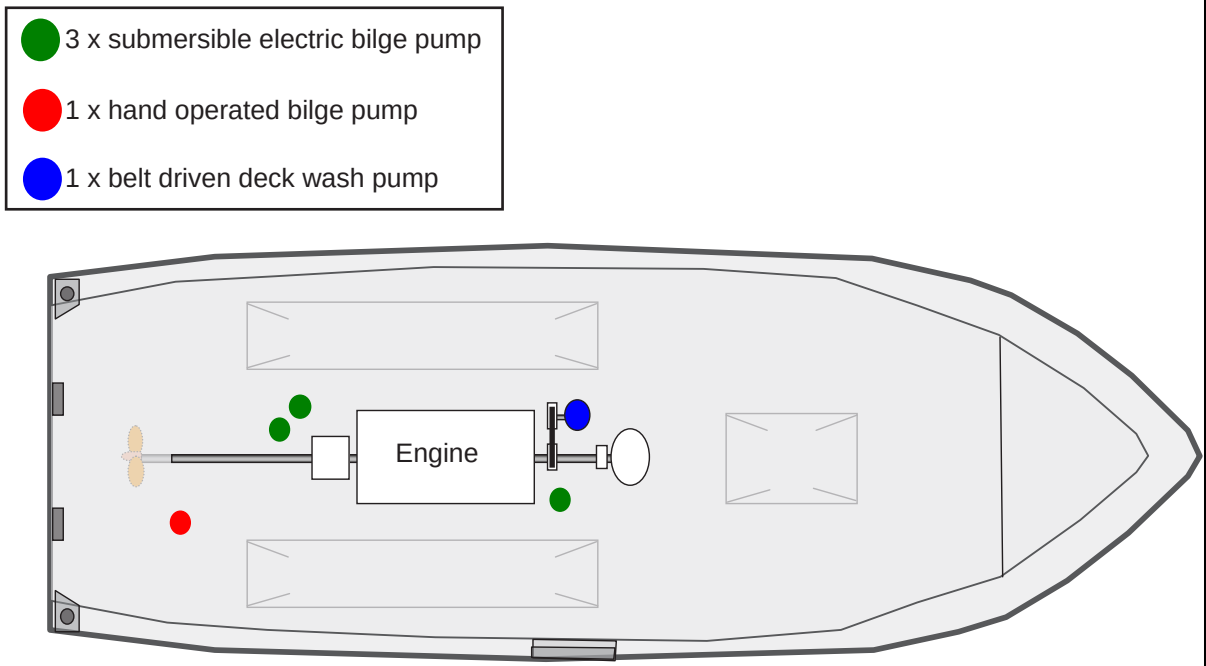


Figure 13: Bilge pump arrangements

1.8 VESSEL SURVEYS AND INSPECTIONS

1.8.1 Requirements for small fishing vessels

In accordance with the Fishing Vessels (Code of Practice for the Safety of Small Fishing Vessels) Regulations 2001, UK registered fishing vessels less than 15m in length had to comply with the Code of Practice for the Safety of Small Fishing Vessels (SFV Code) before being allowed to proceed to sea.

The aim of the SFV Code was to improve safety standards across the small fishing vessel sector and to raise safety awareness of all those involved with the construction, operation and maintenance of such vessels. The SFV Code contained guidance on health and safety risk assessment, safety equipment, safety training and stability, vessel inspections and self certification, and required skippers to operate their vessels accordingly.

Under the SFV Code, the owner of *Purbeck Isle* was required to ensure that:

- He, or other competent persons employed by him, inspected the vessel annually to confirm that:
    - *Safety equipment carried on board the vessel has been suitably maintained and serviced in accordance with the manufacturers' instructions*.
    - *Safety and other specified equipment continues to comply with the checklist* (appropriate to the length and construction of the vessel).
    - *Health and safety risk assessment has been completed*.

- On completion of the annual inspection, the self-certification declaration form was signed **(Annex B)**.

- The vessel was presented to the MCA for inspection on first registration and at intervals not exceeding 5 years.

In addition to the MCA's initial and subsequent periodic (5-yearly) inspections, the MCA often carried out random and targeted inspections intended to check for continued compliance with the SFV Code. A change of ownership of a fishing vessel would also trigger an inspection.

The SFV Code focused predominantly on safety equipment and safety training and contained no requirement for, or guidance on, hull condition or watertight integrity. Despite this, the internal guidance and inspection aide- mémoire **(Annex C)** provided by the MCA to its surveyors for the conduct of inspections to under 15m fishing vessels, directed surveyors to assess some non-mandatory items. These included hull condition, deck condition and overall watertight integrity. However, there was no requirement for the boats to be taken out of the water for these inspections.

As a condition placed on the owner by the vessel's insurer, a full out of water survey had to be undertaken at intervals not exceeding 5 years. These surveys were carried out by surveyors identified and appointed by the owner.

1.8.2 Maritime and Coastguard Agency inspections

Between 1994 and 1998, the MCA inspected *Purbeck Isle* on four occasions. In 2004 and 2008, it carried out the scheduled periodic surveys stipulated in the SFV Code. All the deficiencies formally identified during those inspections related to either life saving appliances (LSA) or other safety-related equipment.

Following the flooding incident that occurred on 3 January 2011 (Paragraph 1.7.4), the MCA carried out a targeted inspection of the vessel. At the time of the inspection, *Purbeck Isle* was out of the water in Weymouth on the drying grid **(Figure 14)**. The deficiencies listed in the surveyor's report were:

- Hull planking fwd stbd requires repair.

- Bilge float for alarm to refit.

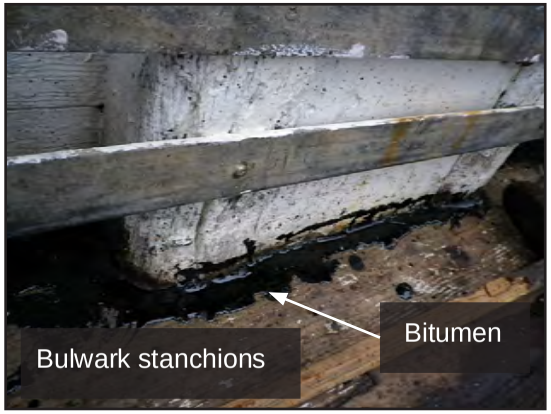
- Steering arm requires repair & refitting.

- Engine alternator to repair/replace.

- Bilge pumps to repair/replace.

The loose plank **(Figure 10)** was repaired, and all the other deficiencies listed were rectified to the satisfaction of the attending MCA surveyor. No hull fastenings were withdrawn for examination during this out of water inspection.

Although there was no mention of the vessel's deck in the report, the photographs taken by the surveyor during his inspection gave an indication of its overall condition and showed the extent of the skipper's attempts to make it watertight.



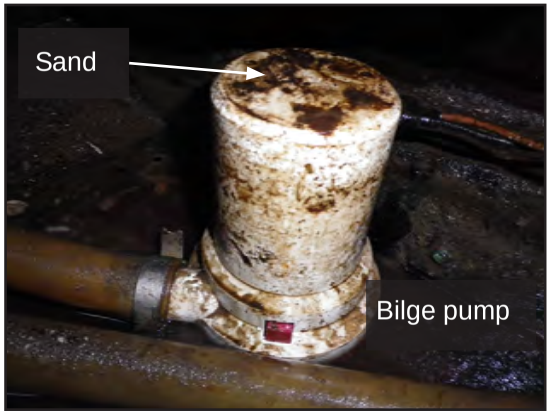


Figure 14: Photographs taken during MCA inspection in January 2011

Large amounts of bitumen had been poured around the outer edges of the deck adjacent to the heavily rotted bulwark stanchions and around the forward end of the wheelhouse **(Figure 14)**.

On 14 June 2011, an MCA surveyor attended *Purbeck Isle* in Weymouth harbour to investigate a hauling gear accident that had resulted in the skipper losing the tips of two of his fingers. Although the primary aim of the visit was to interview the crew and establish the circumstances of the accident, the surveyor also carried out a limited inspection of the vessel. The surveyor was surprised to learn that David McFarlane appeared to have recently taken over the ownership of *Purbeck Isle* given that his records indicated that Maverick (Weymouth) Ltd was still the registered owner of the vessel. This was noted in his report, which also stated that the crew were unable to locate any of the self-certification paperwork required by the SFV Code to be held on board and raised concerns regarding the amount of loose wire visible in the wheelhouse. The surveyor recommended that a follow-up visit to the vessel be undertaken to carry out a thorough inspection as soon as practically possible. A follow up inspection was not carried out.

1.8.3 Insurance surveys

Four insurance surveys had been carried out on board *Purbeck Isle* during the 15-year period prior to the accident. On each occasion, the surveyor was appointed by the vessel's owner and the report forwarded to the insurer.

On 12 December 1997, an out of water survey was conducted on behalf of a previous owner, in which the following observations were made:

- *The hull…had just been repainted and re-antifouled…it was therefore difficult to be certain of her condition but I do suspect some filling has taken place…*
- *There are also a few copper tingles on her undersides that are obviously covering something.*
- *Although the laid deck is not very old, some work is necessary…*
- *Although Purbeck Isle is the type of craft that needs constant maintenance, and I am sure her owners are aware of this, she is generally in a sound, seaworthy condition…*

As a result of the recommendations made in the surveyor's report, the owner fitted the hand-operated bilge pump and suction changeover valve that allowed the deck wash pump to be used to remove bilge water.

Maverick (Weymouth) Ltd appointed a different local surveyor to carry out its insurance surveys in 2001, 2004 and 2009. All three surveys were carried out by the same surveyor on the drying grid in Weymouth harbour, and similar observations were made in all three of his reports. The comments made in the last report, prior to David McFarlane taking over the operation of the vessel included:

- *All hull penetrations were found to be in good operational order and were considered satisfactory.*
- *The hull was examined externally and found in a sound condition with most caulking being tight and well stopped.*

- *The internal framing and planking were examined and found in a satisfactory condition.*

- *The deck was found in a satisfactory condition…some small areas of the pitch were in need of replacement.*

- *This is a typical MFV with little care being given to the cosmetic looks of the vessel, however the structure of the hull, decks and the wheelhouse is sound…*

No hull fastenings were withdrawn for inspection during any of these insurance surveys.

1.9 WHELK POTTING

1.9.1 Local whelk potting season

The local whelk potting season typically lasted 10 months, from December to the following October. At the time of the accident, David McFarlane was midway through his second season of operating *Purbeck Isle*. During his first season, he worked the same winter and summer fishing grounds **(Figure 1)** and had relocated his gear from north to south at about the same time of year.

The whelks landed in Weymouth attracted a steady price of 69 pence per kg and were transported to food processing plants, where they were cooked, packaged and frozen ready for export. During May 2012, *Purbeck Isle* had used about 500kg of broken crab and dog fish as bait and had landed on average about 1,200kg (about 30 sacks) of whelks each day she went fishing. By laying his pots in the deeper summer grounds, the skipper could double his daily catch; however, fishing 9 miles out to sea increased the risk of losing gear because trawlers often operated in that area.

1.9.2 Potting gear

David McFarlane had 25 strings of pots **(Figure 15)**, each having between 40 and 50 pots attached. His pots were hand-made from recycled 25 litre plastic containers. They had one large hole cut in the top, where a net with a central hole was attached, and several smaller holes in the sides to allow water to enter. Concrete was poured into the base of the pot to weigh it down, and a toggle was fitted to allow it to be secured to the leaded main line (or stay).

The pots, each weighing on average about 14kg, were connected to the main line at intervals of about 15m. The total length of the leaded main line rope on the seabed was about 750m and it was anchored at each end by steel anchor weights. This main line was 16mm in diameter and weighed about 0.2kg per metre when wet; each anchor weight weighed about 30kg.

Marker buoys were connected to each end of the main line by float lines (float ropes). The length of each float line was typically 1½ to 2 times the depth of the water. When *Purbeck Isle*'s gear was moved from the winter grounds to the summer grounds, the crew would have had to lengthen the float lines and fit larger marker buoys.

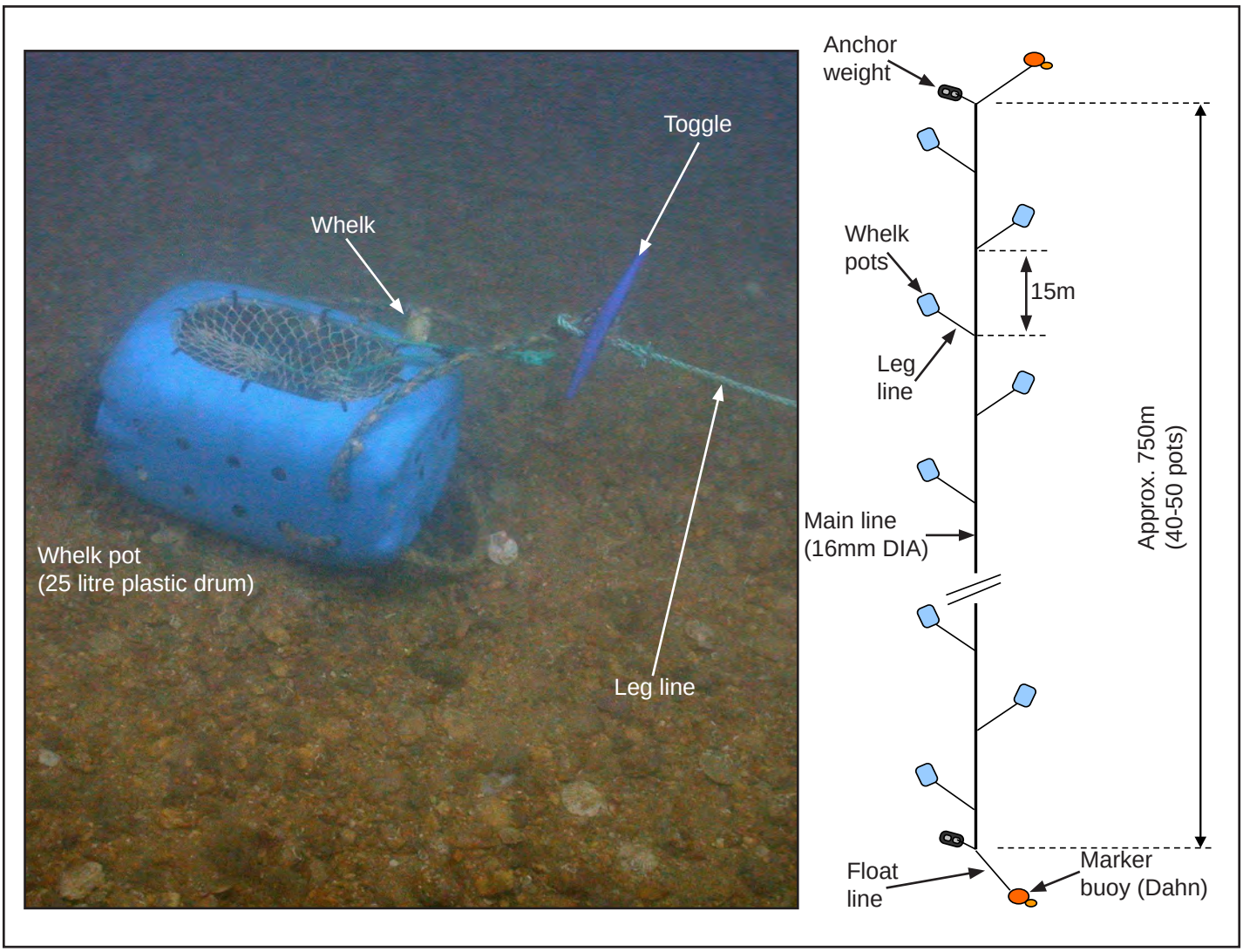


Figure 15: Potting gear arrangement

1.9.3 Hauling, shooting and relocating potting gear

Purbeck Isle's pots were always laid north to south on the seabed, across the prevailing tidal stream **(Figure 16)**. The pots were hauled from north or south depending on the prevailing sea and wind conditions. The bow of the boat was turned into the tidal stream to allow the crew to recover the marker buoys and float line. During hauling, the skipper operated the winch and propulsion controls from the starboard forward side of the deck **(Figure 16)**. As the strings were recovered on board, one crewman emptied the whelks from the pots into the riddle[14] and then re-baited them. The other crewman took the re-baited pots and stacked them on the port side of the deck next to the winch. Once the second bottom weight had been recovered on board, the trailing end rope was usually tied off with its marker buoy being towed astern.

Before re-shooting the gear, the skipper returned to the wheelhouse and manoeuvred the vessel into position. The gear was usually shot from north to south at a speed of 5 to 7 knots and, although *Purbeck Isle* previously had been modified by its registered owner so the strings of pots could be laid using the self-shooting arrangement, both crewmen were required to be on deck to prevent the gear snagging or becoming entangled. One crewman opened the shooting door and let

[14] Riddle – a powered drum that is used to sieve water, mud, sand and undersized whelks from the catch.

go the end rope, causing the bottom weight to be pulled overboard through the door, closely followed by the pots. Due to the tight nature of the stack, a crewman had to stand on the port side of the deck, aft of the pots **(Figure 16)**, and throw them towards the door. When the second bottom weight went overboard, the end rope and marker buoys followed.

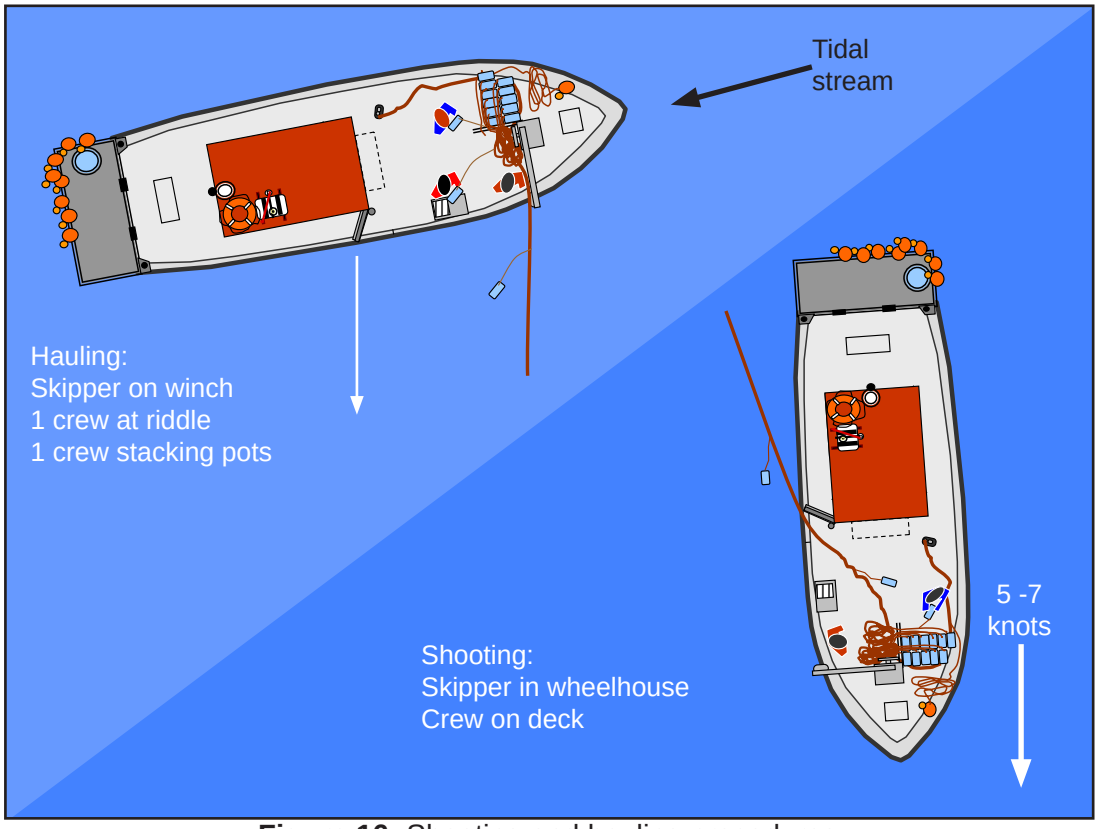


Figure 16: Shooting and hauling procedures

When the pots were moved from one set of grounds to another, the entire string was recovered inboard. To allow the gear to be relocated faster, several strings of pots were stacked on deck at the same time. During the previous season, the crew had carried five strings (about 250 pots) on the deck at a time. To achieve this, one string was stacked in the bow, two on the deck in front of the wheelhouse and one on either side of the wheelhouse **(Figure 17)**. With five strings on deck, the crew could not open the shooting door and had to shoot the first string (the one blocking the door on the starboard side of the wheelhouse) over the gunwale.

After the accident, six strings of *Purbeck Isle*'s pots were recovered from the winter grounds off Chesil Beach and 11½ strings were recovered from the summer grounds. Of the 11½ strings recovered from the summer grounds, 11 had been fully shot, with the half a string still being attached to the wreck. Two of the strings recovered from the summer grounds had 80 to 90 pots attached and appeared to have been made up of two strings tied together.

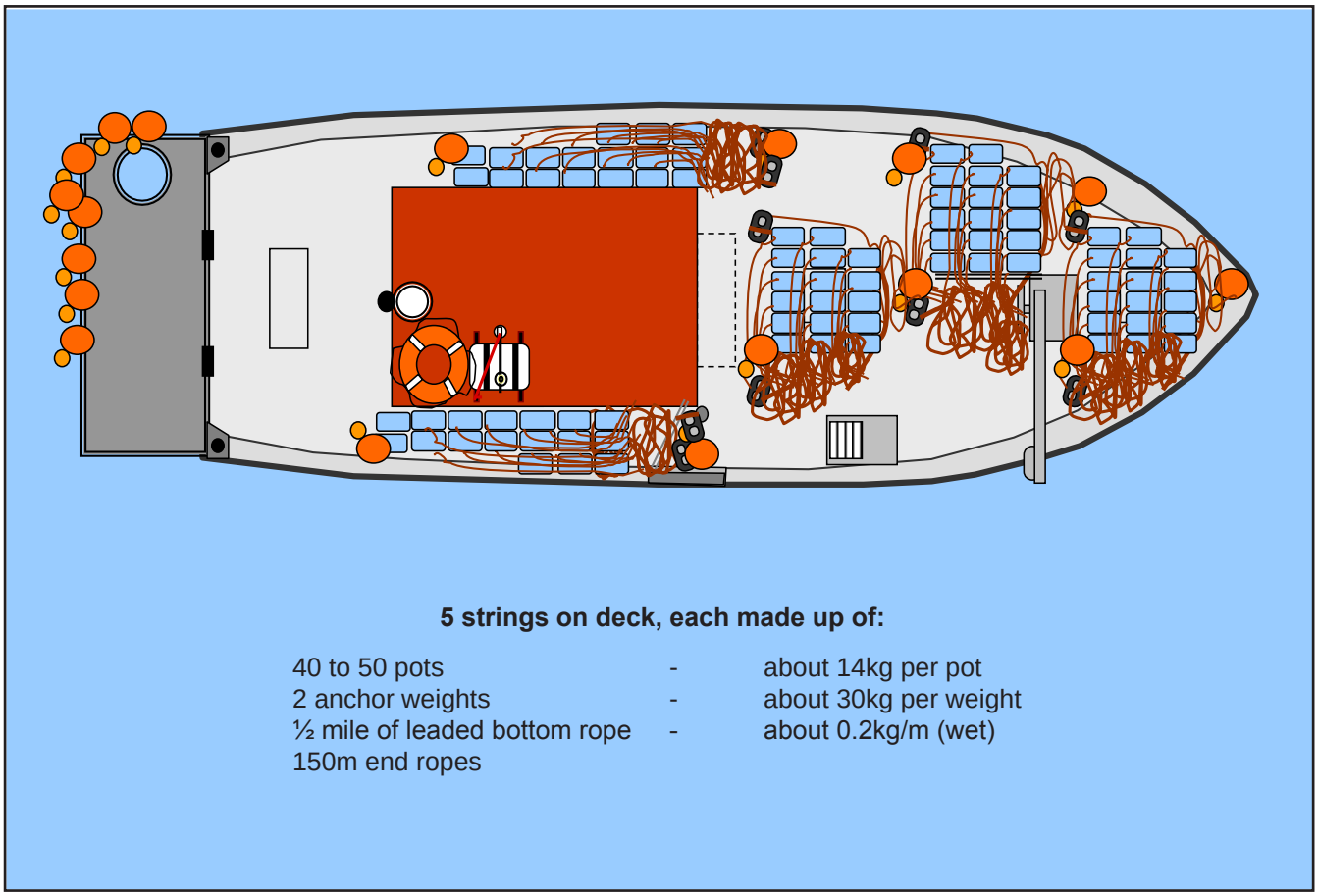


Figure 17: Method adopted for the stacking of pots on deck when gear was relocated during the previous season (2011)

1.10 *PURBECK ISLE*'S LIFE SAVING APPLIANCES AND SAFETY EQUIPMENT

1.10.1 Requirements for small fishing vessels

The SFV Code listed the minimum safety equipment that owners were required to carry on board their vessels. The mandatory equipment listed in the code differed according to the length and construction of the vessel. The list for decked vessels 10m and over registered length, to less than 12m registered length **(Annex D)**, applied to *Purbeck Isle*. In addition to the mandated equipment, the checklists also included safety equipment recommended by the MCA to be carried on board.

Unlike the similar Code of Practice for larger fishing vessels of between 15m and 24m registered length, the safety equipment carried had to be fit for purpose, but did not have to be of a type that had been approved by the MCA.

1.10.2 Lifejackets

The SFV Code required owners to ensure that at least one lifejacket per person was carried on board. The lifejackets had to be of the solid-filled type (inherently buoyant), or of the automatic gas inflation type providing at least 150N of buoyancy. These lifejackets were classed as LSA and were intended to be worn during an emergency, rather than as a precautionary measure while working on deck.

The lifejackets carried on board *Purbeck Isle* were of the solid-filled type and had been stowed below deck in the machinery compartment behind the access ladder. On 19 October 2012, a lifejacket marked with the name *Purbeck Isle* was hauled up from the seabed by an angler fishing to the south of Portland Harbour.

1.10.3 Liferaft

Purbeck Isle was required to carry one liferaft with a capacity sufficient for the total number of persons on board. The owners also had to ensure that the liferaft was serviced and maintained at the manufacturer's recommended service intervals by a service station approved by the manufacturer. The liferaft was required to be positioned or rigged so that it could float free in the event of the vessel sinking. The list of additional non-mandatory equipment recommended in the SFV Code included a liferaft release mechanism.

The liferaft carried on board *Purbeck Isle* was on hire to the vessel's registered owner from Survitec Group Ltd (Survitec). It was a four-man *Seago G Offshore* liferaft that had been hermetically sealed within a transparent protective sack **(Figure 18)** and stowed within a glass reinforced plastic (GRP) canister. It had been manufactured on 11 January 2010 and was delivered to the vessel by a Cosalt Ltd agent in March 2010 (Cosalt Ltd was taken over by Survitec in 2011). In accordance with the manufacturer's recommendations, the liferaft was due its first service in March 2013.

The liferaft canister was secured in a wooden cradle on the roof of the wheelhouse by a centrally located lashing rope **(Figure 6)**.

The lashing rope had been connected directly to an eyebolt on the wheelhouse roof at one end and to an eyebolt on the roof via a hydrostatic release unit (HRU) at the other end. The liferaft did not fit snugly in its cradle and had, in the past, fallen from the wheelhouse roof during rough sea conditions.

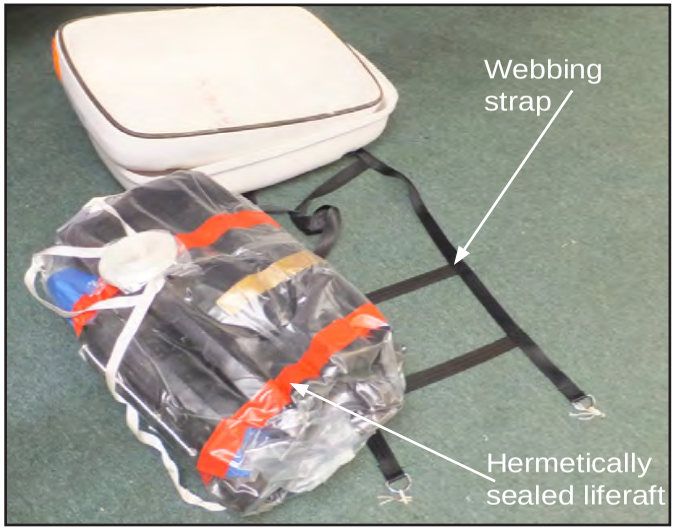
1.10.4 Lifebuoys

In accordance with the requirements of the SFV Code, *Purbeck Isle* had two lifebuoys. They had been rigged on the wheelhouse roof **(Figure 6)**, aft of the liferaft cradle, in a way that allowed them to float free if the vessel sank.

The lifebuoys should have been fitted with reflective tape and marked with the vessel name and fishing vessel number. *Purbeck Isle*'s lifebuoys had reflective tape, but they had not been marked with the vessel's name or number.

1.11 THE *SEAGO G OFFSHORE* LIFERAFT

Seago Yachting Ltd was a UK company that supplied a range of LSA products, which included liferafts and lifejackets. Its products were aimed predominantly at the small leisure craft market. It supplied two types of liferaft **(Annex E)**, the *Seago G Offshore* raft and the *Seago L ISO* raft. The liferafts were manufactured under licence by Shanghai Star Rubber Products Co. Ltd and were subjected to independent third party inspection and testing by ABS Consulting Ltd at the point of manufacture in China.



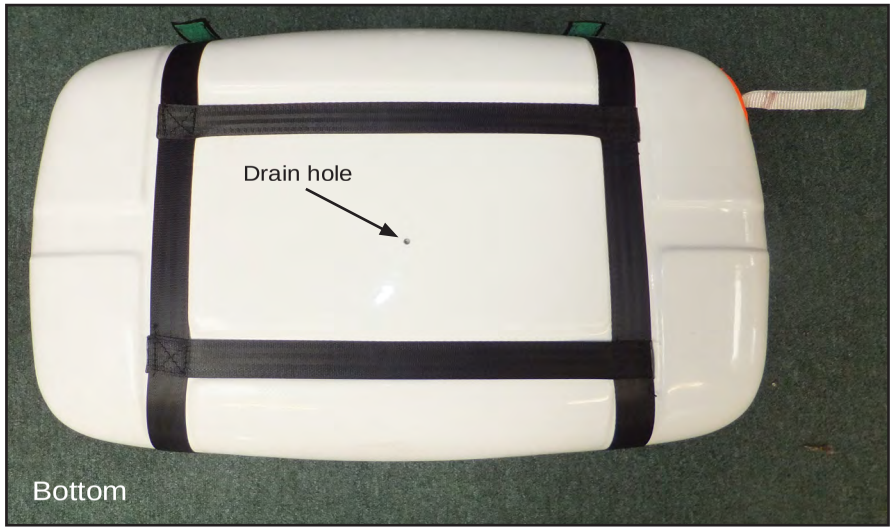


Figure 18: *Seago G Offshore* liferaft

The *Seago G Offshore* liferaft was intended for use on small leisure craft that were used for short offshore voyages, and was specifically designed to be economically competitive. Seago's more advanced *L* liferaft was designed to be used for prolonged offshore cruises and racing. The main differences between the *Seago G* and *Seago L* liferafts, other than price, were:

- type and quality of material used
- operational temperature range
- size of inflation tubes
- size of ballast water pockets under the raft
- boarding arrangements
- size of access opening in the canopy
- contents of the emergency pack.

The four-man *G* and *L* liferafts in their GRP canisters weighed 28kg and 45kg respectively and the canister used for the *G* raft was significantly smaller than the one used for the *L* raft.

The liferafts were supplied with an owner's manual that provided basic instructions on how to launch the liferaft manually, board it and manoeuvre it. The manual also listed the contents of the survival pack and provided some basic survival advice.

The GRP canister consisted of two halves that were held together by velcro webbing straps **(Figure 18)**. The webbing straps were further secured in place by string, which was designed to part as the liferaft inflated. The liferaft could be stowed flat on the deck or up on one of its sides in a bulkhead-mounted cradle.

When stowed flat on deck, the liferaft's information label **(Figure 18)** should be visible on the top half of the canister. The information given on the label included the liferaft type, its serial number, the date its next service was due, and a pictogram illustrating the procedure for manually launching the liferaft.

The bottom half of the canister had a 20mm diameter hole, sealed by a rubber grommet, through which its 14m long inflation painter passed **(Figure 18)**. It also had three small drain holes which were designed to prevent water accumulating within the canister. The Seago liferaft owners' manual did not mention the drain holes, but did emphasise the need to ensure the top cover of the canister was facing upwards when deck mounted, and out when bulkhead mounted.

Photographs **(Figure 19)** taken of *Purbeck Isle* up to and including 7 months before the accident clearly show the liferaft secured upside down in its cradle on the wheelhouse roof.

Figure 19: Liferaft lashed on wheelhouse roof

1.12 LIFERAFT STANDARDS

The international requirements for LSA carried on board merchant ships under Chapter III of the SOLAS[15] Convention are set out in the International Maritime Organization's (IMO) International Life-Saving Appliance Code (LSA Code).

[15] SOLAS - The International Convention for the Safety of Life at Sea (SOLAS) 1974

Liferafts that are designed and built to meet the requirements of the LSA Code are often referred to as SOLAS liferafts. The minimum carrying capacity of a SOLAS approved liferaft is six persons.

In 2005, the International Organization for Standardization (ISO) published its ISO 9650 *Small craft – Inflatable liferafts* standard. The standard was intended for 4 to 12 person inflatable liferafts for use on small craft used for leisure activities. The standard consisted of three parts:

- Part one (ISO 9650-1) specified the design, performance, marking and testing requirements for liferafts carried during extended voyages, where high wind and significant wave heights may be experienced (type I liferafts).

- Part two (ISO 9650-2) was for liferafts carried during voyages where moderate conditions may be met in areas such as, but not limited to, coastal water, large bays, estuaries, lakes and rivers (type II liferafts).

- Part three (ISO 9650-3) covered construction materials.

ISO 9650-1 defined two groups of type I liferaft (Group A and Group B); *Group A* liferafts were suitable for an air temperature range of between -15ºC and +65ºC, and Group B 0ºC and +65ºC. All type II liferafts are designed to operate in an air temperature range of between 0ºC and +65ºC. The guidance given in the ISO 9650 standard stated that the user must be responsible for selecting a liferaft appropriate to the intended circumstances of use. It also emphasised that manufacturers and vendors must inform potential purchasers of the properties of the liferaft, including limits of normal usage, and recommendations on stowage and maintenance.

The *Seago L* liferaft was designed to meet the requirements set out in Part one of the ISO standard. The Seago *G* raft did not meet the ISO standard or comply with any other recognised UK or international standards, and was not designed to be stowed or inflated in ambient temperatures below 0ºC.

1.13 HYDROSTATIC RELEASE UNIT

The HRU used to secure the liferaft to *Purbeck Isle*'s wheelhouse roof was manufactured by the Swedish company CM Hammar AB (Hammar). It was the company's *Hammar H20 Small Rafts* model, which was specifically designed to be used to secure 4 to 12 person non-SOLAS liferafts. The small raft and SOLAS raft HRUs **(Figure 20)** are distinguishable by colour; small raft units are green and SOLAS units are yellow.

The *Hammar H20 small rafts* unit consisted of a double looped white strong rope, a hydrostatic release mechanism and a red weak link with a green lower thimble. The breaking strength of the weak link was 1.2kN.

The green lower thimble should be secured to the deck or liferaft cradle and then the liferaft lashing should be secured to the white strong rope using a slip hook **(Figure 20)**. The liferaft painter line should be secured to the red weak link.

If a ship sinks, the water pressure acting on the hydrostatic release mechanism at a depth of about 2m to 4m will release a spring tensioned knife that will cut through the white strong rope. This will allow the liferaft to float towards the surface **(Figure 21)**, pulling the painter line from the canister. Once fully extended, the painter line will

Images courtesy of Maritime & Coastguard Agency (MGN 343 (M+F) - Hydrostatic Release Units (HRU) Stowage and Float Free Arrangements for Inflatable Liferafts

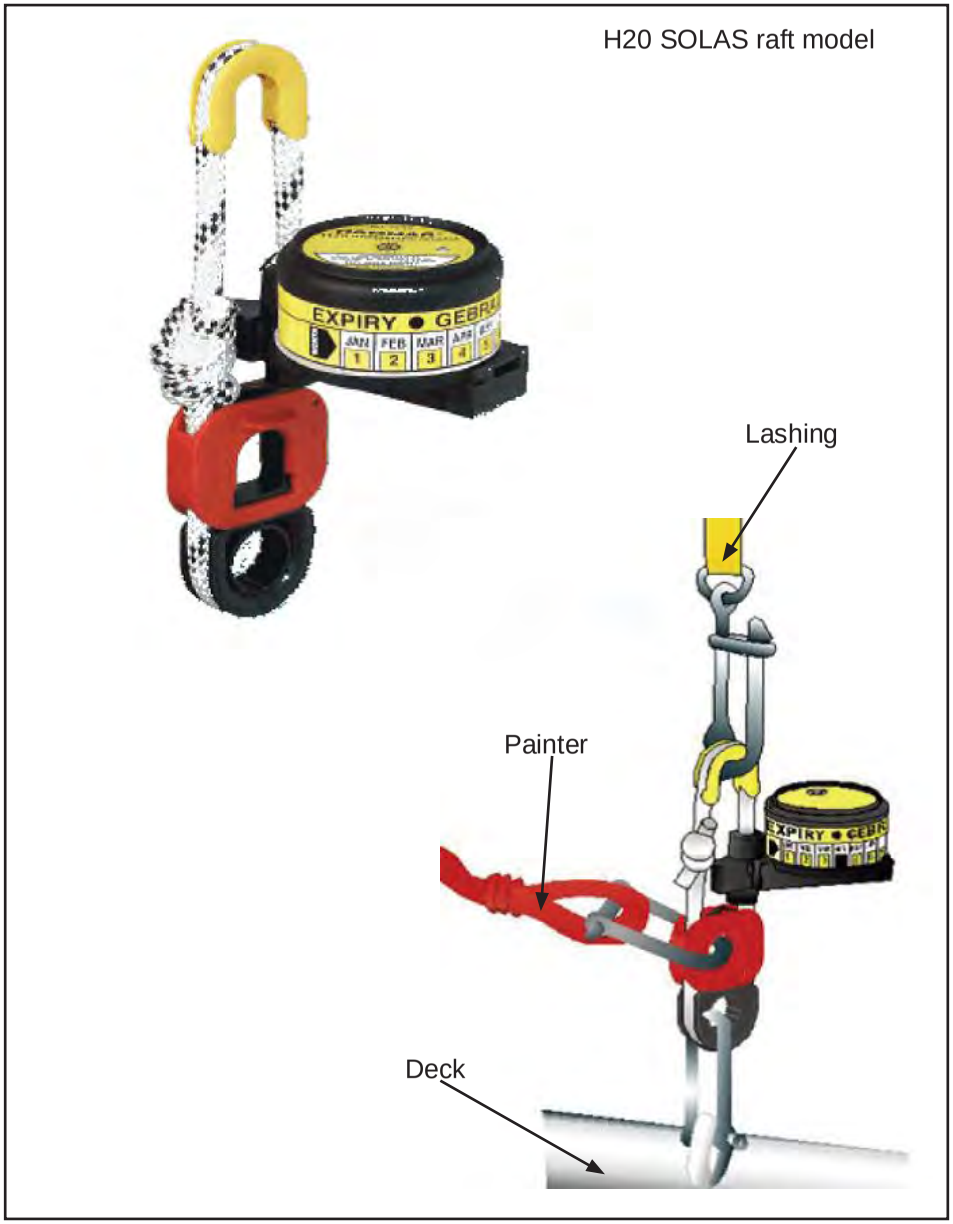


Figure 20: Hammar H20 hydrostatic release units

Images courtesy of CM Hammar website instructional video

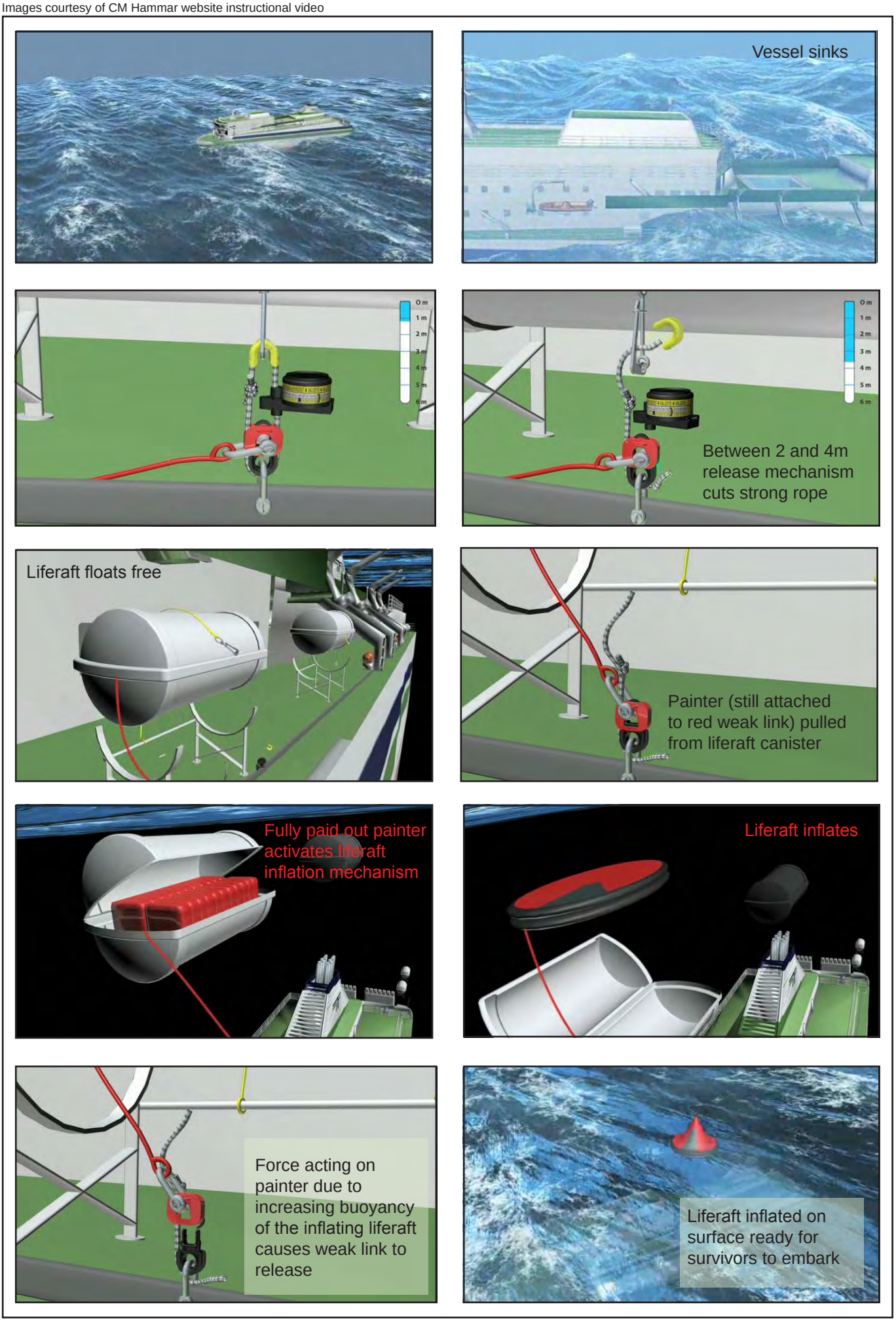


Figure 21: Liferaft deployment and inflation process

tighten and then activate the inflation mechanism. As the liferaft inflates the buoyant forces generated will cause the red weak link to break, allowing the liferaft to float free of the sinking vessel.

The *Hammar H20* units are designed to be maintenance free, but must be replaced after 2 years of use on a vessel.

The units are provided with an instruction leaflet that contains a pictogram illustrating the correct method of rigging. In addition, Hammar's website includes several animated videos showing how they should be rigged and how they operate. The website also has an interactive tool **(Annex F)** that can be used to further aid learning.

1.14 COMMUNICATIONS

1.14.1 Very high frequency radio

Purbeck Isle's fixed marine band VHF *Sailor* radio, manufactured by the Danish company Thrane and Thrane A/S, was positioned on the starboard side of the wheelhouse next to the skipper's chair. While out at sea, it was used routinely by the skipper, on VHF channel 77, to chat to his friend on board *Amanda Jane*.

On the day of the accident, the skipper used his radio during the morning to communicate with the skipper of *Royal Escape*. However, the coastguard did not receive any distress calls from *Purbeck Isle*, and there were no reports of other vessels hearing any distress messages. The radio was not equipped with an integrated digital selective calling (DSC) function[16].

1.14.2 Mobile phones

All three fishermen had their mobile phones with them, and used them on board *Purbeck Isle* during the morning. The last mobile phone activity logged from the vessel was at 0957 and the last signal received from a phone on board was at 1005.

The skipper had used his phone to communicate with several people, including the skippers of *Amanda Jane* and *Royal Escape* during the morning. His last telephone conversation took place between 0845 and 0855, and his phone was last used to dial out at 0913.

Throughout the morning, the fishermen did not raise any concerns or indicate that they were having any difficulties during their telephone conversations or in the text messages they sent.

1.15 EMERGENCY POSITION INDICATING RADIO BEACONS

Emergency Position Indicating Radio Beacons (EPIRBs) are radio distress beacons designed for use on all types of vessels. They operate worldwide using international satellites to send distress signals via the dedicated digital distress frequency of 406MHz. Although it was not mandatory for owners of fishing vessels of <15m (L) to fit an EPIRB, the SFV Code recommended owners to carry them.

[16] DSC function - allows the radio operator to alert other vessels or shore-based coastguard rescue centres that they want to communicate. It is similar to a paging system but has different sound signals for routine and distress calls.

There was a wide variety of EPIRBs available on the market, with the most basic models being manually operated. Small self-contained automatic water-activated float-free type EPIRBs, similar to those carried on board merchant ships, were also readily available. At the time of the accident, the cost of a water-activated float-free EPIRB typically ranged between £400 and £600 sterling.

In the event of a vessel sinking quickly, the float-free EPIRB would be activated automatically when it is submerged in the water and released from its mounting, allowing it to float to the surface. The beacon's distress signal will alert the coastguard rescue services almost immediately. In the event of a vessel sinking slowly, the EPIRB could be activated manually and taken into the liferaft by the crew.

In addition to EPIRBs, a wide variety of other radio distress devices were also available. These included personal locater beacons designed to be activated manually and/or automatically if a crewman fell overboard.

Very few of the fishing vessels operating out of Weymouth at the time of the accident carried EPIRBs. The owner of *Amanda Jane* had fitted the Royal National Lifeboat Institution's (RNLI) *MOB Guardian* personal locater distress system to his vessels. *Purbeck Isle* did not carry an EPIRB or any other type of electronic distress beacon or transponder.

1.16 HEALTH AND SAFETY

1.16.1 General duties

In accordance with Regulation 5 of the Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997, an employer[17] has a general duty to:

> *"ensure the health and safety of workers[18] and other persons so far as is reasonably practicable".*

In order to fulfil their general duties, an employer was required to endeavour to:

- avoid or minimise risks
- evaluate unavoidable risks and take actions to minimise them, and
- adopt safe work patterns and procedures.

1.16.2 Personal protective equipment

Although it is recognised that collective protection methods, such as the provision of guardrails, should always be given priority ahead of personal protection such as safety harnesses, personal protective equipment (PPE) should be provided for use by workers when risks cannot be avoided or reduced to a satisfactory level.

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[17] *Employer* means a person by whom a worker is employed under a contract of employment.

[18] *Worker* means any person employed by an employer under a contract of employment, including trainees or apprentices.

The Merchant Shipping and Fishing Vessels Personal Protective Equipment Regulations 1999 require employers to ensure that PPE is provided for their workers when they are engaged in, or at risk from, a hazardous work activity on board a UK registered ship.

In circumstances where there is a foreseeable risk of crew falling overboard, the recognised PPE includes safety harnesses and lanyards, personal flotation devices (PFD) and thermally-insulated immersion suits.

1.16.3 Personal flotation devices

PFDs are divided into the following two main classes:

- Those which provide face up in-water support to the user regardless of physical conditions (lifejackets); and

- Those which require the user to make swimming and other postural movements to position their face out of the water (buoyancy aids).

The selection of the appropriate PFD is dependent on the task undertaken and the environment in which it is conducted. PFDs that do not require intervention, such as auto-inflation lifejackets, are suited to activities where persons are likely to enter the water unexpectedly. Self-activating lights, whistles and retro-reflective material fitted to PFDs assist in the detection of persons in the water.

The lifejackets stored in the engine room on board *Purbeck Isle* were provided to satisfy the requirements for LSA. There were no PFDs on board for working on deck, and neither David McFarlane nor Jack Craig was wearing a lifejacket when their bodies were recovered from the sea.

1.17 FUNDING FOR NON-MANDATORY IMPROVEMENTS IN SAFETY

The UK Government had set aside about £38 million from the European Fisheries Fund to help the fishing industry adapt to the changing requirements of the Common Fisheries Policy between 2007 and 2013. As part of this initiative, funding was made available in the form of grants for fishing vessel owners to support non-mandatory improvements in safety.

The funds were managed by the UK's Marine Management Organisation (MMO). The size of the grants awarded by the MMO could cover up to 40% of the total cost of improvements proposed by an owner.

Grants were commonly awarded to owners of small fishing vessels to subsidise the cost of items such as PFDs and EPIRBs. Applications for grants were not sent to the MMO by either the registered owner of *Purbeck Isle* or David McFarlane.

1.18 POST-ACCIDENT SURVEYS

1.18.1 *Odyssey Explorer* ROV survey

The underwater ROV surveys conducted by the technical crew on board *Odyssey Explorer* were observed by MAIB inspectors. In total, three dives were carried out over a 24-hour period. The length of each dive was restricted by the tidal conditions

and the strength of the local underwater currents. The underwater visibility was about 5m, but access to *Purbeck Isle* was restricted by the number of buoyant float line ropes that were attached to the strings of pots both on board and on the seabed around the wreck.

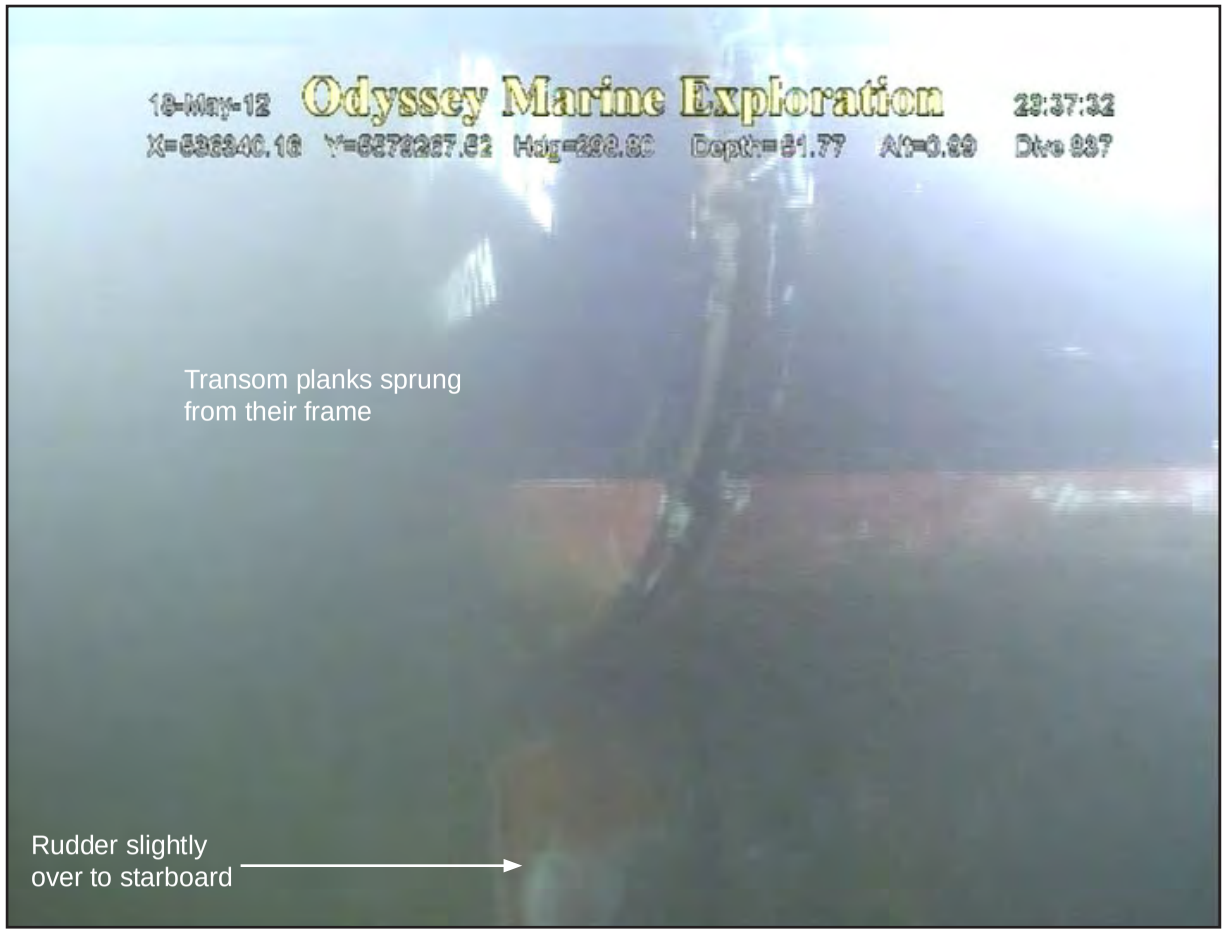
During the first dive, the vessel was positively identified and an initial sweep of the starboard side of the hull, the external wheelhouse and the upper deck was achieved. The second dive included a sweep of the port side of the vessel and provided an opportunity for the MAIB inspectors to direct the ROV pilots to the areas of particular interest identified during the initial sweep of the wreck.

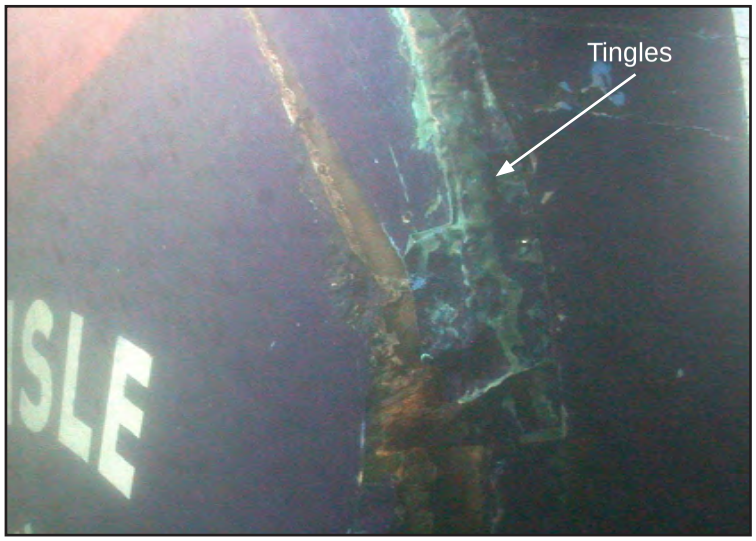
The observations made during the first two dives included:

- The starboard side of the transom had come away from the hull **(Figure 22)**.
- The rudder was positioned slightly to starboard **(Figure 22)**.
- The propeller shaft had remnants of rope around it.
- The side shooting door was closed **(Figure 23)**.
- A leaded main line rope was passing through the shooting door **(Figure 23)**.
- The liferaft, still in its GRP canister, was lying on the starboard side of the deck between the wheelhouse and the shooting door **(Figure 23)**.
- There were several groups of pots lying on the deck and on the seabed around the wreck **(Figure 24)**.
- There were no ropes on the hauling winch drum **(Figure 25)**.
- The shaft gearbox was engaged ahead and the engine throttle was set somewhere between 1200 and 1800rpm **(Figure 26)**.
- The Hammar H20 HRU had activated and released the liferaft's main securing rope **(Figure 27)**.
- A rubber mat that the liferaft had been lying on in its cradle was attached to, and entangled with, a group of knotted ropes and twine on the wheelhouse roof **(Figure 27)**.
- The wheelhouse door and starboard window were open.

During the third dive, the ROV followed the path of the string of pots seen passing through the shooting door. The string was lying in a straight line towards the north of the wreck over a distance of about a quarter of a mile. Thirty-five pots were lying on the seabed between the wreck and the anchor weight, and the pots appeared to have been baited. The third and final dive was aborted when the ROV became entangled in rope.

The ROV was too large to enter the vessel and, despite it providing a limited view into the wheelhouse from the outside, the surveys were not able to establish if the bodies of Jack Craig and/or Robert Prowse were still inside the wreck.





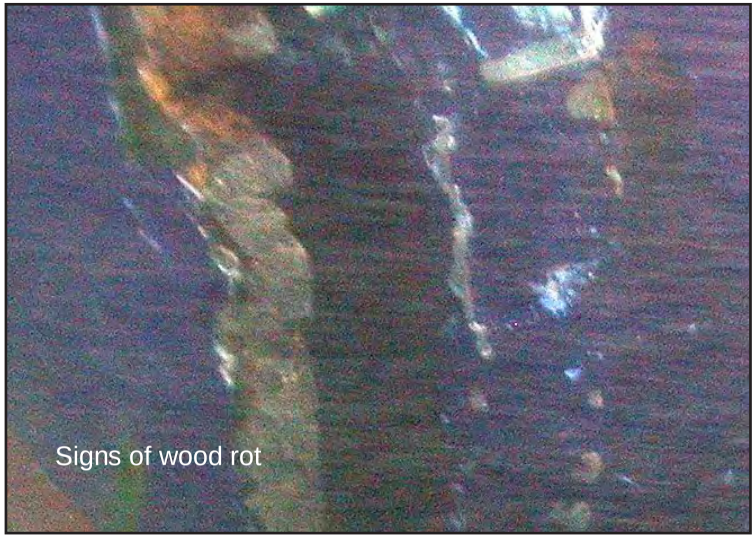


Figure 22: ROV footage showing damage to transom

Figure 23: ROV footage showing the shooting door closed and the liferaft on deck

Figure 24: ROV footage showing potting gear on deck and on the seabed

Figure 25: ROV footage showing the hauling winch

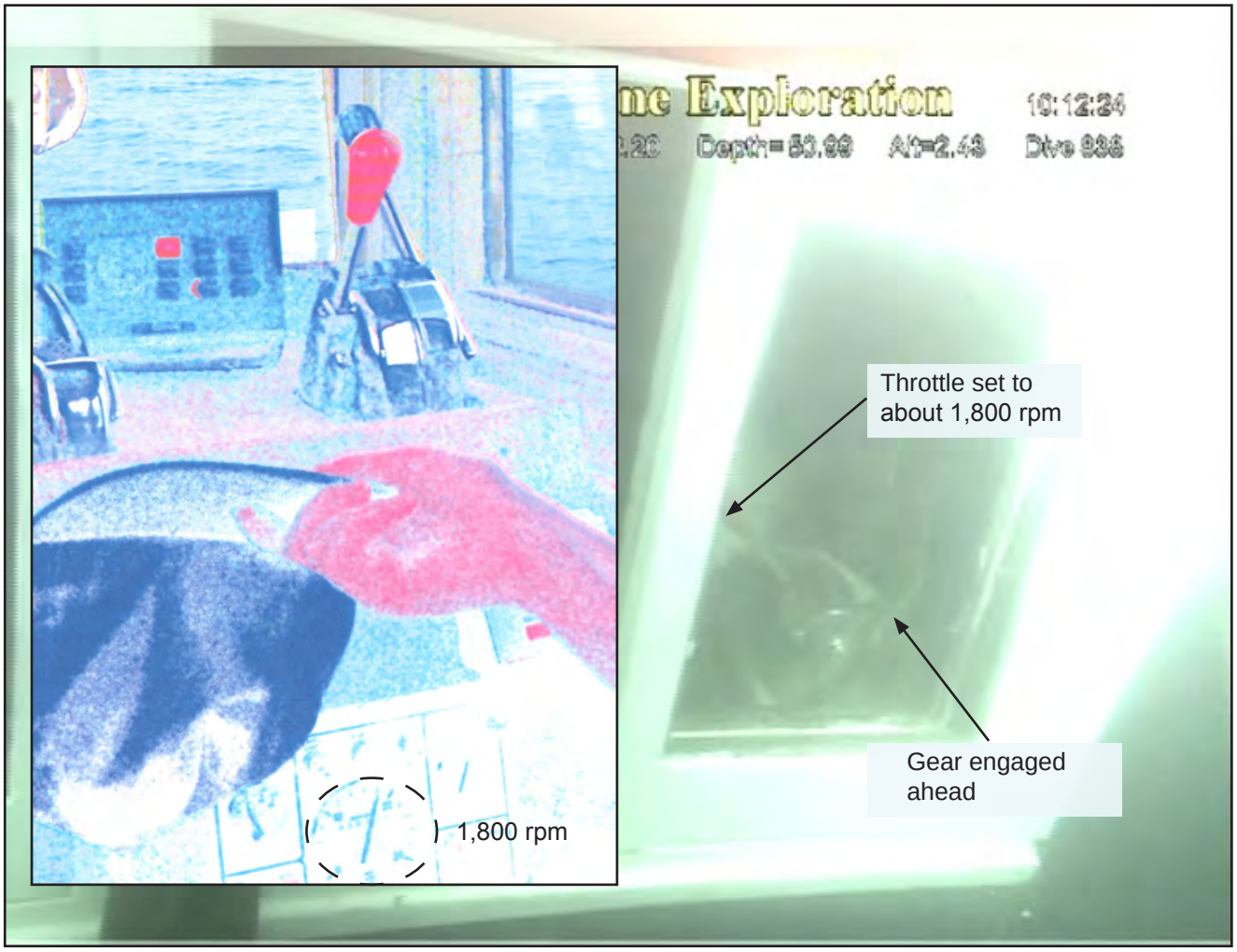


Figure 26: ROV footage showing the wheelhouse propulsion control levers

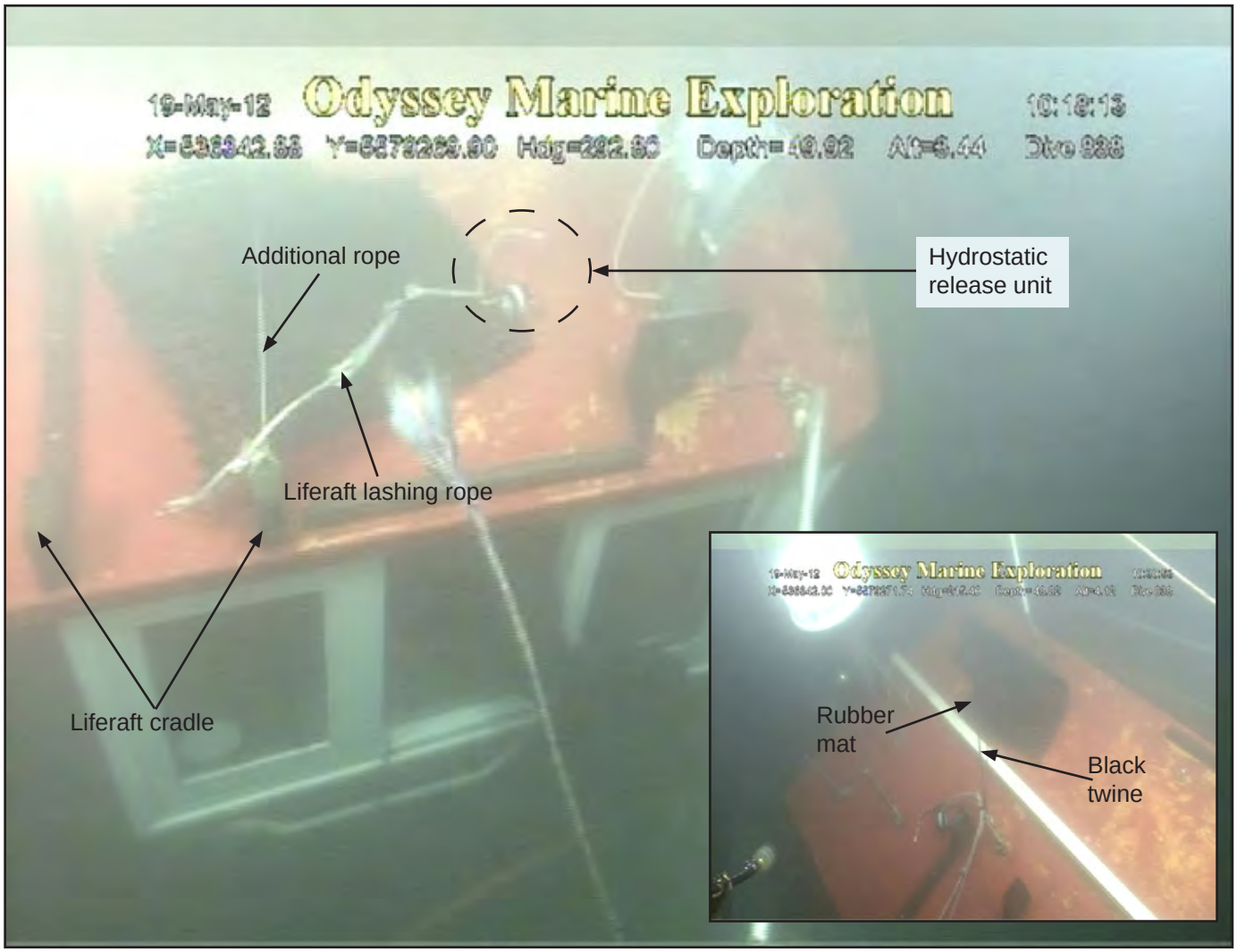


Figure 27: ROV footage showing the liferaft cradle and hydrostatic release unit

1.18.2 Divers' searches

In the weeks following the accident, two targeted underwater searches of the wreck were carried out by two teams of local recreational technical divers. Both dives were filmed and these recordings were passed to the MAIB to support its investigation.

The first dive instigated by the family of Jack Craig, was carried out on 29 May 2012. The aim of the dive was to search for the bodies of the two missing fishermen. The divers searched among the fishing gear on and around the wreck, inside the wheelhouse and inside the compartments below deck. No bodies were found during the search.

The footage taken during the search supported and added to the observations made during the ROV surveys. Of particular note, the following observations were made:

- The liferaft had moved along the deck to the starboard forward side of the boat **(Figure 28)**.
- The side shooting door was now open **(Figure 28)**.
- The wooden hatch covers for the forward store, engine room and steering gear were all missing.

- There were no ropes on the hauling block **(Figure 28)**.
- Bags of whelks were stacked on the port side of the deck outside the wheelhouse **(Figure 29)**.
- Bags of whelks were lying in a row on the port side bench inside the wheelhouse **(Figure 29)**.
- Bags of whelks and ropes were stowed in the machinery compartment **(Figure 29)**.

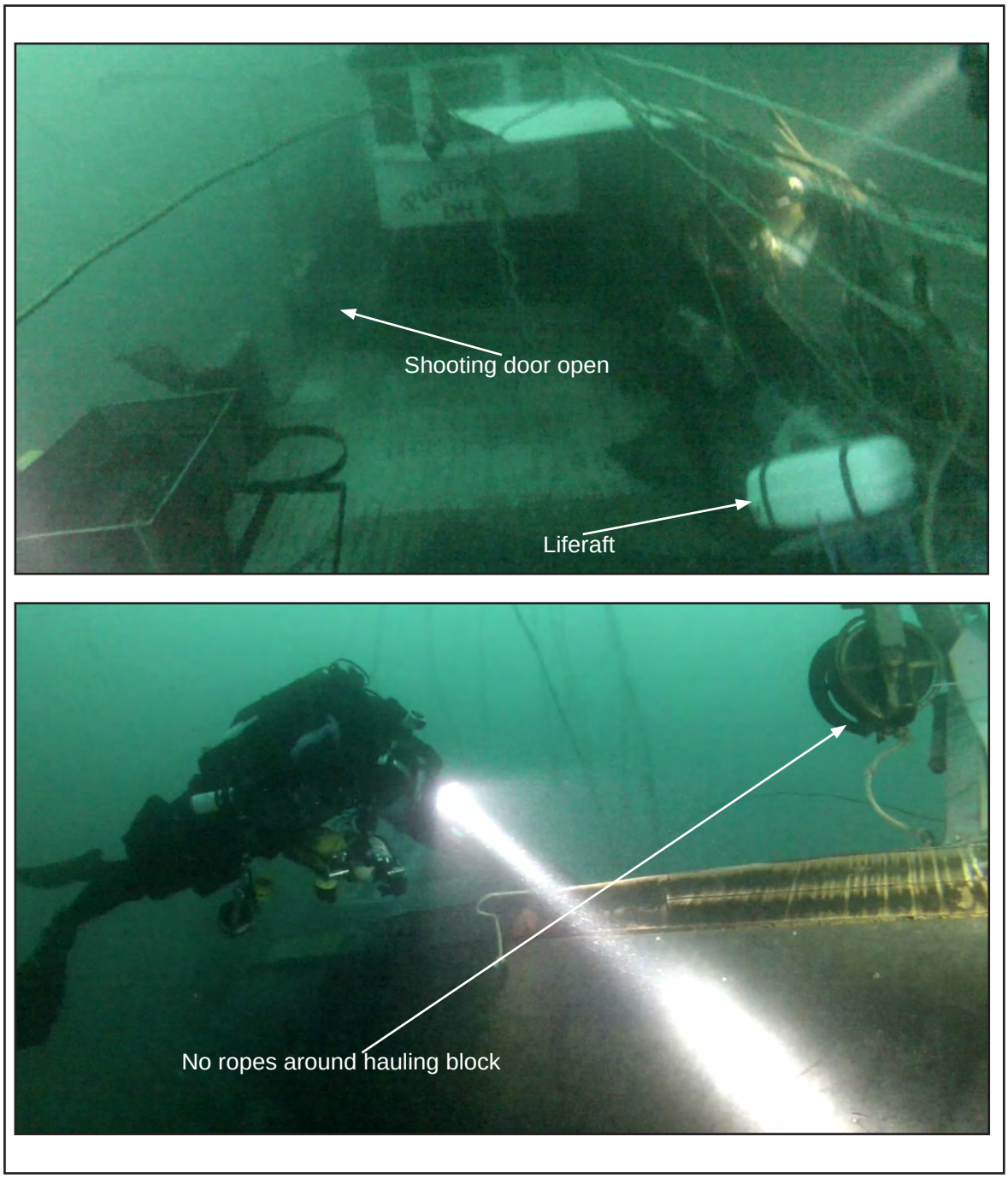


Figure 28: Dive one footage showing the deck forward of the wheelhouse

Figure 29: Dive one footage showing sacks of whelks on deck, in the wheelhouse and below deck

The second dive was carried out on 30 June 2012 at the request of *Purbeck Isle*'s registered owner. The aim of the dive was to recover the liferaft. The divers discovered that *Purbeck Isle* had moved several hundred metres along the seabed, she had suffered damage, and the liferaft was no longer on board and was not found. The video footage taken of the dive provided a clear view of the HRU **(Figure 30)**, which showed that the weak link had not been broken.

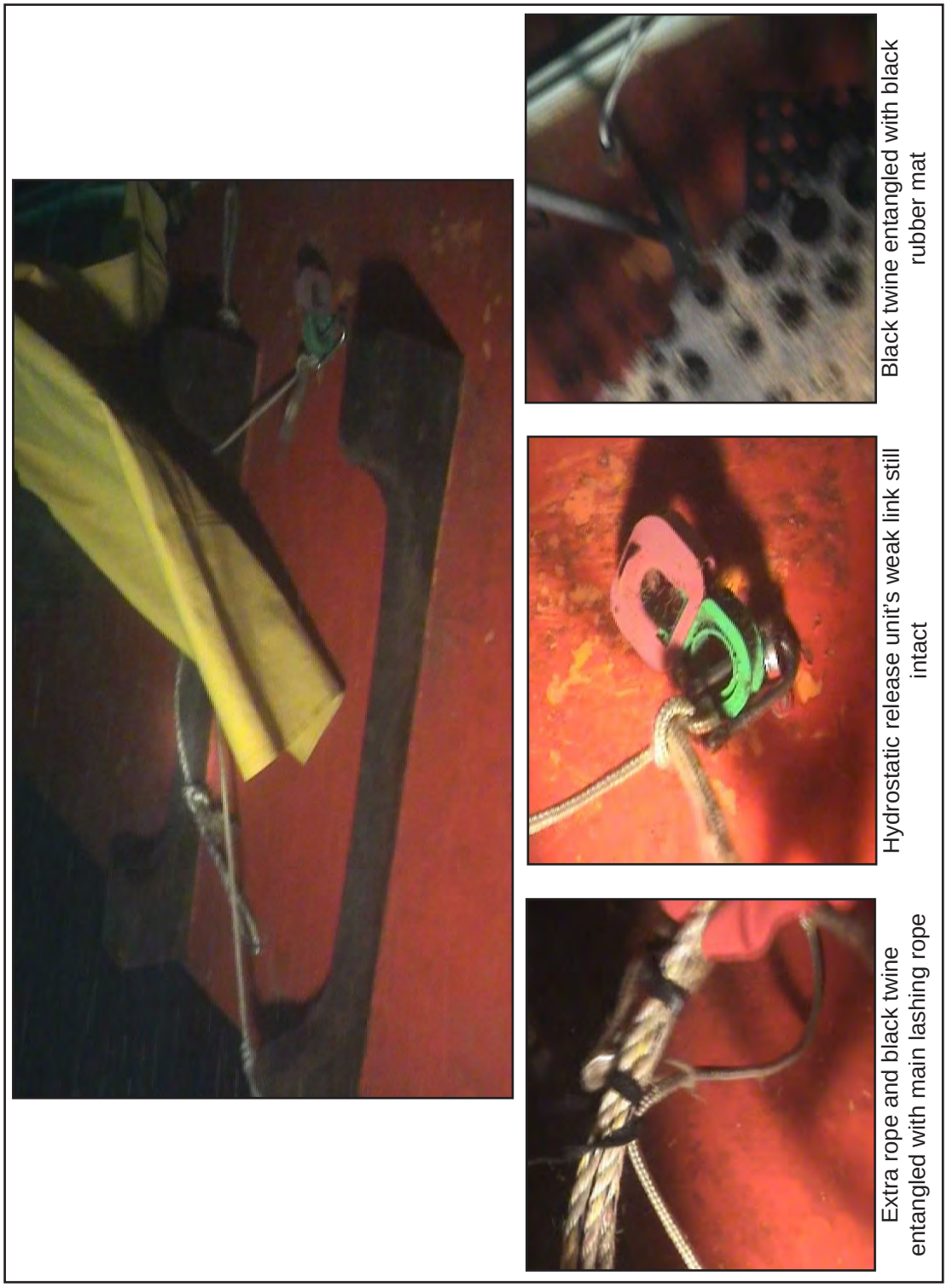
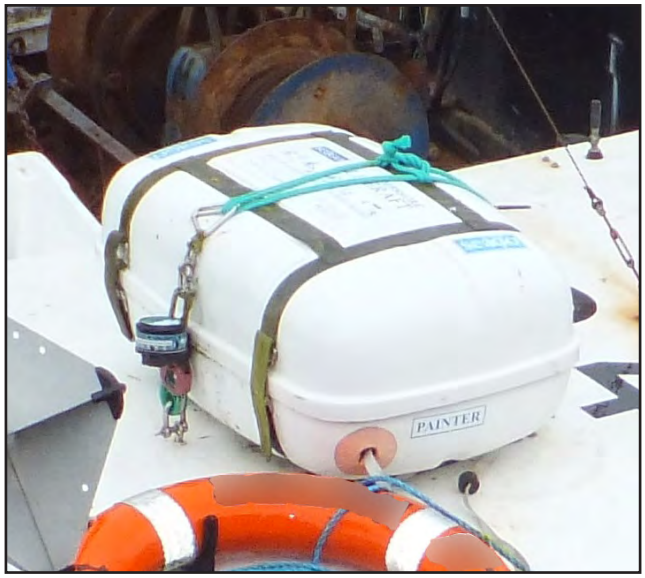


Figure 30: Dive two footage showing hydrostatic release unit with weak link still intact

1.18.3 Fishing vessel liferaft securing arrangements inspection

During a visit to Weymouth harbour 5 weeks after the accident, MAIB inspectors carried out an unannounced inspection of the liferaft securing arrangements on board the small fishing vessels berthed on the quay. At the time of the walk around, four of the ten small commercial fishing vessels inspected had Seago liferafts secured to the roof of their wheelhouses **(Figure 31)**; of those:

- One had its painter attached directly to the wheelhouse roof instead of to the HRU's weak link.
- One did not have its painter attached at all.
- Two did not sit properly in their cradles.



Liferaft rigged to float free but painter line is not attached to the weak link

Liferaft rigged to float free but painter line is not attached to a HRU and raft does not fit in cradle

Liferaft rigged to float free and painter line is attached to weak link. Liferaft does not fit in cradle

Liferaft rigged to float free

Figure 31: Random inspection of fishing vessel liferaft securing arrangements

A Liferaft that was manufactured by a different company, was also found to be incorrectly rigged.

1.18.4 Retrospective desk-top review of vessel condition

As part of the investigation, the MAIB compiled a portfolio of photographs and documents relating to the vessel's maintenance and repair history. Several surveyors and experts in the construction of wooden boats were consulted, one of whom was contracted to carry out a retrospective desk-top review of the evidence and produce a report on his findings.

It was immediately apparent from the photographs provided that a repair had been carried out to the vessel's transom several years earlier **(Figure 32)**. A section of planking on the upper starboard side of the transom had been cut away and replaced with a patch. In addition, it was evident that the seams between the hull strakes and the transom planks had been covered by tingles for many years.

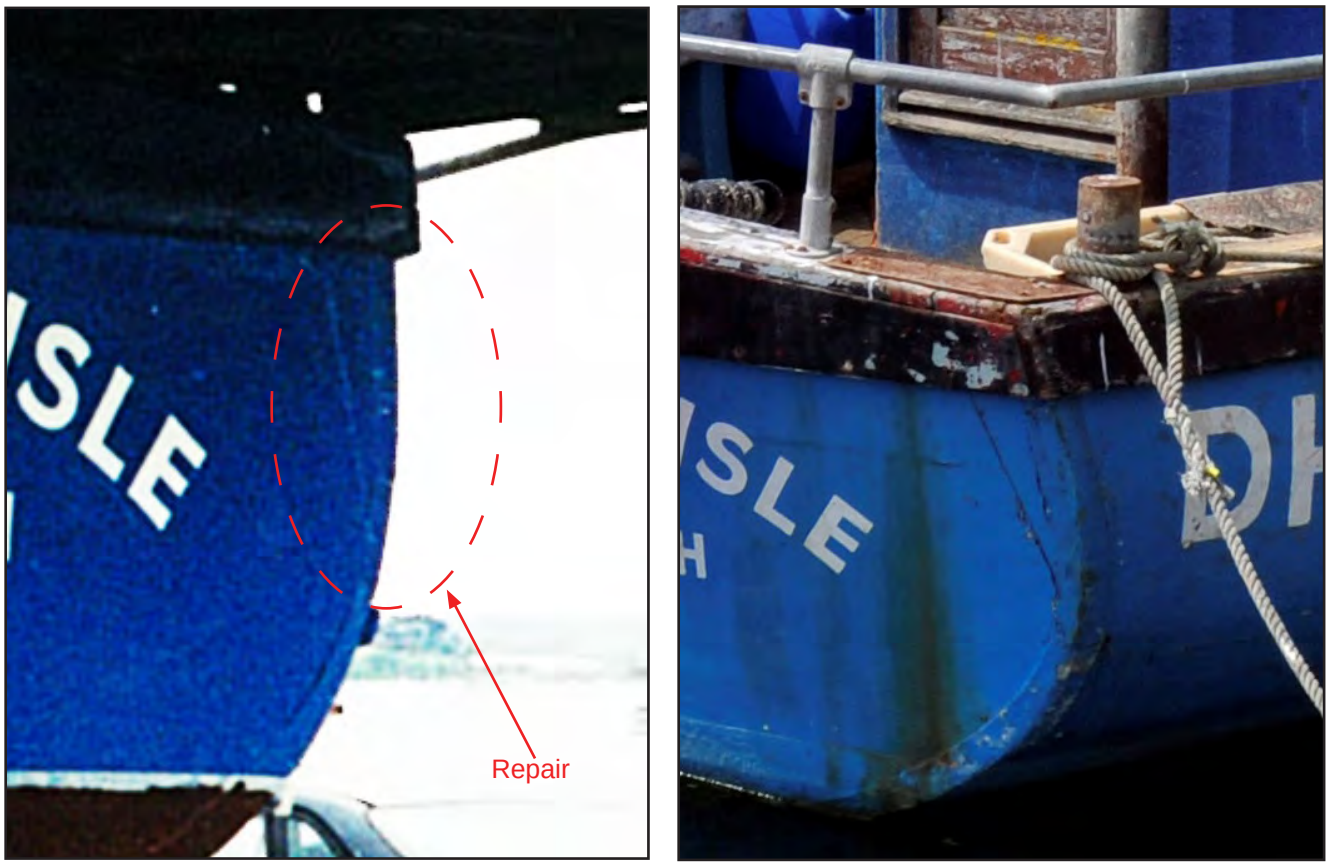


Figure 32: Photographs of previous transom repair

The independent wooden boat surveyor's desk-top review **(Annex G)** also found that:

- There were signs of softening and delignification[19] of the wood in an area around a hull fastening.

[19] Delignification – removal of lignin from wood tissues

- Caulking cotton had been hammered into the central joint of a double frame **(Figure 14)**, which suggested movement between the frame sections and leakage through adjacent plank seams.

- The short plank behind the pot pad was imparting no longitudinal strength to the hull.

- The cutting of a hole in the side bulwark to accommodate the shooting door might have been a contributory factor in any hull failure.

- The bulwark stanchions were in very poor condition.

- The damage to the transom, whether causal to or a consequence of the vessel sinking, indicated that its associated fastenings had little or no integrity and hence it was not properly secured to the vessel.

- The tingles fitted to the starboard side of the hull in a vertical line from the garboard strake up towards the pot pad were particularly worrying because they indicated the possible failure of a frame.

Although the report pointed out that hull fastenings in wooden boats cannot usually be adequately assessed without withdrawing them, it concluded that *Purbeck Isle* "*was in a quite poor state and required major refastening and re-caulking*…".

1.19 PREVIOUS OR SIMILAR INCIDENTS AND ACCIDENTS

1.19.1 *Purbeck Isle*

Up until the accident, the MAIB's database contained four reported incidents involving *Purbeck Isle*. The first two cases occurred in the 1990s and were relatively minor. The latest two casualties were those that occurred in 2011 and led to the MCA inspections discussed in Paragraph 1.8.2.

As a result of the flooding incident on 3 January 2011, *Purbeck Isle* was towed back to port by the all-weather lifeboat. When the vessel had first started to take on water the crew attempted to contain the situation using the bilge and deck wash pumps while the skipper headed back to port. No attempt was made to alert the coastguard until the situation had deteriorated to a point when the bilge pumps failed and the rudder's steering ram parted from the tiller arm. By this time, electrical power to the VHF radio was lost and the skipper was forced to raise the alarm by calling the registered owner on his mobile phone. Once the vessel was under tow, the skipper and his crew were winched off by the coastguard helicopter.

In addition to the reported accidents, *Purbeck Isle* was towed back to port with mechanical problems in December 2010 and February 2011. On both occasions ropes had become snagged around the propeller, causing her gearbox to be ripped from its mountings. Following these incidents, the skipper had a rope cutter fitted to the propeller shaft.

1.19.2 MAIB fishing vessel safety study

In 2008, the MAIB published the findings of its analysis of UK fishing vessel safety between 1992 and 2006. The safety study was carried out because of concerns that, contrary to other hazardous occupations within the UK, the fatality rate among those at the highest risk, offshore commercial fishermen, was not falling. The study highlighted that:

- Over half of all vessel losses were due to flooding/foundering.
- Most flooding/foundering losses occurred in moderate weather conditions.
- 40% (99) of all fatalities were due to flooding/foundering, capsize/listing or missing vessel accidents: 64% (63) of these involved vessels less than 12m in length.
    - In three cases, liferafts failed to deploy correctly and possibly contributed to six deaths.
    - Only one of the vessels was carrying an EPIRB.
    - The vast majority of fishermen killed were not wearing PFDs.

The study made a direct comparison between the requirements of the SFV Code and the Code of Practice for the Safety of Small Workboats and Pilot Boats (the Workboat Code). Although, in many ways not dissimilar to small fishing vessels, it was noted that higher safety standards had been applied to workboats. These included the need for an annual examination of the vessel by a Certifying Authority and the provision of intact and damaged stability information.

Safety culture among fishermen was discussed, with the study report emphasising the positive role owners and skippers can have in the promotion of a strong safety culture and, conversely, the detrimental effects if they show little concern for their crew members' wellbeing. It was apparent from the study that a significant proportion of fishermen had adopted *a fatalistic acceptance that safety at sea could not be improved* and had demonstrated a general reluctance to adopt well recognised safe working practices.

The UK Merchant Shipping and Fishing Vessels (Health and Safety at Work) regulations 1997 were introduced to implement EC Directive 89/391 (commonly referred to as the Health and Safety Framework Directive) and its associated subordinate directives. The study report highlighted that, as a result of the legal interpretation of the definition given for *workers*, these regulations could not be applied to vessels crewed by share fishermen.

This issue had been highlighted 9 years earlier following the fatal accident inquiry (FAI) into the loss of a crewman overboard from the fishing vessel *Annandale* on 9 February 1999. The Sherriff of Grampian, Highland and Islands of Lerwick made a determination that argued that it was a *"nonsense"* that the health and safety regulations that were intended to protect all fishermen did not apply to fishing vessels crewed by share fishermen. The FAI heard how, despite the loss of the fisherman, the vessel's crew continued to refuse to wear the PFDs provided when

carrying out similar work activities on deck. Taking into account the industry's apparent unwillingness to regulate itself, the Sherriff's determination went on to emphasise that urgent amendments to the legislation were needed.

In 2003, following the MAIB's *Amber*[20] and *Kirsteen Anne*[21] investigation reports, the MCA accepted a recommendation to:

> *Ensure the Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations apply to all vessels regardless of the contractual arrangements of the crew.*

Five years later, that recommendation had not been fulfilled, so the fishing vessel safety study recommended the MCA to:

> *Clarify the requirements of The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 to ensure that they apply in respect of all fishermen on board fishing vessels, irrespective of their contractual status.*

Again, the recommendation was accepted. However, other than clarifying that the current legal interpretation was that the regulations did not apply to share fishermen, the MCA has yet to take any further action.

The study also recommended the MCA to:

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

This recommendation was partially accepted, with the MCA undertaking to amend the SFV Code so that vessels between 12m and 15m in length will be required to carry an EPIRB.

1.19.3 Similar accidents with similar outcomes

On 17 November 2004, the 9.7m long fishing vessel *Jann Denise II* flooded and sank rapidly while returning to port, resulting in the loss of both her crew. The coastguard was unaware of the accident until another fishing vessel reported *Jann Denise II* as being overdue in harbour. The vessel did not carry either a liferaft or an EPIRB.

1.19.4 Similar accidents with different outcomes

Crimond II – capsized and foundered on 24 April 2001.

The two crew found themselves in seawater of temperature 8°C to 9°C, clinging onto various items of wreckage, including two lifebuoys and a gas bottle. More than an hour later they were rescued by helicopter, after the coastguard had received a signal from the vessel's EPIRB. Both men were taken to hospital, suffering from hypothermia, but both made a full recovery.

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[20] *Amber* - MAIB report 25/2003
http://www.maib.gov.uk/publications/investigation_reports/2003/amber.cfm

[21] *Kirsteen Anne* – MAIB report 19/2003
http://www.maib.gov.uk/publications/investigation_reports/2003/kirsteen_anne.cfm

Auriga – capsized and foundered on 30 June 2005.

This small GRP trawler capsized and sank while trying to recover her net which had a heavy object in the cod end. Fortunately, the rescue services were alerted to the incident by the automatic activation of the vessel's EPIRB. The crew of two were rescued unharmed from their liferaft by a passing container ship about an hour after the sinking.

1.19.5 Seago liferafts

On 6 August 2010, the crew of a leisure yacht were unable to manually inflate their 10-man *Seago L* liferaft during an emergency abandonment. The crew reported that they had been unable to pull the full length of the liferaft painter from the GRP canister and therefore could not activate the inflation mechanism. The liferaft, supplied to its owner by Cosalt Ltd, was recovered and returned to Cosalt's Southampton Depot where trials were conducted. The manufacturer was unable to determine the exact cause of the failure because the canister seal had been broken during the recovery and its contents disturbed. However, the investigation team did identify that the painter had become knotted and concluded that at some point the liferaft might have moved within its canister, causing it to press on the painter pocket.

This is not the first time this type of problem with a Seago liferaft had been witnessed. In 2007, the RNLI conducted a series of trials on a variety of leisure craft liferafts at its headquarters in Poole, England. During one of the immersion tests, a Seago liferaft, which had previously been serviced by a third party, failed to inflate when it was pulled under water by its fully extended painter. The liferaft was later inflated manually on the pool side, but a significant amount of force had to be applied to the painter.

SECTION 2 - ANALYSIS

2.1 AIM

The purpose of the analysis is to determine the contributory causes and circumstances of the accident as a basis for making recommendations to prevent similar accidents occurring in the future.

2.2 OVERVIEW

The investigation into the circumstances of this accident focused on two distinct areas: the foundering of the wooden fishing vessel *Purbeck Isle*, and the tragic loss of her skipper, David McFarlane, and his two crewmen, Jack Craig and Robert Prowse. In addition to explaining the factors that almost certainly contributed to the loss of *Purbeck Isle* and her crew, the underlying causes that allowed these circumstances to develop will also be discussed in this section.

As there were no survivors from *Purbeck Isle* and no other sources of primary evidence, such as eye witness accounts or emergency distress calls, to establish the exact circumstances of the events leading up to the accident, it was not possible to determine with certainty the exact cause of the foundering. However, analysis of the footage taken during the post-accident underwater explorations, together with the retrospective evidence gathered relating to the vessel's material condition and her skipper's normal working practices, allowed the investigation to establish the probable mechanism of the foundering and the likely contributory factors.

The depth and quality of the post-accident and retrospective evidence gathered by the MAIB allowed the investigation to determine, with some certainty, the reasons why the liferaft failed to deploy and inflate, and why all three lives were lost.

2.3 THE CIRCUMSTANCES ON BOARD *PURBECK ISLE* IMMEDIATELY PRIOR TO HER FOUNDERING

2.3.1 Time of the foundering

In order to help determine what caused *Purbeck Isle* to founder, it was first necessary to establish when she sank and what she was doing at that time. The mobile phone activity from the vessel on the morning of the accident and the timing of the loss of the fishermen's phone signals provided a strong indication of the time the vessel went down.

The last mobile phone communication sent from the vessel was at 0957 and the signals from all three mobile phones were lost by 1005. A text message sent to the skipper at 0958 and three subsequent phone calls made to him between 1029 and 1158 by the buyer's agent were all unanswered. Although it was fairly common for mobile phone signals to be weak or lost in the area south of Portland Bill where the skipper laid his pots during the summer, the mobile phone signals at the location of the wreck during the search and rescue operations were found to be fairly strong. Taking into account these factors, and the known timeline of events leading up to the accident, it is likely that *Purbeck Isle* sank in the morning shortly after arriving at her summer grounds at about 1000.

2.3.2 Crew activity at the time

The ROV survey established that over half a string of pots was lying in a straight line on the seabed from the deck of the vessel, over a distance of about a quarter of a mile to the north. It was therefore apparent that the crew were either shooting or hauling pots when *Purbeck Isle* sank. As the main line rope was seen to be passing through the shooting door, and there were no ropes on the hauling winch drum or block, it is likely that the crew were shooting a string of pots rather than hauling one. Further evidence to support this conclusion included:

- The propulsion gearbox was engaged ahead and the engine throttle appeared to be set at its typical shooting speed position **(Figure 26)**.

- The crew normally laid their pots from north to south.

- Taking into account the prevailing environmental conditions, it was likely that the skipper would have hauled from the north **(Figure 16)**; therefore the pots would have been lying to the south of the wreck.

The only evidence that challenged this conclusion was the fact that the shooting door was seen to be closed during the ROV survey. This might have been an indication that the crew were shooting the gear over the gunwale. However, the door was seen to be in its open position during the subsequent dive surveys, indicating that it might have been released due to the shock transmitted through the hull on impact with the seabed, and then swung to its closed position.

If, as it appears, they were shooting pots, the crew would most likely have been on the deck and the skipper in the wheelhouse at the time she went down. However, it is possible that one of the crew was sent to the engine room to reconfigure the deck wash pump if the skipper had realised that *Purbeck Isle* was taking on a lot of water.

2.3.3 Loaded condition of the vessel

Between 16 and 17 May 2012, *Purbeck Isle* shifted 19 strings of pots from her winter grounds in Lyme Bay to her summer grounds 9 miles south of Portland Bill. Assuming a similar number of pots was carried during each of the three trips made, it is likely that the vessel had between 250 and 300 pots on deck during each transit. This would have equated to a total weight of the fishing gear on deck of between 5t and 5.5t. In addition, on the morning of the accident, *Purbeck Isle* was also likely to have been carrying at least a full days' worth of catch. Taking into consideration *Purbeck Isle*'s average daily catch for May 2012, and ignoring the fact that the pots emptied the day before had been laid for 3 days and were likely to have contained a higher number of whelks than normal, it is likely that there was in excess of 1t of whelks on board.

At the time of her foundering, *Purbeck Isle* still had several strings of pots on deck. The ROV survey and subsequent divers' searches clearly showed that some of the fishing gear and many of the sacks of whelks were still lying on the deck. The majority of the gear and catch was positioned on the port side of the vessel. A total of 19½ strings of pots laid on the seabed were recovered after the accident, therefore it is likely that 5½ strings (about 245 pots) were still on board when *Purbeck Isle* sank.

Owners and skippers of potting vessels recognise that relocating gear is a particularly precarious procedure that requires great care to avoid dangerous losses in freeboard, reserve buoyancy and vessel stability. However, on a purely commercial basis, the more pots that can be carried on board during each move, the better, as it reduces the number of trips that need to be made, and thus the time and fuel spent.

There was no stability data for *Purbeck Isle* and a maximum limit had not been set for the weight of the loads she could carry. It appeared from the manner in which the skipper loaded up his vessel, and the stowing of whelks and ropes in the wheelhouse and engine compartment, that he considered space on deck to be the limiting factor rather than weight. This might be why the crew tied two strings of pots together, as this took up less room on deck because two sets of float ropes, end weights and marker buoys would have been removed. It is without doubt that, during the passage south prior to the accident and at the time of the foundering, *Purbeck Isle* was heavily loaded.

2.4 MATERIAL CONDITION OF THE VESSEL

2.4.1 Hull planks and fastenings

Purbeck Isle had been worked hard during the 18 month period prior to the accident, and had suffered several serious flooding incidents as a consequence of the loosening of her hull fastenings. During her last 6 months of operation, she had been taken out of the water on three separate occasions to allow emergency repairs to be carried out to her exterior hull below the waterline.

The dynamic forces acting on a vessel making way through a seaway induce stresses that cause the hull to twist, rack and bend. In wooden vessels, these racking stresses cause minute movement between the seams of the hull planks. If the fastenings loosen, the movement between the seams will increase to a point where water will seep through, and eventually planks will spring. It is unknown whether *Purbeck Isle*'s hull planks had ever been replaced, but it was evident that they had not been replaced in the last 25 years. It is also likely that the majority of her iron hull fasteners had been in place for the same length of time.

There are no hard rules relating to the life expectancy of a vessel's hull planks and fastenings as much depends on the quality of the wood and the construction methods used. However, once fastenings begin to corrode or the condition of the wood around them begins to deteriorate, the hull connections begin to loosen. If unaddressed, this general weakening process becomes highly progressive and the rate of deterioration increases rapidly. It was clear from the vessel's recent history that *Purbeck Isle*'s hull planking and fastenings were in an extremely poor condition. The planks along her garboard strakes and behind her pot pad were prone to excessive levels of movement, particularly in heavy seas, and many of the seams between planks had been covered by copper tingles in an attempt to make them watertight. This was almost certainly the result of a combination of badly corroded fastenings, and rot in the frames and planks.

2.4.2 The transom

The only structural damage discovered during the post-accident underwater surveys was at the stern of the vessel, where the planks on the starboard side of the transom had sprung clear of the transom frame. It was apparent from the analysis of old photographs that the upper starboard section of the transom had been repaired at least 14 years earlier **(Figure 32)**. It appears that the ends of two or three planks had been cut away and a triangular- shaped patch fitted. This area of a wooden vessel is particularly prone to rotting if rain water penetrates into the seams. Evidence of wood rot in this area could be seen in the photographs taken by the ROV **(Figure 22)**.

It is unknown whether the release of the transom planks occurred before *Purbeck Isle* foundered or as a consequence of the forces generated as she sank to the seabed. Regardless of when it happened, its occurrence was a further indication of the poor state of the hull fastenings. The fact that tingles had been fitted over the seams between the transom planks and the hull strakes further indicates that the area had been troublesome in the past.

2.4.3 The deck

In common with hull planks and fastenings, it is difficult to specify how long a wooden deck should last before it needs replacing; however, the registered owner had previously replaced the majority of *Purbeck Isle*'s deck planks after 8 years' use. At the time of the accident, the majority of *Purbeck Isle*'s deck planking was 13 years old, but the deck's plywood base and the planks around its outer edges had been in place for 21 years.

It was evident from the condition of the bulwark stanchions, the amount of bitumen that had been poured over the outer edges of the deck, and the build-up of sand and silt in the bilges, that water had been entering the machinery space from above for some time. It was also clear from the underwater footage that the vessel's three flush deck hatch covers had not been secured down, and therefore could not have been watertight. Furthermore, the manner in which the skipper had poured bitumen around the edges of the aluminium access patch at the front of the wheelhouse suggests that its joints were not watertight.

Heavy duty matting had been placed over the deck to provide extra protection, but this did not make it watertight and might have promoted the deterioration process. In any event, it is clear that the deck was in a very poor condition, it was porous and it needed to be replaced.

2.4.4 The bilge system

Had all three of the vessel's electric bilge pumps been operable at the time of the accident, the bilge system might, depending on the diameter of its discharge pipework, have been capable of removing up to 15t of water an hour. In addition, the deck wash pump could have been used to assist with the removal of bilge water. The emergency hand-operated pump could not have been used because it had not been maintained in an operable state. The condition of the main bilge system at the time of the accident was unknown, but the crew had experienced problems

in the past, particularly as a result of the build-up of sand and silt (picked up from the seabed with the whelk pots) that had entered the machinery space through the vessel's porous deck.

A vessel should be designed and maintained in a manner that provides a good level of watertight integrity. Bilge systems are necessary to remove water that has built up within the vessel's watertight spaces slowly over time, or as a result of an unexpected system failure or breach of the external boundary. However, the skipper and his crew were heavily reliant on the serviceability of *Purbeck Isle*'s bilge system to keep her afloat. The potential consequence of bilge pump failures was clearly demonstrated when the vessel was almost lost during the previous potting season on 3 January 2011 (Paragraph 1.19.1).

2.5 THE CAUSE OF THE FOUNDERING

As there was no distress transmission from the vessel, and it was apparent that the crew did not have the time to manually launch the liferaft or collect and don their lifejackets, it is likely that *Purbeck Isle* foundered very suddenly, with little or no warning. It was possible that, similar to previous incidents, she had been taking on water for some time, and the level was being controlled by the bilge and/or deck wash pumps to a point where the situation suddenly deteriorated. However, the skipper and crew did not mention any such problems during the morning of the accident in their mobile phone and VHF radio communications.

The possible scenarios considered for the loss of *Purbeck Isle* during the analysis process included:

- Collision with another vessel
- Loss of stability due to snagging of gear
- Flooding due to hull failure
- Downflooding through the deck
- Internal flooding due to pipe failures
- Loss of stability due to overloading.

There was no evidence to suggest *Purbeck Isle* had been in collision with another vessel. Other than the springing of the transom planks, there was no other visible damage to the vessel's hull. Analysis of the radar data recovered from the voyage data recorders of two merchant vessels on passage south-east of Portland on the morning of the accident, indicated that no other vessels were operating in the area of the foundering at around 1000. The skipper's summer grounds were located in a designated submarine exercise area, but no submarines were operating there on 17 May 2012. Therefore, the sudden nature of the foundering points to rapid flooding as a result of either a catastrophic hull failure, swamping over her deck, or capsize due to loss of stability.

The fact that some of *Purbeck Isle*'s fishing gear and a large amount of catch was still on the deck when the vessel was lying on the seabed indicates that she was likely to have sunk bodily. If she had listed over, corkscrewed, or partially capsized prior to her sinking, it is likely, taking into consideration the distribution of the items on deck, she would have gone over to port.

Although the local sea conditions might have been choppy, and the vessel was heavily loaded, it is less likely that either of these two conditions alone could have been the direct cause of the sinking. *Purbeck Isle'*s previous skippers and crew had considered her to be a good sea-keeping boat, and in the past she had encountered worse weather while equally heavily loaded.

However, it is likely that both the local sea conditions and her loaded state were significant contributory factors in her loss. Her loaded condition would have increased the racking stresses placed on the hull and its fastenings and would have reduced her freeboard and reserve buoyancy. With *Purbeck Isle* sitting deeper in the water, the rate of ingress would have been increased and the amount of water required to take her down reduced.

Taking into consideration the material condition of *Purbeck Isle*, her recent history and her loaded condition, the most likely cause of her sinking was rapid flooding resulting from the loosening or springing of one or more of the hull planks due to the racking stresses acting on her hull in the choppy sea conditions 9 miles south of Portland Bill. It is equally likely that the failure of fastenings attaching the transom, the temporary repair to the short plank behind the pot pad, or a single garboard plank, would have been sufficient to cause the vessel to founder very rapidly.

Whatever the route of the water ingress, the prominent causal factor was almost certainly the poor material condition of the vessel's hull.

2.6 LOSS OF LIFE

2.6.1 Survivability

The autopsies carried out on David McFarlane and Jack Craig were unable to determine the precise cause of their deaths. People who enter cold sea water in these types of emergency situations often either drown very quickly due to the effects of cold water shock, or over a period of time due to the intake of water in turbulent seas. If they do not succumb to drowning, their body's core temperature drops to a point where vital organs begin to fail due to the onset of severe hypothermia.

It is difficult to estimate with any accuracy the likely survival times for people immersed in water as there are many uncertainties. However, the temperature of the sea water is the key factor that will influence a person's survival time. Other factors include a person's physical build, the type of clothing worn, the sea state, the person's activity in the water (swimming or treading water), and the person's general health and will to survive.

A significant amount of research has been carried out to help agencies, such as the coastguard, estimate the likely survival times of people immersed in cold water. According to the guidance data issued to the UK coastguard at the time of the accident, the expected survival time for 99% of people immersed in sea temperatures of 11ºC was no more than 4 hours.

2.6.2 Personal flotation devices

David McFarlane and Jack Craig were not wearing PFDs when their bodies were recovered from the sea, and it is likely that all three men were not wearing PFDs when *Purbeck Isle* sank. The lifejacket recovered from the seabed by an angler 5 months after the accident was negatively buoyant and it was probably carried clear of the damaged wreck by the strong underwater currents. The skipper and crew did not have PFDs for working on deck, and the speed at which the vessel sank probably meant they did not get the opportunity to collect their emergency lifejackets from the engine compartment.

It is likely that David McFarlane, with the buoyant support of the vessel's lifebuoys, survived on the surface for several hours before succumbing to the effects of the cold water. However, without the support of a PFD or other buoyant object it is likely the survival times for Jack Craig and Robert Prowse would have been measured in minutes rather than hours.

2.6.3 Failure of the liferaft to deploy and inflate

Purbeck Isle's liferaft canister was clearly seen lying unopened on the deck of the wreck during the ROV survey and the initial divers' search **(Figures 23** and **28)**. The video footage taken during the underwater explorations also showed that its hydrostatic release mechanism had activated and the unit's blade had cut through the white strong rope **(Figure 27)**.

However, it was also clear that the red weak link on the HRU had not been broken and the liferaft's painter line was not attached to it. At the time of the ROV survey, the liferaft canister was not trapped or entangled within the fishing gear, and was free to move or float. Therefore, it was apparent that it had become negatively buoyant.

It was evident from the analysis of photographs taken prior to the accident that the liferaft had previously been stowed upside down on the wheelhouse roof, and that additional lashings had been used to secure it in its cradle **(Figure 19)**. It was also apparent from the underwater video footage that those additional lashings were still in place at the time of the accident **(Figures 27** and **30)**.

Figure 33 is an illustration of how the liferaft was probably secured to the wheelhouse roof and the likely sequence of events that led to its failure to float free of *Purbeck Isle* and inflate as she sank.

1. The liferaft was laid upside down on top of a rubber mat in its wooden cradle.

2. The liferaft's main securing rope was lashed to a steel eyelet screwed in the wheelhouse roof at one end, and directly to the strong eye of the HRU on the other.

3. Black twine was wound around the rubber mat and the liferaft canister.

4. An additional length of rope, secured to the outboard side of the forward cradle bracket, had been fed around the front of the liferaft canister and tied to the shackle that secured the HRU to the wheelhouse roof.

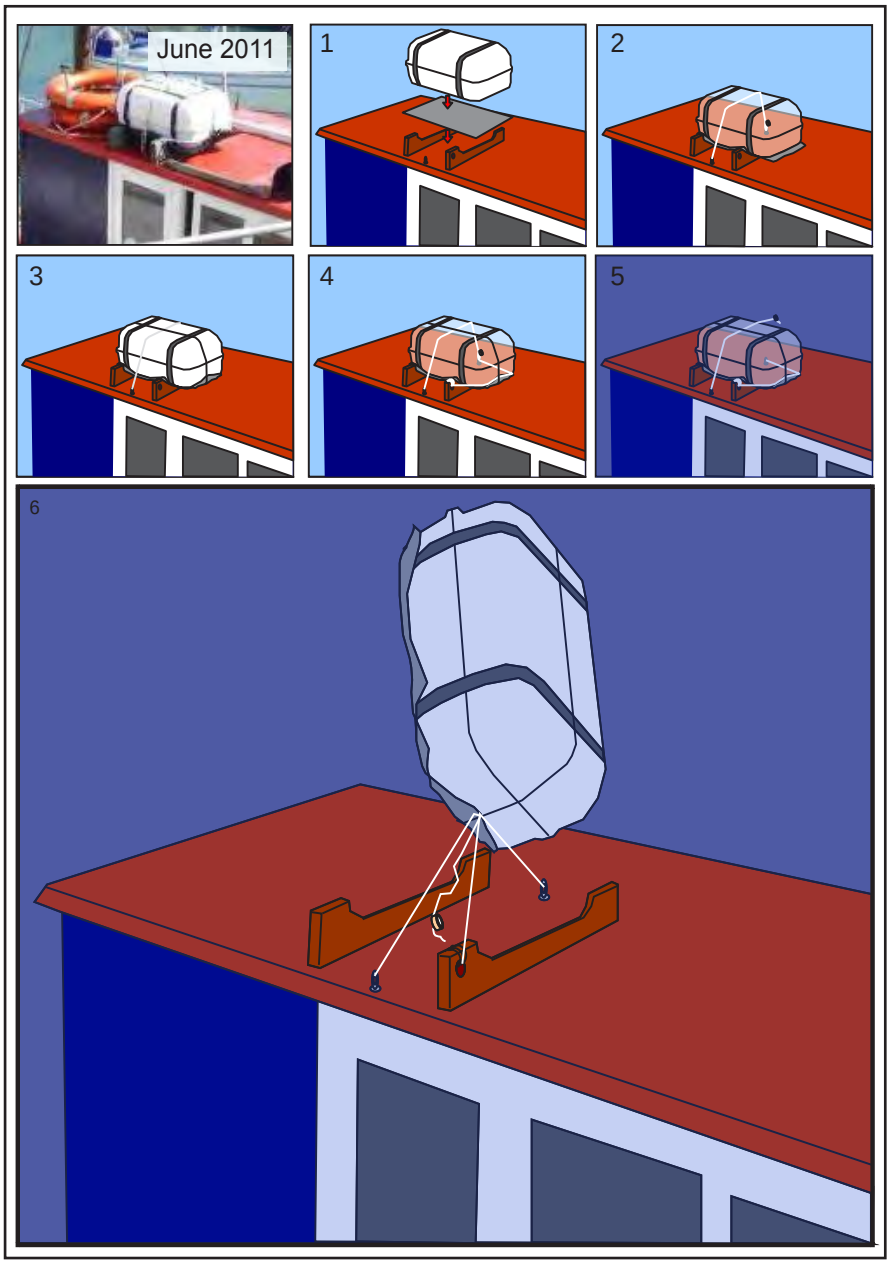

Figure 33: Likely sequence of events leading to failure of the liferaft float free

5. As *Purbeck Isle* sank, the hydrostatic release mechanism activated and released the liferaft canister.

6. Due to the additional lashings being intertwined with the main securing rope, the liferaft was prevented from floating free and sank to the seabed with the vessel.

7. Over time, the liferaft probably worked free in the underwater currents, and was released. However, as the canister was likely to be full of water by this time, it had become negatively buoyant and sank to the deck.

Stowing the liferaft upside down would have prevented any water that might have built up in the canister from draining away. This would have reduced the canister's inherent buoyancy, and possibly led to a deterioration in the condition of the liferaft itself.

Had the liferaft floated free as the vessel sank, it would not have inflated automatically because its painter had not been attached to the red weak link.

Furthermore, had the liferaft floated free and the painter been attached, it is possible that it would not have inflated properly anyway because of the additional binding that had been wrapped around the two halves of the canister.

It is apparent that the liferaft failed to deploy and inflate because it had not been secured correctly to the vessel on the day of the accident. Had the liferaft been rigged correctly it is entirely possible that all three fishermen would have survived. However, their chances of successfully swimming to and boarding the liferaft in the prevailing sea conditions would have been significantly improved had they been wearing PFDs.

2.6.4 Raising the alarm

The skipper and his crew were unable to broadcast a "Mayday" call prior to the vessel going down, and because *Purbeck Isle* was not fitted with an EPIRB or any other type of automatic distress signalling device, the alarm was not raised until 6½ hours after she sank. When the coastguard was alerted to the fact that the vessel was overdue, the lack of clear information relating to the time at which she might have got into trouble and her likely location, adversely affected the search and rescue efforts.

If *Purbeck Isle*'s VHF radio had been fitted with a DSC function, the likelihood of the crew being able to raise the alarm prior to abandoning the vessel would have been increased significantly as the pressing of a single button would have instigated the transmission of a distress call. However, it was apparent that the situation had developed so rapidly that the skipper did not have time to pull the engine out of gear before entering the water. Had *Purbeck Isle* carried a float free EPIRB, and had it been maintained in an operable state, her crew's chances of survival once they had entered the water would have been increased markedly. The coastguard would have been alerted to the emergency situation almost immediately, and as the vessel's position when she sank would have been known the rescue operation would have been initiated promptly and the search area minimised.

Had the alarm been raised immediately and *Purbeck Isle*'s position been known, it was likely that the skipper would have survived as he was being supported in the water by the lifebuoys. It was also possible that, had one or both of the crew been able to share the lifebuoys with the skipper, or find some other buoyant device to support them, they too would have had a good chance of being recovered alive. However, without the support of a PFD their chances of survival would have been extremely low, even if *Purbeck Isle* had been fitted with an EPIRB.

2.7 LSA REQUIREMENTS

2.7.1 Liferaft standards

The *Seago G Offshore* liferaft had not been designed to meet the standards set out in ISO 9650. It was deliberately aimed at the low budget end of the small leisure craft market. The materials used in the manufacture of the *Seago G* liferaft were not of the standard stipulated in ISO 9560 part 3 and the raft's water pockets were smaller than those required to meet the ISO standards. The liferaft would have provided a reduced level of buoyancy and would have been less stable in a seaway than either its SOLAS or ISO compliant equivalents. Furthermore, it was not designed to be stowed or inflated in ambient temperatures below 0ºC.

In accordance with the guidance set out in the ISO standard, liferaft manufacturers and vendors should clearly explain to their customers what standard of liferaft they require. Although Seago did not intend its leisure liferafts to be used on board a commercial vessel such as *Purbeck Isle*, it was evident from the MAIB's post-accident survey in Weymouth Harbour (Paragraph 1.18.3) that other owners were carrying them. It might be that some of the vessel owners' liferaft selections were financially motivated. However, it is likely that many would not have been fully aware of the differing standards applied to the design and performance of liferafts, and the potential consequences of carrying an inappropriate type.

The selection of an appropriate liferaft for use on board small craft is complicated by the fact that there are no SOLAS-compliant 4-person liferafts, and the only other internationally-recognised standard is the one that applies to small leisure craft. Despite this, it is clear that the *Seago G Offshore* liferaft was not suitable for use on board a commercial fishing vessel operating off the south coast of the UK, not least because air temperatures will regularly drop below 0° during the winter months.

The onus should be on owners to ensure that appropriate LSA is fitted to their vessels. However, it was apparent that commercial fishing vessel owners were able to purchase or hire liferafts that were not fit for purpose from established companies, such as Survitec, and carry them on board their vessels without intervention from the regulator. Taking these factors into account, there is a compelling case for appropriate minimum standards to be set for the liferafts mandated in the SFV Code. It is also apparent that Survitec needs to review its procedures to ensure that its customers are given appropriate advice.

2.7.2 The carriage of emergency position indicating radio beacons

In 2008, the MAIB's fishing vessel safety study recommended that the MCA introduce a requirement for all under 15m vessels to carry EPIRBs. This was a significant recommendation that, if implemented, would have financially affected

hundreds, if not thousands, of commercial fishing vessel owners. However, the study identified the significance of the improvements this would bring to the safety of life at sea of those who work on small commercial fishing vessels.

The cost of an EPIRB has dropped significantly over recent years, with float-free models readily available from about £400. Some owners of under 15m fishing vessels had taken advantage of the grants available from the MMO for non-mandatory safety equipment to purchase EPIRBs and other similar electronic radio transmitting devices. Had the owners of *Purbeck Isle* applied for such a grant, they could have purchased a float-free EPIRB at a cost of less than £300.

The MCA partially accepted the recommendation contained in the fishing vessel safety study and undertook to amend the SFV Code to reintroduce a requirement for vessels between 12m and 15m in length to carry EPIRBs. However, if this undertaking had been implemented prior to the accident, *Purbeck Isle* would still not have been required to carry one as she was less than 12m long. There is little doubt that lives could have been saved had an EPIRB been carried on board *Purbeck Isle*, and the loss of her skipper and his two crew add further weight to the intent of the 2008 recommendation.

2.8 UNDERLYING FACTORS

2.8.1 Financial pressures

It was apparent that for some time David McFarlane had been keen to own and skipper his own fishing boat, but had been unable to secure the funds necessary to purchase a suitable vessel and fishing licence outright. The offer made by the registered owner of *Purbeck Isle* allowed him the opportunity to fulfil his ambition. *Purbeck Isle* was over 50 years old when David McFarlane took over her operation and, as stated by an insurance surveyor 13 years earlier (Paragraph 1.8.3), she was the type of vessel that needed constant maintenance.

Whelks were in plentiful supply and, as they attracted a good steady price, David McFarlane had been able to employ two crewmen on a regular basis and pay off about 75% of his debt to *Purbeck Isle*'s registered owner. However, the pressures of trying to complete the purchase of the boat and licence over the agreed 2 to 3 year period were at odds with the funds needed for the level of maintenance required on *Purbeck Isle*. As a result, it was apparent that the levels of risk the skipper was prepared to take to operate his vessel had increased.

Time and money had been spent on the material upkeep of *Purbeck Isle* during the 18-month period prior to the accident. However, the repairs carried out were more reactive than proactive. The repairs were often of a temporary nature and were designed to address the symptoms rather than to resolve the causes of the problems being experienced. As a minimum, to make *Purbeck Isle* watertight, her hull needed to be completely refastened, re-caulked and re-stopped, and her deck needed to be replaced. The evidence suggests that even more extensive work might have been needed to make her seaworthy, and it is likely that it would not have been commercially viable to do this.

2.8.2 Safety culture

David McFarlane was known as a hard working fisherman, but he also had a reputation for taking a fearless approach to his potting activities. Such a fearless approach can lead to a culture of unnecessary risk taking, and this appeared to have been the case on board *Purbeck Isle*. The decision to not carry out the permanent repairs to the hull recommended by the boatyard 7 months earlier, and the decision to load the vessel so heavily on the day of the accident, were unwise and were probably influenced by financial pressures. However, the decisions to lash down the liferaft, store the lifejackets in the machinery compartment where they were not readily accessible, and not provide or use PFDs while shooting gear, demonstrated an irresponsible approach to safety. This is particularly apparent when viewed in the context of the number of warnings presented by the vessel's recent flooding incidents.

Safety culture defines the ways in which safety is managed on board a vessel and is reflected in the shared attitudes, beliefs, perceptions and values of the crew in relation to safety. Safety culture can be difficult to measure or quantify, however it can be summed up as "*the way we do things on board here*". Owners and skippers have the pivotal role of embedding and driving a strong safety culture among their crews. If they do not portray a positive approach towards safety management, then it is likely their crew will adopt similar attitudes, and a poor safety culture will result.

It was clear from the way that *Purbeck Isle* was operated that safety was not a priority and was not promoted. Previous crew members, who had served on board other local potting vessels that had reputations for promoting a stronger safety culture, were aware of many of the shortcomings discussed in this report. However, they were still prepared to go to sea and work on board *Purbeck Isle*. This willingness to accept the working practices adopted on board might have been influenced by the need to earn money, but most of these previous crew members were experienced fishermen who had attended all the mandatory safety courses and were fully aware of the risks involved. This serves as a strong example of how easy it is for the crew of a vessel to willingly adopt similar attitudes and values to those of their skippers. In this case, the skipper's apparent disregard for his own personal safety had encouraged unnecessary risk taking and a weak safety culture on board *Purbeck Isle*.

2.8.3 Occupational health and safety management obligations

On land, the UK's Health and Safety at Work Act 1974 places a general duty on employers to ensure, so far as is reasonably practicable, the health, safety and welfare at work of all employees and anybody else who might be affected by their activities. In accordance with the requirements set out in the EU Health and Safety Framework Directive, the UK's overarching shore-based legislation, and its subordinate regulations, were also applied to the self-employed. The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 were implemented in an attempt to emulate the shore-based regulations and meet the requirements of the EU Directive.

The Merchant Shipping and Fishing Vessels (Health and Safety) Regulations 1997 require owners to take a risk-based approach to occupational health and safety management. Had the registered owner of *Purbeck Isle* or David McFarlane carried out even the most basic of risk assessments for the potting practices undertaken

on board, it would have been clearly apparent that there was a real risk of the crew being dragged overboard with the fishing gear. Safety harnesses and restraint lanyards can be used to reduce the likelihood of this happening. However, as a minimum control measure, PFDs should have been worn by the crew when working on deck in order to mitigate the potential fatal consequences of such a foreseeable risk.

Regardless of the more prescriptive requirements set out in the fishing vessels' codes, had the risk-based principles of The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 been applied by the registered owner of *Purbeck Isle* or David McFarlane, their general duties would have required them to ensure that PFDs had been provided for and worn by those working on deck, particularly while shooting gear with the side door open. However, due to unforeseen legal technicalities these, and all other UK maritime occupational health and safety-related regulations, were not applicable to fishing vessels crewed by share fishermen. As the Sherriff of Grampian, Highland and Islands of Lerwick determined 13 years before this accident, it is *"a nonsense"* that these regulations cannot be applied to protect young men like Jack Craig and Robert Prowse, who earned their living working in the UK's most hazardous industry.

All commercial fishermen are aware of the dangers they face on a daily basis, and the majority of owners and skippers take their general duty, to ensure the safety of their crew, extremely seriously. However, there will always be a minority who will prioritise profit over safety, and for those, the impetus of robust enforcement might be the only option. The application of the Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 and its subordinate regulations as intended can, with the support of approved codes of practice, reduce the need for increasing levels of vessel-specific prescriptive regulation while enabling robust enforcement. Therefore, the MCA should take action to implement the MAIB's previously issued, and accepted, recommendations from 2003 and 2008 to ensure that all Merchant Shipping and Fishing Vessels Health and Safety at Work Regulations apply in respect of all fishermen on board fishing vessels, irrespective of their contractual status.

2.8.4 Effectiveness of vessel inspections and surveys

In accordance with the SFV Code, the owner of *Purbeck Isle* was required to ensure and certify that the vessel had been inspected annually by a competent person, its safety equipment had been maintained and was ready for use, and a suitable and sufficient risk assessment had been carried out for the work activities undertaken on board. In addition, the vessel had to be presented to the MCA for inspection at 5-yearly intervals and immediately following any changes in ownership. The registered owner's insurance company required him to arrange for a full out of water survey to be carried out by a qualified marine surveyor at 5-yearly intervals.

The owner's statutory obligations relating to the annual self-certification process had not been met. However, prior to David McFarlane taking over the operation of the vessel in 2010, her registered owner had facilitated the periodic surveys and inspections required by both the MCA and his insurance company. During the 18-month period that David McFarlane was operating *Purbeck Isle* two unscheduled targeted inspections were carried out by MCA surveyors in response to two separate accidents in 2011.

It was apparent from the retrospective desk-top review carried out following the accident that the material condition of *Purbeck Isle* at the time she foundered was not accurately reflected in the observations made and deficiencies raised in the most recent insurance survey and MCA inspection reports. The vessel's hull planks, frames and deck were in a very poor state, and the evidence suggests that the fastenings were no longer capable of doing their job. It is clear that the surveys and inspection processes were ineffective in this case, as no concerns were raised relating to the condition of the vessel's hull, no fastenings were withdrawn for inspection, and no action was taken to address the increasing reliance on tingles and other temporary repairs. Furthermore, the unsafe manner in which the liferaft was secured to the wheelhouse roof was not indentified.

Unlike larger fishing vessels and equivalent sized workboats, there was no statutory requirement for under 15m fishing vessels to be taken out of the water for periodic hull condition surveys. This might, to a large extent, explain why *Purbeck Isle* had been allowed to continue to operate for over 15 years with a significant number of copper tingles fitted to her hull below the waterline, and why no fastenings had been withdrawn for inspection. However, the vessel was out of the water when it was inspected in January 2011. The MCA's guidance to surveyors contained no information about tingles, or advice on the actions to take if they were found on a hull. It was commonly known that tingles were temporary repairs, but it was common practice to leave them in place for many years. The withdrawal of hull fastenings can prove difficult and can cause damage to planks, so many owners prefer it not to be done. The MCA's Instructions and Guidance for the Survey of Fishing Vessels states that fastenings should only be removed for examination where there is clear evidence of problems (e.g. signs of rust, nail sickness, loose fastenings or timbers etc.) or where there is no clear evidence of examination in the past 5 years. Although there was no requirement to carry out periodic hull condition surveys on fishing vessels below 15m, it is clear that both of these criteria were met when *Purbeck Isle* was inspected out of water in January 2011.

The MCA is not currently resourced to undertake annual inspections and 5-yearly out of water surveys of all under 15m fishing vessels. However, the circumstances of this accident, and the number of other similar accidents, present a strong case for the introduction of such a regime in line with the requirements of the Workboat Code. There is also an urgent requirement for the MCA to produce and issue its surveyors with guidance on the actions they should take if tingles are found on the hulls of wooden boats.

SECTION 3 - CONCLUSIONS

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

1. *Purbeck Isle* was heavily loaded when she sank [2.3.3]

2. *Purbeck Isle* was in an extremely poor material condition:

    - The structural strength of her hull was weak, her fastenings were loose and her planking was prone to suffering excessive levels of movement, particularly in heavy seas. [2.4.1]

    - Temporary repairs had been used extensively in an attempt to prevent water entering the hull. [2.4.1]

    - Her deck was not watertight and needed to be renewed. [2.4.3]

    - The skipper and crew were heavily reliant on the bilge pumps to keep Purbeck Isle afloat. [2.4.4]

3. *Purbeck Isle*'s loaded condition was a significant contributory factor in her foundering, as this would have increased the stresses acting on the hull fastenings and reduced the vessel's level of reserve buoyancy. [2.5]

4. The most likely cause of the foundering was rapid flooding as a result of catastrophic failure of hull fasteners either in way of the hull planking or around the transom. [2.5]

5. The skipper and his crew were lost because the liferaft failed to deploy and the alarm was not raised. The liferaft failed to deploy and inflate because it had been lashed to the wheelhouse roof in a manner that had prevented it from floating free as *Purbeck Isle* sank [2.6.3]

6. Had the liferaft been fitted correctly and/or the alarm been raised, it is entirely possible that all three fishermen would have survived. However, their chances of successfully swimming to and boarding the liferaft in the prevailing sea conditions would have been significantly improved had they been wearing PFDs. [2.6.3]

7. Had a float free EPIRB been carried it is likely that some of *Purbeck Isle*'s crew would have been recovered alive. [2.7.2]

8. The vessel's skipper demonstrated an irresponsible approach to safety; he failed to learn lessons from several recent similar incidents and did little to ensure the safety of his crew. [2.8.2]

9. Contrary to its intent, the Merchant Shipping and Fishing Vessels (Health and Safety) Regulations 1997 were not applicable to fishing vessels crewed by shared fishermen. [2.8.3]

10. The inspection and survey regime undertaken in accordance with the requirements set out in the SFV Code were ineffective and did not address many of the long-standing deficiencies discussed in this report, and there is a strong case for the introduction of a survey regime in line with the requirements of the Workboat Code. [2.8.4]

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

1. The *Seago G Offshore* liferaft provided by Survitec was not suitable for use on board commercial fishing vessels operating off the UK coast. [2.7.1]

SECTION 4 - ACTION TAKEN

4.1 MAIB ACTIONS

The **MAIB** has:

- Issued a safety flyer **(Annex H)** highlighting the shortcomings in the manner in which *Purbeck Isle*'s liferaft was rigged and reminding the fishing industry of the correct methods for securing liferafts using Hammar HRUs.

- Made recommendations in its recent *Heather Anne* investigation report[22] aimed at addressing the safety issues identified in this investigation relating to the consequences of heavily loading small fishing vessels without reference to stability data.

4.2 ACTIONS TAKEN BY OTHER ORGANISATIONS

The **MCA** has:

- Provided additional guidance and instructions to its surveyors regarding the temporary status of tingle repairs and the actions to be taken when they are discovered on the hulls of wooden vessels.

Seago Yachting Ltd has:

- Upgraded the design standard of its offshore G liferafts so that they meet the minimum requirements set out in ISO 9650 Part 2.

- Inserted additional information and warnings relating to the stowage and securing of its liferafts in its revised owners' manual.

- Improved the markings and information provided on its liferaft canisters.

Survitec Group Ltd has:

- Introduced new procedures to ensure that any requests for liferafts from owners of commercial vessels are reviewed by experienced members of its sales team so that the most appropriate type can be recommended.

[22] MAIB Report No. 2/2013
http://www.maib.gov.uk/publications/investigation_reports/2013/heather_anne.cfm

SECTION 5 - RECOMMENDATIONS

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

2013/203 Take action to implement Recommendation 2008/173, issued in the MAIB's 1992-2006 Fishing Vessel Safety Study, specifically by:

- Introducing a requirement for all fishing vessels of <15m (L) overall to carry EPIRBS.
- Ensuring that the Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997 apply in respect of all fishermen on board fishing vessels, irrespective of their contractual status.

2013/204 Align its hull survey requirements for fishing vessels of <15m (L) overall with those applied to workboats under the Harmonised Small Commercial Vessels Code.

2013/205 Set minimum construction, performance and test standards for the liferafts currently mandated in MSN 1813 (F) The Fishing Vessels Code of Practice of Small Fishing Vessels, and any codes that supersede it.

Marine Accident Investigation Branch
May 2013

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

Marine Accident Report