

Report of investigation
into sinking of
fv *Tullaghmurry Lass* N246
with loss of three lives
in the Irish Sea
on 14 February 2002

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The Merchant Shipping
(Accident Reporting and Investigation)
Regulations 1999

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

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GLOSSARY OF ABBREVIATIONS

BS	-	British Standard
gt	-	gross tons
HMS	-	Her Majesty's Ship
HRU	-	Hydrostatic release unit
LPG	-	Liquefied petroleum gas
m	-	metre
MCA	-	Maritime and Coastguard Agency
MGN	-	Marine Guidance Note
mv	-	Motor vessel
PSNI	-	Police Service of Northern Ireland
ro-ro	-	Roll on – roll off
ROV	-	Remotely operated vehicle
SAR	-	Search and rescue
UTC	-	Universal co-ordinated time

SYNOPSIS



Tullaghmurry Lass was a 10.02 metre registered length fishing vessel, of wood construction, operated as a prawn trawler out of Kilkeel, Northern Ireland. At 0340 on the morning of 14 February 2002, she left Kilkeel for a day fishing trip with three people on board. One of these was a child of 8 years of age.

Efforts to contact the vessel later that morning failed, and she was not seen during the remainder of the day. Members of the owner's family alerted the coastguard to the vessel being overdue at 0439 on the morning of 15 February, and a search and rescue (SAR) operation began.

The search was unsuccessful in finding the vessel, or any of the three people on board, and all SAR operations were terminated late afternoon on 16 February.

Subsequent underwater searches for the wreck of the vessel, by the Royal Navy and Irish Navy, were unsuccessful. Following an extensive sonar search by the Irish Fisheries Protection vessel, *Ken Vickers*, the wreck of the vessel was finally found and identified on 23 March, by a team of divers from the Police Service of Northern Ireland operating from *Ken Vickers*. The position of the wreck was about 7 miles south-east of Kilkeel, in the Irish Sea.

An underwater survey by the MAIB showed that the vessel sank because she had suffered an explosion in her cabin area, which had caused catastrophic damage to her hull and wheelhouse. Although gas has been identified as the fuel for the explosion, some uncertainty remains as to the source of the gas. A leak from the vessel's own LPG system is considered most likely.

Owners and skippers of fishing vessels are recommended to heed the advice contained in MCA's MGN 192(F) on the safe use of space heaters which use LPG.

Figure 1



Port side of *Tullaghmurry Lass*

Figure 2



Starboard side of *Tullaghmurry Lass*

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF FV *TULLAGHMURRY LASS* AND ACCIDENT

Vessel details

Vessel name	:	<i>Tullaghmurry Lass</i>
Port of registry	:	Newry
Owner	:	Mr Michael Greene 7 Aughnaloopy Road Kilkeel Co Down N Ireland BT34 4HQ
Port letter and number	:	N246
Construction material	:	Wood
Year built	:	1987
Where built	:	Portavogie
Registered length	:	10.02m
Fishing type	:	Prawn trawler/mussel dredger

Accident details

Type of incident	:	Explosion/foundering
Place of incident	:	53° 59.99'N 005° 48.47'W
Date and time	:	14 February 2002, between 0500 and 0700.
Loss of life or injuries	:	Three persons missing

1.2 SEQUENCE OF EVENTS

All times quoted are UTC

Tullaghmurry Lass left Kilkeel Harbour at about 0340 on 14 February 2002. On board were two crew and the 8 year old son of the skipper. All three were members of the same family.

Other family members attempted to contact the vessel by mobile telephone at 0845. They had no response.

During the remainder of the day, further attempts were made to contact the vessel, and the skippers of other local fishing boats were asked for any reports of sightings. None was made.

Concern for the vessel's safety increased, and she was reported as being overdue to the coastguard at 0439 the following morning, 15 February, just over 24 hours after the vessel left Kilkeel. The coastguard broadcast an alert for *Tullaghmurry Lass* and began a search and rescue (SAR) operation. The first SAR unit, the Newcastle lifeboat, was called at 0508.

The category of the operation was set at "Pan Pan" at 0519.

Responses to requests to Warrenpoint, Portavogie, Ardglass and Newcastle harbours for reports of sightings of *Tullaghmurry Lass* were all negative.

Other SAR units called were rescue helicopter R116, Irish Lights tender *Granuaille*, Kilkeel inshore lifeboat and Nimrod aircraft R51, who were all on scene by 0829.

The coastguard upgraded the incident to a "Mayday" at 0939.

Between 0829 and 1659, rescue helicopter R140, Irish Fisheries Protection Vessel *Ken Vickers*, Nimrod R52, Port St Mary Lifeboat, Peel Lifeboat, Newcastle Inshore Lifeboat, Police Service of Northern Ireland (PSNI) Underwater Search Unit, Rescue Helicopter R122 and up to twenty-six local fishing vessels all joined the search.

Excepting for various breaks for refuelling and crew changes, these SAR units searched a large area of the sea off Kilkeel, including Carlingford Lough and Dundalk Bay. A coastguard team from Greenore searched the shore on the north side of Dundalk Bay. The coastline to the north east of Carlingford Lough was searched by inshore lifeboat and shore teams. In particular, searches by helicopters, and numerous fishing vessels co-ordinated by *Granuaille*, covered the fishing grounds frequented by *Tullaghmurry Lass* **Figure 3**.

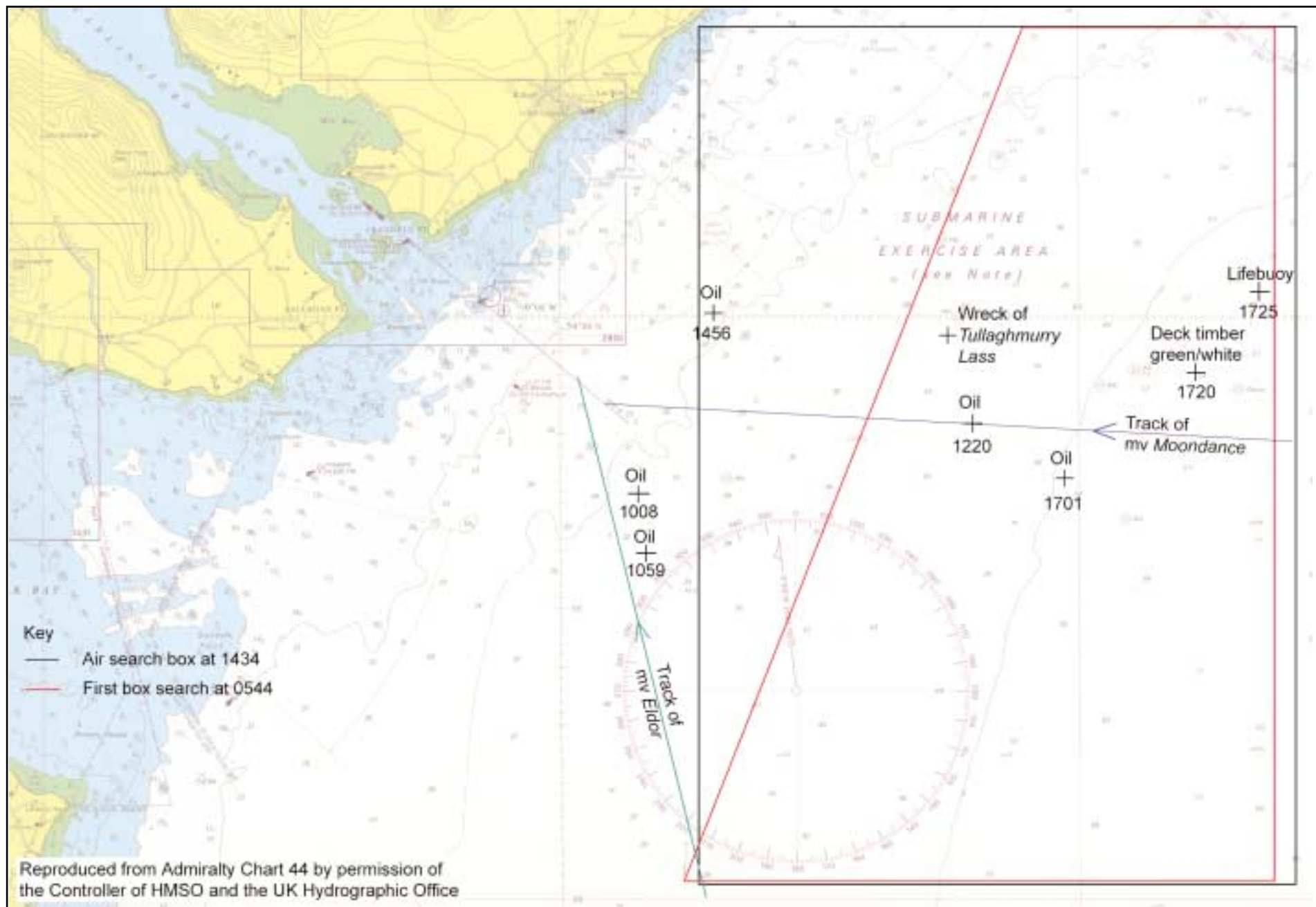


Chart extract showing the searches for *Tullaghmurry Lass* on 15 February 2002

Several sightings of diesel fuel and debris were reported. The Underwater Search Team of PSNI dived at the position of one oil slick to identify its source. The results of this dive were negative. One item of debris, a uniquely marked broom handle used for sounding fuel tanks, was positively identified as being from *Tullaghmurry Lass*.

The coastguard decided to terminate SAR operations for the day at 1800, because of darkness, and the last SAR units, the Kilkeel Inshore Lifeboat and PSNI Underwater Search Unit, were released at 1849. Several local fishing vessels remained in the search area.

A limited surface search was planned for 0800 to 1100 the following day, 16 February. Again co-ordinated by *Granuaile*, local fishing vessels searched the fishing grounds used by *Tullaghmurry Lass*. Newcastle and Clogherhead lifeboats, Newcastle and Kilkeel inshore lifeboats, Portaferry, Ardglass, and Kilkeel Inshore Rescue teams and Rescue Helicopter R140 were also involved between 0800 and 1100. However, some of these units were not released until 1727 and other local vessels continued searching.

None of these searches located *Tullaghmurry Lass*, or any significant wreckage from the vessel.

An offer of assistance from the Irish Navy was accepted, and a request was made to the Royal Navy for similar assistance in the search.

Search for the wreck

It was recognised that any further search would be for wreckage and *HMS Bridport* arrived in the Kilkeel area at 2200 on 18 February for that purpose. She was joined early the following day by the Irish naval vessel *Eithne*. Using sonar underwater detection equipment, these vessels continued searching as the weather, availability and logistical matters allowed.

Owing to other commitments, *HMS Bridport* was diverted to other tasks on 26 February but was replaced by *HMS Bangor* on 1 March, which continued with the search until 1200 on 6 March, when all search operations by the two navies were halted. Weather conditions during several days of this search were poor, and not favourable to collecting good and reliable sonar data.

These searches covered a substantial area off Kilkeel. Some seabed contacts were made by sonar, but none was considered typical of a vessel the size of *Tullaghmurry Lass*.

Following the withdrawal of the navy vessels, local vessels, and in particular the Irish Fisheries Protection Vessel *Ken Vickers*, continued the search as and when time and conditions allowed.

On 22 March, *Ken Vickers* reported she had located a sonar contact with the characteristics of a vessel the size of *Tullaghmurry Lass*. This contact was in position 53° 59.99'N 005° 48.47'W, about 7 miles SE of Kilkeel Harbour.

The following morning, a team of divers from the PSNI Underwater Search Unit embarked on *Ken Vickers* to dive on this contact for the purposes of identification. Later that day, this team confirmed that the contact was, indeed, the wreck of *Tullaghmurry Lass*.

1.3 GENERAL ARRANGEMENT OF VESSEL (Figures 1 & 2)

Tullaghmurry Lass was a fully decked wooden fishing vessel of 10.02m registered length. Her hull was divided into three main compartments by non-watertight bulkheads. The foremost compartment was the engine room, with the fish hold amidships, and cabin aft. A third division separated the cabin from a small space at the stern housing two fuel tanks and the steering gear. Doors in this division gave access to the space from the cabin.

A wheelhouse was fitted above the cabin, with access to the cabin by a hatch in the deck floor of the wheelhouse. This hatch was fitted with a non-weather-tight cover, hinged on its starboard edge, which could be latched open.

In the centre of the deck, forward of the wheelhouse, was a hatch leading to the fish hold. This was fitted with a steel hatch cover, hinged along its aft edge.

The hatch to the engine room was protected by a hood at the forward end of the deck. In the aft vertical face of the hood was a single concertina door, hinged along its port edge. Over this hatch was a gantry mast with the engine's exhaust pipe by its starboard leg.

1.4 LAYOUT OF DECK AND WORKING GEAR (Figures 4 & 5)

Sitting astride the aft end of the wheelhouse, and secured to the deck adjacent, was a gantry frame. Mounted at its top was a hydraulically-powered net drum, having its controls on the aft face of the wheelhouse, accessible from the aft working deck.

When *Tullaghmurry Lass* was not fishing, two trawl doors were normally stowed against this gantry frame, one on each side of the vessel at bulwark level.

On the centreline of the working deck, between the engine room and fish room hatches, was a two wire-drum hydraulically-powered winch. This was also fitted with two warping drums. Engagement of each wire drum with the drive motor was by dog clutches. The winch's motor was controlled with a lever on the forward part of the winch frame.

Power supply to the winch was from a hydraulic pump, driven by the main engine. This pump was engaged and disengaged by a clutch having a remote control lever just inside the engine room hatch. This lever was accessible from the deck.

The same hydraulic pump also supplied power to the net drum, on the aft gantry, and a hauler on the port bulwark. Distribution of hydraulic power supply to the desired unit was by isolating valves mounted on a manifold inside the engine room hatch, forward side.

A prawn washer was situated between the winch and the fish room hatch. To the starboard side of this, was the foot of the gilson derrick.

Just forward and starboard of the wheelhouse, was a small fish pound, formed by wooden boards retained in slotted vertical columns which were, themselves, secured to the deck.

To the port side and forward of the wheelhouse was a shelter, slightly lower than the wheelhouse, constructed of polycarbonate and plywood sheeting on tubular framing. It contained a small gutting table, lighting and seats for the crew's use, while they were gutting/processing catches.

Figure 4



The working deck, forward



Wheelhouse, gantry and shelter

1.5 CREW

Acting as the vessel's skipper was Michael Greene, who held a Deck Officer Certificate of Competency (Fishing Vessel) Class 2 by examination dated 23 November 1990.

Also on board was Edward Michael Greene, who held a Certificate of Competency – Second Hand Special by examination dated 21 March 1977.

In addition, 8 year old Michael Greene was on board for recreation.

1.6 INSPECTION OF THE WRECK

For the purpose of establishing the cause of *Tullaghmurry Lass's* sinking, an underwater survey of the wreck was performed during 26 and 29 March 2002. Poor weather prevented work on the intervening days.

The work was carried out using a small remotely operated vehicle (ROV) supplied by the MAIB, and was controlled from *Ken Vickers* as the surface support vessel. The ROV was fitted with a video camera and lights. Output from the camera was transmitted to the surface vessel via an umbilical cord, which also carried the power supply to the lights and propulsion motors of the ROV. All video output from the ROV was seen by its operator on *Ken Vickers*, allowing him to control its movements around the wreck using a joystick-type control lever. All video output was recorded.

A diving team from PSNI Underwater Search Unit also attended and, at several stages during the work, assisted with placing the ROV in enclosed compartments of the wreck, such as the cabin, engine room and fish hold. The divers also, on several occasions, used the ROV as an underwater hand-held camera, under direction of their supervisor on *Ken Vickers*. This allowed the ROV to be placed on important areas of interest more precisely than was possible under remote control, particularly where its umbilical was likely to become fouled.

Once the ROV survey was finished, the PSNI Underwater Search Unit divers recovered items from the wreck to assist with the investigation. This work started on 4 April. Poor weather prevented further work until 8 April, when the emphasis of the operation became the search and recovery of any bodies within the wreck. This objective was achieved on 12 April, when one body was recovered, and on 13 April, when two bodies were recovered. During this work it was necessary to remove debris from the cabin area of the wreck to gain access to the space. Several pieces were recovered and brought ashore for examination.

1.7 RESULTS OF THE UNDERWATER SURVEY

The sonar contact, found by *Ken Vickers* on 22 March, was identified as *Tullaghmurry Lass* by the name painted on the stern, and the port letter and number, N246, painted on the forward part of the hull.

The wreck was sitting almost upright on the sandy seabed in about 42m of water. Horizontal surfaces had a light covering of silt, but generally all external surfaces of the wreck, above the hull's turn of bilge, were accessible to the ROV's camera.

The lower blades of the propeller, and lower part of the rudder, were partly covered with sand, but neither showed any damage. The rudder was in the "midships" position.

One plank was missing from the port side of the hull about amidships, slightly above the waterline. Another plank was missing below the waterline slightly further aft. Just above the normal waterline, two further planks were sprung at their aft ends, where their fastenings had detached from the frame at the stern. The full length of the port side of the hull was examined, but no other damage was seen.

Several adjacent planks on the transom stern were missing just above the normal waterline. Other planks had been disturbed, but remained approximately in position. These missing planks exposed the two fuel tanks and steering gear. Also visible through these openings was the cabin space, showing that the aft division of the cabin was displaced. This opening in the stern was sufficient to allow the ROV to be manoeuvred into the cabin space.

The frame at the starboard quarter had failed close to the starboard fuel tank. Its uppermost portion remained attached to a section of hull and bulwark which had become detached along its aft and lower edges. Its forward edge, although fractured about level with the wheelhouse, remained attached. The steel rubbing strip had become detached over this length, and extended from the side of the wreck at an angle of about 30°.

The hull below this area of detached structure was also seriously damaged, with several lengths, of planking split and missing. The opening in the hull generated by this damage was sufficient for the ROV to be manoeuvred into the cabin.

No damage to the starboard side of the hull was seen forward of this damage.

The deck aft of the wheelhouse was seriously damaged to a degree where no deck planking remained in position. Deck beams were generally in position, but some had fractured. Forward of the wheelhouse, the deck was intact.

The wheelhouse was seriously damaged. It was displaced from its mounting, which was still in position, and its four sides had separated from each other. The remaining parts of the wheelhouse were generally forward, or to starboard of, their original position. Some contents of the wheelhouse locker remained in position, although the surrounding structure had disappeared.

The framework of the shelter to the port side of the wheelhouse was intact, as was much of its cladding. However, its door had been displaced and was on the forward deck.

Aft of the original position of the wheelhouse was the stern gantry. This showed no signs of serious damage, and the net drum at its top was intact, undamaged and full of net. The trawl doors were hanging from their chains at each side of the gantry.

The fish hatch and its coaming were in place and undamaged. The hatch cover was a few degrees from the fully closed position, sufficiently far open to see parts of buoyant fish boxes in the fish hold.

Forward of this hatch, the prawn washer was in place and undamaged, as was the gilson derrick.

Both drums of the winch were full of wire. Adjacent to the winch was at least one mussel rake loose on the deck.

The door of the engine room hatch was fully open. Neither this hatch, the gantry mast above it, nor the engine exhaust nearby, were damaged.

Manoeuvring the ROV within the engine room gave views of fish boxes normally stored in the fish hold. This indicated the engine room to the fish hold bulkhead was seriously damaged. No other damage was seen in the engine room.

Similarly, from within the fish hold, the ROV could see items also visible from the cabin. In particular, a distinctive blue metal drum and wooden framework were identified. Again, this indicated the displacement of the fish room/cabin bulkhead.

The cabin access ladder was displaced from its normal position beneath the hatch and was lying horizontally in the space. The flexible LPG pipe, and isolating cock, were also lying across the space. The large quantity of debris in the cabin, made a detailed examination of many items, difficult.

1.8 FORENSIC TESTS ON RECOVERED ITEMS

Divers of PSNI Underwater Search Unit recovered several items of bedding and clothing from the cabin of the wreck. When examined, some showed strong indications of flash-type heat damage. Nothing else of significance was noted on these items.

1.9 LPG SYSTEM, ARRANGEMENT

Tullaghmurry Lass was fitted with two gas burner hob units. One was in the wheelhouse, on the starboard side, the second was in the forward part of the cabin.

Both hobs were supplied by a single gas bottle secured by metal straps to the aft end of the wheelhouse, outside. This bottle was fitted with a standard isolating valve and pressure regulator.

Although a short length of flexible pipe connected the gas bottle to the wheelhouse hob, the remaining gas supply piping in the wheelhouse was copper. From its connection to the wheelhouse hob, the copper pipe ran down to the wheelhouse deck, skirted the cabin hatch and passed through the wheelhouse deck on the port side.

Most of the gas piping in the cabin was flexible. Part way along its length was an isolating cock, which was not secured to any part of the structure. Indeed, it appears that there were no securing arrangements for the gas piping in the cabin; it looped down, after passing through the wheelhouse deck floor, before rising into the cabin hob unit. The isolating cock was within this loop.

Neither hob had automatic ignition; matches, or similar, were needed to light the burners.

For the purpose of alerting the crew to any leakage and accumulation of LPG, a gas detector and alarm system was fitted in the wheelhouse. The switch panel of this unit was set in the control console. However, there is no record of any testing of this alarm system and, in the few months before the vessel's loss, her skipper has been noted as saying that the unit did not work.

1.10 LPG SYSTEM, OPERATION

It was the skipper's practice to close the isolating valve on the gas bottle while *Tullaghmurry Lass* was in harbour.

The cooker in the wheelhouse was normally used only while the vessel was mussel dredging. Kettles were boiled on this, in preference to the cabin's cooker, so that crew did not have to enter the cabin in their dirty working gear.

However, in cold weather it was the practice to light the cooker in the wheelhouse for space heating. On these occasions, a wheelhouse window was normally opened to maintain ventilation.

The cooker in the cabin was also used for heating during cold weather. At such times, the door on the cabin hatch was propped open for ventilation.

Of the two cookers, the one in the cabin was used the most for boiling kettles and heating food.

1.11 REQUIREMENTS AND GUIDANCE ON LPG INSTALLATIONS

The Maritime and Coastguard Agency (MCA) offers advice and recommendations in various codes of practice on the safe use of LPG. The Code applicable to fishing vessels of under-12 metre length contains no mention of the safe use of LPG.

The MCA publishes a Marine Guidance Note, MGN 192(F), directed at the owners and skippers of all fishing vessels, on the safe use of space heaters which use LPG. It contains warnings on the dangers of explosions and of carbon monoxide poisoning, and sets out the importance of fitting a gas detection and alarm system.

1.12 SEABED GEOLOGY AND METHANE GAS RELEASE

The hazards which submarine pipelines pose to fishing vessels are highlighted in the *Fisherman's Pilot for Ireland and The Irish Sea*, published by the UK Hydrographic Office. In particular, it mentions the possibility of explosion, or loss of a vessel's buoyancy, owing to gas rising to the surface from a damaged pipeline.

There are no known gas or oil pipelines close by the wreck of *Tullaghmurry Lass*.

South-east of a line about 6 miles offshore, the underlying geological structure of the seabed is one of mud known to generate methane gas. Accumulation of gas pressure may result in the containing strength of the mud being exceeded, allowing gas pockets to escape into the water column.

Where the seabed is mud, the escape of gas may result in pock marks or depressions being formed, up to 100m wide. These are easily detected by survey using side scan sonar.

However, where the seabed is overlaid with sand, no similar evidence is produced other than a depression. These depressions are smaller than the pock marks formed in mud, in the order of 10m wide, and are much more difficult to locate using side scan sonar.

Estimating the age of seabed pock marks requires visual examination, and depends on knowledge of the local rate of colonisation of seabed organisms. This data is not available for this area of the Irish Sea.

There appears to be no similar technique available to estimate the age of depressions caused by gas eruptions through sandy seabeds.

1.13 ODOUR OF LPG AND METHANE

Commercially available LPG in the UK usually complies with the standards of BS 4250 Part 1 1987. This states that, when tested by a standard method, the odour of the gas shall be distinctive and unpleasant, and the odour in a gas/air mixture shall be such that it is detectable down to a concentration of 20% of the concentration corresponding to the lower limit of flammability. An odourising agent is added to LPG to satisfy these requirements.

Methane has no smell, is colourless and is less dense than air.

1.14 LIFESAVING APPLIANCES

Tullaghmurry Lass carried a flat-pack four-person inflatable liferaft which was stowed on the roof of her wheelhouse. The canister was arranged to float free from its stowage cradle and had no securing lashings.

This liferaft was last serviced on 2 July 1999.

Also carried were two lifebuoys stowed on the shelter and wheelhouse, three or four lifejackets stowed in the engine room, and flares in the wheelhouse.

As far as can be established, the vessel carried other safety equipment in compliance with the *Safety Code for Fishing Vessels of Less than 12m length*.

1.15 SAFETY CODE FOR FISHING VESSELS OF LESS THAN 12M LENGTH (THE CODE)

For fishing vessels under 12 metres in length, the *Fishing Vessels (Safety Provisions) Rules 1975* were replaced by the *Fishing Vessels (Code of Practice for the Safety of Small Fishing Vessels) Regulations 2001*. These Regulations brought the Code into force on 1 April 2001.

This Code requires all decked fishing vessels of between 10 and 12 metres registered length to carry the following safety equipment:

- Lifejackets – 1 per person
- Liferaft
- 2 lifebuoys (1 with buoyant line attached) or 1 lifebuoy (fitted with 18m buoyant line) + 1 buoyant rescue quilt
- 3 parachute flares
- 2 hand-held flares
- 1 smoke signal (buoyant or hand-held)
- 1 fire bucket + lanyard
- 1 multi-purpose fire extinguisher (fire rating 5A/34B)
- 1 fire blanket (light duty) in galley or cooking area (if applicable)
- 1 fire pump + hose or 1 fire bucket + 1 multi-purpose fire extinguisher (fire rating 5A/34B) + 1 fixed fire extinguishing system for the machinery space
- VHF radio – fixed or hand-held
- Bilge pump
- Bilge alarm
- Navigation light & sound signals
- Compass
- Waterproof torch
- Medical kit

The Code does not require the equipment to be MCA approved, provided it is fit for its intended purpose.

The Code's guidance notes for surveyors, inspectors and fishermen states that liferafts should be either float free, fitted with an hydrostatic release unit (HRU), or stowed in a position where they are accessible for deployment in an emergency. It/they should have a capacity sufficient for the total number of persons on board.

The Code does not cover the installation or use of LPG.

1.16 KILKEEL AND THE SURROUNDING AREA

Kilkeel is a small town on the east coast of Northern Ireland, in position 54° 03'N 5° 59'W. It lies 3½ miles north-east of Carlingford Lough, south of which is the Irish Republic.

Carlingford Lough runs on a line approximately north-west to south-east. At its north-western end is Warrenpoint Harbour, an important commercial trading port.

The fishing industry is a very important part of the commercial life of Kilkeel. The harbour of Kilkeel is used almost exclusively by commercial fishing vessels, and the area immediately surrounding the wet basins is used by supporting services, such as boat repairers, fish sales people, fish processors etc.

The main area of working quays for fishing vessels in Kilkeel is the Inner Harbour. This lies approximately on a line north-west to south-east. The Inner Harbour is approached from the sea by a channel between two piers, referred to as North and South Piers. This channel is further protected by a breakwater to the east of the North Pier.

The entrance, formed between the South Pier and the breakwater, is subject to silting, particularly during periods of adverse weather from the south-west. The entrance channel also tends to suffer from silting. Indeed, Kilkeel Harbour Authorities employ a dredger full-time to maintain the entrance and channel clear.

The Inner Harbour, under normal circumstances, is part of the routine dredging programme since the area is subject to silting. However, at the time of the accident, dredging of the Inner Harbour had been suspended: pollution problems had prevented the Northern Ireland Fishing Harbour Authority from obtaining a dumping licence for sea disposal of the dredgings. A Notice to Mariners had been issued and regular hydrographic surveys of the Inner Harbour were being carried out to monitor water depths. Meanwhile, the authority was seeking a solution to the dredging problem. It made proposals to, and requested funding from, the government. The government accepted these proposals and agreed to provide funding in July 2002.

The smaller vessels berth at the north-west end of the Inner Harbour. This area partly dries out at low water, and many of these smaller vessels can move to or from their berths only during limited periods either side of high water. This, and the silting at the entrance, sometimes prompts vessels to sail earlier than would otherwise be the case. As a result, fishing vessels planning to fish only during daylight hours sometimes need to leave the harbour early and wait on their fishing grounds. This can sometimes result in a number of fishing vessels drifting on the fishing grounds off Kilkeel, waiting for daylight.

Conversely, it can lead to vessels waiting off Kilkeel until the water at the harbour entrance is sufficiently deep to make a safe entrance. On these occasions, this can result in a number of vessels lying off Kilkeel Harbour.

1.17 FISHING GROUNDS

The grounds to the east and south of Kilkeel are regularly fished by a number of the smaller fishing vessels operating from the harbour. *Tullaghmurry Lass* was one of them.

Inshore, the bottom is sandy, until about 10 miles offshore, where it is mud.

Tullaghmurry Lass's skipper probably intended to fish for prawns on the day she was lost. After reaching the fishing grounds, he was expected to have waited until dawn before shooting the gear and starting a tow. As she left harbour at 0340, and would not have expected to shoot her gear until about 0700, she would have had to wait on the grounds for a while; probably in the order of 2 hours. During this time she, and other vessels, waited with engines ticking over and drifting with the tidal stream.

1.18 TIDE AND WEATHER CONDITIONS

Times for high and low water at Kilkeel on 14 February 2002, the morning *Tullaghmurry Lass* sailed, were 0056 and 0613 respectively.

At 0500 that day, the wind was force 2 from the north, the sea was calm and visibility good.

Approximate times for nautical and civil twilight at the latitude of the wreck on 14 February 2002 were 0630 and 0712 respectively.

1.19 VESSELS IN TRANSIT

The 5881gt ro-ro cargo ferry *Moondance* operates on a regular service across the Irish Sea between Warrenpoint and Heysham. On the morning of 14 February, at 0500, this vessel was approaching Carlingford Lough on a heading of 272° True. At about 0612, she was at Hellyhunter Buoy, approaching the entrance to Carlingford Lough (**Figure 3**). This track passes about 2 miles south of the position of the wreck of *Tullaghmurry Lass*. Although they sighted several fishing vessels south-east of Kilkeel, the watchkeepers on board this vessel reported no observations of any vessel in difficulty between these times.

A second vessel is recorded as entering Carlingford Lough that morning. Shortly after 0800, the 1441gt general cargo vessel mv *Eldor* approached Hellyhunter Buoy from the south, on a heading of 347°. The closest point of approach of this track to the wreck of *Tullaghmurry Lass* is 6 miles (**Figure 3**).

Another vessel, of about 60 metres length, was sighted at 0430 about 2 miles east of Kilkeel. At the time of sighting, she appeared to be hove-to. However, 30 minutes later she was seen heading south. This vessel has not been identified.

SECTION 2 - ANALYSIS

2.1 AIM OF ANALYSIS

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

2.2 ACTIVITY OF *TULLAGHMURRY LASS* AT TIME OF SINKING

The underwater survey of the wreck showed that the vessel's trawl doors were in their stowed position. The net drum was also full of net, and the wire drums on the winch were full of wire. The state of these three key pieces of equipment clearly shows that the vessel was not fishing at the time of her loss.

When in use, fishing gear can generate a substantial and often catastrophic heeling moment on a vessel, particularly when the gear becomes snagged on a seabed fastener. This effect has caused the capsize and subsequent loss of many fishing vessels.

As none of this gear was in use at the time of the accident, the possibility that the fishing gear contributed to the vessel's loss is dismissed.

2.3 VESSEL BEHAVIOUR AT TIME OF SINKING

MAIB records show that even when a vessel capsizes and sinks, she invariably rotates while sinking so that she sits on the seabed in, or very close to, the upright position. Thus, the upright condition of the wreck of *Tullaghmurry Lass* is not seen as significant in establishing whether she capsized.

Although fishing gear induced loads have been ruled out as a cause for the capsize of *Tullaghmurry Lass*, any vessel may capsize due to other mechanisms. Again, records show that numerous vessels have been affected by ingress of sea water, resulting in a reduction in stability and, ultimately, capsize.

It has been impossible to establish whether this vessel was having problems controlling bilge water levels in the period between leaving Kilkeel and the time of her loss. Thus, notwithstanding a history free of this type of problem, the possibility of gradual water ingress cannot be dismissed.

However, any problems of this type that might have occurred were not sufficient to cause *Tullaghmurry Lass* to capsize. This is evident from the state of several pieces of the vessel's equipment sighted during the underwater survey.

These are:-

Tyre fenders all remain outboard of the bulwarks

On the 'high side' of a capsized vessel, at least some of these fenders would be expected to have swung over the bulwark rail as the vessel rolled over. These would then be seen on her deck during an underwater survey.

A mussel rake remaining in position on the forward deck

This rake was seen on the starboard side of the deck, abeam of the winch, and appeared not to be secured in place. Again, had *Tullaghmurry Lass* capsized, this rake could have been expected to have fallen to the seabed.

Loose, small items of equipment in wheelhouse cupboard

These items were found sitting on what is assumed to be the bottom of the locker. The original top, three sides, and the door of the locker are missing. Assuming this damage was caused before the vessel left the surface, with no retaining barriers, any capsized vessel would be expected to cause these items to slide.

For these reasons, it is concluded that the vessel did not capsize, nor did she move far from the upright position as she sank.

2.4 VESSEL'S CONTACT WITH SEABED

Without the effects of watertight internal bulkheads, the degree of initial flooding would have been total, and the remaining buoyancy minimal. Insufficient air was trapped in any compartment to offer any significant buoyancy, all were open to the sea. Only a small level of inherent buoyancy, and a degree of drag, would have been present to limit the speed with which the vessel hit the seabed.

Damage found on the wreck was much more severe than has ever been found as a result of a vessel hitting the seabed, particularly a soft sandy bottom as found in the area of the wreck. The damage was concentrated aft, suggesting an impact with the seabed in that area, possibly to the stern frame, propeller or rudder. None of these fittings showed any damage.

Whatever the intensity of the vessel's impact with the seabed, some disturbance of her structure or equipment might have occurred. The degree of damage caused in this way cannot be quantified, but is judged as insignificant in comparison to the level of damage seen during the survey.

2.5 NATURE OF VESSEL DAMAGE

Three characteristics of the vessel's damage are worth noting: the degree to which it is concentrated around the cabin area; the outward displacement of structure from the cabin; and the catastrophic level of damage.

The degree and position of the damage suggests a large amount of destructive energy was released in the region of the cabin and wheelhouse. The outward movement of parts, particularly the aft deck and starboard part of the hull, suggests the energy release was in the form of forces radiating from the cabin space. This is clear evidence of an explosion.

The bulkheads of the vessel also suffered dramatically. Both bulkheads between the cabin and fish room, and between fish room and engine room, were destroyed. This might have been caused by the same mechanism that resulted in the damage to the hull and deck aft. It is also possible that it was at least partly the result of the sudden inrush of water, from the cabin towards the bows, as the vessel flooded and left the surface.

Whatever the cause of bulkhead destruction, their loss indicates that *Tullaghmurry Lass* flooded very rapidly once the hull's watertight integrity, in way of the cabin, had been lost.

2.6 CAUSE OF VESSEL DAMAGE

The possible involvement of another vessel in the sinking of *Tullaghmurry Lass* was considered from the earliest stages of this investigation.

Before the wreck of *Tullaghmurry Lass* was discovered and identified, merchant vessels, known to be in the Kilkeel area at the assumed time of her sinking, were boarded and their crews questioned. Samples of paint were also taken from the hulls of these vessels, particularly from areas of scuffing and minor damage.

The tracks followed by these vessels were plotted and, once the wreck of *Tullaghmurry Lass* was found, compared to her position.

The vessel which came nearest to the wreck site was the ro-ro cargo ferry *Moondance*. Her closest approach was about 2 miles.

In considering the significance of this distance, it is recognised that *Tullaghmurry Lass* sank very rapidly. Thus, she could not have moved far, owing to the effect of tidal stream or otherwise, from the position where she suffered damage. Certainly, she could not have drifted the 2 miles, while sinking, to her position on the seabed, if the damage had been caused by contact with *Moondance*.

A similar argument applies to the general cargo vessel *Eldor*, which had a closest point of approach to the wreck position of about 6 miles. The possible involvement of either of these vessels in the loss of *Tullaghmurry Lass* is thus dismissed.

Tests on the paint samples taken from these two vessels gave no evidence to challenge this conclusion.

A third vessel was seen in the general area, although it has not been identified. Her course cannot be compared to the position of the wreck, so her involvement cannot be considered in the same way as above.

However, consideration of the damage to *Tullaghmurry Lass*, suggests it was not caused by a collision. In particular, contact with another vessel, sufficient to cause serious damage to the cabin and wheelhouse, would be expected also to seriously damage the aft gantry, which was positioned between the two. The gantry showed no damage.

2.7 FUEL FOR EXPLOSION

Consideration of the damage sustained by *Tullaghmurry Lass* has suggested it was caused by an explosion. This is supported by forensic examination of material recovered from the cabin of the wreck.

It is known that she carried no significant quantities of flammable material, other than diesel fuel and LPG.

Diesel fuel typically has a flash point in excess of 60°C, making it unable to generate a flammable vapour at normal ambient temperature. At the temperatures normally found in the fuel tanks and systems of diesel engines, this temperature would never be reached while the fuel was exposed to the atmosphere. No mixture of diesel oil vapour and air could thus be generated. The involvement of diesel fuel in this explosion can, therefore, be safely disregarded.

In the absence of any indication that any type of explosive substance was involved, only gas remains as the fuel for an explosion. The most obvious likely culprit is the LPG carried for cooking.

Records show that leakage of vapourised LPG can be the cause of explosions on any type of vessel where it is used. Because the gas is heavier than air, a leakage of gas seeps into the lower parts of a vessel's hull. In the absence of positive ventilation, the gas remains, or even accumulates, until a source of ignition is encountered. The results are always catastrophic.

Leakage of LPG can normally be detected in one of two ways; an electronic gas detector or smell.

Tullaghmurry Lass was fitted with a gas detector mounted in the wheelhouse instrument console. It is not known whether this unit served both the wheelhouse and the cabin, with a sensor in each space. However, whether or not each space had a sensor, it is likely that this unit was not functioning during the last months of the vessel's service and, therefore, unable to sound to indicate a gas leakage.

The degree of damage caused to the cabin and wheelhouse has made it impossible to locate the site of any likely leakage from the LPG system. Much of the gas system which has been found, has clearly been damaged by the explosion, so any conclusion based on an assessment of its condition may be uncertain. However, it is clear that the gas installation did not comply with the best practice set out in advice given by the Maritime and Coastguard Agency and others.

Another possible source of gas, in this area of the Irish Sea, is the seabed, which is known to be capable of discharging methane gas. It has been suggested that a cloud of methane released from the seabed could have enveloped *Tullaghmurry Lass* and been drawn into her cabin.

In considering this suggestion, it is recognised that methane, being less dense than air, would have risen clear of the sea surface, and could not have drifted a significant distance over the surface. Thus, to become engulfed in such a gas cloud, *Tullaghmurry Lass* needed to be immediately adjacent to the position where the gas broke the surface of the sea.

Existing survey techniques, and level of knowledge, do not allow a reliable conclusion to be reached as to the possibility of a recent release of seabed methane in the vicinity of *Tullaghmurry Lass*. For this reason, the MAIB carried out no seabed survey of the area.

Because of the seabed's geology, and that lack of quantitative data, the probability that seabed methane was the fuel for the explosion cannot be assessed. However, this possibility cannot be completely dismissed although the combination of circumstances required for it to have occurred might be seen as very remarkable.

On balance, therefore, it is considered most likely that the gas involved in the explosion came from the vessel's own LPG system.

2.8 GAS DETECTION

All advice offered to the users of LPG systems at sea include the provision of a gas detecting and alarm system. It is likely that the alarm system fitted to *Tullaghmurry Lass* was not operational at the time of her loss.

However, odour is the other important means of detecting LPG leaks. Most people who regularly use LPG are aware of the smell it emits, even from small leaks. This is readily apparent when, for example, gas bottles are changed.

It is reasonable to expect that the two adults on *Tullaghmurry Lass*, both experienced fishermen and users of LPG, would have recognised the smell caused by a leak of gas. However, a fishing vessel has other odours from her catch, bilge water, diesel oil etc which, to a degree, might combine to mask the odour of LPG. This reduces the reliability of smell alone in detecting system leaks. It may also partially explain why a leak could have gone undetected, or at the very least, escaped detection for a time.

No similar strong smell is associated with methane gas. If the vessel was unfortunate enough to have been shrouded by a cloud of methane gas, nobody on board could have detected it by smell alone. The gas detection and alarm system would, however, be expected to be activated by methane as well as LPG. Thus, a working alarm system could have alerted the crew to a problem of gas and a potentially dangerous condition, but they would not have known the origin of the gas, and could have done little more to protect themselves, other than to extinguish all naked flames. Even this would have required quick reactions and prompt action.

2.9 TIME OF SINKING

The condition of the vessel's fishing gear indicates that *Tullaghmurry Lass* had not started fishing at the time of her loss.

It is known she left Kilkeel at about 0340 on the morning of 14 February. As her skipper probably did not expect to start fishing until the onset of daylight, she probably steamed slowly to her chosen fishing grounds. She was found about 7 miles from Kilkeel and, assuming she made about 5 or 6 knots, this would have taken her about 1¼ hours; to about 0500.

Assuming the onset of daylight was between nautical and civil twilight for that latitude, the skipper was not expected to start fishing until some time between 0630 to 0715.

Tullaghmurry Lass was thus likely to have been waiting on the fishing grounds for about 2 hours before her planned start of fishing operations. It is likely that it was during this period that the vessel sank, that is between 0500 and 0700.

Although several other local fishing vessels had also left Kilkeel that morning, and were also waiting on same fishing grounds for daylight, none recall seeing *Tullaghmurry Lass* during these 2 hours. This is not particularly remarkable, as it was dark and all these vessels were simply drifting, waiting for daylight, but neither was she seen after 0700 when the light began to improve.

It is thus concluded that *Tullaghmurry Lass* sank some time between 0500 and 0700 on 14 February 2002.

2.10 POSITION OF SINKING

On several occasions following capsizes, flooding or collision, fishing vessels have been known to remain on the surface and to drift considerable distances before finally sinking. In all of these cases, the necessary buoyancy to remain at the surface has been provided by air trapped within the hull or other enclosed spaces.

All three main compartments of *Tullaghmurry Lass* were fitted with hatches, the cover or doors to which were found open during the underwater survey. Thus, the only way in which significant quantities of air could have been trapped in the vessel is if she had capsized and inverted, trapping air beneath the hull.

The possibility of capsizes has already been considered and dismissed. It follows that the vessel could not have drifted any significant distance between being damaged and striking the seabed. It further follows that the latitude and longitude of the wreck on the seabed, 53° 59.99'N 005° 48.47'W, was her position at the time of the accident.

2.11 THE CREW

There are no statutory requirements for fishing vessels under 16.5 metres registered length to carry a person holding a certificate of competency. Nevertheless, both adults on *Tullaghmurry Lass* held a certificate of competency which allowed them to sail on fishing vessels above 16.5 metres length.

By the general standards of small fishing vessel operations, the crew of *Tullaghmurry Lass* were unusually well qualified.

2.12 POSSIBLE CREW ACTIONS

The catastrophic level of damage in the cabin area of the wreck indicates that *Tullaghmurry Lass* flooded rapidly because of water ingress through the badly damaged hull. The rate of flooding throughout the vessel was high, and was not controlled or significantly restricted by the intervening bulkheads, probably already seriously damaged by the explosion.

The rate of flooding gave the three people on board little chance of taking action to employ any lifesaving appliance, such as the liferaft, or to summon assistance using the VHF radio or flares. In these conditions, the vessel's lifesaving equipment was of no value to the crew.

SECTION 3 - CONCLUSIONS

3.1 CAUSES AND CONTRIBUTING FACTORS

1. *Tullaghmurry Lass* sank because of serious damage caused by a gas explosion centred on the cabin.
2. The vessel's gas alarm was probably not functioning at the time.
3. The *Safety Code for Fishing Vessels under 12m length* has no requirements covering gas installations used for heating and cooking.

3.2 OTHER FINDINGS

1. The damage to *Tullaghmurry Lass* was not consistent with her being in a collision.
2. The damage to the vessel caused her to flood and sink extremely rapidly, without capsizing.
3. The vessel sank too quickly for those on board to take any action to help themselves or to summon assistance.
4. Other larger vessels known to be in the area followed tracks which were at least 2 miles away from the position of sinking of *Tullaghmurry Lass*.
5. The seabed in the area of the sinking has a geological structure which generates methane gas and, occasionally and randomly, releases gas into the sea.

SECTION 4 - RECOMMENDATIONS

It is known that *Tullaghmurry Lass* sank because she suffered a gas explosion in her cabin area. The precise source of the gas cannot be established with certainty. The most likely source was from a leak in the vessel's own LPG system.

The Chief Inspector of Marine Accidents, therefore, recommends all owners and skippers of fishing vessels to:

1. Heed the advice in MCA's MGN 192(F) on the safe use of space heaters which use LPG. This contains warnings on the danger of explosions and of carbon monoxide poisoning, and sets out the importance of fitting a gas detection and alarm system.

**Marine Accident Investigation Branch
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