



## Marine Accident Report 1/98

Report of the Inspector's Inquiry  
into the sinking of the Fishing Vessel

**PESCADO PH409**

with the loss of life of all six of the crew  
in February 1991



September 1998

Marine Accident Investigation Branch  
of the Department of the Environment  
Transport and the Regions: London

Department of the Environment, Transport and the Regions  
Eland House  
Bressenden Place  
London SW1E 5DU  
Telephone 0171 890 3000  
Internet service <http://www.detr.gov.uk/>

© Crown Copyright 1998

*Copyright in the typographical arrangement and design vests in the Crown.*

*Extracts of this publication may be made for non-commercial in-house use, subject to the source being acknowledged.*

*Applications for reproduction should be made in writing to The Copyright Unit, Her Majesty's Stationery Office, St Clements House, 1-16 Colegate, Norwich NR3 1BQ.*

Further copies of this report are available from:  
The Stationery Office bookshops  
or alternatively

Department of the Environment, Transport and the Regions  
Publications Sale Centre  
Unit 21  
Goldthorpe Industrial Estate  
Goldthorpe  
Rotherham S63 9BL  
Tel: 01709 891318  
Fax: 01709 881673

ISBN 1 85112 101 3

Printed in Great Britain on material containing 75% post-consumer waste and 25% ECF pulp.  
September 1998

**Marine Accident Investigation Branch  
Department of the Environment, Transport and the Regions  
Carlton House  
Carlton Place  
Southampton SO15 2DZ**

**9 March 1998**

*The Right Honourable John Prescott MP  
Deputy Prime Minister and Secretary of State  
for the Environment, Transport and the Regions*

Sir

I have the honour to submit the report on the loss of the UK registered trawler PESCADÒ which sank with the loss of six lives while fishing off the south coast of Cornwall in February 1991.

The investigation had to be suspended between 1991 and 1997 while criminal proceedings arising from the accident, and an appeal, took place.

I have the honour to be  
Sir  
Your obedient servant

*J S Lang*

J S Lang  
Rear Admiral  
Chief Inspector of Marine Accidents

**Extract from  
The Merchant Shipping  
(Accident Reporting and Investigation)  
Regulations 1994**

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

# CONTENTS

	Page
<b>GLOSSARY OF ABBREVIATIONS</b>	<b>7</b>
<b>SYNOPSIS</b>	<b>9</b>
<b>SECTION 1 FACTUAL INFORMATION</b>	<b>10</b>
1.1    Particulars of Vessel and Incident	10
1.2    Background to the Voyage – 1956-1990	11
1.3    Background to the Voyage – Nov. 1990-25 February 1991	13
1.4    Narrative – The Incident Voyage and Subsequent Events	16
1.5    Vessel's Description and Certification Requirements	19
1.6    Personnel, Crew, their Certification and Ashore Management	22
1.7    Weather Conditions	23
1.8    PESCADO's Fishing Gear and Operation	24
1.9    Summary of the Underwater Surveys	25
1.10   Surveys of the Wreck following Salvage	28
1.11   Survey of the Vessel during Scrapping	33
<b>SECTION 2 ANALYSIS</b>	<b>34</b>
2.1    The Vessel's History	34
2.2    General Analysis of the Incident	34
2.3    Vessel's Certification Requirements	35
2.4    Crew	38
2.5    Fishing Operations	40
2.6    Surveys of Wreck Underwater and in Dry Dock	41
2.7    Possible Failure/Loss Scenarios	47
2.8    MAIB Reconstruction of the Accident	53
<b>SECTION 3 CONCLUSIONS</b>	<b>64</b>
3.1    Findings	64
3.2    Causes	67
<b>SECTION 4 SAFETY RECOMMENDATIONS</b>	<b>68</b>
4.1    Safety Recommendations made in June 1992	68
4.2    Current Status of Safety Recommendations made to MSA in June 1992	69
4.3    Action taken as a result of Safety recommendation No 8	71
4.4    Safety Recommendations – 1997	71

**ANNEXES**

Annex A	A Review of the stability of PESCADO	73
Annex B	Vessel's General Arrangement Drawing	82
Annex C	Sketch Plan of the Wreck and Gear on the Sea bed	83
Annex D	View of Vessel and Fishing Gear	84

**APPENDICES**

1.	Alternative Text	86
2.	Supplementary Information	87

# Glossary of Abbreviations

<b>BBC</b>	-	British Broadcasting Corporation
<b>DOM</b>	-	date of manufacture
<b>DOT</b>	-	Department of Transport
<b>EPIRB</b>	-	Emergency Position Indicating Radio Beacon
<b>FV</b>	-	fishing vessel
<b>GM</b>	-	metacentric height (measure of a vessel's statical stability)
<b>GPS</b>	-	Global Positioning System
<b>GZ</b>	-	Vessel's righting lever
<b>HRU</b>	-	Hydrostatic Release Unit
<b>kg</b>	-	kilogramme
<b>kW</b>	-	kilowatt
<b>m</b>	-	metres
<b>MAFF</b>	-	Ministry of Agriculture, Fisheries and Food
<b>MAIB</b>	-	Marine Accident Investigation Branch
<b>MCA</b>	-	Maritime and Coastguard Agency (formerly the Marine Safety Agency)
<b>MRCC</b>	-	Maritime Rescue Co-ordination Centre
<b>MOD</b>	-	Ministry of Defence
<b>MSA</b>	-	Marine Safety Agency (formerly the Marine Directorate of the Department of Transport)
<b>MSN</b>	-	Merchant Shipping Notice
<b>MGN</b>	-	Marine Guidance Note
<b>MIN</b>	-	Marine Information Notice
<b>NAVTEX</b>	-	Navigational Telex Service
<b>RNAS</b>	-	Royal Naval Air Station
<b>RNLI</b>	-	Royal National Lifeboat Institution
<b>ROV</b>	-	Remotely Operated Vehicle
<b>RN</b>	-	Royal Navy
<b>RSS</b>	-	Registry of Shipping and Seamen
<b>SAR</b>	-	Search and Rescue
<b>S/N</b>	-	serial number
<b>UKFV</b>	-	United Kingdom Fishing Vessel (Certificate)
<b>V</b>	-	volts
<b>VCG</b>	-	Vertical Centre of Gravity
<b>VHF</b>	-	Very High Frequency



# Synopsis

PESCADO was reported missing to the Marine Accident Investigation Branch by the Falmouth Coastguard on 5 March 1991. The investigation began after wreckage, identified as coming from PESCADO, was reported on the 8 March 1991. The initial investigation was undertaken by two MAIB Inspectors but was suspended during a court case and subsequent appeal. It was continued, and the report completed, by Mr K Dixon, Principal Inspector, with contributions from Mr O Brown, Inspector, experienced beaming and scallop fishing skippers and other consultants.

During the early evening of 25 February 1991, the United Kingdom registered fishing vessel PESCADO, with a crew of six, sailed from Falmouth for fishing grounds south of the Lizard before moving, possibly to the Irish Sea and using Fleetwood as the base port.

On 5 March 1991, Falmouth Coastguard received a report that PESCADO was overdue. As a result of a wide ranging and intensive search, wreckage from the vessel was found and identified on 7/8 March. The body of a member of the crew was located the same day.

During March, reports were received by Falmouth Coastguard suggesting that a new wreck had been discovered off the south coast of Cornwall, and on 26/27 April, its position was confirmed thirteen miles south of Dodman Point. On 22/23 May, using a remotely operated vehicle (ROV), it was positively identified as PESCADO, lying virtually upright, at a depth of 75 metres.

The wreck of the vessel and the surrounding sea bed were examined using an underwater ROV.

The investigation into her loss revealed that PESCADO was unsafely operated. Her FV Safety Certificate was purported to have been withdrawn by the Marine Directorate, her Skipper was not qualified to the required standard, only one crewmember had undergone any safety training and none had any significant scallop fishing experience. PESCADO's safety equipment was deficient in several areas. The loss of PESCADO with all her crew probably occurred sometime between 25 and 28 February 1991 when visibility was fair to good with a broadly southerly wind of force 5 to 6 and a swell of 1.0 to 2.5 metres.

The investigation concluded that PESCADO's fishing gear became fast on the sea bed. Whilst trying to free it she heeled excessively, flooded progressively and sank.

Safety Recommendations arising from the investigation have been made to the Marine Safety Agency (MSA) regarding certification, promulgation of safety advice to the fishing industry, testing of liferafts and an understanding of how fishing vessels sink, and to the Ministry of Agriculture, Fisheries and Food (MAFF) relating to grant systems.

# SECTION 1

## Factual Information

**All times are Universal Co-ordinated Time**

### 1.1 PARTICULARS OF THE VESSEL AND INCIDENT

Name	:	PESCADO
Type	:	Fishing Vessel (Scallop dredger)
Port of Registry	:	Plymouth
Fishing Number	:	PH409
RSS Number	:	A 21225
Built	:	1956, Netherlands
Material of Construction	:	Steel
Length (Overall)	:	22.00 metres
Length Registered	:	21.55 metres
Beam	:	5.83 metres
Gross Tonnage	:	55.91
Loaded Draught (depart port)	:	2.89 metres
Engine Make and Power	:	Badouin 12P15 400 kW
Speed	:	9/10 knots
Owner	:	Guideday Ltd
Shore Manager	:	Mr Joseph O'Connor
UKFV Certificate	:	Purported to have been withdrawn 9/5/90, in accordance with the practice of the time.
Persons Onboard	:	Six
Casualties	:	Loss of six lives
Damage	:	Total loss
Position of Incident	:	13 miles south of Dodman Point, South Cornish Coast
Date	:	Between 25 & 28 February 1991
Time	:	Unknown
Pollution	:	Nil

## 1.2 BACKGROUND TO THE VOYAGE 1956-1990

PESCADO was designed and built as a traditional side trawler in 1956 at Zwolle in the Netherlands. She was built of steel with welded and riveted components. In 1967 she was fitted with a Kromhout 5 cylinder 340 hp engine.

On 13 December 1981, PESCADO, then registered in Castletown, Isle of Man, ran aground in Fishguard harbour in very severe weather reported as storm force 11-12. The three crew on board were rescued but the vessel was declared a constructive total loss.

The Skipper at the time subsequently bought PESCADO's wreck from the insurers with the intention of salvaging the vessel and re-registering her in the south-west of England.

PESCADO was eventually registered in Plymouth and given the fishing number PH409. She was surveyed on 21 September 1983 in accordance with the requirements of the Fishing Vessel (Safety Provisions) Rules 1975, as amended. The survey identified 19 defects, including the requirement for a roll test to determine the vessel's stability.

The roll test was conducted by a Department of Transport Surveyor on 29 September 1983 with satisfactory results.

The next day PESCADO was sold to Mr Snoek, a Netherlands national. The new owner sailed the vessel to Scheveningen where he overhauled her. His intention was to use PESCADO to fish out of Falmouth.

PESCADO eventually returned to the United Kingdom in June 1987 and was presented for survey. She was roll tested in Plymouth on 12 June 1987, in a condition representative of her mode of operation at that time as a beam trawler, as part of the survey for the issue of a United Kingdom Fishing Vessel (UKFV) Safety Certificate. A UKFV Safety Certificate was issued.

On 15 December 1989 PESCADO was advertised for sale because the then owner, Wherry Fish Selling Company Ltd, was in receivership. She was described as a stern trawler, currently without an engine, lying in Plymouth. PESCADO's original Certificate of Registry was cancelled when Wherry Fish Selling became bankrupt.

PESCADO was bought by Guideday Ltd in March/April 1990 for £5500 from Messrs Cork Gully, the appointed Receivers for the failed Wherry Fish Selling Company. At that time the vessel had been laid up in the Tamar River for about 18 months. Guideday Ltd, which was formed on 16 March 1990, intended refurbishing PESCADO and using her for fishing.

Before being purchased by Guideday Ltd, PESCADO had been rigged as a twin beam trawler. During the period April to December 1990 she was extensively refurbished while laid-up alongside in Millbay Docks, Plymouth. She was refitted to operate scallop dredges and re-engined. Additional fuel oil tanks were fitted to increase her endurance.



Figure 1 PESCADO alongside on 17 April 1990

Guideday Ltd arranged and paid for the equipment to be provided and fitted. The work was carried out to Guideday's instructions.

**On** 27 April 1990 the Registrar General of Shipping and Seamen advised the Department of Transport's Marine Directorate that PESCADO had been accepted as eligible for re-registration and drew attention to the fact that the Safety Certificate was valid until 30 November 1991 but, according to the sale notice, she had no engine.

**On** the 4 May a Marine Directorate Surveyor visited PESCADO in Millbay Docks and found the main engine had been removed. To achieve this, the deckhead and watertight bulkhead had been opened up. The Surveyor suggested that if PESCADO was detained by the Department until such time she could be cleared to go to sea, then the vessel could be registered. This was the last recorded visit to the vessel by a Marine Directorate Surveyor before the tragic accident.

On 8 May Guideday Ltd asked the Department of Transport's Marine Office in Plymouth for clarification of the status of the FV Certificate. The Registrar General informed Guideday Ltd that because the vessel had no engine, PESCADO could not be registered. This left Guideday Ltd in a position of being unable to obtain a mortgage to finance the refurbishment.

On 9 May the Marine Directorate wrote to Guideday Ltd notifying them that PESCADO's UKFV Certificate had been withdrawn. This conformed with the normal practice of the time. The company was also informed that in removing the engine without informing the Department an offence had been committed under the FV (Safety Provisions) Act 1970. The company was asked to give full particulars of any alterations to the Plymouth Marine Office.

On 15 May PESCADO was registered, with Guideday Ltd named as the owners. Plymouth Marine Office wrote to Guideday Ltd on 23 May 1990 requesting to be kept informed of how PESCADO's refit and re-engining was progressing. The company was also told that a Surveyor would need to inspect the vessel once the new engine had been installed to ensure the deck and bulkhead had been properly closed, and that life-saving and fire fighting equipment arrangements met the statutory requirements.

The Marine Office was not informed of the completion of the refit and, as a result, PESCADO was never surveyed, nor inspected again, by a DOT Surveyor.

In July, Guideday's Shore Manager, Mr J O'Connor, contacted Mr Geoffrey Wilford, a Naval Architect, of Maritime Design Services Ltd, and asked him to visit Millbay Docks, Plymouth, to advise on the stability of PESCADO and state whether she would meet the Department of Transport requirements. Mr Wilford visited PESCADO on 30 July and 12 August and concluded that PESCADO did not meet the stability requirements of the 1975 Fishing Vessel Rules. Mr O'Connor was present on each occasion. Mr Wilford made further calculations assuming the addition of extra ballast and structural alterations. Even with these modifications Mr Wilford calculated PESCADO would not meet the stability criteria and informed Mr O'Connor of his findings.

PESCADO remained in Millbay Dock until completion of her refurbishment in November 1990.

### **1.3 BACKGROUND TO THE VOYAGE – NOVEMBER 1990 TO 25 FEBRUARY 1991**

To better understand the circumstances of PESCADO's loss, it is necessary to describe in some detail the events that occurred between mid-November 1990 and late February 1991. Between these dates when PESCADO first went to sea following her refit, her initial sea trials and fishing trips were characterised by constant breakdowns, difficulties with the fishing gear and frequent changes of crew.

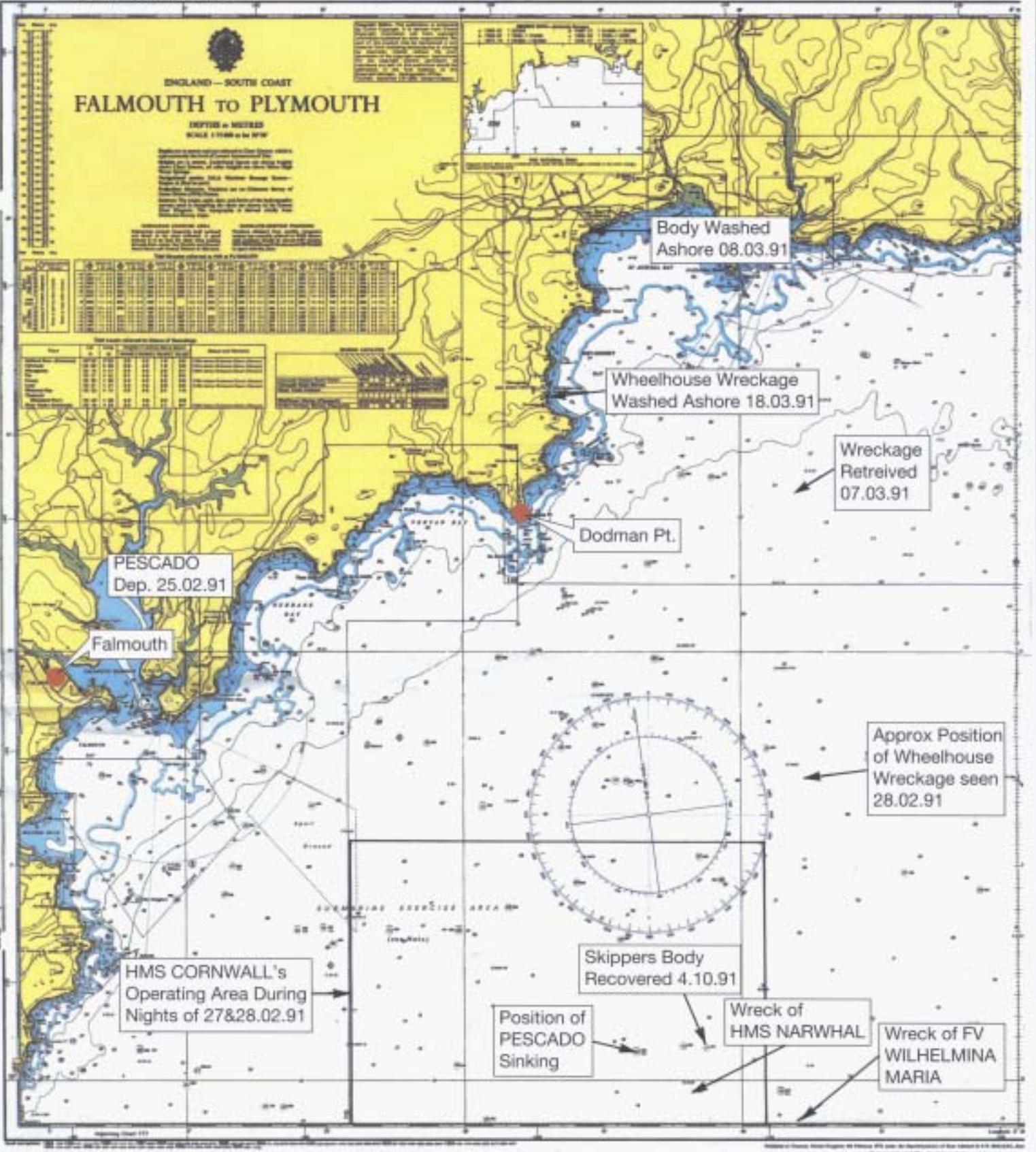
On 10 November 1990 Mr O'Connor hired Mr Sean Deakin, a certificated fishing vessel Skipper, as Skipper for PESCADO. On 18 November Mr Deakin took PESCADO into Plymouth Sound to test the winches with Mr O'Connor on board. Fumes from the engine exhaust filled the wheelhouse. After about two hours, the vessel returned to harbour.

A further trial was conducted on 25 November to test the engine.

On 1 or 2 December, PESCADO went into Plymouth Sound for compass adjusting and auto-pilot testing. In the event neither was achieved. The compass was still being fitted and could not be swung. No deviation card was issued. The auto-pilot was inoperable. Mr Deakin never went to sea in PESCADO again.

Three days later the vessel went to sea to test the fishing gear. It was swung over the side and brought back inboard without being fully deployed. This was repeated three or four times with apparent success. However when the vessel was back in Plymouth, a further trial to lift the gear resulted in the disintegration of the coupling between winch and drive.

On 11 December PESCADO sailed for further trials to test the steering and auto-pilot but, once again, the latter did not function.



The vessel went to sea on 13 December with the UKFV Certificate purported to have been withdrawn and without a suitably qualified Skipper on board to check the correct operation of fishing gear. PESCADO returned to Millbay Dock on 15 December with eight bags of scallops and changed her fishing gear from the original split beams purchased from Bee-Jay Engineering to single 8.84 metre beams borrowed from the fishing vessel FLETE LADY PH36.

During December Mr Steven Hulme, a fisherman, answered an advertisement in the trade newspaper "Fishing News", seeking a Skipper for PESCADO, based in Plymouth. He met Mr O'Connor on 18 December in Millbay Docks and agreed to embark as Mate, not Skipper, of PESCADO for 6% of the gross earnings. Two days later Mr Hulme met Mr Ayres, financial investor and Director of Guideday Ltd, who came aboard PESCADO to see if she was ready to proceed to sea the next day.

On 21 December, Mr Currie, who identified himself as the Skipper, was interviewed by a MAFF Fisheries Officer. PESCADO's Certificate of Registry was not available for inspection by the Fisheries Officer, who informed Mr Currie that the vessel did not have a fishing licence. Mr Currie had been under the impression that PESCADO had a scallop licence. Only an application for this licence had in fact been submitted.

Later the same day, PESCADO went to sea to fish, with Mr O'Connor as the Skipper, instructing Mr Currie. Mr Hulme sailed as Mate with Mr Purcell as the Engineer and Mr Southern the deckhand. PESCADO remained at sea for three days and caught eighty bags of scallops. During this time Mr Southern was injured while working with the dredges.

PESCADO's next fishing trip began on either 8 or 9 January 1991 with Mr O'Connor again sailing as Skipper instructing Mr Currie. Mr Hulme remained as the Mate and Mr Purcell the engineer. Mr Southern was no longer a member of the crew. During this trip further problems arose with the fishing gear, the weather was poor and the vessel rolled heavily. The trip lasted four days and the catch was thirty bags of scallops.

On 23 January, PESCADO again went to sea with, on this occasion, Mr Currie embarked as Skipper. Mr Hulme sailed as Mate, Mr Purcell the Engineer and Miss Jo Anne Thomas as the cook. The trip lasted two days. Mr Purcell left on return to port.

On about 26 January, PESCADO returned to sea with Mr Currie as the Skipper. Mr Hulme remained as Mate, Mr O'Connor sailed as a deckhand and was joined by Mr Gary Taylor; Miss Thomas stayed as cook. The weather was good and about one hundred and twenty bags of scallops were caught. On 28 January, PESCADO was routinely boarded by a Sea Fisheries Officer from HMS SOBERTON, 8.3 miles SE off St Anthony's Head. The trip lasted about five days.

On 3 February PESCADO sailed with Mr Currie as Skipper, Mr Hulme as Mate, Mr Taylor as deckhand and Miss Thomas as cook. The weather was poor and the dredging gear caught an underwater obstruction bending the starboard derrick.

On its return to Plymouth on 8 February, about one hundred bags of scallops were landed. The Mate, Mr Hulme, left the vessel and was replaced by Mr Birley.

On 16 February PESCADO went to sea, but engine problems curtailed the trip after a few hours. Mr Currie was the Skipper with Mr Birley as Mate. Messrs Gary Taylor, David Irwin and Steven Duncan were onboard as deckhands.

The vessel sailed again next day and began fishing but the steering gear broke and a wrench had to be applied directly onto the rudder stock to steer the vessel for the six hour voyage to Falmouth. She arrived on 19 February.

Mr Taylor, Mr Irwin and Mr Duncan left PESCADO in Falmouth and were replaced by Mr Hardy and Mr Kelly.

#### **1.4 NARRATIVE – THE INCIDENT VOYAGE AND SUBSEQUENT EVENTS**

##### **25 February to 4 March 1991**

At about 1900 on Monday 25 February 1991, PESCADO sailed from Falmouth after the necessary repairs to the steering gear had been completed. Six crew were on board.

No further reports were received of any communication with, or sighting of PESCADO after her departure from Falmouth.

##### **5 March**

At 1028 a man with an Irish accent telephoned Falmouth Marine Rescue Co-ordination Centre (MRCC) and reported that he was very concerned about the fishing vessel PESCADO. He said that he had been trying to get link calls to the vessel via Portishead Radio for the previous three days but without success. He also reported he had checked Falmouth and Fishguard harbours but had been unable to contact the vessel.

This man reported that the vessel had left Falmouth at about 1900 on 25 February to fish south of the Lizard and, if results were unsatisfactory, move to the Irish Sea to try off Fishguard and then the Isle of Man. The intention had been to land the catch at Fleetwood.

Mr Ayres supplied the Coastguard with the names of the crew on board.

The Coastguard made extensive enquiries into areas where the vessel could have been operating including the Irish Sea, Swansea, Milford Haven, Fishguard Harbour, Holyhead, Liverpool, Belfast, Isle of Man, Ramsey Harbour, Fleetwood, Clyde, Aberdeen and harbours on the east coast of Eire. Land's End Radio, Valentia Radio, Malin Radio, Irish Coast Radio Stations, French MRCC, and South Coast CG were given all details. No positive responses were received.

##### **6 to 7 March**

Coastguard stations continued their search on 6 March, and fish-markets were checked for possible landings from PESCADO. At 0930, Portishead Radio sent an "Urgency" signal via NAVTEX seeking information about the missing vessel.

The broadcasts, enquiries, harbour checks and coastal searches continued throughout this period.

Falmouth Coastguard initiated a wide-ranging and intensive search. At 0626 on 7 March BBC Radio 4 broadcast a message after the shipping forecast.

Meanwhile, Falmouth MRCC had received a VHF call at 1937 on 7 March from the fishing vessel SCATH DU with the information that a piece of wheelhouse roof, approximately 2.0 by 1.2 metres, had been recovered from the sea. The wreckage was of wooden construction covered with orange coloured fibreglass with a hardwood surround. The letter "P" was

visible on the top and the port side navigation light was in place. On the underside was a Mark 21 Decca Navigator unit displaying co-ordinates which, when interpreted by the Coastguard, gave a position of 50° 13'.7N 04° 37'.8W. The wreckage was found 0.4 miles south-east of Killigerran Head to the east of Falmouth Harbour and did not appear to have been in the water for long.

### **8 March**

By 0645 on 8 March there was sufficient daylight to start a full sea and coast search using a Royal Navy helicopter, RNLI Offshore Lifeboats from the Lizard and Falmouth, and five Coastguard teams.

Mr Ayres arrived at Falmouth MRCC at 0700 but was unable to identify the wreckage recovered the previous day.

Although the helicopter searched a two mile area around the position obtained from the Decca Navigator unit recovered from the wreckage, nothing further was found.

At 0918 the fishing vessel MAXINE'S PRIDE FY38 reported that the top of a wheelhouse had been seen floating southeast of Dodman Point, some days before. The Skipper had kept a detailed log in which he had recorded that at about 0930 on 28 February, whilst in position five miles west of the Radar buoy east of Dodman Point, he saw "a front corner, varnished window intact wheelhouse roof, definitely white, but didn't get close enough to retrieve."

Twenty minutes after receiving this information the Coastguard requested HMS BRERERTON to carry out a sonar search in the vicinity of the position extracted from the recovered Decca Navigator unit. The sonar search was completed without finding anything that might represent the wreck of a 21m trawler.

At 1225 on 8 March, a carpenter who had worked on PESCADO, examined the wreckage which had been taken to the Falmouth MRCC and confirmed it came from PESCADO.

The area of search was expanded and more wreckage was found, including a large piece of brown wood near Mevagissey, and a piece of wheelhouse deckhead on Pentewan Beach.

At 1705 a body was reported to have been found on Duporth Beach and that the police were in attendance. It was later identified as Miss Jo Anne Thomas, PESCADO's cook.

The sea search was terminated by the Coastguard's Regional Controller at 1750 on 8 March, but coastal searches by land, sea and air on 9 and 10 March failed to find any more bodies or relevant wreckage.

### **10 to 11 March**

The fishing vessel TREVAS lost her trawl in a position 168°, 12.8 miles from Dodman Point, and on 11 March, the fishing vessel GOLDEN FLEECE reported an oil slick in the same position, adding that oil had also been sighted there on 6 March.

### **16 March**

The Trinity House vessel MERMAID carried out a full sonar and echo sounder search over an area two miles east/west and one mile north/south centred on the position given by TREVAS. No wreckage was located but light oil was sighted in the area. The weather at the time of the survey was a southerly wind, force 6-7, with moderate sea and swell. The

rise and fall of the vessel was 2-3 metres which caused background noise on both sonar and echo sounder which could have masked a small target. Trinity House were satisfied from this survey that the reported wreck did not pose any threat to surface navigation.

### **18 March**

A section of wheelhouse window frame was washed up on Polkirt Beach near Mevagissey.

### **23 to 24 March**

The sea-angling vessel AQUILA located a possible wreck on her echo sounder in 50° 00.8'N 04° 43'.8W. Local fishermen reported this as a new obstruction.

The Newlyn trawler LIA G, whilst operating in an area about 13 miles south of Dodman Point, caught her net on an underwater object and subsequently found an aerial tangled in it.

### **23 to 27 April (neap tide)**

An underwater survey team commissioned by the MAIB located a wreck using side scan sonar in a position 50° 00' 32".94 N 04° 43' 53".34 W, some 13 miles south of Dodman Point on the Cornish coast, at a depth of 75 metres. Bad weather prevented further wreck investigation.

### **22 to 23 May (neap tide)**

Another team, commissioned by Mr Ayres, investigated the wreck further and positively identified it as PESCADO. An underwater survey of the wreck, fishing gear and sea bed was carried out using a ROV. Video recordings were made.

### **4 to 11 June (neap tide)**

The MAIB carried out an underwater survey of the wreck, fishing gear and sea bed using a ROV to make video recordings.

### **4 October**

A body dressed in fishermen's oilskin (wet weather) clothing was recovered from MYRIPRISTIS's trawl net, in position 160° x 13.9 miles from Dodman Point. It was subsequently identified by pathological means as PESCADO's Skipper, Mr Currie.

In February 1992 MAIB released a Summary Report. Copies were sent to next-of-kin and interested parties.

### **20 May 1992**

A body, later identified as Mr Peter Birley, PESCADO's Mate, was dredged up by a fishing vessel. The body was dressed in a yellow oilskin bib and brace type overall, waterproof hooded jacket, long sleeved sweater and trousers .

### **June 1992**

MAIB forwarded safety recommendations (see Section 4) to the Marine Directorate, the Seafish Industry Authority and the Ministry of Agriculture, Fisheries and Food.

### **25-27 September 1992 & 25 -29 June 1993**

Swan Salvage, under contract to Devon and Cornwall Constabulary, made two unsuccessful attempts to recover the wreck using their vessel GOLDENEYE. The undamaged beam and dredges (starboard set) were, however, recovered together with part of the trawl wire.

## September 1993

The Devon and Cornwall Constabulary contracted Stolt Comex Seaway Ltd to raise the wreck of PESCADO. Their vessel SEA HARRIER completed the task on 20 September 1993. The salvaged wreck was placed in a dry dock at the Devonport Royal Dockyard.



Figure 2: Recovery of PESCADO on 20 September 1993. [Photograph by courtesy of the Chief Constable of the Devon and Cornwall Constabulary]

## 1.5 VESSEL'S DESCRIPTION AND CERTIFICATION REQUIREMENTS

### 1.5.1 Description and Navigational Aids

The steel-hulled FV PESCADO was built in the Netherlands in 1956 and powered by a Badouin 12P15 400 kW engine driving a single propeller which gave a service speed of about 9 or 10 knots. She operated as a stern and twin beam trawler.

The 1990 refurbishment included the following principal alterations:

- a. The vessel was re-rigged for working as a beam trawler with scallop dredging gear. The main mast was reinforced and longer derricks and associated equipment were installed.
- b. The whaleback was made watertight by fitting a bulkhead. This enclosed space would provide residual buoyancy above the weather deck.
- c. The Calor gas system was replaced by an electric system.
- d. Two extra fuel oil storage tanks were fitted in the engine room.
- e. A replacement main engine, gear box and generator were fitted.

- f. Ballast was stowed in the engine room below the floor plates.
- g. The fishing winch was converted to hydraulic drive.
- h. The net drum used when stern fishing was removed from the aft deck space.
- i. Steel channels were added to the top of the bulwarks, in way of the main working deck area, to support the dredge gear when unloading the catch.
- j. A shower space was built onto the aft end of the galley space.

In addition, various items, systems and areas of the vessel were upgraded and/or serviced. Examples were:

- a. The tail-shaft was removed and checked and the stern gland was repacked.
- b. Three seacock were overhauled and the filters cleared.
- c. The hull was shot-blasted and repainted.
- d. The bulwark brackets were made good as necessary.
- e. The freeing port shutters were refitted in the bulwarks.
- f. The oil fuel transfer system was fitted with a power pump with the manual pump retained as a back-up.
- g. The electric wiring was extensively renewed.
- h. The above-deck vent pipes were made good.

### **Navigation Aids**

At the time of the accident PESCADO was fitted with the following navigational and communication equipment:

- a. Raytheon R 41X radar;
- b. JMC Belmar colour navigation plotter model NP-100;
- c. RX Vigil Navigator;
- d. Marconi colour echo-sounder;
- e. Decca Mark 21 Navigator;
- f. A paper roll recording sounder of unknown make;
- g. Magnetic compass of unknown make;
- h. VHF radio – Skanti or Sait;
- i. Single Side Band radio of unknown make.

An electronic device was fitted to the magnetic compass to transmit the direction of the vessel's head to the auto-pilot.

#### **1.5.2 Vessel's Certification**

To operate as a UK registered fishing vessel, one of PESCADO's size must be surveyed and comply with the Merchant Shipping "The Fishing Vessels (Safety Provisions) Rules 1975". These Rules include requirements on structural strength, watertight integrity, freeboard and stability, machinery, bilge pumping arrangements, electrical equipment, miscellaneous plant, structural fire protection and fire detection, protection of the crew, nautical equipment, life-saving appliances, fire appliances etc.

On 27 January 1988, PESCADO was issued with a United Kingdom Fishing Vessel Safety Certificate. However, a Marine Directorate Surveyor visited PESCADO on 4 May 1990 and found the engine had been removed. This invalidated the Safety Certificate.

The Marine Directorate (now the MCA) wrote to Guideday Ltd to inform the company that PESCADO's UKFV Safety Certificate had been withdrawn. It was not the practice at the time to cancel certificates. (For further details see section 2.3).

The Certificate of Registry was issued on 15 May 1990.

A Multiple Species Fishing Licence was issued by MAFF on 6 February 1991.

#### **1.5.3 The Stability**

The regulations covering the stability of Fishing Vessels are set out in Rule 16 of the Fishing Vessels (Safety Provisions) Rules 1975. (See Annex A).

The statutory powers upon which the 1975 Safety Provisions Rules are based are set out in the Fishing Vessels (Safety Provisions) Act 1970. Section 5 of this Act requires the owner or master of a fishing vessel to give written notice to the Safety Certificate issuing Authority, of any alterations to the vessel's hull, equipment or machinery which affect the seaworthiness of the vessel.

PESCADO was surveyed in June 1987 for her UK Fishing Vessel Safety Certificate. Her stability was assessed by roll test and found to be satisfactory.

During the refit in August 1990 the vessel was inclined. The purpose of the inclining test was to provide guidance on whether or not her standard of stability was sufficient to meet the relevant regulations. PESCADO's stability was found to be insufficient to satisfy the requirements of the regulations.

#### **1.5.4 Life-Saving Appliances (LSA)**

PESCADO had a registered length of 21.55 metres which required her to carry safety equipment under the FV (Safety Provision) Rules 1975, and included:

- a. Two liferafts of aggregate capacity to accommodate twice the number of persons on board;
- b. An approved lifejacket for every person on board;
- c. At least four lifebuoys, half of which were required to be fitted with self-activating lights, and two with self-igniting smoke signals;

- d. Not less than 12 parachute distress rockets;
- e. A line-throwing apparatus;
- f. Portable radio equipment for use in the survival craft.

In addition, The Fishing Vessels (Life-saving Appliances) Regulations 1988 required PESCADO to carry an Emergency Position Indicating Radio Beacon (EPIRB) mounted on a float-free arrangement whose operation would activate the EPIRB, or for each liferaft to carry an EPIRB so that they would automatically release and float free in the event of the vessel sinking.

## **1.6 PERSONNEL, CREW, THEIR CERTIFICATION AND ASHORE MANAGEMENT**

### **1.6.1 The Crew**

On her final voyage PESCADO carried a complement of six:

Name	Position	Age
Neil Currie	Skipper	28
Peter Birley	Mate	32
Jo Anne Thomas	Cook	22
Steven Hardy	Deckhand	33
Adrian Flynn	Deckhand	21
Sean Kelly	Deckhand	17

They were all hired by Mr O'Connor.

None of the crew held a Certificate of Competency. Under The Fishing Vessels (Certification of Deck Officers and Engineer Officers) Regulations 1984 there should have been one person on board holding at least a Class 2 (Fishing Vessel) Certificate. All UK seagoing fishing vessels of 16.5 metres or over in length are required to carry a Certificated Skipper.

Fishermen's Safety Training – Merchant Shipping Notice No M.1367 dated February 1989 required Skippers and crew to have undertaken safety training courses on basic sea survival techniques, basic fire-fighting and prevention, and basic first aid.

In 1991 these requirements were being phased in, with the actual date by which training was to be completed being determined by the age of crewmembers. The only person required to have undertaken this training was the youngest, Mr Kelly. Records show he was the only crewmember to have done so.

### **1.6.2 Director of Guideday Ltd – Mr Alan Ayres**

Mr Ayres was a Director of Guideday Ltd, the owning company of PESCADO. He had no knowledge or experience of fishing, and was unfamiliar with safety regulations.

### **1.6.3 The Shore Manager – Mr Joseph O'Connor**

The Shore Manager Mr J O'Connor, had a wide knowledge of fishing vessel operations. He holds a Certificate of Competency No 33858 (Second Hand Special (Fishing)). Mr O'Connor's operational experience of scallop dredging is unknown.

#### **1.6.4 The Skipper – Mr Neil Currie**

The Skipper was an experienced fisherman who had sailed on fishing vessels all his working life but possessed no formal fishing qualification. However, in May 1984, an exemption to sail as second hand on FV SIBON, a Spanish-owned side-launched stern trawler, was issued by Plymouth Marine Office, and was valid until 31 December 1984. Similarly an exemption was issued for the same vessel for the period 27 June 1986 to 26 June 1987. PESCADO was the first vessel in which he had been beam trawling. He was reported to have been a safety conscious fisherman (see Appendix 2).

#### **1.6.5 The Mate – Mr Peter Birley**

An experienced fisherman. He joined PESCADO in Plymouth on about 17 February 1991 (see Appendix 2).

#### **1.6.6 Deckhand – Mr Steven Hardy**

Trained as a welder, he had worked on PESCADO during the refit and between 19-25 February 1991 whilst the vessel was in Falmouth. He had previously sailed in several other fishing vessels including one twin-beam trawler.

#### **1.6.7 Deckhand – Mr Adrian Flynn**

Understood not to have any fishing experience. He joined PESCADO on 16 or 17 February 1991 in Plymouth.

#### **1.6.8 Deckhand – Mr Sean Kelly**

He had about six months experience on fishing vessels. Joined PESCADO in Falmouth on 21 February 1991.

#### **1.6.9 Cook – Miss Jo Anne Thomas**

The cook had sailed on two previous trips on PESCADO. She was the Skipper's fiancée.

### **1.7 WEATHER CONDITIONS**

For the purposes of this report, weather conditions for the period 25 February to 8 March are recorded in full.

On 25 February 1991, the day PESCADO sailed from Falmouth, local Coastguard recorded the weather at 1800 as wind SSE force 3. By midnight the wind had increased to SSE force 6. The visibility remained good throughout the day. The following day the wind was mainly from the South varying between force 3 and 6. The visibility was fair in the morning and good for the rest of the day.

During the early morning of 27 February the wind direction was between SSE and SSW force 5. After 0900 the wind became W and less than force 2, and remained that way for the rest of the day. A vessel in the area where PESCADO was thought to have operated recorded a westerly wind force 3 with a smooth sea and visibility of 5.5 miles. The Meteorological Office assessed the swell to be from W to SW and 2.5 metres high.

The wind on 28 February was calm at first but gradually increased to NE force 4. The visibility was about 5.5 miles. The swell was assessed by the Meteorological Office to be SW'ly 2.5 metres decreasing to 1.5 metres by mid-day. For the rest of the day the area was then affected by a secondary swell from the E which built to 1.5 metres whilst the SW swell decreased to 1 metre.

The weather for 1 March was wind variable in direction, force 3 or less. The visibility remained good.

During 2 March the wind increased during the early morning until, by 0900, it was S by E force 7. By 1200 it had veered to SW 6. By 2100 it had decreased to force 4 and, by midnight, 5. The visibility was good throughout.

On 3 March the wind had eased to WSW force 4 at 0300 and SW force 3 by 0900. It had backed to S 3 by 1500, to SE 3 by 2100 but increased to 6 by midnight. The visibility was good throughout.

By 0300 on 4 March the wind was SE force 7 increasing to 8 by 0900. The visibility was fair. The wind then decreased slightly becoming force 7 to 8 by 1800, then veered to SW 9 by 2100. The visibility improved from fair to good through the second half of the day.

By 0300 on 5 March the strong gale eased to gale, still from the SW. The wind decreased throughout the morning to S force 3 to 4 by noon. During the afternoon and evening the wind was SE force 2 becoming 6 by 2100 easing to 4 by midnight. The visibility was generally good.

On 6 March the wind eased to E force 3 in the very early morning but then veered to ESE and increased to force 6 by 0900. The wind then backed to the E again and increased in strength until by 1800 it was at force 7. The visibility was fair to good becoming poor in rain between 1200 and 1800. By midnight the wind was SE force 4.

On 7 March the wind eased to SE force 2 by 0300 then back to ENE where it remained until 1800 increasing to force 4. By midnight the wind was E by S 5. The visibility was good throughout the day.

On 8 March the wind was E force 4 at 0300 and NE by E force 5 increasing to force 6 by 0900. By 1200 the wind was NW force 2 becoming SW force 3 by 1500. It stayed in the SW for the rest of the day at between force 3 and 5. The visibility was good to fair with occasional rain.

## **1.8 PESCADO'S FISHING GEAR AND OPERATION**

### **1.8.1 Fishing Gear**

Scalloping, with equipment as carried by PESCADO, involves dragging metal rakes or dredges along the sea bed to dislodge the scallops which are then gathered into chain bags forming part of the dredge.

In PESCADO, a trawl was fitted on each side of the vessel, consisting of ten spring-loaded dredges attached to a beam which was pulled along the sea bed by the trawl wire. The trawl was held clear of the hull by passing it through a block at the end of a horizontal derrick, the other end of which was attached to the base of the mast. When not fishing the trawls were stored inboard and the derricks topped at about 45°. To set the gear for fishing, the trawls were lifted outboard, the derrick lowered to a horizontal position abeam the vessel and the trawls lowered to the sea bed using the winch brakes to control the speed. Trawling continued until the gear was lifted back on board. There was a quick release mechanism whereby the block at the outer end of the derrick could be let go. When this was operated, the trawl load at the derrick head was effectively moved to the vessel's side.

### **1.8.2 Trawl Wires**

PESCADO's towing wires on each drum were about 125 fathoms (230 metres) long.

### **1.8.3 Fishing Winch**

The fishing winch comprised two inboard trawl winches or warping drums, two outboard topping drums and two whipping drums. The original whipping drums had been changed to a smaller size. The fishing winch which had been installed during the vessel's refit of 1990 was powered by a new 85 hp hydraulic pump, and was driven by the main engine. The winch controls, clutches and brakes, were situated on the winch. The winch had twice been tested by Mar-Lift, a marine lifting services company in Plymouth. On 15 January 1991 the hydraulic winch system was adjusted to give a pull of 10 tonne. A month later, on 15 February, Mar-Lift engineers measured the maximum pull of the winch as 7.2 tonne.

### **1.8.4 Winch Brakes**

These contracting band type brakes were controlled locally by hand wheels. Extension bars had been welded across the diameters of the hand wheels serving the brakes of the towing drums. According to an ex-crew member it was necessary to throw sand onto the brake surfaces to achieve the required efficiency.

### **1.8.5 Dredge Gear**

The original dredge gear was supplied new by Bee-Jay Welding Engineers of Warley, West Midlands. On each side the gear consisted of one 6 metre towing beam with two 4.27 metre towing beams attached. From each 4.27 metre beam five spring loaded dredges were suspended, giving a total of ten dredges each side. The empty weight of the dredging gear on each side was 2081 kg. On 15 December 1990 this dredge system was changed to a single towing beam of 8.84 metres length on each side, keeping the ten dredges per side. This reduced the weight of the empty gear to 1835 kg per side.

However, the saving in weight was offset by the length of the single beam and the difficulty in handling it in the limited deck space available. The distance between the foremast and the deckhouse was 5.89 metres and, from the foremast to the whaleback front, 2.56 metres, with the deck space area reduced by the run of the main deck into the bow. The smaller whipping drums allowed the gear to be worked more easily on deck.

### **1.8.6 Derricks**

The port and starboard derricks were attached to the mast by a "gooseneck" assembly. This assembly allowed the derricks to move forward, aft or vertically. The derricks were 9.2 metres long, constructed of steel tube and reinforced through the length by flat plate webs. The derricks were lifted or "topped-up" by means of the winch via the topping wires and were retained in the longitudinal position by stays fore and aft. The fore stay was a fixed length and the back stay had means of adjusting the length.

The derricks could be topped using the outer drums on the winch.

## **1.9 SUMMARY OF THE UNDERWATER SURVEYS**

### **1.9.1 General**

Two underwater surveys using unmanned ROVs were carried out on PESCADO in 1991, during neap tides, at a depth of about 75 metres. The first identified the wreck as PESCADO and carried out a detailed survey of wreck and fishing gear. The second surveyed the wreck, fishing gear and the adjacent sea bed which was found to be sandy with some shelved rocky outcrops.

The wreck was found to be lying to port on her port bilge keel, with the bow pointing north-east.

Two further underwater surveys were carried out in 1993. Salvors used a ROV on the first survey and divers on the second. All recordings of underwater surveys and salvage operations were viewed by the Inspectors. The significant data extracted is summarised in the following paragraphs.

### 1.9.2 Watertight Integrity

The door to the whaleback store was ajar with some rope and electric cable protruding.

The hatch cover to the net room was closed but not dogged down.

The hatch cover to the fish room had been forced into the hatch and the hatch coaming was bent in on the aft side.

It was not clear whether the door to the engine room was open or shut.

The stable door to the galley was in the wide open position.

The aft escape hatch from the accommodation was not dogged shut.

The weather deck cover plate to the steering gear was missing.

### 1.9.3 Life-saving Equipment

An inflatable liferaft in its fibreglass container, was seen on the port aft side on top of the deckhouse. Although it appeared not to be secured by any means other than its painter attached to the adjacent rail, it had not floated free. The rails were bowed. The surveys revealed no sign of a HRU fitted to the liferaft, or a EPIRB.

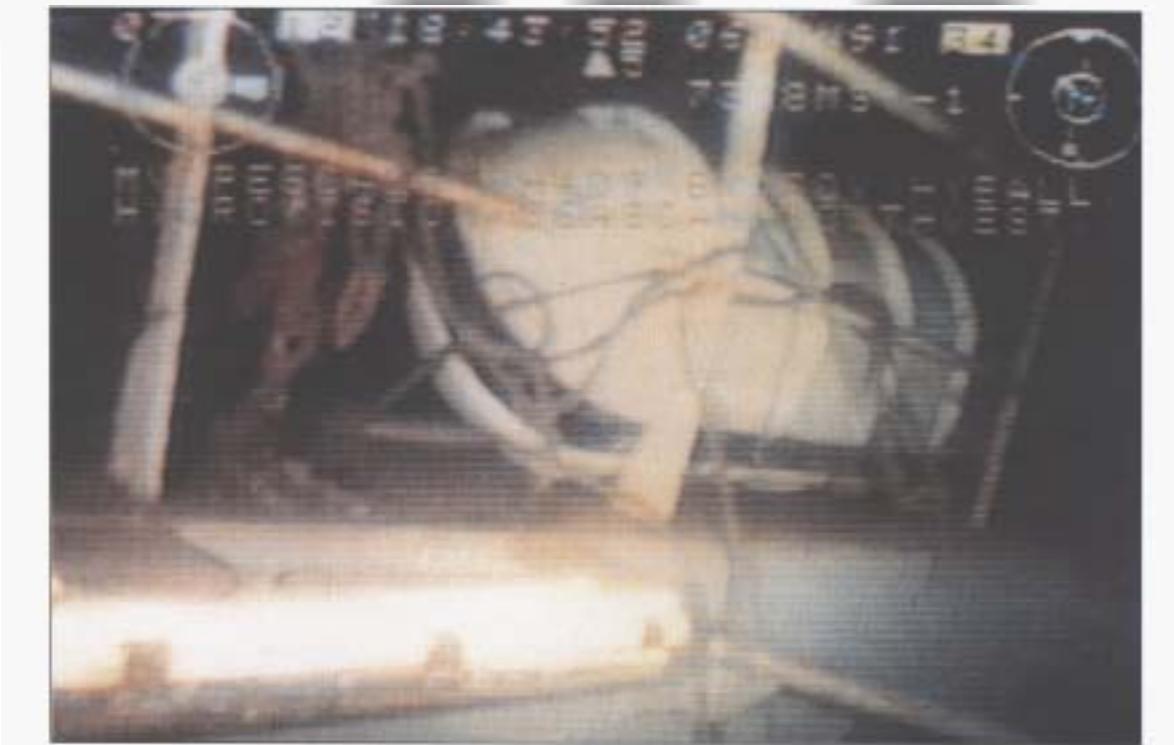


Figure 3: Underwater photograph shows liferaft against guard rails

#### 1.9.4 Fishing Winch and Equipment

The status of the winch and its controls was as follows:

port topping drum had a proportion of its wire still wound on, the brake was released and the clutch out;

the port hauling drum had a proportion of its wire still wound on, the brake was released and the clutch out;

the starboard hauling drum had no wire remaining on it, the brake was released and the clutch out;

the starboard topping drum had a proportion of its wire still wound on, the brake was on and the clutch out.

The port derrick was in the “raised” position some 30-40° relative to the main mast. The starboard derrick was at 90° to the main mast.

Both derrick head back stays were attached to the port and starboard posts abreast the aft end of the deckhouse.

The port derrick topping wire was very slack, lying loose on the deck, but still led through the appropriate blocks to the head of the port derrick.

The starboard topping wire was taut and led through the appropriate blocks to the derrick head.

The quick release mechanism on the starboard derrick was intact and had not been activated. The quick release mechanism on the port derrick had been activated. The port derrick head block was on the port forward side of the weather deck. (See Figure 4.)



Figure 4: Underwater photograph, 6 June 1991 showing a loop of the port trawl wire with the derrick head block at bottom of loop inboard

The port beam and dredges were inverted, or 'on their backs', and damaged. The dredges were empty. The port towing wire ran from the port beam, which was about 12m ahead of the wreck's bows, over the bows and through the derrick head block, which was lying in the forward port corner of the weather deck. It then ran up to the whaleback shoulder block and from there taut back through the main mast tabernacle roller to the winch drum. It is estimated that some 40 to 70 metres of the port towing warp was off the winch drum. The 1993 underwater survey showed that the port trawl wire had been removed from the drum and wreck.

The starboard beam and gear was in a towed formation on the sea bed some 40 metres off the starboard bow of the wreck. The trawl wire was seen to be lying clear of the wreck on the starboard side in a rough coil. On the sea bed the lead of the starboard hauling wire ran round, and under, the port beam gear.

The starboard shoulder block had swung outboard and was resting on the whaleback shoulder.

#### **1.9.5 Machinery Controls and Rudder**

The wheelhouse controls, observed during the early underwater surveys, indicated the main engine was clutched in to drive PESCADO ahead at about three quarters maximum revolutions.

The rudder was set at 2° to 5° to port.

#### **1.9.6 Damage**

The starboard bilge keel was distorted over 2 metres towards its forward end and the hull plating had associated indents either side of the forward bulkhead of the engine room.

Most of the upper wooden structure of the wheelhouse including the top, the window frames and one of the doors were missing from the wreck.

The weather-deck wood sheathing on the port side had sprung. The aluminium alloy hatch cover to the fish hold had been pushed into the hatch coaming.

#### **1.9.7 Surrounding Sea Bed**

The 1991 underwater surveys of the sea bed in the immediate vicinity of the wreck showed it to be fairly flat. The more extensive surveys undertaken in 1993 revealed it to be rougher and more uneven further away from the wreck. Medium sized rocks, some capable of being lifted by one man, were strewn nearby together with larger ones which would not fit into the dredges. A large rock formation which appeared to be a fault line made of solid rock was also seen. The gear was found to be at the top of what appeared to be a bank or ledge. A large boulder showing signs of damage consistent with it having been hit or dropped, was located near the gear. The port gear appeared to be at the bottom of a bank.

### **1.10 SURVEYS OF THE WRECK FOLLOWING SALVAGE**

Some 31 months after she sank, PESCADO's wreck was raised on 20 September 1993 by salvors operating from the Stolt Comex diving support vessel SEAWAY HARRIER. PESCADO was taken to the Royal Dockyard at Devonport where she was surveyed by several interested parties. MAIB Inspectors also surveyed her a number of times during 1993 and 1997. Their observations are recorded in the following paragraphs.

### **1.10.1 Hull and Structural Strength**

The hull was very rusty and covered with marine growth. The port side was undamaged while the starboard side was intact except for the local damage shown in Figures 7 and 12.

Both sides of the hull forward of the net store showed signs of being uniformly stove in, most likely as a result of implosion arising from hydrostatic pressure building up on the outside of an airtight compartment as the vessel sank. The wooden weather deck in this general area was also stove in for the same reason.

It was confirmed that two additional oil fuel tanks had been fitted one each side at the after end of the engine room. Their details were noted.

### **1.10.2 Watertight Integrity**

The door to the whaleback store was fitted with a single securing clip and was found to be wide open.

The hatch to the fore peak within the whaleback was not fitted with a cover.

The hatch to the net room was fitted with two screw down securing devices. The hatch cover had been opened during recovery for pumping operations.

The hatch to the fish room was fitted with two screw down securing devices on the coaming, the aluminium alloy cover was in five pieces and badly corroded.

The door to the engine room was fitted with one securing clip and was in the closed position when recovered.

The stable door to the galley was fitted with a securing clip on the top and lower parts of the door, but was found wide open.

The hatch to the accommodation in the galley did not have securing arrangements.

The hatch to the engine room in the galley was fitted with one securing clip.

The aft hatch to the accommodation was fitted with a single securing clip and was open when recovered.

### **1.10.3 Freeboard and Stability**

An inclining test was conducted by Motte and Associates under contract to the Devon and Cornwall Constabulary on 6 October 1993 and was observed by a Surveyor from the Department of Transport (MSA).

The purpose of this inclining test was to provide data from which the stability and displacement of the vessel could be calculated. The hull form used in these calculations was that measured by Mr Wilford in 1990.

Motte's calculations indicated that the vessel's stability fell well short of that required by the regulations for twin beam trawlers.

Burness, Corlett Partners were engaged by the solicitors acting for Mr O'Connor to carry out their own assessment of the vessel's stability. The shape of the vessel was measured by theodolite while in dry dock. This data was used in conjunction with the results of the

inclining test carried out by Mr Wilford in 1990, to calculate the stability of the vessel. These indicated the vessel's stability was only marginally short of that required by the regulations.

It was essential to the completeness of the MAIB investigation to re-examine the conflicting evidence on the fundamental issue of the vessel's stability. On 11 July 1997 MAIB Inspectors carried out a survey of the vessel to determine her displacement. This was followed by a full inclining test on 24 September which confirmed PESCADO's stability did not meet the standard required for beam trawlers.

#### **1.10.4 Nautical and Radio Equipment**

Echosounder – Video-Koden Chromoscope CV8-8808 – switch in 'off' position.

Echosounder – Paper Plotter – Simrad – impossible to read back plate.

AP40 Autopilot – impossible to deduce the settings.

Skanti TRP6000 Radio – set to send.

Skanti TRP2500 GB VHF Radio Telephone – set on to channel 72.

#### **1.10.5 Life-saving Appliances (LSA)**

The LSA sighted on board the wreck on 1 October 1993 during the inspection whilst in dry dock were as follows:

Liferaft – one on board, RFD serviced 6/88, S/N 6240: other details were not evident. Single RFD 10 man inflatable liferaft complete with bursting bands intact, as seen in Figure 3, was recovered with the wreck. This liferaft was later inspected and contents checked by the manufacturer's representatives. The liferaft and canopy were satisfactorily inflated within the normal expected time scale.

Remains of three or four lifejackets, in shreds, see Figure 5.

Two line throwing appliances, one Date of Manufacture (DoM) 7/88, the other's DoM not known.

Parachute distress rockets DoM 1/89.

Medical stores and safety harness.



Figure 5: Disintegrated lifejacket recovered with PESCADO

#### 1.10.6 Fire Appliances

One red nine litre portable water extinguisher recovered by divers.

One 10 lbs CO<sub>2</sub> extinguisher found in engine room.

A small axe was found on board.

#### 1.10.7 Fishing Winch and Gear

##### Fishing Winch

There was no wire on the port and starboard towing warp drums. The topping wires were taut from the starboard drum to derrick and slack on the port side. The clutches and brake settings were as observed during the underwater survey, see Section 1.9.4.

The control lever to the hydraulic power drive from the main engine was confirmed in the engaged position.



Figure 6: View of the fishing winch after vessel's recovery. [Photograph by courtesy of the Chief Constable of the Devon and Cornwall Constabulary]

## Derricks

The wreck was recovered with both derricks positioned over the port side (see Figure 6). The measured length of each derrick was 9.2 metres.

## Quick Release Mechanism

The quick release mechanism on the starboard derrick was intact and had not been activated. The quick release mechanism on the port derrick had been activated. This could be seen during the underwater survey. The port derrick head block was on the port forward side of the weather deck. A rope messenger was attached to the port quick release gear; none was attached to the starboard gear.

## Beams and Dredges

Both beams and dredges had been recovered and taken to a store in the Naval Base. These beams were surveyed and identified by the position of the tailing rope fitted. The following observations were made.

## Port Beam and Dredges

These were damaged. The beam had a curve in its length and some of the dredges had become detached from the beam but were still connected to the other dredges. Damage had occurred to the back of the dredges, consistent with being towed on their back. The port beam trawl weighed 1.81 tonne. The overall length of the beam was 8.8 metres. One of the bridle chains had parted at mid length.

## Starboard Beam and Dredges

These were not damaged. The starboard beam trawl weighed 1.89 tonne. The overall length of the beam was 8.8 metres.

There were about ten spare dredges stored in the fish hold on the starboard side.

### **1.10.8 Engine Room**

A work bench was situated against the vessel's starboard side at the aft end of the engine room. Items normally stowed here were seen on top of the bench.

### **1.10.9 Machinery**

#### **Main Engine**

Inspections of the main engine, its fuel injection system and gearbox, (performed on behalf of Devon and Cornwall Constabulary) established the following:

- Fuel pump control rack in a position corresponding to a low engine speed.
- Gearbox control in position corresponding to neutral.
- The clutch, through which the hydraulic pump unit was driven, was found engaged.

#### **Bilge Pumping Arrangements**

The main engine sea water cooling pump was able to take water either from the sea or the bilge system, and was, at the time of MAIB's inspection, lined up to take water from the sea.

Both the engine driven and the electrically powered bilge pumps were set to draw from the sea.

#### **Electrical Equipment and Systems**

Because the vessel had been submerged in sea water for over two years, it was extremely difficult to test the electrical equipment and circuitry properly. However, reports indicate the electrical system was in reasonable order.

## **1.11 SURVEY OF THE VESSEL DURING SCRAPPING**

PESCADO was scrapped at the end of November 1997. During the scrapping operation the fishing winch was opened up and inspected. The gears and shafts in the box were in good condition with no evidence of fracture or tooth damage. The scallop dredges and chain stored on the starboard side in the fish hold were weighed; the total weight was 1.64 tonne. No significant pockets of sea water were found during the dismantling of the vessel.

# SECTION 2

# Analysis

## 2.1 THE VESSEL'S HISTORY

After her construction in 1956 the vessel operated as a trawler. PESCADO was first surveyed in the UK by DOT in 1983 and then again in 1987. On both occasions the vessel's stability was assessed by simple roll tests. These stability assessments showed compliance with the DOT requirements for beam trawling.

Following the withdrawal of the UKFV Certificate in 1990 and whilst refurbishment was being carried out, a full inclining test was performed. The results of this test indicated that the vessel's stability did not comply with the DOT requirements for twin beam trawling.

PESCADO was not re-surveyed, but commenced commercial fishing as a scallop beam trawler in late 1990 without the identified stability deficiency being rectified.

At the same time as the stability test was carried out, an application was made to MAFF for a licence to fish using twin beams. This was obtained in February 1991 and allowed the vessel to fish commercially even though the UKFV Certificate had been withdrawn. Had there been a requirement for the vessel to hold a valid UKFV Certificate before a Fishing Licence was issued the vessel might not have gone to sea.

## 2.2 GENERAL ANALYSIS OF THE INCIDENT

### 2.2.1 Reporting to Coastguard

On the 28 February 1991 part of the wheelhouse roof was seen by another fishing vessel. No positive identification was made to indicate it came from PESCADO, but it is likely this was the same wreckage recovered by another vessel on 7 March. Failure to report this first sighting to Coastguard meant that no SAR operation started until many days later. Mariners should be aware of the importance of reporting floating wreckage to the Coastguard.

### 2.2.2 Reporting Overdue Vessels

The Coastguard was informed that PESCADO was overdue on 5 March, eight days after sailing from Falmouth. The caller, with the Irish accent, said he had attempted, unsuccessfully to contact the vessel for three days prior to calling the Coastguard.

An owner/shore manager can be expected to make contact with his fishing vessel at least once each day. If the owner is aware the vessel has poor communication arrangements, the interval between contacts might be longer. For an owner or operator not to inform the authorities of his concerns until eight days had elapsed without making contact, shows a lack of responsibility for the safety of a vessel and its crew.

### **2.2.3 Search and Rescue Operations**

The emergency response of HM Coastguard to the report that PESCADO was missing was correct, extensive and efficiently carried out.

### **2.2.4 Preservation of Evidence**

#### **Royal Naval Divers**

There has been speculation that Royal Naval divers operated on the wreck of PESCADO and interfered with the evidence.

The Ministry of Defence denies that Naval divers ever operated on the wreck and no evidence has come to light to indicate they did.

At 75 metres, PESCADO lay at a depth requiring saturation diving. RN clearance divers operate down to a depth of 54m and therefore would not attempt diving to 75 metres in a non-saturation diving environment. The Royal Navy had a saturation diving capability but only with the support of a specially equipped surface vessel of about 20,000 tonne. At no time was such a vessel deployed anywhere near PESCADO.

The MAIB has also explored the possibility of naval divers operating in the vicinity of the submarine HMS NARWHAL which was deliberately sunk in position 50°00' 45.5"N, 04°41' 17.5"W several years earlier on 3 August 1983. NARWHAL lay 1.6 miles from PESCADO. A saturation diver's radius of action is constrained by a short umbilical cable connected to the diving bell. Although some diving may have occurred following the sinking of HMS NARWHAL in 1983 there is no evidence to suggest that Naval divers revisited the site after PESCADO sank.

There is no evidence to indicate Royal Naval divers conducted diving operations on, or near, PESCADO at any time while the wreck lay on the sea bed.

Inquiries were also made to establish whether any other organisation dived on the wreck apart from those involved in the salvage operation. No evidence has emerged to indicate they did.

#### **Salvage Team Divers**

The only saturation divers to operate on the wreck of PESCADO were salvage divers working for Stolt Comex during the recovery in 1993 and much of their operation was recorded on video. This video has been viewed by MAIB, and showed that some important items of equipment sighted underwater during early survey operations had been disturbed during salvage attempts.

## **2.3 VESSEL'S CERTIFICATION REQUIREMENTS**

### **2.3.1 Fishing Vessel Safety Certificate**

Under The Fishing Vessels (Safety Provisions) Rules 1975 ("the Rules") the 21.55m long PESCADO, was liable to a four-yearly survey and certification. A vessel of 12m or over which goes to sea to fish for profit without a valid UKFV Certificate contravenes the Fishing Vessels (Safety Provisions) Act 1970 ("the Act").

Following PESCADO's last, and successful, survey in November 1987, a UKFV Safety Certificate was issued with an expiry date of 22 November 1991.

### **Withdrawal of the Safety Certificate**

When application was made in April 1990 to re-register the vessel, the Registrar General of Shipping and Seamen (RGSS) drew the Marine Directorate's attention to the fact that the vessel was being re-engined. Under the Act, an owner is required to give notice of any alterations to the vessel affecting its compliance with the Rules. Under the same Rules, the Secretary of State may cancel a certificate if the hull, equipment or machinery are subsequently found to be inadequate for the intended service.

Work to refit the engine was confirmed by the DOT's Surveyor who reported it had been removed by opening up the deck and a watertight bulkhead. In accordance with the then DOT practice, the owner was notified that the vessel's UKFV Certificate had been withdrawn. Guideday Ltd was asked to return the certificate to the DOT and told to give full particulars of the alterations to the vessel to the DOT's Fishing Vessel Surveyors in Plymouth. The certificate was not however surrendered, and the owners did not approach the Department's Surveyors prior to the vessel going to sea. The Registrar proceeded with the registration of the vessel. The DOT heard nothing further from the company before the vessel went to sea on 25 February 1991.

The DOT considered at the time that withdrawal of a UKFV Safety Certificate was sufficient to invalidate it until, and unless, work on the vessel had been completed to the satisfaction of a Surveyor at which point the certificate would be restored. The Department therefore concluded that PESCADO had gone to sea without a valid certificate. Legal advice to MSA has indicated that withdrawal of the certificate did not in fact alter its validity and the DOT/MSA has accepted that the correct procedure in such cases is to cancel rather than withdraw the UKFV Certificate.

Although PESCADO sailed on its final voyage with an apparently valid UKFV Certificate, the owner was, in any event, in breach of the Act having failed to give notice on completion of the alterations to the vessel. Had such notice been given, the DOT would have taken action to establish whether the vessel still complied with the Rules following the alterations.

The 1997 methods adopted by MSA to prevent a fishing vessel leaving a UK port when there is serious contravention of the Rules, is to either serve a "detention notice" or, more rarely, cancel the certificate. Because fishing vessels are not normally subject to port clearance procedures it is necessary for the MSA to inform the local port authority, such as the Harbour Master, and MAFF of the vessel's detention.

By 1997 the MSA was carrying out over 600 general inspections of fishing vessels each year. These inspections can be random and are additional to the main surveys. The intention is to target the fishing vessel operator who lets his vessel fall below the requirements of the Rules and Regulations. Such vessels are detained when necessary. If the MSA receives a report of a fishing vessel that is unsafe or is not complying with the Rules, it is treated in confidence and an inspection carried out. It will followed up with the appropriate action being taken.

During 1997 DOT and MAFF agreed measures to ensure that current standards are met by the UK fishing industry. In particular:

- MAFF's British Sea Fishery Officers (BSFO) will detain vessels which do not have valid safety certificates and check that fishing crews hold appropriate certificates; and

- there will be increased emphasis by the Registry of Shipping and Seamen (RSS) to remove any vessel from the register that does not have a safety certificate.

A Multiple Species Fishing Licence was issued to PESCADO by MAFF on 6 February 1991. The Certificate of Registry in force at the time of the accident was issued on 15 May 1990.

### **2.3.2 General Conclusions**

PESCADO was re-registered despite having had her UKFV Certificate withdrawn. The vessel was also issued with a MAFF Fishing Licence without reference to the safety certificate's withdrawal.

There may be sound commercial reasons for not rigidly linking a vessel's registration to the possession of a valid UKFV Certificate. Registration, for example, may be required to make a successful application for a mortgage on the vessel. As the primary task of any commercial fishing vessel is to catch fish in a safe manner, and no fishing can legally be performed without a valid licence from MAFF, a connection between the Fishing Licence and the UKFV Certificate may be of value.

Present regulations allow substantial penalties to be imposed on fishermen for proven breaches of their MAFF Fishing Licence conditions. Although penalties may also be imposed for breaches of fishing vessel safety regulations, they are of a lesser magnitude. This difference is unfortunate and may cause fishermen, and others, to place a greater emphasis on satisfying conservancy regulations than on safety.

An association between the MAFF Fishing Licence and the UKFV Certificate of any fishing vessel is likely, in the long term, to relate safety with permission to fish. This link could make a valuable contribution to the fishing industry by enhancing the importance of safety standards.

### **2.3.3 Vessel's Stability**

Every effort has been made to produce an accurate picture of the stability of PESCADO at about the time of her loss since there is strong evidence to suggest she was lost because she "capsized". (Capsized in this context is used fairly loosely to describe a situation where the vessel loses stability and takes up a large angle of heel sufficient to cause unrestricted flooding, but does not necessarily imply the vessel inverts). This task has not been straightforward. It has involved the re-analysis of data produced several years previously. Much of it produced conflicting results, and it proved a difficult and lengthy task to try and resolve these differences. Full details are contained in Annex A.

Following careful analysis it was finally concluded that none of the earlier data on the vessel's stability was relevant to her condition at the time of her loss. As the re-analysis of the stability data progressed the investigation team became increasingly confident that an accurate stability assessment could only be derived from the results of a further inclining test. On 24 September 1997 one was carried out by the MAIB in No 3 basin Devonport Royal Dockyard, Plymouth.

The results of the inclining test, whilst not necessitating any modification to the hypothesis for the manner in which the vessel was lost, indicated that PESCADO's stability did not meet the full requirements of the Regulations for a twin beam trawler. A comparison between her estimated stability characteristics and those required by regulation are detailed in Table 1, Annex A. This shows that at angles of heel below about 25° the vessel had good

stability. This would have been characterised by a quick roll which would perhaps have made her uncomfortable in a seaway. However, at angles of heel greater than 25°, and in the deeper loading conditions, her stability fell short of that required by the Regulations.

The first point of down flooding is the engine room door, the sill to this door becomes immersed at between 33° and 39°, depending on the loading of the vessel.

The stability determined for PESCADO, whilst unsatisfactory, is sufficiently close to the prescribed level to suggest that this was not the decisive factor which caused the loss of the vessel. It is almost certain that even had she met the stability criteria in full she would still have been lost in the particular circumstances which it is believed overwhelmed PESCADO.

Section 1.2 of this report has already given details of the correspondence between the owner of the vessel and the Fishing Vessel Surveyor of the Marine Directorate at the time of the vessel's refit in 1990. This correspondence culminated in the purported withdrawal of the Fishing Vessel Safety Certificate and a request from the Surveyor that the owners advise him of the completion of the refit in order that the vessel could be surveyed. The owners did not advise the Surveyor of the refit completion.

Had the owners fulfilled their duty under the Fishing Vessels (Safety Provisions) Act 1970 then PESCADO would have been surveyed and, almost certainly in view of the extent of the refit, an inclining test would have been required to demonstrate the vessel had adequate stability. She would not, consequently, have been allowed to proceed to sea until she complied fully with the Regulations. This may well have required the addition of ballast and a watertight poop, as proposed by Mr Wilford in 1990, and is a common modification required of vessels of PESCADO's age and type.

#### **2.3.4 Entrapped Water on Deck**

Sea water on the weather deck of a fishing vessel can have an adverse effect on stability if it cannot drain away quickly. The effect is more pronounced if the vessel has an initial heel or list due to other forces.

PESCADO had 11 freeing ports either side in the bulwarks, the drainage capacity of which was well in excess of that required by the Rules. However, these ports were all fitted with vertically sliding shutters which had to be opened manually. The inspection of the wreck showed that all but two freeing ports in the port side bulwark were closed.

No firm conclusion can be drawn from the underwater observation regarding the state of these shutters at the time of the accident. It is thought that a large angle of heel and the heavy impact with the sea bed could have caused a number of the shutters to shut.

### **2.4 CREW**

#### **2.4.1 Disposition of Crew, 1992 Analysis**

Based on the analysis of the video tape of the underwater inspection, the information available with respect to various equipment on board and the normal onboard procedures for operating that equipment, the *probable* positions of the crew prior to the accident, are outlined in this Section.

The main engine was clutched in and the throttle set to give ahead revolutions to the propeller. An experienced crew member, either the Skipper or the Mate, should have been

in the wheelhouse when the vessel was on passage, towing her fishing gear or clearing snagged gear.

When recovered, the Skipper's body was fully dressed for work on deck with personal clothing, overall, duck suit and sea-boots on. It could therefore be assumed that the Mate was in the wheelhouse conning PESCADO during the period prior to the accident.

The body of the cook was also recovered dressed in 'indoor' personal clothing which would indicate that just before the accident she was in the accommodation, probably the galley or the wheelhouse area.

Immediately prior to the accident the galley door, the engine room door, the forward store hatch and the door to the whaleback were not secured closed.

To maintain warmth in the accommodation area when the crew were not working on deck, it was the necessary and normal practice in PESCADO to keep the galley door closed.

To work the port and starboard derricks at the same time, which is the recognised practice on this type of fishing vessel, it was usual to have four crew working on deck, one on each drum brake and clutch, topping and hauling, port and starboard. It is therefore envisaged that besides the Skipper, the three remaining crew were on deck when the accident occurred.

PESCADO's burning gear (oxy-acetylene) hoses were running out on the port side of the whaleback front, with the burning head draped over the winch guard and port hauling drum. As one crew member was an experienced welder/burner he may have been preparing to use the burning gear.

From the above, it is thought unlikely any of the crew were below deck prior to the accident.

#### **2.4.2 Disposition of Crew, 1997 Analysis**

Although the exact disposition of all the crew cannot be determined, further evidence enabled a reasonably accurate crew disposition to be deduced. In May 1992 the body of the Mate was recovered. He was also found clothed in fisherman's oilskins, indicating he was involved in activities on the weather deck. This does not support the earlier assumption that he was in the wheelhouse conning the vessel. It is very unlikely that any crew members dressed in oilskins would have been in the heated wheelhouse. This evidence suggests that the two experienced fishermen on board, the Skipper and Mate, were on deck, with the cook and possibly one other deck hand conning the vessel in the wheelhouse.

When the wreck was raised in September 1993, no other bodies were found. Only one set of oilskin clothing was found onboard which indicates that all the crew except one were outside on deck. As the cook's body did not have oilskins on, it is reasonable to assume she was inside the vessel, possibly in the wheelhouse. Some support for this suggestion is also offered by the loss of the wheelhouse roof, recovered early in the incident, which would have allowed anybody in the wheelhouse to be swept free.

#### **2.4.3 Crew Composition**

There were constant crew changes between December 1990 and February 1991. Eleven people are recorded as having embarked as crew or skipper. One of the largest changes occurred between 19 and 25 February 1991 when she was in Falmouth. Messrs Taylor, Irwin

and Duncan left PESCADO shortly before she sailed on her final voyage and were replaced by Messrs Hardy and Kelly.

Had the vessel been able to retain a core of personnel with twin beam trawling experience, who were familiar with the vessel and its characteristics, this turnover may not have been significant. However, the maximum experience which any crew member had of PESCADO was 21 days at sea, not all of which were spent fishing. This manning pattern is strongly indicative of a crew which lacked intimate knowledge of their vessel.

Compounding the crew's unfamiliarity with PESCADO was the skipper's limited experience of twin beam trawling, a uniquely hazardous method of fishing. Crew, fresh to a vessel, can reasonably expect to be instructed by those already on board who would have greater experience of both the vessel and fishing technique employed. This traditional mode of learning and instruction, usually performed informally, was not available in PESCADO.

Although the number of crew carried by PESCADO was typical for a fishing vessel of its type and size, the absence of sufficiently experienced persons among their number must be seen as a serious criticism of the vessel's managers.

Additional criticism must be directed at the vessel's managers for failing to ensure the designated Skipper was in possession of the mandatory Certificate of Competency. Assessing a person's suitability from their experience alone can sometimes be no more than a matter of opinion; whereas no such ambiguity exists when an individual can show an appropriate certificate.

## 2.5 FISHING GEAR AND OPERATION

Of all the fishing methods used around Britain today, beam trawling, and especially scalloping, is regarded as the most dangerous. The trawler tows two heavy sets of gear, one from each side, hard on the sea bed at speeds of between 1.8 and 4.5 knots. The stability of these vessels is critical. If one set of gear becomes fast (snagged) on an obstruction it will pull the vessel over and cause her to heel heavily. If two sets of gear become entangled, either by the beams meeting or, more often, by the wire of one catching the beam of another, immense stability problems can occur when attempts are made to lift the gear and the collective weight shifts to one side. This can also cause the vessel to heel heavily as illustrated in Figure 13.

It is essential that a beam trawler is operated by a fully qualified and experienced Skipper familiar with the workings and behaviour of such vessels. He should have a good working knowledge of the grounds in which he is operating and be aware of wrecks, hitches, banks, and possible obstructions. Experience in assessing any condition involving the snagging of fishing gear is also vital for the Skipper. He must be supported by crew who are experienced and familiar with the procedures which he requires them to undertake. Errors in clearing gear can easily result in excessive heeling moments leading to the loss of a vessel and lives.

The limited practice on PESCADO was to sail direct from port to the scallop fishing grounds, commence fishing on arrival and continue without a break until finished. Each tow would last about two and a half hours. When launching or recovering dredges, the entire crew apart from an experienced man in the wheelhouse, were normally on deck.

In addition to the known problems which are common to all beam trawlers, PESCADO's difficulties were magnified by the poor match of fishing gear to vessel.

The two 8.8m long beams were difficult to handle. When being worked they swung excessively and caused problems when getting gear in and out.

When the derricks were rigged with one out and one topped up, PESCADO was reported to list heavily which signified her fishing gear was too heavy.

The extension bar fitted to the winch brake handwheels showed that the effort needed to apply the brake bands was greater than that achieved by just the hand wheel. The large force used to apply the brakes would require corresponding force to release them. This would translate to a delay when trying to release them in an emergency.

A previous Skipper of PESCADO, who operated her prior to December 1990, informed Inspectors that the winch had two speeds, full speed or stopped; there was no safe slow speed. He recalled two accidents to crew members resulting from winch operation.

## **2.6 SURVEYS OF THE WRECK UNDERWATER AND IN DRY DOCK**

### **2.6.1 Hull – Permanent List**

Although her fishing gear was stowed centrally, PESCADO developed a list to starboard once she was refloated after salvage. 2.6 tonne of additional ballast was required to correct this. Apart from a generator unit, some loose fishing gear dredges stowed on the starboard side of the fish room and the damage to the starboard bilge, there was nothing obviously asymmetric about the hull or equipment that could justify this list to starboard.

### **2.6.2 Damage to the Vessel**

#### **Hull and Bilge Keel damage**

Part of the bilge keel on the starboard side was found pushed upwards against the hull. The damage was tucked in at the turn of the bilge and was well inside the breadth of the vessel. The observed damage form was waved and distorted with impact to the hull plating, extending about two metres (about 9% of the vessel's length). The plating had not been penetrated, but was stove in either side of the forward engine room bulkhead. This can be seen in Figure 7 below. As no angular impact damage has been seen the impact which caused the damage was applied at a right angle to the hull. The framing inboard also showed distortion damage.



Figure 7: Damage in way of starboard bilge keel

The vessel's structure in the vicinity of the damage was analysed by a number of professional structural engineers and MAIB Inspectors. An extremely detailed inspection was made of the indented part of the hull which revealed there was no evidence of "steel to steel" contact which would have occurred had there been a collision with another vessel. It is therefore concluded that the damage was not caused through contact with another vessel but by uniform pressure exerted on that part of the hull where it impacted heavily on the sea bed that comprised a sand upper surface on a solid base.

Had the damage been caused by collision with another vessel, the forward starboard engine room bulkhead would also have been distorted and taken the line of the indented damage on either side of the bulkhead. It didn't and was not therefore "steel to steel" collision damage.

### **Wheelhouse damage**

The condition of the wreckage supports the conclusion that the wooden wheelhouse structure was effectively pushed off the vessel by the pressure build-up resulting from the progressive flooding of PESCADO's house as she sank.

The damage to the deck sheathing, seen on the wreck, occurred as a result of pressure difference. As the vessel sank, atmospheric pressure was maintained in the closed net compartment allowing hydrostatic pressure to build-up on this structure. The resultant weakest part which was the deck, failed, to allow the net space to flood with loss of buoyancy.

Apart from the fish hold hatch, no other damage from hydrostatic pressure was seen on the hull. This indicates the rest of the hull flooded shortly after leaving the surface, and is consistent with the underwater video showing doors in the open position.



Figure 8: View of fore deck showing damage to deck sheathing. [Photograph by courtesy of the Chief Constable of the Devon and Cornwall Constabulary]

### 2.6.3 Possible causes of the scuff marks

Scuff marks, consisting of black parallel lines on the aft starboard side of the hull were clearly seen on the underwater video, but were only just visible on the wreck when recovered.

There is a possibility that PESCADO's own starboard trawl wire caused these scuff marks.

Had she snagged her port gear there would have been a period when control of the vessel would have been very difficult until the winch was manned. During this period, the tarred and greased starboard trawl may well have made contact with the hull to leave black lines marked on the hull.

Another explanation arises from the incident on the 10 March 1991 when FV TREVAS's gear became snagged. The disposition of TREVAS's fastened fishing gear, relative to the wreck, led the Inspector to surmise that the black lines could have been caused by the TREVAS's combi or wire warps making contact with the hull.

It cannot be envisaged how the black lines might have resulted from a collision or contact incident with another vessel. This matter is considered in greater detail in later sections.

### 2.6.4 Life-Saving Appliances

#### a) Inflatable liferafts

It was reported that prior to the sea trials in November and December 1990, the Shore Manager, Mr O'Connor, put two six person liferafts on board which were two years outside their service date.

One liferaft was seen on the top of PESCADO's house during the ROV inspections and was later identified by the manufacturer (RFD) as probably being a 10-man model.

There was no evidence of a float-free arrangement being provided. It was secured by its painter and failed to float free from the vessel at the time of the accident.

Although only one liferaft can be accounted for, two may have been onboard at the time of the accident.

One reason for the liferaft not floating free was that no Hydrostatic Release Unit (HRU) had been fitted. These units are designed to either cut the canister's lashing arrangements or to come apart once they are immersed to a depth between one and four metres to enable the canister to float free. A HRU also incorporates a weak link to which the painter should be secured and is designed to fail when the buoyancy force on an inflated, or inflating, liferaft exceeds a predetermined figure. The arrangement allows the liferaft to float to the surface for use by survivors.

PESCADO sank in 75 metres of water, greater than the length of the liferaft's painter. With the painter's end secured to a rigid part of the vessel's structure, the liferaft would not have been free to float to the surface.

The position and status of the liferaft on the wreck, together with information obtained from the liferaft manufacturer, indicates that the vessel must have been heeled to over 70° before the liferaft became submerged. The liferaft became lodged against the rails on the top of the wheelhouse and caused the rails to bow.

The liferaft seen during the underwater survey was lashed to the guard rail and had no apparent buoyancy. In an emergency, a liferaft is expected to have inherent buoyancy for efficient and proper operation. The evident lack of buoyancy in this incident necessitated further investigation.

The liferaft recovered from the wreck was an RFD 10-man liferaft, serial No 6240. It had not been serviced in the twelve month period prior to the accident and did not, therefore, comply with DOT requirements. As part of the investigation the container and liferaft were unpacked and inspected. No EPIRB was found in the container which was slightly damaged in two places. The liferaft was repacked and an inflation test carried out. It was satisfactory.

It is concluded that had the vessel been provided with two six-man liferafts with float-free systems, the chances of anyone surviving would have been greatly enhanced.

b) **Lifejackets**

It was reported that during sea trials eight lifejackets were stowed in the cupboard behind the freezer in the galley. A further, unverified, report suggests that four lifejackets were brought on board by a crew member at a later date.

The remains of three or four lifejackets, without lights, were retrieved from the wreck.

c) **Emergency Position Indicating Radio Beacon (EPIRB)**

One was required to be fitted. None was registered or sighted on the wreck nor have any belonging to PESCADO been recovered. It is concluded she never carried one.

Had an EPIRB been correctly fitted it should have floated to the surface after

PESCADO sank, and transmitted a signal via a satellite to a shore rescue centre giving a code representing the identity of the vessel and the beacon's position. Proper registration of the EPIRB would have assisted in the rapid identification of the casualty vessel. The signal or "hit" would have been relayed to Falmouth Coastguard who would have activated a search and rescue operation. A helicopter from nearby RNAS Culdrose could have flown to the search area in about twelve minutes.

Had an EPIRB been carried by PESCADO, and operated automatically at the time of the foundering, survivors boarding the liferaft or liferafts would have had a good chance of being successfully rescued.

#### d) Lifebuoys

Only two lifebuoys were on board at the time of the accident, neither of which had any of the required attachments. They were stowed in racks fixed to the port and starboard house sides, adjacent to the galley.

One new unmarked lifebuoy was recovered on 8 March 1991 during the search for PESCADO, but no lifebuoys were retrieved from the wreck.

#### e) Line Throwing Appliances

Three sets were retrieved from the wreck; four are required to be fitted. One of PESCADO's sets was out of date.

#### f) Distress Rockets

Not less than 12 parachute distress rockets were required. Two out of date rockets in a red container were recovered with the wreck.

#### g) Flares

Eight in date Ikaros hand flares in two yellow drums were recovered with the wreck.

#### h) Portable radio

None was found on the wreck although one was required to be carried.

PESCADO was deficient in the LSA carried in several important and critical areas.

### **2.6.5 Fire-Fighting Appliances (FFA)**

One nine litre portable water extinguisher and one 4.5kg (10lb) CO<sub>2</sub> extinguisher were found in the engine room.

A small axe was retrieved from the wreck; one fireman's axe was required to be carried.

### **2.6.6 Fishing Gear and Winch**

*The surveys revealed the following:*

The control for the hydraulic powered winch was seen in neutral, the normal position when not being used. This winch control lever was spring loaded to return to neutral when released. No firm conclusion can therefore be made as to whether or not the winch was being used at the time of the accident.

The status of the winch brakes were confirmed when the vessel was inspected in dry dock. As seen, three brakes were off and the starboard topping wire drum brake was on. The removal of the trawl wire from the port drum prior to the salvage in 1993 supported the status of the port trawl drum brake and clutch as being disengaged.

A length of port towing wire led over the whaleback to the damaged port fishing gear and was entangled with the starboard towing wire. This was about 40 metres forward of the wreck.

A rope messenger was attached to the port quick release gear which suggests it had been released deliberately and under control. The crew would have been preparing to undertake an unusually heavy lift and thought it prudent to take this safety measure.

The port topping wire was very slack, lying loose on the deck, but still led through the appropriate blocks to the top of the port derrick. This suggests the port derrick was not deliberately winched into the 45° position as seen, but was in the near horizontal position whilst the vessel was upright on the surface. This is supported by the second salvage underwater survey in 1993 showing the port derrick down and the topping wire in the normal position for the derrick in this position. The port derrick probably swung into the position observed in 1991, about 45/50° to the mast, when the vessel heeled to an angle greater than 90° during the accident.

The port trawl wire drum had no wire on it when the wreck was raised in 1993. The retaining bar which held the bitter end of the port wire was not in place. The wire had not been removed from the drum long before salvage as there was no marine growth on the inner barrel of the drum. However this wire could have been pulled off the drum by vessels fishing or attempting salvage operations. The evidence relevant to the cause of the accident came from the 1991 underwater survey video film which showed wire on the port drum.

The starboard trawl wire drum had no wire on it when seen during the video survey on the 22 to 23 May 1991, nearly two months after the sinking. The wire was seen in a rough coil on the sea bed near the wreck. This is significant as it indicates the vessel remained in the same location when the wire came off the drum. Had the vessel been making way through the water there would have been no coil, only a straight line of wire.

Other vessels had fished in the area of the wreck. Two reported snagging it. It is possible that one of these had trawled into the unmarked wreck of PESCADO and snagged the starboard trawl wire. The starboard trawl wire drum brake was found off. Had the clutch been, or become, disengaged on the vessel's impact with the sea bed, there would have been limited resistance to the wire coming off the drum. It is accepted that wire which is wound onto a drum needs substantial force to remove it. In this case the force of another fishing vessel's gear would have given sufficient pull to remove the wire from the drum.

All scallop trawlers use "tailing" ropes on the inside end of the dredge gear to pull it forward when it is being returned to the water. Differentiating between PESCADO's port and starboard gear from the videos of the underwater surveys wasn't easy because of limited visibility and the confusion of wires. Nonetheless, PESCADO's gear had ropes attached at each end and it can be deduced that the damaged gear would have been the port side. This is contrary to what was reported by Motte and Associates in their report, but is consistent with common fishing practices.

### **2.6.7 Navigational Equipment**

The main electronic items of navigational equipment were in good working order in PESCADO on 19 February 1991. The radar, navigation plotter and Vigil navigator were all new. She was also fitted with both colour and paper recording echo sounders.

The magnetic compass was not in a secure position. It could not be used in bad weather necessitating the vessel having to return to harbour. The auto-pilot did not work and the vessel was always steered by hand.

The auto-pilot did not function at any time after the refit but the reason for this has not been determined. The lack of reliable compass information might have rendered the auto-pilot unusable.

### **2.6.8 Machinery**

The settings of the main engine's fuel pump rack and gearbox control, as established after the vessel's salvage, were at variance with the settings observed during the underwater surveys of the wreck. The observations during the underwater survey were made very much closer to the time of the accident, and therefore could reasonably be expected to be more reliable. However, these controls could have been displaced from their ultimate working setting during the sinking; particularly when the wheelhouse structure was damaged. It is therefore considered unwise to place any significance on any of the recorded control settings.

As set out in Section 1.10.9 all the vessel's bilge pumps were found to be set to draw from the sea, leading to the conclusion that no bilge pumping operations were taking place when the vessel sank.

## **2.7 POSSIBLE FAILURE/LOSS SCENARIOS**

Several possibilities are examined to explain why PESCADO sank. Although the evidence available does not support a collision scenario with a surface vessel or a submarine, it has been addressed in response to speculation about the causes.

### **Review of PESCADO's damage**

The damage (as measured by theodolite) to PESCADO's starboard side extends in length over some 14 frame spaces (about 5.6 metres), and in girth about 0.8 to 0.9 metres either side of the bilge keel. This means that the top edge of the damage would have been about 0.7 to 0.8 metres below the water-line. Above this the hull plating to the top of the bulwark rail is undamaged. The damage did not puncture the hull plating nor is there any evidence to indicate steel to steel contact.

An examination of the measured shape of the damaged bilge plating along frame lines shows that the frames have been deformed to an approximately flat surface. However, this pattern is disrupted by the forward engine room bulkhead which, due to its much greater strength, has been able to resist the full extent of the imposed deformation. The "flat" surface is inclined at approximately 45° to a vertical through the centre-line of the upright vessel.

In between the frames the unstiffened plating is "dished in". This effect is most marked in the plating immediately either side of the engine room bulkhead.

Some two metres of the starboard bilge keel has been pressed upwards flat against the deformed bilge plating.

The conclusion that the damage on the starboard bilge keel was caused by impact with the sea bed is fully supported by evidence. However, there has been extensive speculation to suggest that PESCADO's loss was due to a collision or contact with another vessel, and that she may or may not have been fishing at the time of the accident. These possibilities have been carefully considered and are discussed below.

### **2.7.1 Submarines**

#### **Collision with a submerged submarine**

As the wreck was located in a known Submarine Exercise Area, enquiries were made to establish whether there had been any submarine activity in the area during the period of interest. On 4 April 1991 the Ministry of Defence Secretariat (Naval Staff) was asked whether any reports, possibly relevant to the loss of PESCADO, had been made by vessels under naval operational control and operating in the area of the wreck during the relevant dates.

The reply received on 11 April 1991 indicated that all submarine movements had been on the surface and no reports of apparent relevance to the accident had been recorded.

In June 1991, a local boat operator reported that the submarine HMS SWIFTSURE had blue paint streaks on her bow; suggesting the paint was from the blue painted hull of PESCADO. The Naval Secretariat was again approached for information regarding this submarine's movements. They confirmed the submarine had been alongside in Devonport throughout the period 25 February to 8 March 1991.

It was later reported that the substance on HMS SWIFTSURE came from blue paint that had been spilled into the sea area nearby. However, an alternative explanation is that the blue substance came from wires routinely towed by HM submarines. Traces of the substance on a submarine's hull is therefore unsurprising. The second explanation is considered to be the most plausible.

A report was received that a submarine was sighted off Pendennis Point on 5 March 1991. The MOD stated that the submarine was operating approximately 200 miles south-west of Land's End on the day of the alleged sighting. However, this submarine may have been seen off Pendennis Point on the afternoons of 12 to 18 March 1991.

#### **Dragged down by a submarine**

A similar scenario to the ANTARES and HMS TRENCHANT accident in 1990 has been considered, but cannot be supported because PESCADO's fishing gear was located in the vicinity of the wreck. Had the fishing vessel been towed this would not be the case. Furthermore, it is not consistent with the MOD's reports on submarine movements.

### **2.7.2 Collision with a Surface Vessel**

#### **Negative Reports**

The previously mentioned reports from MOD (N) indicate that no submarine running on the surface could have been involved. Neither HM Coastguard nor MAIB received any report of a collision or contact with any unidentified vessel or object for the period 25 February to 8 March 1991.

### **Royal Naval Vessels**

On 8 October 1991, a letter was received by HM Coastguard from a member of the public, reporting explosions/lights seen at sea at the end of February 1991. HMS CORNWALL, the only warship known to be in the area, was exercising on the 26-28 February. None of her officers, who were interviewed by MAIB, heard or saw anything resembling the explosion or green lights referred to in the letter.

Those same officers had seen vessels fishing, which was quite normal, but their ship had kept clear of them following established Royal Naval fleet operating procedures.

Furthermore, nothing unusual which could reasonably be associated with PESCADO had been recorded in the vessel's log, or could be recalled by CORNWALL's officers.

### **Commercial Vessels**

The scenario that a commercial surface vessel was in collision with PESCADO and had caused her loss has been considered. Two other cases of serious damage resulting in the loss of a fishing vessel and crew have been reviewed and compared with the damage seen on PESCADO.



Figure 9: Damage to FV LARISSA shows serious hull failure (Note the bilge keel is bent down and split from the hull)



Figure 10: Damage to WILHELMINA J is severe with hull failure from keel to top of rail with damage to derrick and associated gear

The damage seen in Figures 9 and 10 are extensive and resulted in the tragic loss of both vessels and their crew. WILHELMINA J was fishing in thick fog when she was in collision with a 8,714 GT vessel. LARISSA was not fishing but crossing a Traffic Separation Scheme in moderate visibility when she collided with a 11,356GT vessel fitted with a bulbous bow.

The photographs show extensive damage to both these fishing vessels. A feature applicable to both is that the point of impact caused the bilge keel to deflect downwards. There is no resemblance to the minor damage seen on PESCADO.

The speculation suggesting that PESCADO with her relatively minor damage was lost following a collision with an unknown vessel, is not supported.

### **Commercial Vessel with a Bulbous Bow**

The minor damage to a fishing vessel, seen in Figure 11, is reported to have been the result of a collision with a coastal tanker fitted with a bulbous bow. This relatively minor damage, comparable in severity with that seen on PESCADO, shows a single plain indentation which did not hole the hull. The bilge keel is bent downwards and split from the hull. This damage is typical of that caused by passing collision.

The most obvious difference between this damage and that seen on PESCADO is that on this vessel the bilge keel was bent downwards whilst on PESCADO it was bent upwards. No details on the geometry of this damage were available to compare with the “flattened” bilge plating seen on PESCADO.

The MAIB tested the hypothesis that the distortion to the bilge keel observed on PESCADO, was the result of a collision with the bulbous bow of a merchant ship. It was found that such an impact would be most likely to force the bilge keel downwards, as is indeed shown in Figure 11, and not upwards as on PESCADO, see figures 7 and 12 .



Figure 11: Photograph shows minor collision damage with bulbous bow vessel (Note bilge keel is deflected downwards and split away from the hull) [Photograph courtesy of Hodge Jones and Allen, Solicitors]

The damage observed on the hull of PESCADO is shown in Figures 7 and 12. Whilst it appears similar (only a comparison of photographs of the respective damage has been made) to that observed after a collision between a fishing vessel and the bulbous bow of a small tanker (reported above), it differs in one significant respect – the bilge keel is deflected up and not down. However, this comparison supports the conclusion reached by the MAIB as the result of some basic calculations for PESCADO; in a collision where the initial impact is transmitted through a bulbous bow the bilge keel will almost certainly be deflected downwards. Thus it is concluded that the damage observed on PESCADO was unlikely to have been caused by an impact with a bulbous bow.



Figure 12: Local damage to PESCADO's starboard side as seen in dry dock [Photograph by courtesy of the Chief Constable of the Devon and Cornwall Constabulary]

### 2.7.3 A Collision whilst PESCADO was on passage to Fishing Grounds or Trawling

When the bodies of the Skipper and the Mate were recovered, they were wearing warm clothing and oilskins. Oilskins are normally worn when on deck as protective clothing. When the wreck was recovered only one oilskin was found on board. The fishing derricks, beam positions, the quick-release gear in the activated position and winch control settings, all support the theory that PESCADO was involved in fishing operations.

Had PESCADO been in a collision whilst fishing/towing, she would have sunk well in front of the dredges being towed, and not, as found, alongside them.

It is concluded that PESCADO was not involved in an incident whilst on passage to fishing grounds, or while trawling. The evidence indicates she was stopped, or nearly stopped, at the time of her loss.

#### **2.7.4 Damage after Capsize**

The possibility of the vessel capsizing and then being struck by an unknown vessel while inverted cannot be supported. PESCADO did not fully capsize as items of tools were seen on the workbench in the engine room, galley items remained on work surfaces, and clothes stayed on hooks in an orderly state. Furthermore and as previously stated, there were no sign of steel to steel damage.

#### **2.7.5 Cause of Damage**

The minor damage to PESCADO did not support the collision and loss scenarios. More extensive damage and penetration of hull plating, and damage to fishing gear would have resulted, similar to that seen in Figures 9 and 10.

The damage was very local and does not support steel to steel damage which would occur on collision with a submarine or surface vessel. A submarine hitting PESCADO would have received major damage which would have been impossible to conceal.

The damage seen on PESCADO was not caused by collision.

The cause of the hull damage which has been observed on PESCADO is most easily explained as an impact with a level surface which allows the hull to sink into it while the pressure builds up. This pressure causes “dishing” to the plating between frames and can be clearly seen on Pescado’s hull. This is consistent with damage arising from the vessel landing heavily on a sandy sea bed on her starboard bilge. The sea bed in the immediate area of the wreck was relatively flat and covered with sand.

### **2.8 MAIB – RECONSTRUCTION OF THE ACCIDENT**

Having considered the evidence, the MAIB has carefully constructed a likely sequence of events to explain the sinking of PESCADO.

Although there are no survivors of, nor witnesses to the accident, the MAIB investigation indicates the vessel and her crew were lost during fishing operations. The probable circumstances leading up to the loss are described in the following sections.

#### **2.8.1 The Circumstances leading to the Loss**

During scallop trawling over a very rough sea bed on the fishing grounds off Dodman Point, PESCADO snagged her port dredges on a bank, ledge, large boulders or rock formation.

Although it is not known for certain which of several possible sequences of events led to PESCADO’s two sets of fishing gear fouling each other, it is probable this happened whilst corrective action was being taken after the port dredges had snagged.

The port gear became fast on rough ground, causing the vessel to pull to port. The crew member in the wheelhouse would have instinctively eased off the main engine power and called the other crew members to assist. While the crew dressed and proceeded on deck, the vessel continued to pull round to port. This would have brought the starboard gear around and caused the starboard trawl warp to become entangled in the port gear, resulting in both sets of gear becoming connected. By the time the crew arrived on deck the vessel would have had a heavy heel angle to port. At that stage the observed damage to the beam and dredge would have occurred. A decision to activate the port quick release gear would have

been made. This would enable the port snagged gear to be retrieved without putting a large heel on the vessel.

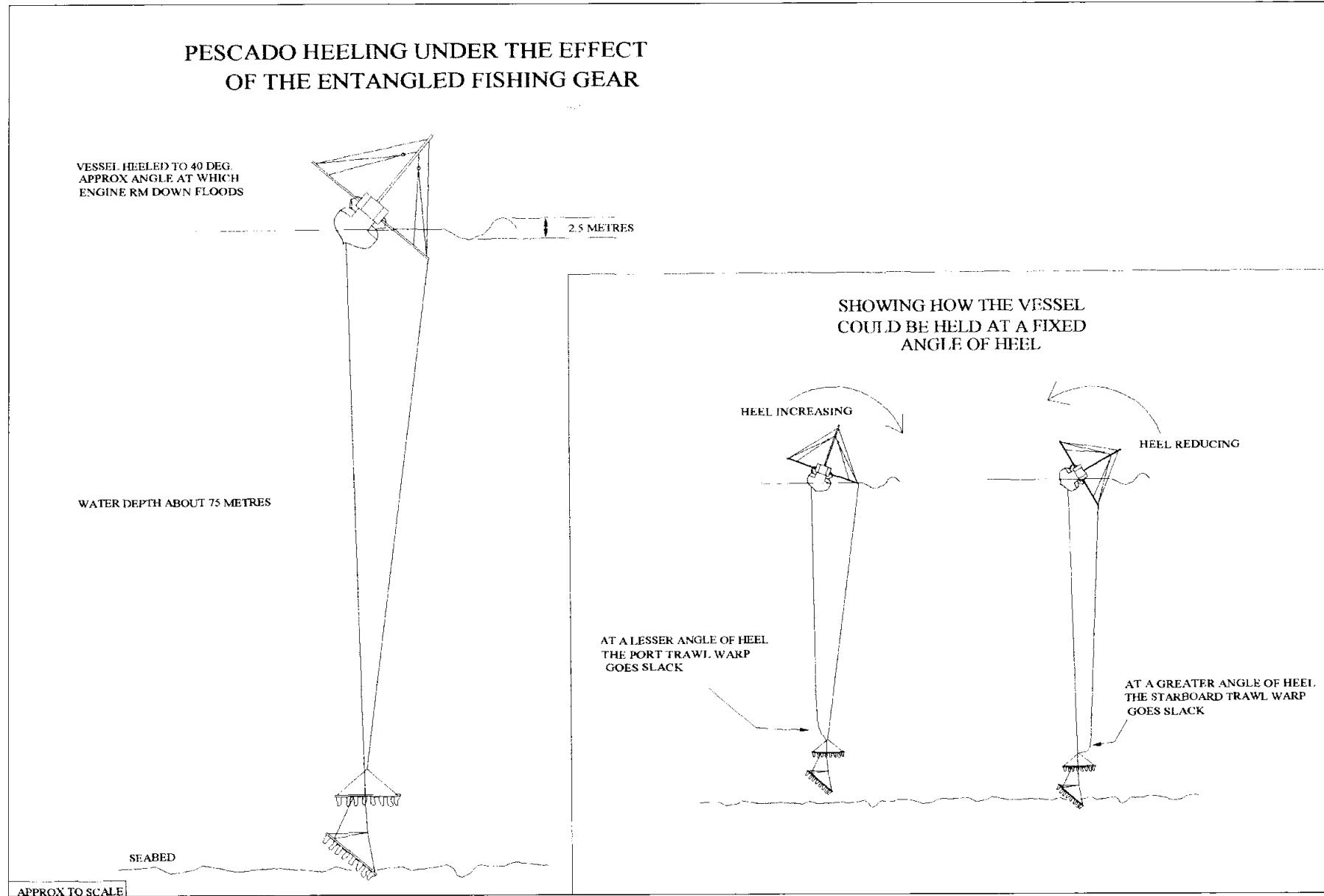
To accomplish this, the port trawl drum brake would be released to take the heel off the vessel. To operate the quick-release in a controlled manner, a messenger rope would have been attached to the hard eye at the quick release clip and led to a secure position near the senhouse slip on the port derrick. With the derrick near horizontal position the safety ring would then have been removed and the quick-release senhouse slip activated with a hammer. The port derrick block, with the chain and wire still attached would have then run down the trawl, only stopping when the messenger became taut. This procedure, performed in this fashion, would have been a prudent safety measure designed to reduce the size of heeling moments on the vessel when retrieving the port gear.

At that stage of the operation the port derrick would have been nearly horizontal, with its weight being taken by either the topping wire or the preventer.

Once the port quick-release had been operated the trawl drums' brakes would have been engaged, followed by the clutches, after which hauling would have started. A decision to haul both sets of gear at the same time would have been normal. After the slack in the trawls had been taken up, the gear would be lifted off the sea bed, probably the port gear first, which would have resulted in the vessel heeling about 50° to port, if directly over the gear. When the starboard gear was lifted off the bottom it would have swung to starboard to a point under the derrick head, bringing the attached port gear with it.

The weight of both sets of gear coming onto the extended starboard derrick, as seen in Figure 13, would have induced a much larger angle of heel than expected.

Figure 13



The Skipper is unlikely to have anticipated going from a port list to a heavy starboard list, and would have decided to drop all the gear back to the bottom and restart the operation. To drop both sets of gear, the brakes would have had to be applied, clutches taken out, and the brakes taken off. This would have been an extremely difficult operation for the crew to perform with the vessel heeled over. It is hard to estimate how long this would have taken but in ideal conditions it might have taken about a minute. In severely heeled conditions it would have taken longer.

During these efforts the vessel would have continued heeling to starboard. Unless the corrective action of dropping the gear was taken at a stage before significant amounts of water had come onto the deck, and before the vessel had reached an angle of heel of 27°, the vessel's roll to starboard would have continued. With the vessel heeled to about 25°, water would have flooded over the bulwark rail to become trapped on deck with the freeing ports closed, to cause the vessel to heel further to starboard. At about 40° water would have downflooded through the engine room door which would have swung further open as the vessel heeled to starboard.

The length of time taken for the vessel to lie over on her beam ends is difficult to estimate because of the effect of various factors, such as sea condition, load on towing wire and rate of flooding into the vessel. As a guide, it is known from another accident investigation that a small beam trawler took just 16 seconds to lay over on her beam ends in a smooth sea with no swell. The heel to 90° of PESCADO would have been very quick, possibly of the same order as the small beam trawler's 16 seconds, or even less.

## 2.8.2 Direction of Heel

The assumption that PESCADO heeled to starboard is based on evidence.

The swivel block at the starboard side of the whaleback was seen to be outboard of the whaleback's shoulder during the underwater survey. The normal attitude of this block, with no load on the towing wire, would have been to hang down inboard of the whaleback's shoulder. It is hard to conceive a sequence of events which would have placed this block in the position seen, other than with a heel to starboard.

After PESCADO was recovered, an inspection of the internal spaces showed that many items were in their expected positions on the engine room work bench, which was on the starboard side. Anything other than a starboard heel would have displaced these items from their normal positions. The 1993 underwater survey showed all the loose items on the deck of the galley had moved to the starboard side and the port side was clear.

During the roll of the vessel, the port derrick would have been free to swing to starboard once the vessel exceeded an angle of 90°. As the port derrick head block, port quick-release mechanism and messenger remained connected to the derrick, this assembly would have moved to starboard with the derrick. The part of trawl in the block would have been pulled in the direction of the derrick as it moved to starboard.

The block and trawl would have moved up the hull and bulwark until they fell vertically and inboard, into the position seen on the video in Figure 4. A roll to port could not have placed these components, particularly the port trawl block, in the positions found during underwater survey.

### 2.8.3 The Sinking

The following description has been based on evidence obtained from the wreck of PESCADO and the findings of a research project into the sinking of fishing vessels, carried out in 1993 by Wolfson Marine Technology Unit, Southampton University, on behalf of the MAIB. The report concluded that:

The vessel heeled to starboard with the weight of both sets of fishing gear acting at the end of the starboard derrick. It has been calculated that in this state her stability would have been reduced and she would have heeled to an angle of about 90°. This suggestion is supported by the behaviour of models observed during the above mentioned tests.

As modelled, the vessel would have lain over on her beam ends, or partially submerged on her side at about 90°, with the port bulwark near the surface. Down flooding would have continued through all openings, but mainly through the deckhouse openings and into the engine room. The model tests suggest that this stage of the sinking would have taken a few minutes (see Figures 14 and 15). Flooding of the hull would have continued until sufficient buoyancy had been lost to cause the vessel to sink deeper (see Figures 16 and 17). The vessel would most likely have sunk by the stern because of a greater number of flooding openings aft.

The hydrostatic pressure damage to the deck in way of the net store, confirms that the forward net store initially remained watertight and buoyant, supporting the fore end of the vessel at the early stage of sinking. Once the vessel had left the surface, she would have descended quite rapidly. With air being expelled, flooding would have continued, the hull sinking to the sea bed still tethered to the starboard trawl by the trawl wire. During descent the hull would have swung in an arc on a fairly even keel, developing an angle of heel of about 45°, which brought the starboard derrick in line with the submerged trawl wire (see Figures 16, 17 and 18). At this angle the starboard bilge keel would be the first point of impact with the sea bed, (see Figures 19 and 20) causing damage to the turn of the bilge. Sufficient kinetic energy remained in the hull to cause her to roll to port and take up a nearly upright position on the sea bed. (See Figures 21 and 22). Figure 23 shows a graphical representation on how the vessel sank to the sea bed.

With the brake off and the clutch disengaged, the starboard trawl wire would, if tarred and greased, come off the drum easily whilst under load. The initial load would have been exerted by the vessel sinking to the bottom. However, when the wreck was surveyed in June 1991 there was no wire on this drum. The remaining wire on the drum was most likely pulled off it by fishing vessels which were known to have unintentionally trawled into the wreck.



Figure 14: Model heeled heavily to starboard with weather deck awash and wheelhouse flooded



Figure 15: As seen underwater just below the surface tethered by the starboard trawl wire



Figure 16: Model leaving the surface, descending in an arc (the port derrick could swing inboard)



Figure 17: Model observed during descent from starboard side



Figure 18: Model heeling heavily to starboard, descending and close to sea bed



Figure 19: Model seen descending from port side, air escaping first point of impact will be starboard turn of bilge



Figure 20: Model making impact on starboard side with the sea bed.



Figure 21: Model impacted on sea bed as observed from port side



Figure 22: Vessel at rest on the sea bed in a nearly upright position

## GRAPHICAL REPRESENTATION OF VESSEL SINKING

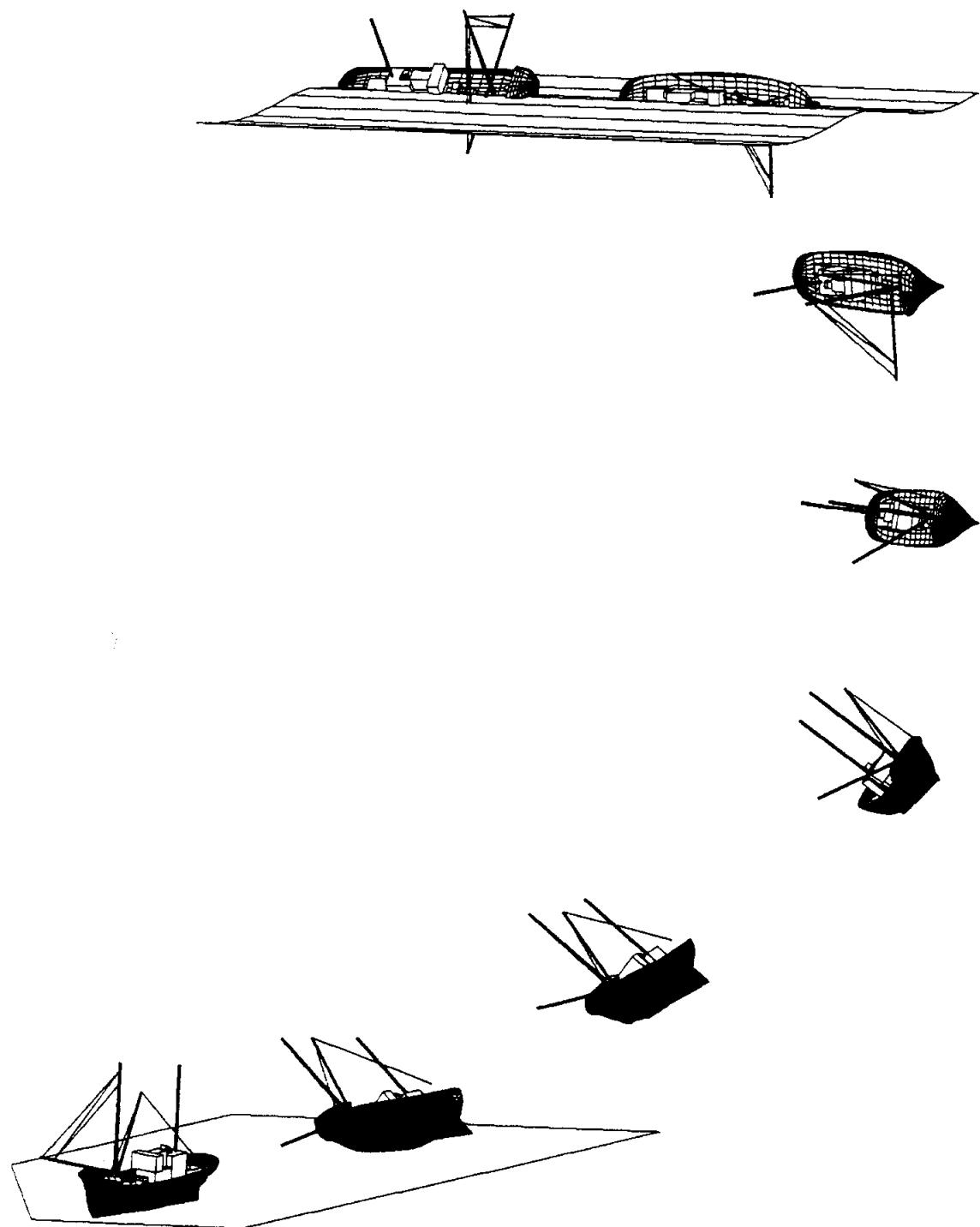


Figure 23

# SECTION 3

## Conclusions

### 3.1 FINDINGS

1. PESCADO was constructed in 1956 as a traditional side trawler and refitted at the end of 1990 to scallop twin beam trawling. [1.2]
2. The vessel had operated as a scallop twin beam trawler for a maximum of three months after her refit. [1.3]
3. Eight days passed between the vessel leaving harbour on 25 February 1991 and anyone reporting concern to the Coastguard. [1.4, 2.2.2]
4. A comprehensive Search and Rescue operation was carried out. [1.4, 2.2.3]
5. The vessel sank in 75 metres of water in a location some 13 miles south of Dodman Point. The position of the wreck was 50° 00' 32.94" N, 04° 43' 53.34" W. [1.4]
6. A substantial piece of floating wreckage was seen on 28 February 1991 but not reported to the Coastguard. [1.4]
7. The loss of the lives of the six crew from PESCADO was a direct result of her foundering.
8. The accident most likely occurred between 25 and 28 February 1991. [1.4]
9. The port gear of PESCADO probably snagged on the sea bed whilst the vessel was towing. [2.6.6, 2.8]
10. After snagging, the two sets of gear probably became tangled.[2.6.6, 2.8]
11. PESCADO probably heeled very heavily to starboard due to the weight of both sets of fishing gear coming onto the starboard derrick. [2.8.1, .3)
12. PESCADO sank due to downflooding through openings which were not secured closed. [1.9.2, 2.8.3]
13. Weather conditions between 25 and 28 February were generally moderate. The wind, mainly from a southerly quarter during the period, reached force 6 for a time on 26 February. Visibility was fair to good. [1.7]
14. PESCADO was operating in an area where the sea bed is rough and uneven. [1.9.7]

15. At the time of the accident the Fishing Vessel Safety Certificate for PESCADO had been purported to have been withdrawn, in accordance with the practice of the time. [1.2] and [2.3]
16. The vessel had been issued with a certificate of registration by the Registrar General of Shipping and Seamen, and with a Multiple Species Fishing Licence by MAFF. [1.5, 2.3]
17. No crew member held a Certificate of Competency as required by the DOT for fishing vessels of PESCADO's length. [1.6.1]
18. The Skipper and crew had only limited experience of twin beam trawling. [1.6]
19. The Skipper had operational experience of PESCADO, but the other crew members did not. [1.6]
20. At the time of the accident not all the vessel's watertight openings were secured closed. [1.9.2]
21. One inflatable liferaft was found onboard. [1.9.3, 1.10.5]
22. The liferaft was 20 months overdue for servicing. [1.10.5, 2.6.4]
23. The liferaft did not float free. [1.9.3]
24. There was no HRU fitted to the liferaft. [1.9.3]
25. The liferaft was incorrectly secured to the vessel. [1.9.3, 2.6.4]
26. There was no EPIRB onboard. [1.9.3, 2.6.4]
27. The inadequate life-saving equipment reduced the chances any survivors might have had. [2.6.4(a), (c)]
28. A wreck was found between 23 and 27 April 1991. [1.4]
29. The wreck was not positively identified as PESCADO until the underwater survey which took place between 22 to 23 May 1991. [1.4]
30. The wreck was found on the sea bed lying to port on her port bilge keel, head to the northeast. [1.9.1]
31. The starboard derrick was 90° to the mast, and the port derrick was at about 30-40° relative to the mast. [1.9.4]
32. The derrick stays were intact, and the port topping wire was very slack, starboard topping wire was taut. [1.9.4]
33. Both sets of trawl gear were on the sea bed, and were in the vicinity of the wreck. [1.9.4]
34. The port quick release gear had been activated, and the derrick head block was on the port fore side of the weather deck. [1.9.4]

35. The starboard trawl wire was completely off the winch drum. [1.9.4]

36. There was wire on the port trawl drum, it was connected to the beam. [1.9.4]

37. The fishing winch status was: [1.9.4]

Port topping drum – brake . . . off, clutch . . . out

Port hauling drum – brake . . . off, clutch . . . out

Starboard hauling drum – brake . . . off, clutch . . . out

Starboard topping drum – brake . . . on, clutch . . . out

38. No significance can be placed on the main engine and gearbox control settings as they are likely to have been disturbed during the vessel's sinking. [1.10.9, 2.6.8]

39. The rudder was set at 2° to 5° to port. [1.9.5]

40. Most of the wooden structure of the wheelhouse was missing from the wreck. [1.9.6]

41. The starboard bilge keel was distorted and plating on the turn of the bilge over a length of about two metres was seen indented. [1.9.6, 1.10.1]

42. The hull and wooden deck damage in way of the net store was the result of hydrostatic pressure. [1.10.1]

43. The bilge keel damage does not equate with steel to steel collision. [2.7]

44. The bilge keel damage demonstrates a typical case of bottom grounding. [2.6.2, 2.7]

45. No other markings were considered to be significant in establishing the cause of the vessel's sinking. [2.6.3]

46. The brakes on the towing wire drums were not operating efficiently. [1.8.4, 2.5]

47. It is unlikely that an experienced person was in the wheelhouse at the time of the accident. [2.4]

48. The Skipper, Mate and some other crew members were working on deck at the time of the accident. [2.4]

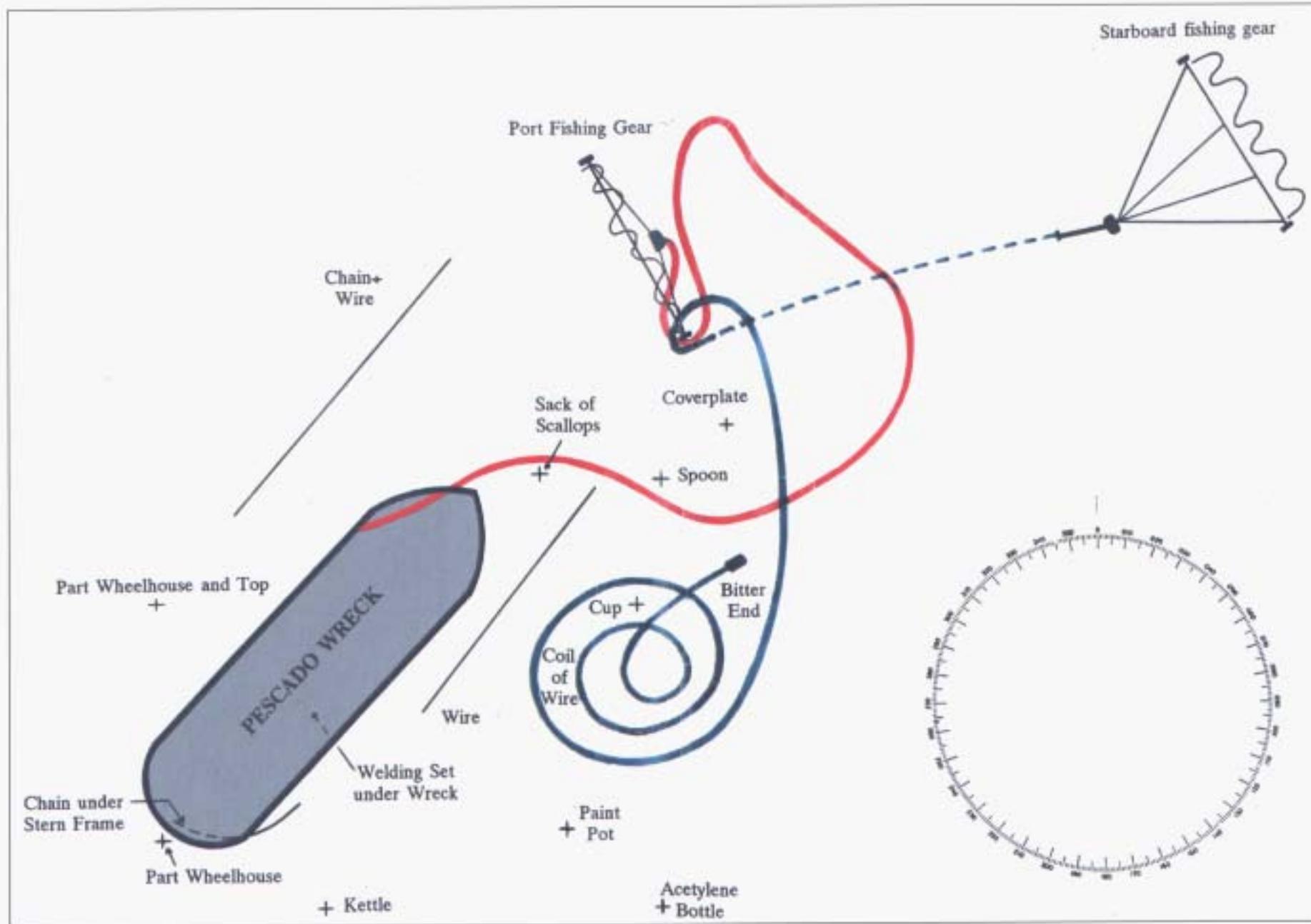
49. The stability characteristics of PESCADO did not meet the required DOT standard. [2.3.3]

50. PESCADO's unsatisfactory stability was not the decisive factor which caused her loss. [2.3.3]

51. PESCADO sank during the recovery of her fishing gear. [2.8]

52. During the sinking the vessel did not fully invert. [2.8]

Annex C: Sketch Plan of the Wreck and Gear on the Seabed from MAB's Summary Report 1992



53. The MCA now carry out a much more proactive role in enforcing the safety rules for fishing vessels. [2.3.1]
54. PESCADO was clearing her snagged gear and was not fishing or on passage to fishing grounds at the time of the accident. [2.7, 2.8]
55. The winch gearbox had not failed and was therefore not a factor in this accident. [1.11]
56. The weight of the scallop dredges and chain accounted for a large part of the observed vessel's angle of heel to starboard. [1.11]
57. There were no hidden pockets of sea water on PESCADO when inclined in 1997. [1.11]

### **3.2 CAUSES**

The immediate cause of the loss of PESCADO was excessive heeling, and flooding as a consequence of being subjected to an adverse heeling moment induced while attempting to recover fouled fishing gear.

The lack of a properly qualified and experienced crew, together with inadequate life-saving appliances which were incorrectly installed and improperly maintained, contributed to the loss of the vessel and crew. In turn, these contributory factors were caused by shortcomings in the shore management of the vessel.

# SECTION 4

## Safety Recommendations

### 4.1 SAFETY RECOMMENDATIONS MADE IN JUNE 1992

Based on the Inquiry into the incident and the findings of the Inspectors, the following recommendations were made in June 1992.

The recommendations for consideration by other bodies are as follows, with the name of the body to whom they are addressed in italic:

1. Consideration should be given to instituting a grant system to encourage the industry to upgrade the winches, winch controls and quick release systems on older fishing vessels. [2.5, 2.8.2]

*(Marine Directorate (now MCA) and Seafish Industry Authority)*

2. No change is recommended to the procedures for the registry of fishing vessels, but there should be an absolute requirement that a Fishing Licence shall not be issued to any vessel required to have a United Kingdom Fishing Vessel Certificate, unless the vessel holds such a Certificate and it is valid. [2.3.2]

*(Marine Directorate (now MCA) and Ministry of Agriculture, Fisheries and Food)*

3. The work currently being carried out by Marine Directorate (now MCA) to improve the promulgation of advice, guidance and information to fishermen should be pursued as expeditiously as possible. It is further recommended that consideration should be given to replacing the present reliance on Merchant Shipping Notices by a system dedicated specifically to the fishing industry. Particular attention should be paid to ensuring that material put out under such a system is given the widest possible distribution to serving Skippers and fishermen.

*(Marine Directorate (now MCA))*

4. Among the matters to be covered by the new system referred to in Recommendation 3 should be:

- a) Advice on the safe operation of beam trawlers, to replace that presently given in Merchant Shipping Notice No M.699; [3.2]
- b) Clear information on the requirements for the certification of vessels, skippers and crew;
- c) Guidance on training courses, including the requirements for safety training;
- d) A plain summary of the requirements and recommendations for safety equipment.

*(Marine Directorate (now MCA))*

5. A particular effort should be made to stress to owners and to skippers the importance of compliance with the existing requirement that a list of crew be kept ashore, and amended whenever changes take place, so that at all times when the vessel is at sea the names of all her complement are known. It should be emphasised that the crew list requirements are not a matter of red-tape: the distress of the bereaved is made even greater when, because a definitive list cannot be found, there is a long delay before the identity of those on board a missing ship can be confirmed.

(Marine Directorate (now MCA))

6. Tests should be carried out to ascertain the behaviour of containers for inflatable liferafts when forcibly submerged to a greater depth than that at which they will presently float free or operate. Bearing in mind that a liferaft and its container which is initially trapped when a vessel capsizes may become free as she sinks or reaches the bottom, it is important that buoyancy is maintained to as great a depth as is practicable. [2.6.4]

(Marine Directorate (now MCA))

7. Mariners should be advised that in every case where debris is seen at sea which might be floating wreckage, the circumstances should be reported as soon as possible to the appropriate Search and Rescue authority; that is in UK waters to HM Coastguard. [3.1.6]

(Marine Directorate (now MCA))

8. Research should be put in hand to develop the understanding of modes of sinking of fishing vessels.

(Marine Accident Investigation Branch)

## **4.2 CURRENT STATUS OF SAFETY RECOMMENDATIONS MADE TO MSA IN 1992**

### **Safety Recommendation 1:**

The only aid available for equipping fishing vessels is aid for new items of safety equipment required to enable a vessel to obtain an MSA Fishing Vessel Safety Certificate under the provisions of the Fishing Vessel (Safety Provisions) Rules 1975. EU rules prevent aid to fishing vessels from being used to increase fishing effort and so MAFF cannot grant aid any work linked to new fishing gear. The safe operation of fishing gear is regarded as properly the responsibility of the Owner in ensuring that the vessel is fit for its purpose and therefore it is not possible to implement this recommendation.

The recommendation has been REJECTED.

### **Safety Recommendation 2:**

MSA has pursued the matter of a direct conditional link between licensing and certification with MAFF. The latter has suggested that the same results might be achieved through merchant shipping legislation, since the removal from the register of a vessel without a valid UKFV Certificate has the effect of invalidating the licence.

The recommendation has been ACCEPTED and the action is ongoing.

### **Safety Recommendation 3:**

The methods of issuing information and guidance has undergone a number of reviews, especially following the de-regulation unit report on MSNs. The publication of information is being addressed through:

- a. the RNLI's Sea Safety Liaison Working Group safety advice booklet;
- b. changes to the MSN system has resulted in MSN, MGN and MIN being issued which each identify whether the guidance applies to the fishing vessels. This helps reduce the need to search for the details;
- c. changes are being sought to improve the safety information and advice carried in yearbooks and nautical almanacs;
- d. MSA has targeted fishing vessels in its 1997/98 business plan, and beyond, in an attempt to reduce fishing vessel accidents. In association with the industry a Fishing Vessel Safety Trends Initiative has been set up which has targeting of safety advice and guidance as a key issue;

The recommendation has been ACCEPTED. Various methods being initiated to improve distribution of guidance and safety information. The action is ongoing.

#### **Safety Recommendation 4:**

MSN No 699 was replaced by M 1657 in March 1996. The RNLI Sea Safety Initiative has produced a number of colourful pamphlets and simple to read guidance booklets aimed at fishermen. The MSA issued the third edition of "Fishermen and Safety" in 1996.

The recommendation has been ACCEPTED. This remains an ongoing implementation process as information technology provides an ever widening array of methods whereby guidance can be distributed. Action ongoing.

#### **Safety Recommendation 5:**

MSN No 662 was originally issued in July 1973 and regularly features as an important item during fishing vessel accident follow up inquiries. The MSA will re-emphasise, in a MIN, the need for an up-to-date crew list being available on shore. The MIN will be published as soon as Ministers have taken decisions about possible crew agreement changes.

The recommendation has been ACCEPTED. Action is in hand to re-publish requirements.

#### **Safety Recommendation 6:**

This recommendation was the subject of MSA Research Project No 341 undertaken during 1993. It was satisfactorily demonstrated with the various sizes of liferafts tested that in their GRP containers they retained positive buoyancy when forcibly submerged to a depth of 15 metres over a time period of up to 13 hours. After release, all containers floated to the surface in periods from 10 to 15 seconds and on inflation were all boardable within 10 seconds.

The recommendation has been ACCEPTED. Research project and action completed.

#### **Safety Recommendation 7:**

This recommendation was incorporated into the Annual Notice to Mariners and last appeared in ANM 4 (Distress and Rescue) under "reporting of shipping accidents" on page 29 of 1997 annual summary.

The recommendation has been ACCEPTED. This matter is related to Merchant Shipping (Navigational Warnings) Regulations 1996, MSN No 1641/NW1 also applies. Action completed.

#### **4.3 ACTION TAKEN AS A RESULT OF SAFETY RECOMMENDATION NO 8**

MAIB commissioned the Wolfson Marine Technology Unit of Southampton University to carry out a research project into the sinking of fishing vessels. The project was completed in August 1993 and the findings presented to the Fishing Industry Safety Group later that year.

#### **4.4 SAFETY RECOMMENDATIONS – 1998**

**With the investigation now complete the MCA is further recommended to:**

1. Carry out a general inspection on any fishing vessels owned, or managed, by Mr O'Connor or Mr Ayres. [ref: 3.1.3, 3.1.15, 3.1.17, 3.1.18, 3.1.19, 3.1.21 to 27, 3.2]
2. Reconsider the holding of an inquiry, under Section 52 of The Merchant Shipping Act 1970, (now Section 61, 1995), into the fitness of Mr J O'Connor to hold the Certificate of Competency No 33858 (Second Hand Special (Fishing)) and perform the duties of an officer holding such a certificate. [ref: 3.1.3, 3.1.15, 3.1.17, 3.1.18, 3.1.21 to 27, 3.2]

# GLOSSARY OF TERMS

aft	rear of the vessel	hove-to	when a vessel is slowed or stopped and lying at an angle to the sea which affords the safest and most comfortable ride
beam trawler	fishing vessel which uses two beams for fishing operations	keel	lowest longitudinal structural member
beam	width of a vessel	list	angle of tilt caused by internal distribution of weight
bilge	space for the collection of surplus liquid	Marine Directorate	Now the MCA
bulkhead	nautical term for wall separating one compartment from another	offsets	measurements from the centre line of vessel defining the shape of the hull
conning	another term for "has conduct" or "in control"	painter	rope attaching liferaft to vessel
deckhead	nautical term for overhead ceiling	senhouse slip	a quick release shackle
derrick	equipment from which trawl gear is hauled	statical stability	measure of a vessel's stability in still water
dog	cleat or device for securing weathertight openings	tailing rope	rope attached to the inside end of a beam
draught	distance from keel to waterline when the vessel is afloat	whaleback	the forward end of the fo'c'sle deck on a fishing vessel
fo'c'sle	forecastle (raised structure on the bow of a vessel)	wheelhouse	structure from where a vessel is navigated and directed
freeboard	distance from the waterline to the deck edge		

# ANNEX A

## A review of the stability of Pescado

### A.1 THE STABILITY REGULATIONS APPLYING TO THE VESSEL

The regulations covering the stability of Fishing Vessels are set out in Rule 16 of the Fishing Vessels (Safety Provisions) Rules 1975, which were in force at the time of PESCADO's loss. The specific requirements for beam trawlers are:

- i) a transverse metacentric height (GM) of at least 0.42 metres;
- ii) a righting lever (GZ) of at least 0.24 metres at an angle of heel equal to or greater than 30°;
- iii) the maximum GZ to occur at an angle of heel not less than 25°;
- iv) an area not less than 0.066 metre-radians up to an angle of heel of 30°;
- v) an area not less than 0.108 metre-radians up to an angle of heel of 40° or to a lesser angle of heel at which the lower edges of any openings in the hull or superstructure, which cannot be closed weathertight, become immersed;
- vi) an area not less than 0.036 metre-radians between the angles of heel of 30° and 40°, or a lesser angle as defined in v) above.

The Fishing Vessels (Safety Provisions) Rules 1975 introduced, for the first time, a system of regular statutory surveys for the purpose of issuing safety certificates to fishing vessels. It was envisaged from the outset that the Rules would be applied to existing vessels only as far as was reasonable and practicable, and that for these vessels, exemptions from complying with particular rules could be granted. In respect of the stability criteria enshrined in Rule 16 an exemption was granted to all existing beam trawlers subject to a satisfactory roll period test and subject also to the carriage of suitable guidance notes for the Skipper.

The statutory powers upon which the 1975 Safety Provisions Rules are based are set out in the Fishing Vessels (Safety Provisions) Act 1970. Section 5 of this Act requires that the owner or master of a fishing vessel has to give written notice to the Authority which issued the safety certificate of any alterations to the vessel's hull, equipment or machinery which affects the seaworthiness of the vessel.

## A.2 TECHNICAL ASPECTS OF THE STABILITY DATA

### A.2.1 Conflicting Data

As part of the investigation a full re-analysis of the data relating to the inclining tests in 1990 and 1993 was carried out. The hull form used as the basis for this analysis was that derived from measurement in dry dock by Devonport Management Limited on behalf of Burness, Corlett and Partners following the salvage of the vessel, see Figure 24.

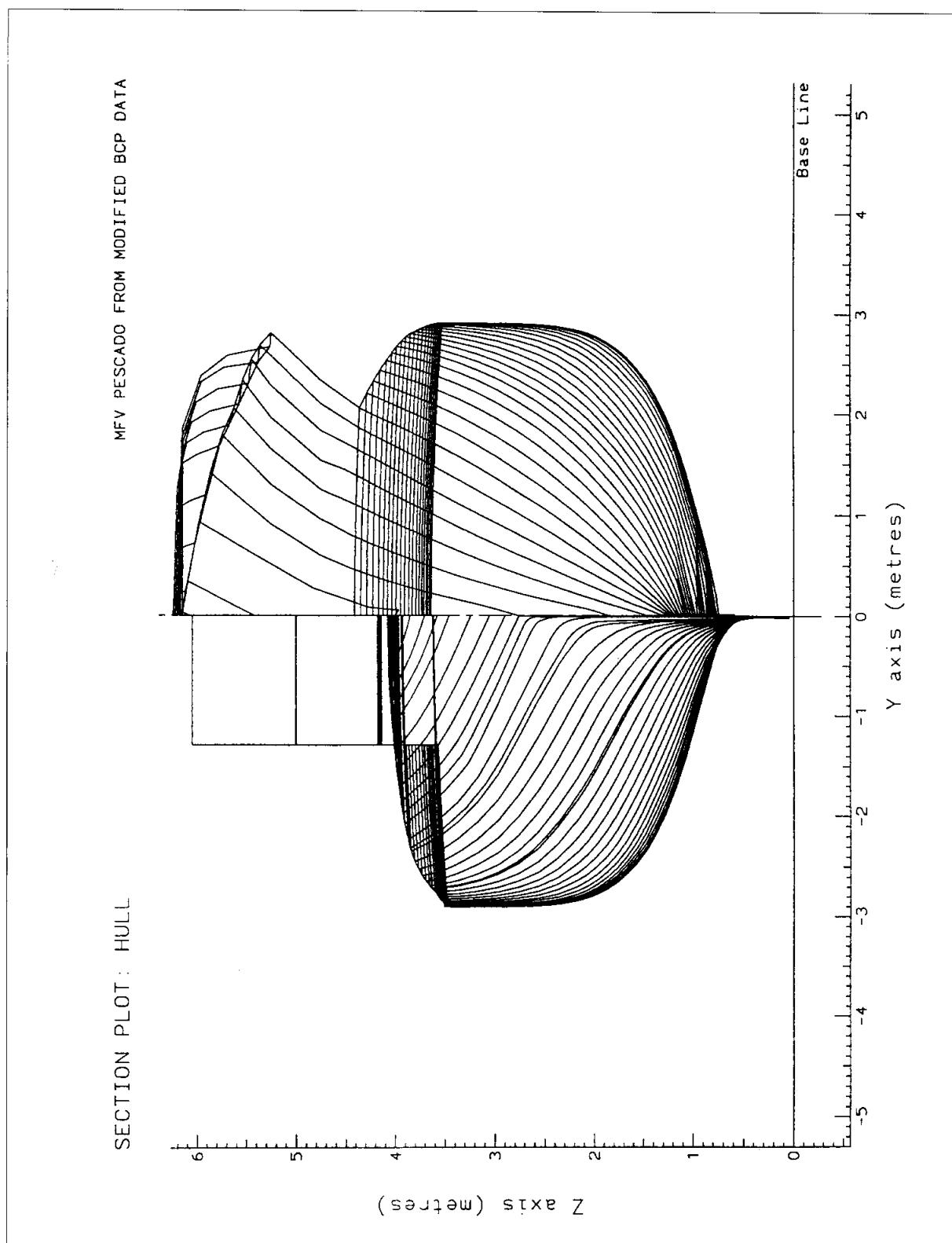


Figure 24

It was found that there was a marked difference between the results of the two inclining tests. Consequently, there was a considerable variation in the estimated stability for the vessel, depending upon which set of results was used to derive the lightship condition. This is clearly illustrated in Figure 25, which shows the righting lever (GZ) curves for the Depart Port condition. It can be seen that the maximum righting lever determined using the “1990” inclining test is some 80% greater than those determined using the “post salvage, 1993” inclining test; while the metacentric heights (GM) differ by about 26%. There was an equally remarkable difference in the lightship weight estimates: the “1990” lightship weight estimate was 101.2 tonne whilst that derived from the “1993” inclining test was 122.2 tonne, a difference of over 20%.

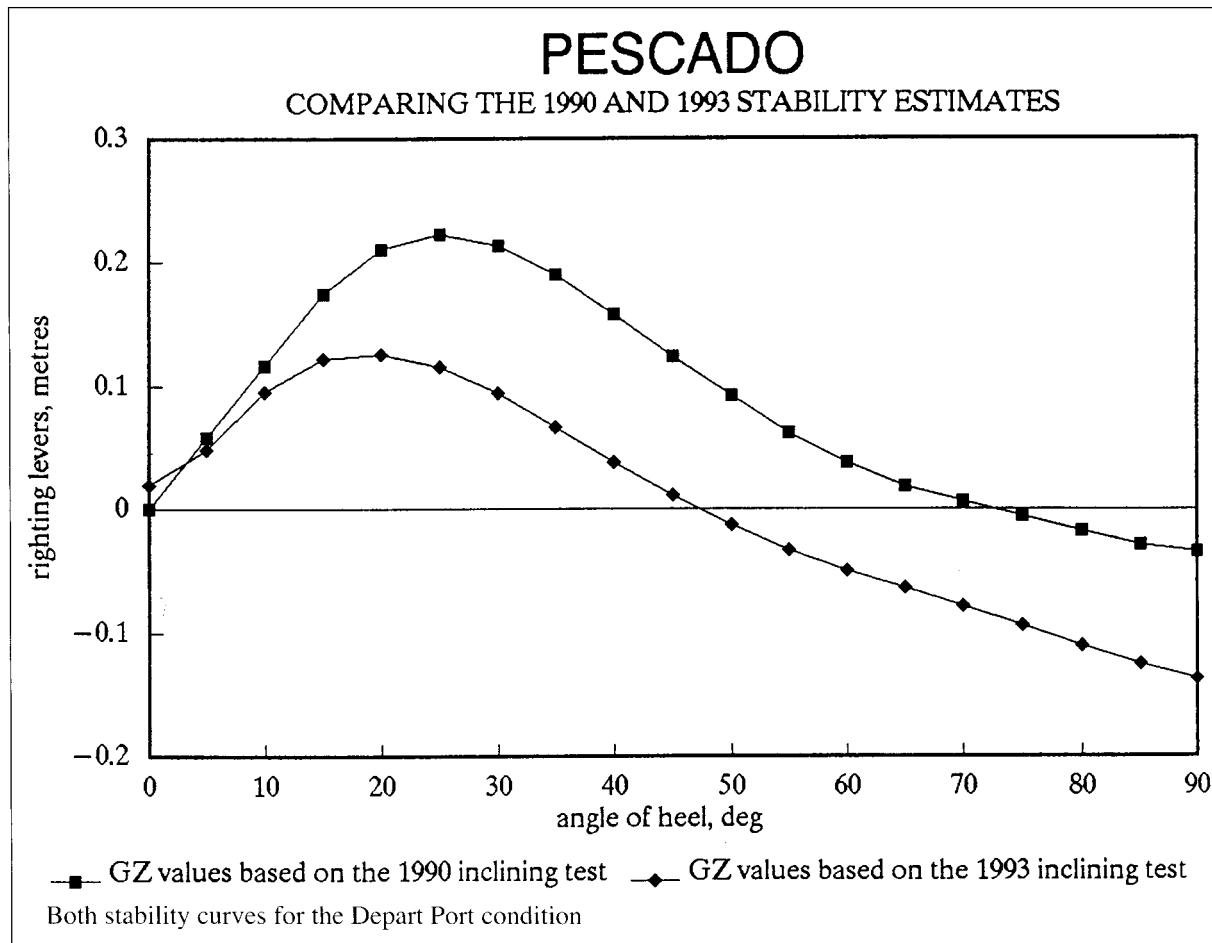


Figure 25

### A.2.2 Investigating the Weight Difference

Because of the apparent conflict in the available data, neither could immediately be used as the basis from which to assess the stability of PESCADO without further investigation. It was decided to begin by trying to identify why there was such a large difference in the lightship weights. To this end the MAIB carried out a lightship survey of the vessel in July 1997.

The results of this survey were not particularly helpful in resolving the difference between the existing data, and in fact raised even more questions. A lightship weight of 113.5 tonne was estimated as a result of the survey, this was 8.7 tonne lighter than that derived from the “1991” data. It was not immediately apparent why this relatively large weight loss had occurred since all enquiries indicated that no items of lightship weight had been removed from the vessel since the inclining experiment in 1993.

One factor which was considered, and which undoubtedly accounted for a significant part of this weight loss, was the effect of the vessel "drying out" over the intervening four year period. PESCADO had a timber deck and substantial timber linings to the net store, fish room and accommodation areas. It is estimated that the timber would have originally amounted to a total "dry" weight of some 6 tonne. This timber would have become heavy with water during the time that the vessel lay on the sea bed. The water pressure at this depth, of about seven atmospheres, would have magnified the effect. Over the four years since her salvage the water content of the timber, and hence its weight, would have dropped markedly.

Another source of data on the vessel's lightship is the record of roll tests. The freeboards measured during the "1987" roll test enabled an estimate of the lightship to be determined. This estimate produced a lightship of about 105 tonne, which is remarkably close to that derived from the "1990" data. However, it has to be borne in mind that in 1990 the vessel was substantially refitted. The inclining test in 1990 was carried out after the major part of this refit had been completed. How this refit might have affected the lightship weight cannot be determined. The refit included the following major modifications: the main engine was replaced with one substantially lighter; a watertight bulkhead was fitted to the whaleback; a shower cubicle was built onto the aft end of the accommodation block; heavier derrick booms were fitted; heavier trawl beams were fitted and new fuel tanks were constructed inside the engine room. Unfortunately, no complete records exist of the various items of weight added and removed during the refit. It was concluded that the roll test data could not be relied upon to give an accurate estimate of the current lightship weight of the vessel given the extensive refit in 1990.

After exhaustive examination of the problem the following was concluded:

- a) that no significant items affecting lightship weight had been removed from the vessel since the inclining experiment in 1993;
- b) that the vessel was now "dry", in that any water absorbed during her time on the sea bed had evaporated;
- c) that no satisfactory explanation existed for the apparent increase in the lightweight of the vessel since the inclining test in 1990;

and further,

- d) that the stability of the vessel in her current condition could not be estimated with any reasonable accuracy without re-inclining her.

It was decided that the vessel should be inclined to determine her stability in her current condition. Every indicator suggested that the results of the inclining test would allow a valid lightship condition to be determined.

### A.2.3 The Final Inclining Test

The vessel was inclined on 24 September 1997 in No 3 basin of the Devonport Royal Dockyard, with the assistance of Devonport Management Ltd. The basin is fitted with a caisson to render it non-tidal. The depth of water in the basin is maintained at around 11 metres.

Particular care was taken to ensure that the vessel had no "hidden" areas of trapped water.

To this end the sole of the aft cabin and the engine room floor plates were lifted. All areas were pumped dry, and silt from underneath the aft cabin sole was dug out.

All tanks had their inspection covers removed. Only the hydraulic oil tank in the engine room contained any liquid. Since this tank is small and of a regular shape the contents were measured and left in place. All other tanks were dry.

The sumps of the engines and gearbox were examined by a marine fitter. All contained liquid to about their normal working level.

Loose gear from the fo'c'sle was removed and weighed. The deck was cleared of debris, all of which was weighed. Where appropriate these weights were added back into the lightship weight or treated as deadweight items.

The inclining test took place in good conditions with the vessel breasted off from the quay and held on bow and stern lines, with the springs and breast lines slack.

Freeboard measurements were taken down both sides of the vessel at each of the eleven (per side) freeing ports. The waterline positions at the stem and stern were photographed for comparison with the sketches produced during the inclining experiment in 1990.

The inclining test produced the following results:

- a) lightship GM of 0.705 metres;
- b) lightship weight of 112.9 tonne;
- c) when light, the vessel listed about 4° to starboard and 2.566 tonne of righting ballast was required to bring the vessel upright.

The physical position of the waterline at the time of the inclining test was seen to be close to that sketched for the waterline during the "1990" test. This suggested that the light weight of the vessel in 1997 was in reality little different to that in 1990. It has been concluded that the difference which exists between the 1990 and 1997 estimates of light weight is due to the inaccuracies inherent in deriving a hull shape based on measurements taken with the vessel afloat; which were the conditions prevailing when the measurements were taken in 1990. Regarding the difference between the lightship weight estimates for 1993 and 1997, it is believed that this is wholly attributable to an excess of water and silt on the vessel in 1993.

### **A.3.0 The Stability of the Vessel**

Using, as a basis, the results of the MAIB's inclining test and the hull form derived from the measurements of DML but refined by consultants Marine Data International (See Figure 26) an estimate was made of the likely stability characteristics of the vessel. Her stability was found to be generally below the standard required for a beam trawler which is set out in the Fishing Vessel (Safety Provisions) Rules 1975. This is illustrated in Table 1, which compares the results of a set of standard calculations with the requirements of the regulations. In essence this outcome agreed with the findings of Mr Wilford in 1990. It can be seen that the vessel does in fact meet the criteria in the lightest seagoing conditions.

It should be noted that the first point to be immersed as the vessel is heeled, and which would cause flooding into the interior, is the engine room door which opens on to the

starboard side decking. Immersion of the engine room door sill occurs between about  $33^\circ$  and  $39^\circ$ , depending upon the loading of the vessel. The engine room door has been taken as a non-weathertight closure because inspection of the vessel showed that it had been rigged with a counterweight so that it would pull to (but not lock) after use. Consequently, if the vessel was heeled substantially to starboard it would swing open and allow water into the engine room. Unrestricted flooding of the engine room would cause the vessel to founder.

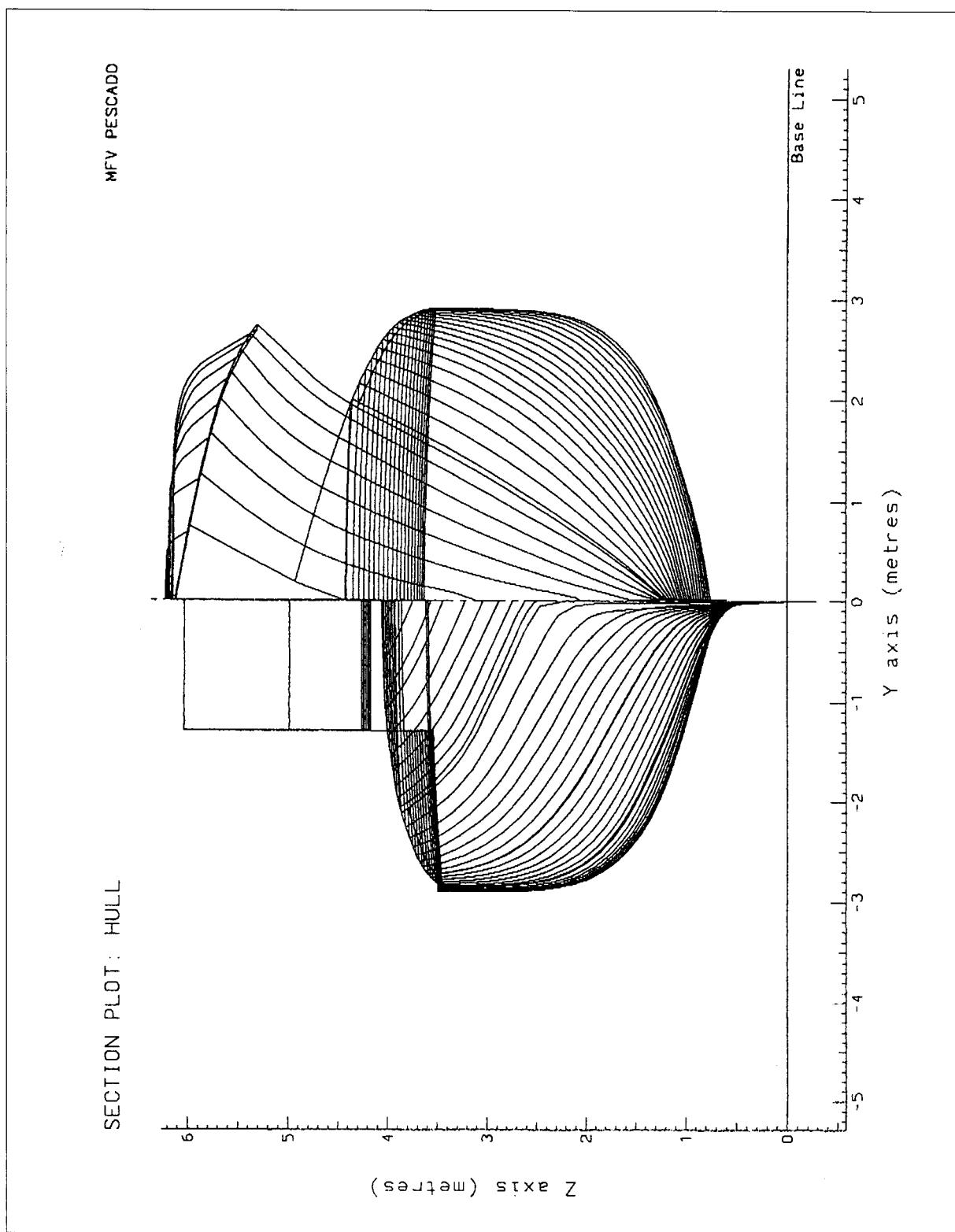


Figure 26

**Table 1: A comparison between the stability of PESCADO and the criteria set out in the Fishing Vessels (Safety Provisions) Rules 1975**

<b>Criteria</b>		<b>Criteria Description</b>												
1	Metacentric height, GM (metres)													
2	Angle of max righting lever, (deg)													
3	Max righting lever at or beyond 30° of heel													
4	Area under GZ curve to 30° (metre. radians)													
5	Area under GZ curve to down flooding point or 40° (metre. radians)													
6	Area under GZ curve between 30° and the angle to down flooding or 40° (metre. radians)													
<b>Standard Conditions Evaluated against Regulations</b>														
Crit No	Min Req	Dep Port	Arrive Grounds	Dep Grounds 100%	Dep Grounds 20%	Arrive Port 100%	Arrive Port 20%							
1	0.420	0.653	0.663	0.719	0.725	0.725	0.724							
2	25.0	23.5	23.9	25.0	25.9	26.0	26.8							
3	0.240	0.193	0.200	0.218	0.238	0.238	0.253							
4	0.066	0.071	0.073	0.080	0.084	0.084	0.087							
5	0.108	0.082	0.085	0.091	0.109	0.109	0.125							
6	0.036	0.011	0.012	0.011	0.024	0.025	0.038							
Note: The stability of the vessel is assessed in six standard seagoing conditions;														
1	Departing port full of fuel and stores.													
2	Arriving at the grounds having consumed the appropriate quantity of fuel and stores.													
3	Departing from the grounds with a full catch having consumed the appropriate quantity of fuel and stores.													
4	Departing from the grounds with 20% of her full catch having consumed the appropriate quantity of fuel and stores.													
5	Arriving in port with a full catch and 10% in tanks.													
6	Arriving in port with 20% catch and 10% in tanks.													
Note: A full catch is assumed to be 10 tonne of fish plus cooling ice.														
It is assumed that 3 tonne of ice is carried on depart port.														
The full load of fuel (98% capacity) is 13.7 tonne.														
The full load of fresh water is 1.9 tonne.														
The first point of down flooding is the engine room door, the sill to this door becomes immersed at between 33° and 39°, depending on the loading of the vessel.														

An attempt has also been made to estimate the stability of the vessel at the time of her loss. The stability curve is shown in Figure 27 where it is compared with a notional curve which just meets the stability regulations. The deadweight table describing the corresponding vessel's condition is shown in Table 2. It is estimated that the engine room door sill would be immersed at about 38° angle of heel to starboard in this condition.

The data presented in Table 1 and Figure 25 indicates that at angles of heel below about 25° the vessel had good stability. This would have been characterised by a quick roll which would perhaps have made her uncomfortable in a seaway. However, at angles of heel greater than 25°, and in the deeper loading conditions, her stability fell short of that which was required by the regulations. This indicates that the vessel lacked freeboard when heavily loaded, suggesting that she would have readily shipped water onto her working deck. In her deepest condition (departing port full of fuel) the maximum righting lever was about 80% of that required by the regulations.

The stability determined for PESCADO, whilst unsatisfactory, is sufficiently close to the prescribed level to suggest that this was not the decisive factor which caused the loss of the vessel. It is almost certain that even if she had met the stability criteria in full she would still have been lost in the particular set of circumstances which it is believed overwhelmed PESCADO.

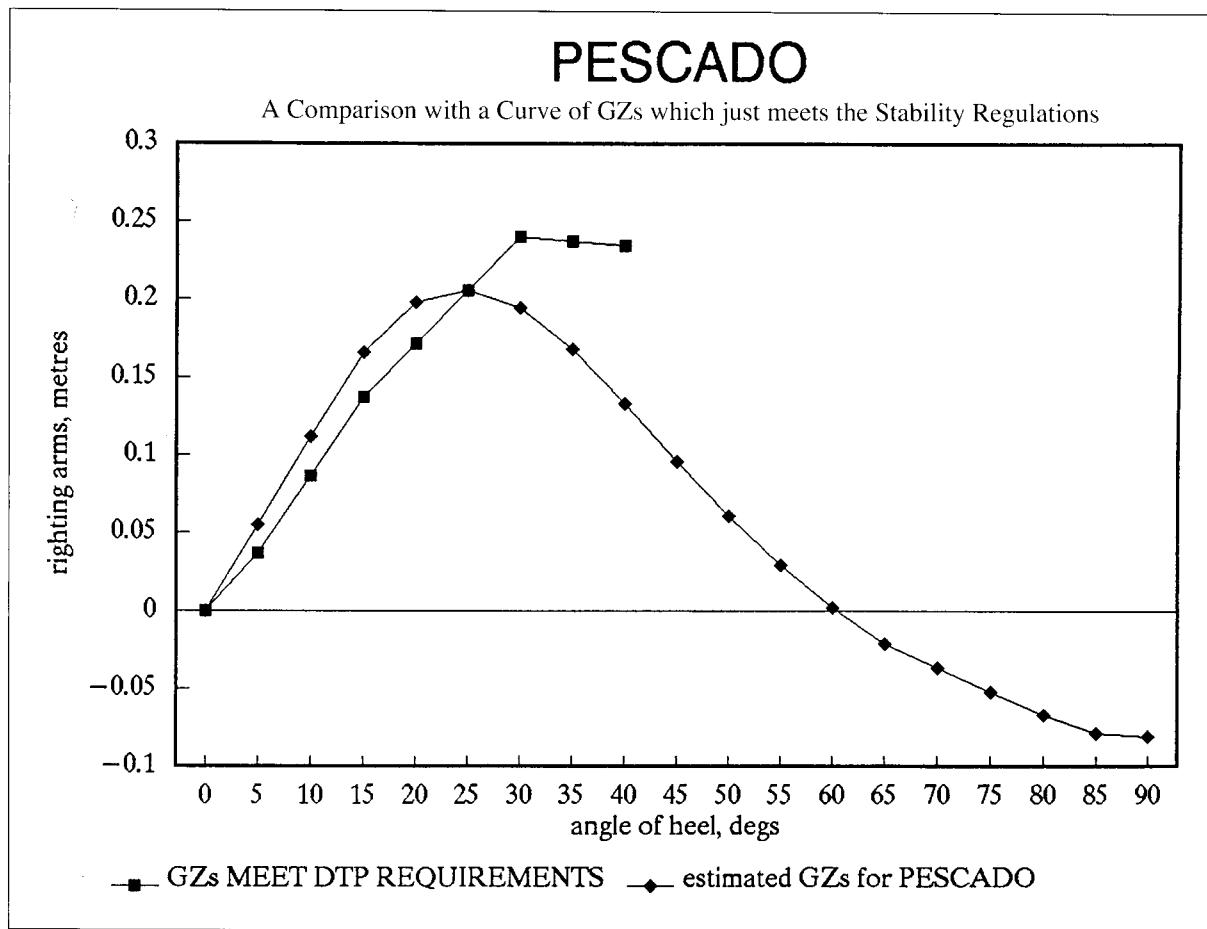


Figure 27

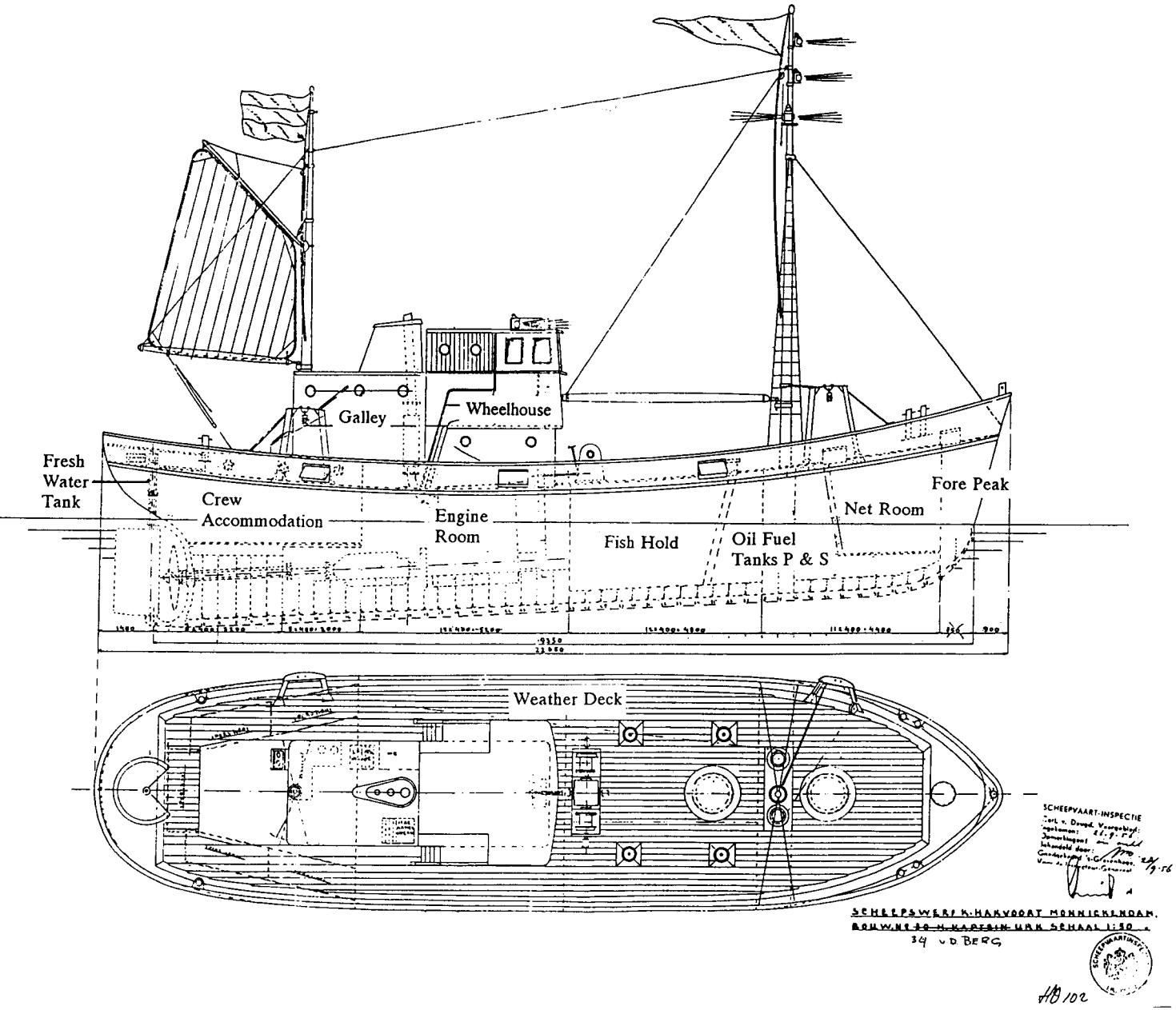
Table 2: Deadweight Table

**Vessel:** MFV PESCADO  
**Condition:** ESTIMATED SAILING CONDITION ON OR ABOUT 25/02/91  
**State:** INTACT AND UNDAMAGED HULL  
**Water SG:** 1.025  
**Compliance:** Vessel fails requirements in this condition

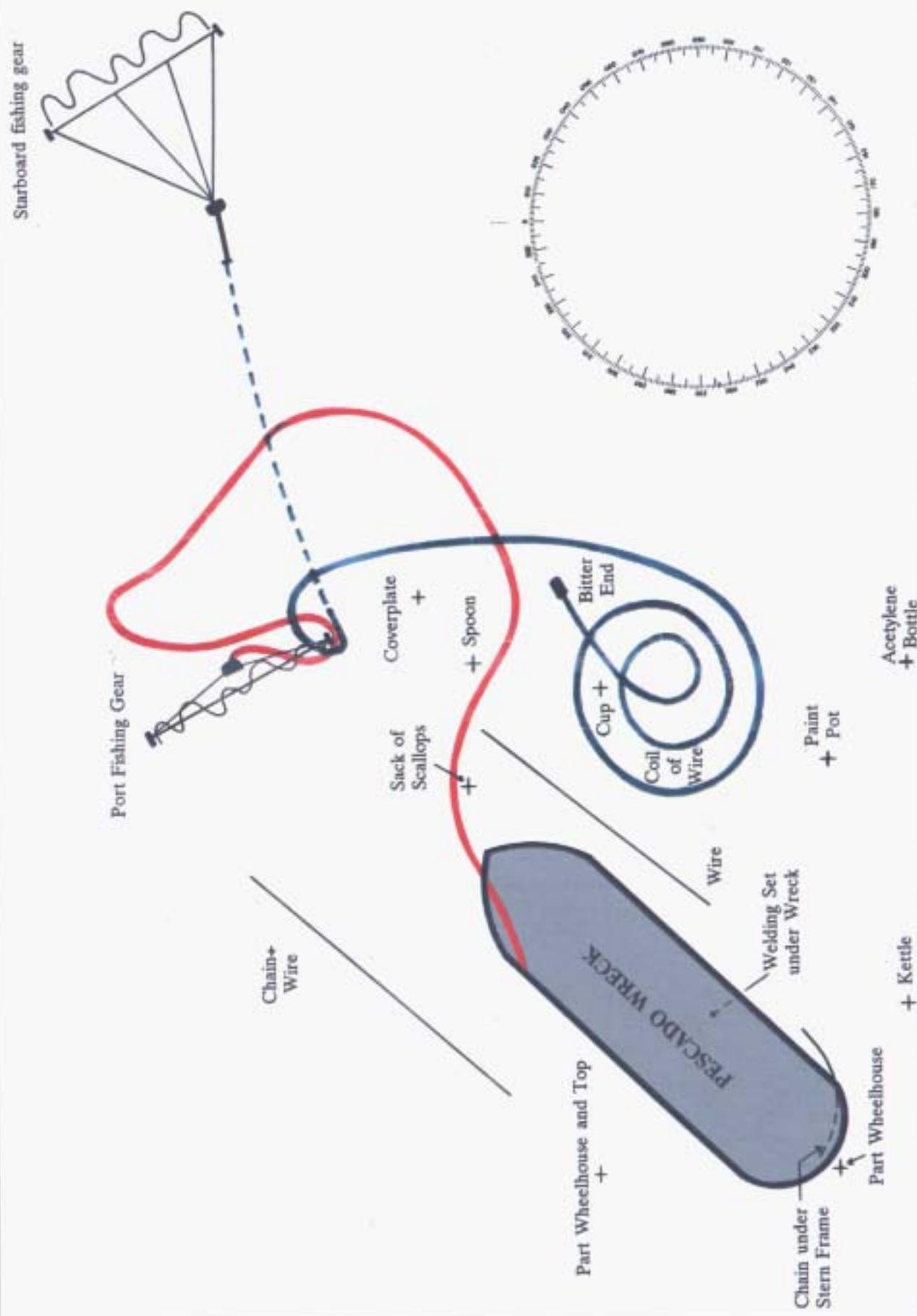
Longitudinal dimensions about AP (-ve aft, +ve forward)  
 Vertical dimensions about Base Line (+ve above, -ve below)

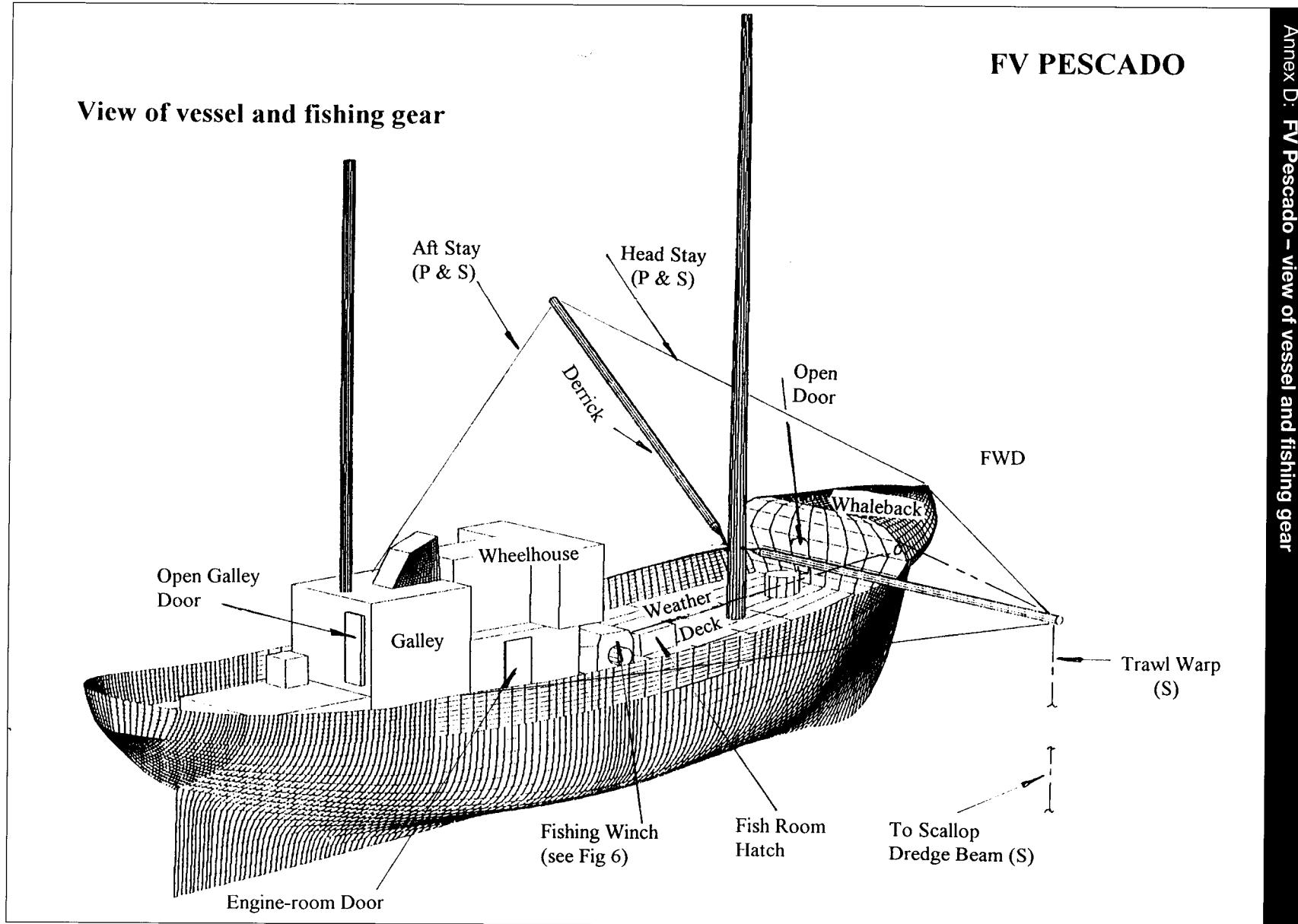
Deadweight Item	Weight	LCG	Longitudinal	VCG	Vertical	Free Surface
	tonnes	Metres	moment t.m	metres	moment t.m	moment t.m
1 OIL FUEL AFT - P	0.329	5.73	1.885	1.573	0.518	0.038
2 OIL FUEL AFT - S	0.329	5.73	1.885	1.573	0.518	0.038
3 OIL FUEL FORWARD - P	3.016	15.347	46.287	2.655	8.007	0.928
4 OIL FUEL FORWARD - S	3.016	15.347	46.287	2.655	8.007	0.93
5 OIL FUEL DAILY SERVICE	0.468	6.555	3.068	4.248	1.988	0.02
<b>TOTAL OIL FUEL</b>	<b>7.158</b>	<b>13.888</b>	<b>99.411</b>	<b>2.66</b>	<b>19.038</b>	<b>1.954</b>
6 HYDRAULIC OIL	0.309	8.355	2.582	3.813	1.178	0
7 FRESH WATER	1.935	-0.157	-0.304	3.347	6.476	3.923
8 CREW (6+EFFECTS)	0.6	6.49	3.894	4.529	2.717	-
9 CONSUMABLES	0.25	5.49	1.372	5.029	1.257	-
10 CATCH IN POUND #2 - P	0	0	0	0	0	0
11 CATCH IN POUND #2 - S	0	0	0	0	0	0
12 CATCH IN POUND #3 - P	0	0	0	0	0	0
13 CATCH IN POUND #3 - S	0	0	0	0	0	0
14 CATCH IN POUND #4 - P	0	0	0	0	0	0
15 CATCH IN POUND #4 - S	0	0	0	0	0	0
<b>TOTAL CATCH</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
16 SPARE DREDGES	1	10.2	10.2	2.3	2.3	-
17 ICE POUND	0	0	0	0	0	0
18 LOOSE GEAR FOC'SLE	0.54	18.7	10.098	5	2.7	0
<b>DEADWEIGHT</b>	<b>11.795</b>	<b>10.792</b>	<b>127.254</b>	<b>3.025</b>	<b>35.667</b>	<b>5.877</b>
<b>LIGHTSHIP</b>	<b>112.895</b>	<b>9.523</b>	<b>1075.099</b>	<b>3.056</b>	<b>345.007</b>	-
<b>DISPLACEMENT</b>	<b>124.687</b>	<b>9.643</b>	<b>1202.353</b>	<b>3.053</b>	<b>380.674</b>	<b>5.877</b>
<b>Free Surface Correction (Total free Surface Moment/Displacement)</b>				<b>0.047</b>	VCG fluid	

## Annex B: Vessel's General Arrangement Drawing as built in 1956



## Annex C: Sketch Plan of the Wreck and Gear on the Seabed from MAIB's Summary Report 1992



**Annex D: FV Pescado – view of vessel and fishing gear****FV PESCANO****View of vessel and fishing gear**

## **APPENDICES**

# APPENDIX 1

## Alternative Text

Regulation 9(4) and 9(16) of the Merchant Shipping (Accident Reporting and Investigation) Regulations 1994 provide that any person whose reputation is likely to be adversely affected by the Report shall have the opportunity to submit to the Chief Inspector alternative text for any passages in the Report which are critical of the person and remain in issue.

Mr O'Connor's representatives have provided the alternative text for Section 4.4 Safety Recommendation – 1997. The numbers in square brackets have been altered to reflect the section numbers in this Report.

*"Suggested safety recommendations involving any enquiry into Mr O'Connor's fitness to hold a Certificate of Competency No. 33858 or involving inspections to vessel owned or managed by Mr. O'Connor are not justified by findings in the foregoing report or by outcome of criminal proceedings in which both Mr. O'Connor and Mr. Ayres were fully exonerated."*

*Mr. O'Connor has owned and managed vessels since 1970 and has held a Certificate of Competency for 17 years. During that period there have been no findings against him, nor any disciplinary proceedings involving him.*

*Insofar as Mr. O'Connor was involved with the Pescado, it was not as an owner or manager. He had no civil legal liability for the vessel, the responsibility for the vessel lying with its owners, Mr. Ayres and Guideday Ltd. a company with which Mr. O'Connor was not connected. Responsibility for notifying the coastguard of the vessel's loss [3.1.3] for its confiscation [3.1.15] for its crew [3.1.17-19] and for its general safety equipment [3.1.21-27] did not lie with Mr. O'Connor.*

*While Mr. O'Connor disputes many findings of the report, in particular the conclusions drawn about the reasons for the vessel's loss, on the basis of the report as drawn, there is no justification for the suggested safety measures set out here, which are not merited either by reference to Mr. O'Connor's previous actions or by his limited involvement with the Pescado."*

# APPENDIX 2

## Supplementary Information

Subsequent to the expiry of the second twenty-eight day period allowed for consultation, information supplied to MAIB cast doubt as to who was PESCADO's designated skipper at the time of her loss. Various sources of information suggest either Mr N Currie or Mr P Birley could have been Skipper.