Report on the investigation of

the flooding and foundering of

CHRISTINE NIELSEN (GY 298)

120 miles north-east of River Tyne

on

18 March 2001

Marine Accident Investigation Branch
First Floor
Carlton House
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Southampton
United Kingdom
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Extract from

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(Accident Reporting and Investigation)

Regulations 1999

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

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GLOSSARY OF ABBREVIATIONS

EPIRB	Emergency Position Indicating Radio Beacon
gt	gross tonne
INMARSAT	International Maritime Satellite
kW	kilowatt
m	metre
MAIB	Marine Accident Investigation Branch
MCA	Maritime and Coastguard Agency
MGN	Marine Guidance Note
MRCC	Maritime Rescue Co-ordination Centre
MRSC	Maritime Rescue Sub-Centre
SFIA	Sea Fish Industry Authority
UK	United Kingdom
V	volt

SYNOPSIS

On 18 March 2001, the MAIB was notified that a fishing vessel had suffered substantial flooding, and had sunk 120 miles north-east of the River Tyne. An investigation began that day.

The North Shields steel fishing vessel *Christine Nielsen* was fishing 120 miles north-east of the River Tyne when her nets became fast on the seabed. While the crew were trying to haul back the starboard net, a hydraulic pipe from the winch to the hydraulic motor burst. All three crew spent the following several hours on deck replacing the burst section of pipe.

While they were on deck, the vessel suffered substantial flooding to the engine room. The flooding was not discovered until one of the crewmen went down into the engine room for a section of hydraulic hose. By then, the level of floodwater was well above the engine room floor plates. With the engine room in virtual darkness, because of the failure of the 24V electrical system, it was not possible to locate and open the valve in the bilge valve chest to operate the engine-driven bilge pumps.

After unsuccessful attempts were made to regain power to the 24V electrical system and to transmit a "Mayday", the crew abandoned the vessel into the liferaft. *Christine Nielsen* capsized soon after.

Shortly after boarding the liferaft the crew managed to activate the EPIRB which they had taken with them from the vessel. Three hours later they were rescued from the liferaft by a coastguard rescue helicopter.

One, or a combination of the following factors caused *Christine Nielsen*'s loss:

- A breach in the hull plating.
- Failure of a non-return valve in an overboard discharge, resulting in back- flooding.
- Engine room seawater piping failure due to erosion/corrosion.

Contributory causes were:

- Leaving the wheelhouse unattended for approximately 8 hours.
- The probable lack of a watertight bulkhead between the engine room and cabin.

The investigation has resulted in a recommendation to the skipper/owner of the vessel, to ensure that the wheelhouse is manned at all times at sea on any future vessel for which he is responsible.

Figure 1

Christine Nielsen

Figure 2

SECTION 1 - FACTUAL INFORMATION

1.1 PARTICULARS OF *CHRISTINE NIELSEN* AND ACCIDENT

Vessel details

Registered owner	:	K C Fishing, Whitley Bay, Tyne and Wear
Manager	:	Caley Fisheries, North Shields, Tyne and Wear
Port of registry	:	Grimsby (GY 298)
Flag	:	UK
Type	:	Fishing vessel (trawler/seiner)
Built	:	Esbjerg, Denmark, 1975
Construction	:	Steel
Length registered	:	23.99m
Length overall	:	26.50m
Gross tonnage	:	196
Engine type and power	:	B & W Alpha, 298kW
Service speed	:	10 knots

Accident details

Time and date	:	0350, 18 March 2001
Location of incident	:	55° 47.23 N, 001° 49.04 E, 120 miles north-east of River Tyne
Persons on board	:	Three
Injuries/fatalities	:	None
Damage	:	Total loss

1.2 DESCRIPTION OF VESSEL

The trawler/seiner *Christine Nielsen* was built in Esbjerg, Denmark in 1975. The vessel was constructed of steel and incorporated one main deck above the waterline. The wheelhouse was situated aft of amidships and the main deck was enclosed under a non-watertight three-quarter length shelterdeck.

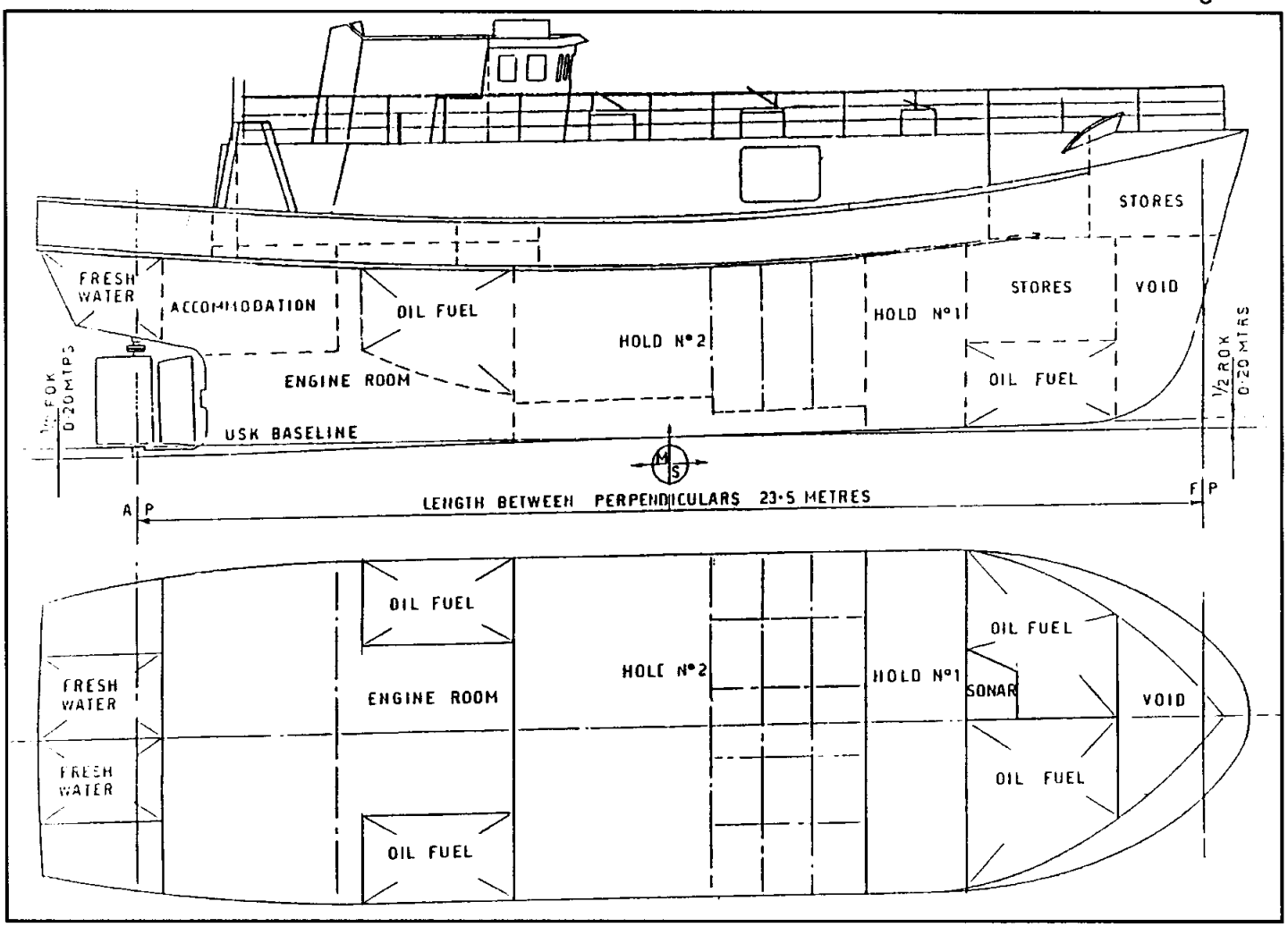
The crew accommodation was situated below the main deck aft. The engine room was forward of the accommodation space. Forward of this was the aft fishroom, ice lockers, forward fishroom, sonar and storage spaces.

Bulkheads separated the engine room from the cabin and fishroom. The bulkhead between the engine room and fishroom was watertight. It is unknown whether the bulkhead between the cabin and the engine room was watertight.

Christine Nielsen was equipped for trawling and seine netting. The hydraulically-operated trawl winch was situated on the main deck beneath the shelterdeck. A net drum was situated aft of the wheelhouse outside the shelterdeck.

Christine Nielsen held a valid UK fishing vessel certificate.

Figure 3



Christine Nielsen - General arrangement

1.3 BILGE PUMPING ARRANGEMENTS

Christine Nielsen was fitted with the following bilge pumping arrangements:

Bilge pump	*Compartment*
Electric-driven Desmi SA 50	Engine room/forward fishroom
Hydraulic-driven Desmi SA 20	Aft fishroom/Sonar room
Auxiliary engine-driven	Engine room
Main engine-driven	Forward fishroom
Hydraulic hand pump	Engine room
Hydraulic hand pump	Aft fishroom

Both the engine room and sonar space were fitted with high-level bilge float switches, with an audible and visual alarm in the wheelhouse. Additionally, a separate bilge alarm system for the engine room was also installed. These alarms were checked and tested at the end of every trip.

The discharge outlets for the motor-driven bilge pumps were situated on the starboard side, in way of the engine room, just above the waterline. They were fitted with non-ferrous screw-down non-return valves.

1.4 BACKGROUND

Christine Nielsen was purchased by her owner, the skipper, in 1996. She replaced his previous vessel *Achilles*.

The vessel was well known in her home port of North Shields and was considered to be one of the top earning and better maintained vessels in the port. She was employed in bottom trawling, twin rig, or seine netting; depending on the time of year. Since the latter part of 2000, she had been employed in bottom trawling only, spending periods of up to a week at sea, in between periods of poor weather.

When seine netting, *Christine Nielsen* normally carried a crew of six to eight men. When trawling, this number was reduced to four. However, since the beginning of 2001 she had been operating with only three, as it was difficult finding experienced crewmen.

1.5 THE CREW

At the time of the accident *Christine Nielsen* carried a crew of three: the skipper and two deckhands. The *Fishing Vessels (Certification of Deck Officers and Engineer Officers) Regulations 1984,* required the vessel to carry at least one holder of a deck officer certificate of competency (fishing vessel) class 2.

The skipper was the holder of a (Second Hand Special) certificate of competency issued before 1984, equivalent to a class 2 (Limited) fishing vessel certificate of competency. He had several years' experience in the fishing industry, having been employed as skipper since 1985, owning and operating three of his own vessels.

Both deckhands were also experienced fishermen. They had been employed on board *Christine Nielsen* for some time.

All three crew members had undergone mandatory training in basic sea survival, first-aid and fire-fighting.

1.6 ENVIRONMENTAL CONDITIONS

The weather reported throughout the incident was an easterly wind of force 5 with a moderate sea and easterly swell. The visibility was poor with snow showers.

1.7 NARRATIVE OF EVENTS

Christine Nielsen sailed from her home port of North Shields on 14 March 2001 bound for fishing grounds 120 miles south-east of the Tyne. After a short period fishing in this area she moved to new grounds several times, in an effort to improve her fishing prospects.

On the morning of 17 March she began fishing in a position approximately 145 miles east-north-east of the Tyne. Once the gear was shot, she began towing in a west-south-westerly direction. After towing for approximately 6 to 7 hours, the gear was hauled and reshot.

Shortly after reshooting the gear, the nets became fast on the seabed in position 55° 48' N 001° 48' E. The time was approximately 1830. The obstruction was uncharted and not in an area of charted oil or gas pipelines.

The crew hauled back on the gear, eventually managing to retrieve on board the port side trawl door and net. However, the starboard gear remained fast on the seabed. Further efforts were made to free the starboard gear by heaving on the winch when the vessel dipped in the swell. However, when she rose on the following swell the gear was pulled back out.

Realising the gear was not going to be freed easily, the skipper decided to wait until the tide turned before making another attempt. While waiting for the tide, the crew took the opportunity to have their evening meal, leaving the vessel attached to the seabed by the starboard gear.

Because of the high financial value of the fishing gear, and the fact that it was uninsurable, as is common with all fishing gear, it was important for the skipper to make every effort to retrieve it. Consequently, at approximately 2000, a further attempt was made to free the gear. However, shortly after heaving on the winch, the crew heard a loud bang. The hauling operation was stopped and further investigation, first on deck, then in the engine room, revealed that one of the hydraulic pipes to the winch had burst in the engine room; spraying hydraulic oil everywhere. The engine room bilges at this time were noticed to be relatively dry.

When the pipe was located, it was found that the burst section was almost inaccessible. Attempts were made to repair it, but, ultimately, the skipper decided, as a temporary measure to restore power to the winch, to run a flexible section of hose from the winch on deck to the hydraulic pump in the engine room, by-passing the damaged section.

All three crewmen then spent several hours on deck attempting to break the joints in the hydraulic pipes from the winch, to enable the flexible hose to be connected. By the time the joints were broken it was some time into the early hours of the following day, 18 March 2001. The vessel was still attached to the seabed by her starboard gear.

One crewman went forward for a flexible section of hydraulic hose, another went aft to the engine room to locate the most suitable connection point to the pump. On entering the engine room he noticed the lights were very dim and the space was flooded. Immediately, he left the engine room, went back on deck and informed the skipper. He in turn, along with the other crewman, went aft where they discovered the engine room lights had just about failed. In the near darkness they could hear floodwater sloshing about. The skipper instructed the two crewmen to make ready the lifesaving appliances, and prepare for launching the liferaft. Meanwhile, the skipper rushed to the wheelhouse with the intention of sending a distress message. No attempt was made to use the engine room manually-operated bilge pump.

Once in the wheelhouse he tried transmitting a "Mayday" on the VHF and MF radios but was unable to do so, as there was no power to the radio sets. He then tried the INMARSAT. This too failed.

In an attempt to restore power to the radio sets, the skipper rushed forward to start the auxiliary generator, which supplied a back-up to the 24V electrical system. Unable to start the generator, he again went aft to the engine room, after collecting a torch. There he discovered the floodwater was level with the upper side of the main engine casing.

By this time, the other two crewmen had grabbed survival suits and lifejackets and launched the liferaft, inflating it ready for boarding.

In a last attempt to restore power, the skipper went forward again to try and start the auxiliary engine, but while doing so felt the vessel lurch to one side as if about to capsize. He ran aft, seized a hand-held VHF and a box of flares from the wheelhouse. He passed these to the other two crewmen who had just boarded the liferaft. He then grabbed the EPIRB before boarding himself.

Soon after the crew boarded the liferaft and cut the painter, *Christine Nielsen* rolled over to starboard. As the vessel capsized, a wave carried the liferaft clear.

Shortly after boarding the liferaft, the crew managed to activate the EPIRB.

At 0350, 18 March 2001, MRCC Falmouth received a 406MHz distress beacon alert. This was identified as belonging to *Christine Nielsen*. In turn, MRSC Tyne Tees were informed. They made enquiries ashore, to confirm the vessel was not in harbour.

It was decided to await a second confirmation alert due to the unreliability of the first one. When this was received at 0605, rescue helicopter R131 was tasked to the scene, arriving at 0654. The three crewmembers were airlifted from the liferaft and transferred ashore.

1.8 LOSSES OF FISHING VESSELS THROUGH FLOODING

Marine Guidance Note, MGN 165(F) published by the MCA, and entitled *Fishing Vessels the Risk of Flooding* states in part:

Introduction

Inquiries into the loss of fishing vessels have shown that:

- *the flooding was discovered too late for the cause to be located or any remedial action to be taken;*
- *in many cases not even the most basic action was taken to prevent further flooding;*
- *bilge level alarms were either not fitted or failed to give the intended warning;*
- *the carriage of a portable diesel driven salvage pump with an adequate length of suction hose could have saved many vessels.*

During operation

Do ensure that all valves in seawater and bilge systems are regularly checked for correct operation.

Do regularly (preferably daily) test bilge level alarms by moving the float by hand to check that the visual and audible alarms actually work.

Do regularly (at least monthly) ensure all valves in the bilge system and all sea valves (and other valves that control the inlet and outlet of water through the hull) are free to move so they can be operated in an emergency.

Do check that all non return valves are clear of debris and in good condition each time the vessel is slipped, dry docked or otherwise out of the water.

In an emergency

Do try using the bilge pump or ejector and hand pumps when provided.

Do close all sea valves (and other valves controlling the inlet and outlet of water through the hull) when the cause of the flooding is not known or cannot be controlled.

'*Flooding*', a safety leaflet also published by the MCA, contains the following advice:

Getting it right

- *Consider carrying a portable, diesel salvage pump with an adequate length of suction hose - just in case.*

- *Forgetting to check all unattended spaces regularly.*

1.9 FLOODING AND FOUNDERING

MAIB statistics show that flooding to fishing vessels account for more vessel losses than any other cause. Of these losses, the majority have been attributed to seawater piping failures, and in some cases back-flooding because non-return valves have failed.

In response to the concern felt by the industry into these losses, members of the Fishermen's Safety at Sea Working Group, of which MAIB is a member, agreed to commission a research study into critical pipework aboard fishing vessels. It is envisaged that a report detailing the study, its findings, and any recommendations, will be available early to mid-2002.

Because of the large number of flooding incidents, and, following the investigation into the loss of the fishing vessels *Jasper III (PD 174)* and, more recently, *Annandale (BF 89)*, a recommendation was made to the Maritime and Coastguard Agency to:

Consider making it a condition of the four yearly safety survey for fishing vessels, that a competent person carries out an inspection report on the engine room pipework at the time of the survey - before a Safety Certificate is granted.

It was partially accepted, subject to the outcome of the critical pipework study, when the MCA would use the study's findings to determine the action to be taken in response to the MAIB recommendation.

Additionally, the Sea Fish Industry Authority produced a report entitled *Vessel Floodings - a Discussion Document.* The object of the report was to discuss the high incidence of vessel floodings and the actions that can be taken to combat such situations. Critical areas identified as to the cause of floodings were:

- Failure of bilge level alarms
- Engine room pipework corrosion/erosion
- Lack of watertight bulkheads
- Effective pumping systems
- Accessibility of seacocks
- Failure of non-return valves.

1.10 MANNING AND MAINTENANCE

There is no requirement to have a minimum manning certificate on board fishing vessels.

Provided the required number of certificated persons are carried in accordance with *The Fishing Vessel (Safety Provision) Rules 1975,* fishing vessels can operate with as few people as the skipper/owner sees fit.

On board *Christine Nielsen,* not only was the skipper responsible for the profitable operation of the vessel but, as he owned the vessel, he was also responsible for maintaining the plant and machinery. No dedicated engineer was employed.

1.11 THE VESSEL (SURVEYS)

Christine Nielsen was built in compliance with *The Fishing Vessel (Safety Provision) Rules 1975.*

Since then she was surveyed in accordance with the Rules at four-yearly intervals. Her last survey was carried out on 17 September 1999, valid for four years.

During this survey, *Christine Nielsen* was slipped at Esbjerg, in Denmark, and a survey of the hull was carried out. As part of this survey, ultrasonic testing was conducted. The hull was found to be in good condition, with minimum plate wastage. The minimum thickness of the hull plating was found to be no less than 6.75mm.

All overboard inlet and discharge valves were opened for inspection and servicing. They were found to be in satisfactory condition. However, the survey, in accordance with *The Fishing Vessel (Safety Provision) Rules 1975*, was restricted to inlet, discharges and other opening and closing arrangements on board. It did not include inspection of engine room pipework.

The stern gland was opened and the tail shaft drawn. These were also in satisfactory condition.

1.12 UNATTENDED WHEELHOUSES (FISHING VESSELS)

Guidance and advice in keeping a safe navigational watch on board fishing vessels is given in *Marine Guidance Note, MGN 84 (F)* published by the MCA, and entitled *Keeping a Safe Navigational Watch on Fishing Vessels.*

Paragraph 2.2(a) states:

The wheelhouse must not be left unattended at any time.

Paragraph 4.4 states:

The person in charge of a navigational watch should not undertake any duties that would interfere with the safety of the vessel.

1.13 COLLISION REGULATIONS

Rule 5 of *The International Regulations for Preventing Collisions at Sea 1972* states:

Every vessel shall at all times maintain a proper lookout by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

1.14 RISK ASSESSMENT

In accordance with *The Merchant Shipping and Fishing Vessels (Health and Safety at Work) Regulations 1997*, a risk assessment on (behalf of) *Christine Nielsen* had been carried out. This was in the form of a standard SFIA (Sea Fish Industry Authority) pro-forma risk assessment document. It had been completed by the skipper. The crew was not involved in the process and was unaware that such a document existed.

The risk assessment document was lost with the vessel. No copy was kept ashore.

In the risk assessment document, hazards associated with the engine room included corroded pipes, loose fittings and worn seals. The consequences were identified as possible loss of the vessel, resulting in deaths. Also in the document, hazards associated with wheelhouse operations included leaving the wheelhouse unattended. The consequences were again identified as possible loss of the vessel, resulting in deaths.

It is unknown what specific control measures, if any, the skipper implemented to minimise these hazards, but suggested measures in the SFIA pro-forma risk assessment document for corroded pipework were: regular checks and maintenance of all seawater systems. For leaving the wheelhouse unattended: to have a man on watch at all times.

SECTION 2 - ANALYSIS

2.1 AIM

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

2.2 GENERAL

Despite many investigations carried out by the MAIB and the lessons learned from them, safety advice produced by the MCA and the SFIA in the form of *Marine Guidance Notes, Seafish Reports* and various safety campaigns directed at the fishing industry, a high number of fishing vessels continue to be involved in flooding accidents.

In many cases this has resulted in the loss of the vessel and, in some cases, crews on board have narrowly escaped with their lives. The MAIB believes that, in the majority of these accidents, seawater pipework failure and back-flooding, coupled with bilge alarm failures, was the main cause.

However, in this case, it is fair to say that a major contributory cause was that the wheelhouse was left unattended for several hours. Had this not been the case, the accident could have been avoided.

2.3 SOURCE OF FLOODING

The cause of engine room flooding can either be the result of direct breach in the hull, back-flooding, failure of seawater piping, collision or grounding.

There was no evidence of collision or grounding in this case.

The hull had been surveyed and found to be in good condition in September 1999. However, this was almost two years before the accident, which was sufficient time for either wear and tear or corrosion to have had an effect on the hull plating. Steel fishing vessels are prone to wear and tear in certain areas of the hull because of the frequent hauling and shooting of fishing gear. In this case, the most wear occurs to the engine room hull plates, against which the trawl doors are hauled.

Christine Nielsen, a steel vessel, did not normally suffer from leaks. This is more common with wooden vessels. The bilge pumps in the engine room were only used as and when required, and were not in use when the flooding was discovered. The overboard discharge and inlet valves had all been overhauled during her last survey, and were found to be in good condition at that time. However, she was attached to the seabed by her fishing gear and was heeled over to starboard for approximately 8 hours. This meant the overboard

discharges were submerged, if not continuously, then certainly every time she dipped on the swell. This meant there was sufficient time for back-flooding to occur through one of the overboard discharges, had one of the non-return valves failed.

There were no known ongoing problems with the engine room pipework. The vessel was well maintained by her skipper/owner and any visible problems with seawater pipework would have been rectified. However, it is usually extremely difficult to detect any corrosion or erosion to the pipework until flooding actually occurs; mainly because of the poor accessibility of the pipework and the acceptance by fisherman of minor leaks as part of overall vessel operation. Consequently, corrosion/erosion to the engine room seawater pipework remains a strong possibility as the cause of the flooding.

Without further conclusive evidence, it is not possible to determine the exact cause of flooding to the engine room. A breach in the hull plating, failure of a non-return valve in one of the overboard discharges, resulting in back- flooding, or engine room seawater piping failure due to erosion/corrosion, appear to be the most probable causes.

2.4 BILGE PUMPS

There were three separate means of pumping out the engine room;

- Main engine electric-driven bilge pump
- Auxiliary engine-driven bilge pump
- Hydraulic manually operated bilge pump

When flooding occurred, the valve for the engine room bilge system was closed. To use the engine-driven pumps, the valve on the valve chest had to be opened. It was extremely difficult to locate and open the valve on the bilge valve chest when it was submerged in water and in darkness. Therefore, it is understandable that no attempt was made to use the engine-driven pumps. No attempt was made to use the manually operated bilge pump. It is unknown whether the use of this pump could have coped with the rate of ingress of water.

However, it would probably have been possible to cope with the ingress of water, had a portable diesel-driven bilge pump been available for use, in accordance with the advice given in *MGN 49 (F)*. This would have enabled the crew to cope with the flooding until power to the 24V system was restored and help was summoned.

The carriage of such pumps for use in case of an emergency is strongly advised, and is seen as a prudent measure against flooding.

2.5 WATERTIGHT BULKHEADS

Christine Nielsen was required, under *The Fishing Vessel (Safety Provision) Rules 1975,* to have a watertight machinery compartment.

The bulkhead between the engine room and fishroom was watertight. It is unknown whether the bulkhead between the engine room and the cabin was watertight. However, the Rules do not require fishing vessels to be able to survive flooding of the engine room, and it is unlikely that this bulkhead was watertight. Had it been so, it is unlikely that the vessel would have foundered with only the engine room flooded.

2.6 UNATTENDED WHEELHOUSES

Leaving the wheelhouse unattended on fishing vessels is becoming more commonplace; especially in vessels with a reduced number of crew, either because of commercial pressure, or the lack of available experienced men.

In order to maintain a proper lookout, in accordance with the Collision Regulations, a crewman should have been stationed in the wheelhouse. It was impossible to maintain a proper lookout on deck working beneath a three-quarter length shelterdeck.

Leaving the wheelhouse unattended at any time while at sea is risky. In this case, had the skipper, or a member of the crew remained on watch in the wheelhouse, in accordance with *MGN 84(F),* while repairs to the hydraulics were being carried out, the flooding would probably have been detected at an earlier stage.

The audible and visual alarms in the wheelhouse would have given early warning to the flooding, and allowed the crew more time to operate the bilge pumps and inform the rescue services. This might well have prevented the vessel from foundering. For these reasons a recommendation has been addressed to the skipper/owner not to allow the wheelhouse to be left unattended at sea on any future fishing vessel for which he is responsible.

It is assumed the alarms were in a good working condition at the time of the accident because they were checked at the end of every trip.

2.7 MANNING

Manning a vessel such as *Christine Nielsen* with only three people is questionable, especially as far as the safe operation of the vessel is concerned.

It is appreciated that the hauling and shooting of the fishing gear on modern trawlers probably only requires three persons: one in the wheelhouse and the other two on deck. In the case of an emergency, however, and to combat fatigue, three men is considered insufficient for a vessel of this size.

Manning any fishing vessel with the minimum number of people requires careful management to ensure the overall safety of the vessel. A commonsense approach as to the number of crew should be adopted at all times.

Had the vessel been manned by a crew of four or five persons, and the wheelhouse not left unattended, the flooding would probably have been detected at an earlier stage, and the vessel prevented from foundering.

2.8 HUMAN FACTORS

A major contributory factor into this accident was the skipper's decision to leave the wheelhouse unattended for a period of approximately 8 hours.

It was unnecessary for the skipper to leave the wheelhouse for such a long time; the two other crewmen could have dealt with the repairs to the hydraulics probably as efficiently as three crewmen.

The skipper might have felt it was necessary to supervise the operation to ensure the repairs were carried out correctly. If so, one of the other crewmen should have been instructed to stay in the wheelhouse.

However, this might have given the impression to the crew that one of them was not pulling his weight in the emergency with the fishing operation. Therefore, it is unlikely he would have remained in the wheelhouse for more than a short time, and either elected to come on deck himself, or been asked to assist those already on deck.

Unfortunately, during the emergency in repairing the hydraulic pipes, the importance of having someone on watch at all times in the wheelhouse was overlooked.

This again raises concerns about the safety culture on board some fishing vessels.

2.9 RISK ASSESSMENT

The skipper had carried out a risk assessment on board *Christine Nielsen*. In accordance with statutory regulations he had a duty to implement any control measures to bring risks within acceptable levels. Flooding of the vessel is an identifiable risk, and measures should have been place, which could have included regular inspection of the hull plating, non-return valves and engine room pipework.

He was probably aware of the need for safer standard operating procedures. However, any control measures, which might have been implemented by him, failed to prevent the vessel from flooding and foundering.

Leaving the wheelhouse unattended was also an identifiable risk, and again, measures should have been in place, including sufficient manning, or the management of the available crew, to ensure the wheelhouse was not left unattended while at sea.

SECTION 3 - CONCLUSIONS

3.1 FINDINGS

1. The wheelhouse was left unattended for approximately 8 hours. [2.2]

2. *Christine Nielsen* had not been involved in a collision, grounding or any form of contact. [2.3]

3. The cause of the flooding was probably a result of a breach in the hull plating, the failure of a non-return valve or seawater piping failure. [2.3]

4. Locating and opening the valve on the bilge valve chest was extremely difficult when it was submerged in water and in darkness. [2.4]

5. No attempt was made to use the manually operated bilge pump. [2.4]

6. The carriage and use of a portable engine-driven salvage pump might well have prevented *Christine Nielsen* from foundering. [2.4]

7. It is unlikely the bulkhead between the engine room and cabin was watertight. [2.5]

8. A watertight bulkhead between the engine room and cabin might well have prevented *Christine Nielsen* from foundering. [2.5]

9. Flooding would have been detected at an earlier stage, had the wheelhouse not been left unattended. [2.6]

10. Three men are considered insufficient to man a fishing vessel such as *Christine Nielsen* safely. [2.7]

11. Had she been manned by a crew of 4 or 5 persons, which would be a commonsense approach, she may well have been prevented from foundering. [2.7]

12. It was unnecessary for the skipper to leave the wheelhouse for such a long period of time; the two other crewmen could have dealt with the repairs to the hydraulics probably as efficiently as three crewmen. [2.8]

13. During the emergency in repairing the hydraulic pipes, the importance of having someone on watch at all times in the wheelhouse was overlooked. [2.8]

14. A risk assessment had been carried out. However, the crew was not involved in the process and was unaware that such a document existed. [1.14]

15. Control measures, if any, implemented as a result of the risk assessment failed to prevent the vessel from foundering. [1.14, 2.9]

3.2 CAUSES

One or a combination of the following factors caused *Christine Nielsen*'s loss:

- A breach in the hull plating.
- Failure of a non-return valve in an overboard discharge, resulting in back-flooding.
- Engine room seawater piping failure due to erosion/corrosion.

3.3 CONTRIBUTORY CAUSES

1. Leaving the wheelhouse unattended for approximately 8 hours.
2. The probable lack of a watertight bulkhead between the engine room and cabin.

SECTION 4 - RECOMMENDATION

Mr K C Caffery, the owner/skipper of *Christine Nielsen* is recommended to:

1. Ensure that he does not allow the wheelhouse on any vessel for which he is responsible, to be left unattended when at sea.

Marine Accident Investigation Branch
November 2001

EXTRACT FROM SFIA PRO-FORMA RISK ASSESSMENT

Standard Risk Assessment Form			WHEELHOUSE AND GALLEY			
Activity or area	**Possible hazards**	**Possible consequences**	**F/P**	**S**	**F/P x S**	**Control measures necessary with respect to your vessel**
Wheelhouse Operations	Falling asleep on watch	Vessel loss, deaths				
	Leaving wheelhouse unattended	Vessel loss, deaths				
	Inexperience	Vessel loss, deaths				
	Bad posture when sitting and standing	Back injuries, leg problems				
Galley	Inexperienced persons	Burns, scolds, cuts, fire				
	Cluttered working area	Trips and falls				
	Slippery floor	Slips				
	Lack of hygiene	Food poisoning, disease				
	The condition and use of LPG (Calor Gas) equipment	Explosion, fire, vessel loss, deaths				
Other						

Frequency/Probability (F/P) (How likely that **harm** may occur)		Severity (S) (How harmful)	
1	Very unlikely	**1**	Slightly harmful
2	*Unlikely*	**2**	*Harmful*
3	Likely	**3**	Very harmful

Risk Factors (F/P x S)

1	-	No action is needed
2	-	Can be tolerated, but make sure that it does not become worse
3/4	-	Take action but subject to it being reasonable and sensibly possible
6	-	Must be attended to, you must reduce the risk
9	-	Cannot be accepted and work/activity must not continue

Engine Room

Poor Access
There is the potential for persons to fall down or to trip over obstructions with serious consequences when gaining access to the engine room. Ladders should be in good condition with adequate handholds at the top. Oil drums lashed to the foot of the ladder are a typical hazard.

Unsafe walkways
Walkways with damaged/missing or slippery floor plates and inadequate handrails are a hazard which could result in a serious accident. Floor plates must be safe and secure and handrails should be present to ensure that anyone who stumbles does not fall onto dangerous machinery.

Inadequate lighting
Failure to see dangers because the lighting is inadequate is an hazard that is common in engine rooms. Good lighting is necessary, not only in the main walkway areas, but also in areas behind machinery or low down where good vision is required for maintenance work. A light switch should be easily found at the top of the ladder to give safe access.

Head level obstructions
Obstructions at head level are sometimes unavoidable in engine rooms but they are liable to result in serious consequences. Lighting should be sufficient to ensure that they are clearly visible. Warning signs should be positioned and protection such as padding installed on sharp corners etc.

Unguarded machinery and drives
Unguarded machinery is a hazard with the potential that someone could be seriously injured. Belt drives are often used and these are very dangerous if unguarded or fitted with inadequate guards. Drives are often left unguarded because they are out of the way, below the deck plates or away from where persons will stand and walk. This may seem reasonable in normal circumstances but in situations when things have gone wrong, deck plates are lifted and people climb in to gain access and are at risk from the unguarded drive.

Exposed hot surfaces
Hot pipes and surfaces are an obvious danger, not only those that people have to regularly pass near but also those who may be a danger when routine maintenance work is being performed. Lag exposed hot pipes and ensure that manifold heat shields are in place and in good condition.

Noise
Engine room noise is fairly widely understood to be a hazard to hearing and generally people do wear ear defenders. At levels of 100 dbA or more, typical of most engine rooms, hearing damage can occur in minutes and hence you must ensure that all persons wear ear defenders in the engine room.

Leaking fuel or oil
Fires are major risks in engine rooms and are often caused by leaking fuel or oil coming into contact with hot surfaces. Regular checks need to be made.

Unclean engine room
The consequence of a dirty, littered engine room could be extremely harmful as a fire could result. Dirty conditions reduce the likelihood that fuel or oil leaks will be readily seen and hence there could be a serious fire hazard.

Standard Risk Assessment Form			ENGINE ROOM			
Activity or area	**Possible hazards**	**Possible consequences**	**F/P**	**S**	**F/P x S**	**Control measures necessary with respect to your vessel**
	Batteries	Explosion, fire				
	Electricity	Electric shock, burns, fire				
	Compressed Air	Explosion				
	Hydraulics	Equipment failure, vessel at risk				
	Corroded pipes, loose fittings, worn seals	Flooding – vessel loss, possible deaths				
	Bilge level alarms not fitted or working	Flooding not detected				
	Sea inlet valves siezed or cannot reach them	Flooding cannot be stopped				
	Inexperience/lack of training	Vessel breakdown, vessel and crew at risk				
Other						

Frequency/Probability (F/P) (How likely that **harm** may occur)		Severity (S) (How harmful)	
1	Very unlikely	**1**	Slightly harmful
2	Unlikely	**2**	Harmful
3	Likely	**3**	Very harmful

Risk Factors (F/P x S)

1	-	No action is needed
2	-	Can be tolerated, but make sure that it does not become worse
3/4	-	Take action but subject to it being reasonable and sensibly possible
6	-	Must be attended to, you must reduce the risk
9	-	Cannot be accepted and work/activity must not continue

Engine Room

New equipment or systems
New items of equipment, or new systems e.g. a refrigeration system may be installed on a vessel. Without proper training and instruction the person operating or maintaining such equipment may place themselves, or the vessel in danger through lack of knowledge. Ensure that training and instruction is given when having new equipment installed.

Lone Working
One man looking after the engineering requirements is normal on most fishing vessels. He will visit the engine room at various times to make checks, operate pumps, transfer fuel etc. and will be alone in the engine room. Should an accident occur no one would be aware. A system of reporting to the wheelhouse should be used when persons are working along.

Inadequate or badly maintained fire fighting equipment
Fire fighting equipment for the engine room should be regularly checked. Regulations set minumum requirements but you should consider your vessel; how likely is it that a fire could occur and how would you deal with it. If necessary install extra equipment or chose better locations.

SFIA REPORT NO SR536

VESSEL FLOODINGS – A DISCUSSION DOCUMENT

SEA FISH INDUSTRY AUTHORITY

TECHNOLOGY

Vessel Floodings - A Discussion Document

Seafish Report No. SR536

February 2001

SEAFISH

The Sea Fish Industry Authority

Seafish Technology

Vessel Floodings - A Discussion Document

Seafish Report No. SR536

A. Dean
February 2001

Sea Fish Industry Authority
Seafish Technology

Vessel Floodings - A Discussion Document

Seafish Report No. SR536

A. Dean
February 2001

Summary

The statistics indicate that the cause of many vessel losses is due to flooding. This report discusses the incidence of flooding, the measures to combat it and possible improvements that can be instigated. Particular suggestions, received from persons with considerable experience of fishing vessels, are for the remote operation of sea inlets and for improved or additional bilge suctions to cope with debris.

The intention of the report is to promote consideration of vessel flooding and to encourage the implementation of practical measures to improve the situation.

Contents

1. Object

To discuss the high incidence of vessel floodings and the actions that can be taken to combat such situations.

2. Introduction

Each year founderings and floodings feature prominently in the fishing vessel incident statistics and are the dominant cause of vessel losses. Tragically, in some instances the lives of crewmembers are lost and if it were not for the ability and dedication of the rescue services in 'air lifting' emergency pumps to vessels in trouble, many more vessels would be lost. Ingress of water, either through hull damage, failed pipework or hatches, doorways etc. must always be guarded against and indeed, vessels are equipped with watertight bulkheads and pumps to combat such a situation. So, why are vessels still being lost due to flooding and what more can the industry do to improve the situation?

3. Background

From MAIB investigations vessel floodings account for more vessel losses than any other cause. Hull failures account for half of the floodings with the remainder being sea water pipe failures. Vessels of all ages may suffer flooding, but most susceptible are vessels over twenty years old because they may not receive the level of maintenance necessary to investigate and replace corroded pipework and fittings or to ensure the integrity of the hull. Corrosion in pipes and fittings can result from various causes; galvanic corrosion resulting from the use of incompatible materials, erosion caused by turbulent flow, or simply through long term slow corrosion that eventually results in a thick section of pipe becoming wafer thin in places. Even pipes made from materials that are not expected to corrode, such as copper or brass, may fail due to the ageing process. Over the years, the pipe or fitting will work harden and lose its ductility becoming brittle. Vibration of the vessel may cause the pipe to suddenly break resulting in water flooding the vessel.

It is possible to use materials such as cupronickel for pipes and fittings and thus resolve the concern about corrosion. However, due to the high cost of such materials, the owner having the new vessel built is liable to be reluctant to pay the extra cost. The boatyard will typically fit galvanised mild steel pipes that can be expected to give at least ten years problem free service before the galvanising fails. The new vessel owner is likely to have sold the vessel before problems occur and hence has no incentive to pay for relatively expensive pipework materials when the vessel is being built. Thus, most fishing vessels, unless thorough maintenance is carried out, may eventually suffer failures of pipework and fittings with the possibility of serious flooding perhaps, resulting in the loss of the vessel and even lives.

4. Bilge Level Alarms

The essential first requirement in combating any flooding situation is to know as soon as possible that it is occurring. All too often the first indication that the crew have of a flooding problem is when the lights fail or the engine falters. Usually it is then too late to do much about it. Bilge level alarms are vital to give early warning of flooding and as a simple float switch is all that is required, it would seem easy to equip all vessels with a reliable bilge level alarm system. The problem would appear to be reliability.

Some water will generally be present in the bilge space of the vessel and with vessel motion it will slosh from side to side, sometimes activating the bilge alarm. This is particularly so when the alarm float switch has been installed with little thought being given to its location. Intermittent sounding of the bilge alarm in the wheelhouse every time there is vessel motion often results in the alarm being turned off. The float switch needs to be above any nominal bilge level such it only activates when bilge pumping does need to be carried out. Bilge alarm systems are available with an electronic delay incorporated to ignore intermittent signals from the float switch and to only sound an alarm when a more continuous signal is received. Alternatively, a possible means of overcoming the human tendency to ignore initial warnings as 'merely a slight bit of water in the bilge' is to install the float switch at a higher level. Thus, when the alarm does sound it is because the water is at a significant level. Perhaps two switches need to be installed; one at a normal level, just activating a warning light with a second switch at a higher level, activating an audible warning.

A bilge level alarm system is not 'rocket science' and hence it is hard to understand why MAIB investigations reveal so many instances when the alarm failed to operate or was even 'turned off'. Known reasons are electrical failure, debris and the human factor.

Electrical Failure: Although the float switch may be totally waterproof and designed to operate in the harsh conditions of the bilge area, the switch typically will be supplied with only 1 to 2 metres of cable. This necessitates a connection fairly close to the hostile area and introduces a potential failure point. Terminal connector block may well be used and the screw terminals provide an opportunity for corrosion resulting in the connection failing. To ensure long-term reliability a waterproof connection box is required or, solder joints should be made and well sealed over, for any connection that is located in a damp environment.

Debris: Inevitably, the bilge will end up with items of debris washing around in it and quite often the reason for bilge alarm system failure has been found to be due to debris fouling the float switch. Placing the float switch inside a vertical tubular shield will protect it from debris and also provide a baffle as water flows from side to side with vessel motion.

Human Factor: As previously mentioned, it is quite likely that a bilge level alarm that activates every time there is vessel motion will be ignored or turned off. The alarm must have credibility and therefore, if spurious alarms occur the installation needs to be investigated and improved. Skippers need to appreciate the importance of having an effective

bilge alarm system and ensure that it is always in good working order. It should be tested before sailing and of course, regular manual checks should be made of all spaces when at sea.

The technology of a bilge alarm system can be quite basic or quite sophisticated. Recently Banff and Buchan College at Fraserburgh have developed a computer-based system that continually monitors levels in the bilge spaces and is linked to the overall computer system for the management of the vessel. This is a very desirable feature for those vessels that utilise computer technology. However, many other vessels may just have a simple float switch wired to a buzzer. Whatever is being used, it must be credible and must be reliable and to ensure reliability it must be checked!

A further possibility, which Seafish is considering, is a self-contained, bridge mounted monitor to detect changes in trim, list and roll/pitch periods, which may indicate otherwise undetected flooding or other unusual loading conditions.

5. Watertight Bulkheads

To combat a possible flooding situation vessels are designed with watertight bulkheads thereby limiting the flooding to the compartment where the ingress of water originated.

MAIB point out in their Fishing 2000 Safety Digest that there is no reason why a well maintained vessel should sink if the flooding can be contained in a single compartment. However, too often in their investigations they find that the bulkheads were not watertight and flooding seeps from one compartment into the next. Skippers need to ensure that any penetrations in bulkheads for cables or pipes are properly sealed and that watertight doors and hatchways are always left closed.

However, Seafish are not aware that flooding survivability (trim and stability) calculations are routinely carried out for UK fishing vessels. Thus there may be many boats in the current fleet which cannot meet even a "one-compartment" standard. Whether such a standard should be introduced is a matter for debate between the industry and MCA.

6. Pumps

An effective pumping system is essential to be able to cope with a flooding situation. Aside from the condition of the pumps, strum boxes need to be kept free of debris and valves must function correctly. The pumping system on vessels is often difficult to understand for anyone who is not familiar with the system. Hence, in an emergency mistakes may be made resulting in the vessel being lost. All crewmembers should be aware of the operation of the pumping system and other emergency measures. Clear labels on valves will greatly assist.

If reasonably possible, consideration should be given to the carriage of a portable diesel driven salvage pump along with a suitable length of suction hose such that it can be used to pump out any compartment.

7. Seacocks/Sea Inlet Valves

When failures of the seawater pipework occur or, perhaps a pump gland failing, the flow of water can always be stopped by simply closing the seacock. This may sometimes be quite difficult.

A longstanding problem that affects many fishing vessels is the difficulty of being able to close seacocks when required. In normal circumstances it may be necessary to close a seacock for maintenance work and typically, the cock will be found to be seized necessitating a large 'stilson' wrench being applied to force it. In a flooding situation, aside from the difficulty of turning the seacock, it may be impossible to reach it due to the depth of water. Seacocks are located low down and hence will be rapidly under water if flooding occurs. Furthermore, they may be fairly inaccessible being underneath floor plates or behind machinery. Extension handles are a good idea to enable them to be closed in a flooding situation but not all vessels are equipped with these.

8. Possible Improvements

From the foregoing discussion it is evident that maintenance and regular checks are essential to ensure the well being of the vessel and that bilge alarms are essential to give early warning to be able to successfully combat any flooding situation. Areas where improvements need to be achieved are:

materials for pipework and fittings,
reliable bilge level alarm installations,
easy operation of seacocks/sea inlet valves,
bilge suction pipes that are less prone to blockage by debris,
maintenance of hull integrity.

8.1 Piping Materials

As discussed in section 3.0 it is quite feasible to specify materials that will not be susceptible to corrosion such as cupronickel but the cost is likely to deter the owner who is having the vessel built. The Fishing Vessels (Safety Provisions) Rules 1975 specify for over 24.4 metre vessels that:

> Bilge pipes in boiler or machinery spaces including spaces in which oil settling tanks or fuel pumping units are situated shall be of steel or equivalent material. Bilge suction pipes shall be fitted with flanged joints and shall be properly secured in position and provided with expansion joints or bends.

For vessels 12 to 24.4 metres:

> Bilge pipes shall be of steel or other suitable material having flanged or screwed joints, provided that flexible piping, if accessible for inspection and jointed with suitable clamps, may be installed where necessary.

In drawing up these rules, consideration is being given to the possibility of fire and hence heat resistant pipes are specified. For vessels below 24.4 metres flexible piping may be installed where necessary, as will be required to accommodate movement of the pump. However, it is not specified that the flexible pipes are heat resistant.

In many other industries, problems of corrosion have been totally solved by using PVC or ABS pipes and fittings but such materials have limited strength at temperatures above 20°C and certainly would not resist fire. Indeed, toxic fumes would be given off when such materials burn. Thus, even though the statistics indicate a higher risk to vessel and crew from flooding, the inability to resist fire means that plastic pipes are not suitable for fishing vessels and metallic pipes only can be considered. Galvanised mild steel pipework is widely used because of cost but perhaps, a study into the costs and benefits of using stainless steel and other exotic materials may justify their wider use.

8.2 Reliable Bilge Alarm Installations

Bilge alarm systems can be very simple or quite sophisticated but, whatever type is chosen it will be the quality of the installation that is key to long term reliability. Careful thought must be given to the location of the sensors to avoid false activation. Protection must be provided from debris in the bilge and all of the electrical circuit must be suitable for the conditions where it is located. A study to investigate problems being experienced on fishing vessels with respect to bilge alarms has been proposed by the Banff and Buchan College.

It is anticipated that the results of the study will lead to a new design being developed to avoid the problems currently experienced. This initiative is very much welcomed and it is hoped that vessel owners will co-operate fully with the study.

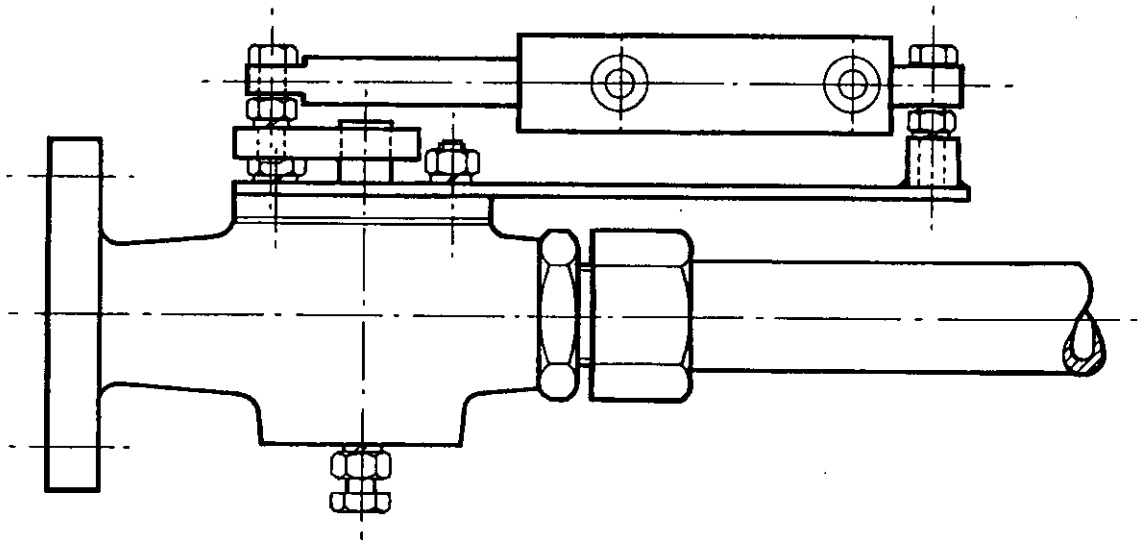
Regardless of the quality of the alarm system and its installation, it will still be essential that system be tested very regularly to ensure that it will work if ever it is needed.

8.3 Operation of Seacocks/Sea Inlet Valves

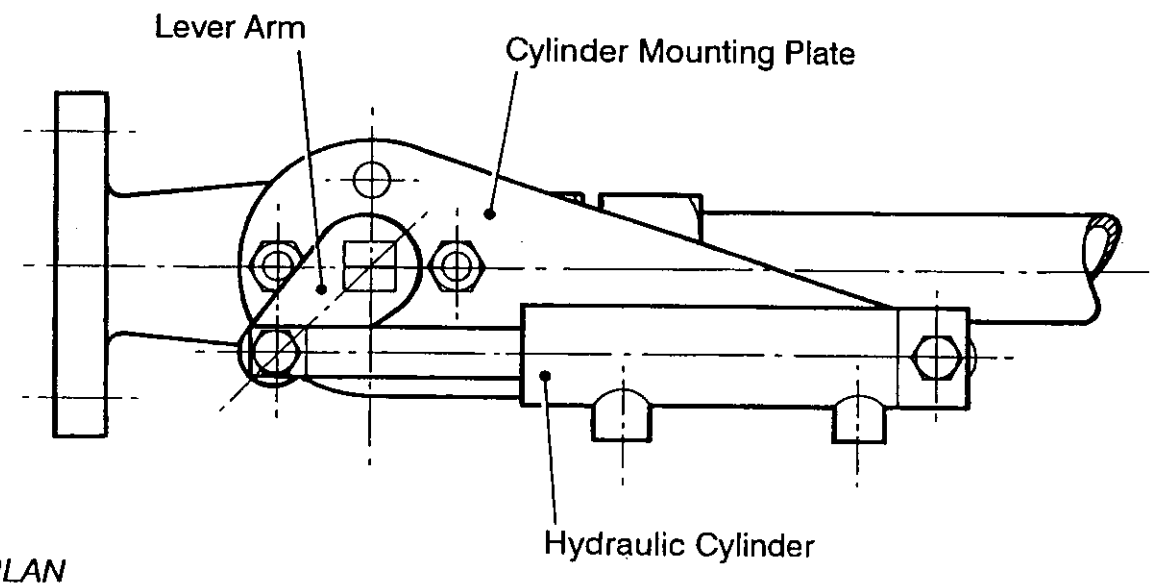
Being able to quickly and easily close a sea inlet is vital when pipework failure occurs. As previously discussed, seacocks are notorious for seizure and the level of water may make it impossible to even reach the seacock with the result that the vessel is likely to be lost. Extension handles are one means to solve the problem but these have limitations and the location of some sea inlets would make it difficult to fit an extension. One solution proposed by Mr John Buchan, a retired marine engineer from Peterhead, is for remote operation of sea inlets utilising hydraulics. This may initially sound expensive but a simple actuator, powered by a hand pump is all that is proposed and indeed has been provisionally patented by Mr Buchan. Kits to convert existing seacocks and valves are a possibility enabling modification to be made to vessels to give remote operation of sea inlets from the top of the engine room or any desired position. Aside from the emergency situation, remote operation will make it easy and convenient to close sea inlets when routinely leaving the vessel.

8.3.1 Basic Concept

As shown in Figure 1 (overleaf), the proposal is to use a small hydraulic cylinder to rotate a standard taper seacock through 90° from 'open' to 'closed' and visa-versa. A lever arm fits on the cock spindle and is coupled to the cylinder rod end. The cylinder can be mounted in a variety of positions relative to the seacock giving flexibility to accommodate obstructions that may restrict the space.



SIDE VIEW



PLAN

Figure 1 - Seacock with Hydraulic Actuator

Activation of the cylinder is via a small hand pump with an in-built reservoir. A low cost rotary valve selects whether the seacock is to be opened or closed and the operation will be completed with several strokes of the hand pump. Small-bore tubing will connect the pump to the cylinder and the one pump can operate a number of cylinders, simply by selecting the appropriate cylinder valve.

Thus, it is envisaged that on a vessel with three sea inlets, a hand pump coupled to three small rotary lever valves would be mounted in a suitable location at the entrance to the engine room. Small-bore tubes will lead from each valve to the cylinders on the seacocks and simply by selecting the valve positions, any one or, all three seacocks can be operated simultaneously and remotely. Clear labelling alongside each valve would identify the seacock it controlled and the position for 'open' or 'close'. (Figure 2).

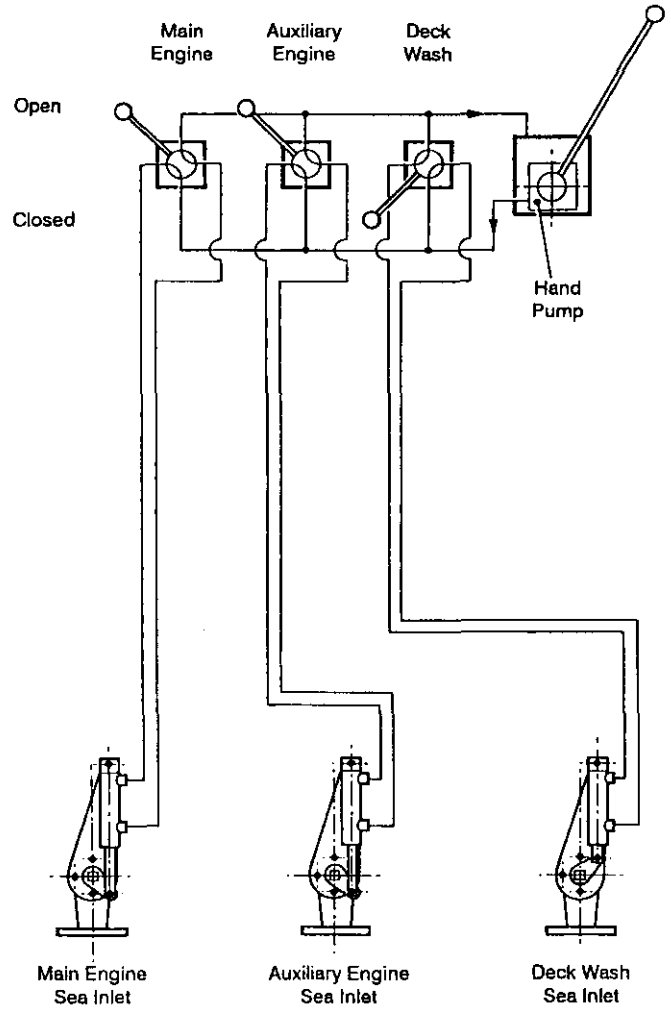


Figure 2 - Remote Operation of Seacocks

8.3.2 Seizure of Seacocks

In first approaching the problem Mr Buchan considered the standard taper brass seacock, as is approved for use on most vessels below 500 HP. These are notorious for seizure and in order to safeguard against this problem he devised a simple modification (see Figure 3 below). The taper provides a seal between the spindle and the body, but after a long period in a fixed position, the very tight fit results in seizure. Mr Buchan's modification is to drill and tap for a screw in the body to bear against the end of the taper spindle section and hold it just slightly clear of the matching taper in the body. This slight clearance ensures that the cock will not seize. A cork gasket, positioned underneath the spindle clamp plate, seals any leakage from the top end of the taper. This simple modification would seem to be very worthwhile to the design of all taper seacocks, regardless of the decision to add remote operation.

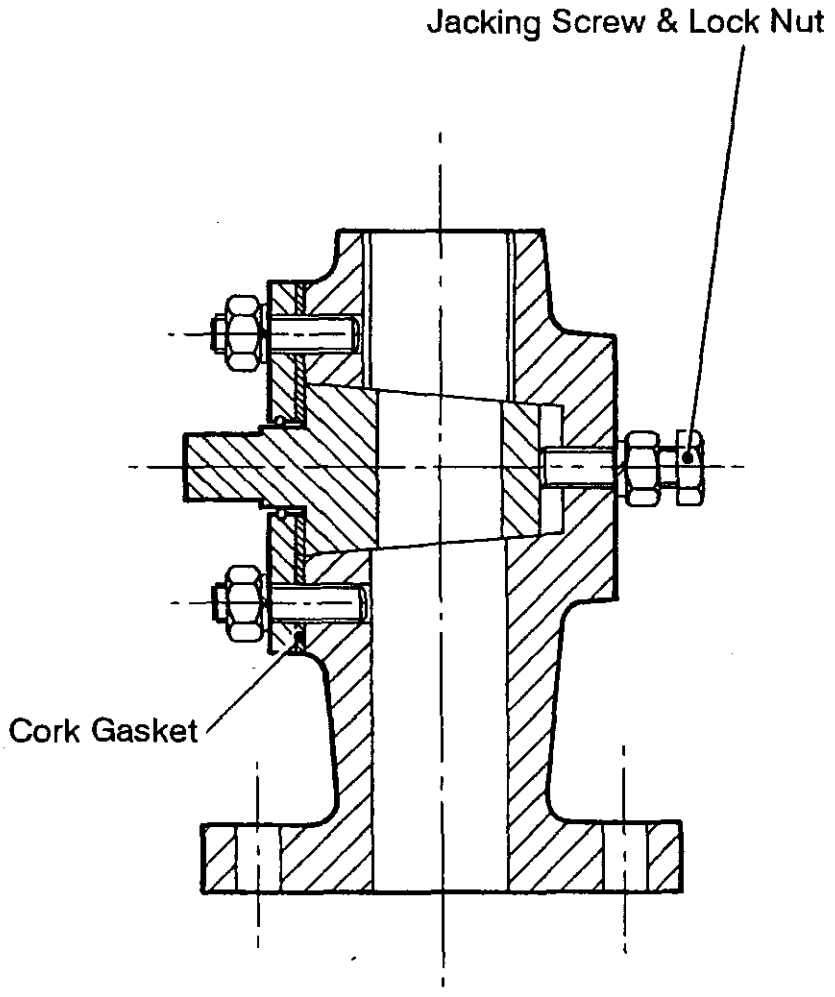


Figure 3 - Modification to Seacock to Prevent Seizure

In considering the taper seacock another disadvantage is the difficulty in being sure of it's position. A line is marked in the end of the spindle but after several years of ageing in the depths of the vessel and with poor lighting it is not easy to discern exactly the position of the cock. With no limit stops on the rotation it is easy to turn the cock too far. Positive stops with clear indication would seem to be another improvement that is needed. Other types of valves, such as ball valves need to be considered.

The problems often experienced with seacocks can be expected to be resolved by Mr. Buchan's hydraulic actuator. It has ample power to easily turn the cock and the fixed stroke length will ensure that the cock is either fully open or closed. The position of the cylinder will indicate at the seacock whether it is opened or closed and the settings of the control valves will show the situation at the remote operation position. Alternatively, lights can be installed to indicate positions on a panel.

8.3.3 Application to Screw Down Valves

Vessels above 500 HP are likely to have screw down sea inlet valves and these would appear to necessitate a multi turn rotary actuator to remotely operate them. However, Mr. Buchan's suggestion is to replace the threaded spindle with the hydraulic cylinder rod and to directly move the valve disc with the cylinder. This certainly seems a viable idea worthy of further exploration.

8.4 Blockage of Bilge Suction Pipes

Debris in the bilge area can block the suction pipe and prevent pumping. Debris may also choke pipework and jam in valves. Therefore, measures must be taken to protect against this by fitting strum boxes or strainers. Despite existing measures, incidents do occur in which vessels are placed at risk through blockages in the bilge system; rags or paper in the engine room and fish in the fishroom. Hence, consideration needs to be given to any possible improvements. Bilge arrangements vary but a common set up for a suction intake on many vessels is simply a short length of pipe with holes drilled into it. This is easily clogged and a possible improvement suggested by retired Peterhead Skipper Robert Reid is shown in Figure 4.

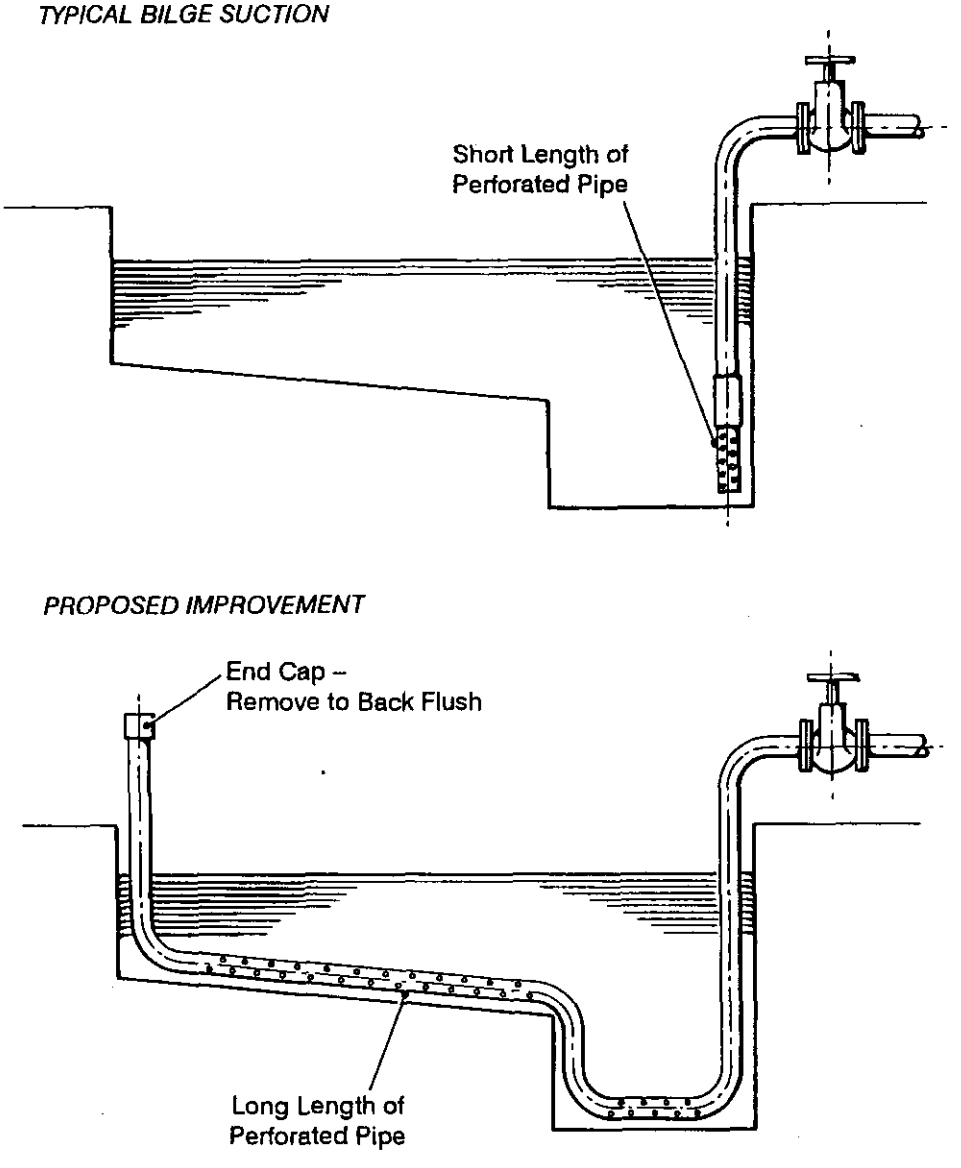


Figure 4 - Suggested Improvement for Bilge Suctions

This utilises a much longer length of pipe perforated with holes laid length-wise in the bilge. Thus, because of the greater area of holes it is much less likely to be blocked by debris. By fitting a bend at the end of the pipe with an upright section clear of the bilge, it is possible to easily flush clear the bilge suction by removing the end cap and using a hose to back-flush the system. An extended perforated pipe may be installed as a back up to the existing suction, with a valve installed to select it should a blockage occur. Alternatively, it may replace the original suction line. The concept could be very desirable in the fishroom where the boxes of fish may make it impossible to gain access to the bilge sump to clean a conventional suction strainer.

One simple improvement that can be added to existing bilge suctions is a sliding strainer cover. Wire/plastic mesh sheeting or perforated sheet is corrugated around the suction pipe to provide an additional strainer over the perforated end of the pipe. A rod, or even a wire, attached to the strainer will enable it to be pulled upwards, should it become choked, thus exposing the clear suction pipe and allowing pumping to continue.

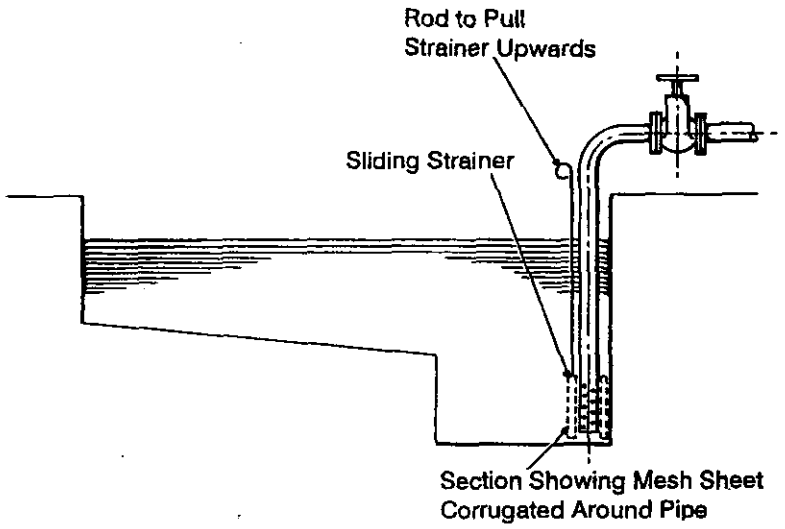


Figure 5 - Sliding Suction Strainer

A further suggestion from Skipper Reid is to guard against problems with valve chests. From his own experience and from discussions with a ship's plumber, flooding situations often occur through debris becoming lodged under valve seats such that, although the valve has been screwed down tight it is not in effect shut. A simple measure employed by Skipper Reid on his own vessel, after twice suffering flooding, is to mark the valve hand wheels with a spot of white paint, such that when each valve is fully closed all the spots are in line. Thus, if debris does become lodged in the valve preventing closure it will be obvious from the position of the handwheel.

These ideas are worthy of further consideration and as with bilge alarm systems, there is a need to investigate the experience on vessels to define what action is needed.

8.5 Vessel Motion and Trim Monitor

This is purely a concept at this point in time and will need to be proved and developed. The concept was formed in considering how to provide a practical means of monitoring the stability of a vessel and though vessel stability can only be assessed by calculation, it was appreciated that the changes in vessel motion do signify a change in stability. Changes in vessel motion can result from various causes, the quantity of fish in the fishroom, the fuel that has been used, the loads from fishing gear, fish on deck and from flooding. Although sea state varies widely, the motion of the vessel will have a consistent resonant period mostly affected by the loadings on the vessel. It is difficult, especially in a seaway, for skippers to judge if the vessel is carrying significant trim or list, which are also indicators of vessel loadings. Flooding and overloading are the causes of vessel losses and hence an instrument that monitors the vessel and warns of significant change would be beneficial.

Envisaged is a wheelhouse mounted self-contained small unit containing two inclinometers (longitudinal and transverse) feeding data to a microprocessor. The unit would establish, under skipper control, a memory of vessel behaviour and constantly compare new data with the memory. Should a change occur to the condition of the vessel, the unit will monitor the change and indicate it with a variable level of warning. Flooding, particularly in spaces above the bilge level, is perhaps the most likely change that occurs on vessels and is not detected until it is too late.

9. Conclusions

9.1 MAIB investigations do show that flooding is problem that needs to be addressed on fishing vessels.

9.2 Effective bilge level alarms in working order are essential to give early warning to be able to take action to stop the flooding. All too often bilge alarms are found to be out of order or even switched off.

9.3 Watertight bulkheads are designed to prevent vessel loss if flooding occurs. The integrity of bulkheads must be maintained and not compromised by pipes and cables passed through the bulkhead without effective sealing after the vessel is built.

9.4 The ability to be able to close sea inlets quickly and easily, even when an area is flooded, is vital to be able to combat failures in pipework and fittings.

9.5 Pumping systems may be made ineffective through debris blocking suction pipes or preventing the operation of valves. The means of preventing debris entering the system must be adequate.

10. Actions

The object of this report is to promote discussion and consideration of the flooding situation. Hence, the report is to be widely circulated to government bodies, the fishing federations, vessel builders, vessel insurers and other organisations and individuals. Any comments, suggestions and offers of participation are requested from all parties. Seafish propose the following actions:

10.1 To liase with all interested parties in an examination of practical cost effective measures that can be taken. Banff and Buchan College are playing a leading role in addressing the flooding situation, particularly in the consideration of bilge level alarms. Therefore, Seafish will liase closely with the College.

10.2 To put forward a plan of action and to seek the necessary funding to carry forward work that will result in practical improvements being demonstrated on vessels. Work will include:

Seeking comment on the concept for the remote operation of sea inlet valves and subject to a positive response, to work with Mr Buchan to demonstrate the system.

Investigating the actual measures in place on fishing vessels for preventing debris from choking pumping systems and exploring possible improvements.

Investigate the practicalities and likely cost of a vessel motion and trim monitor.

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MARINE GUIDANCE NOTE MGN 84(F)

MARINE GUIDANCE NOTE

MGN 84 (F)

Maritime and Coastguard Agency

KEEPING A SAFE NAVIGATIONAL WATCH ON FISHING VESSELS

Notice to Owners, Operators, Skippers and Crews of Fishing Vessels

This Notice supersedes Merchant Shipping Notices: M1020, M1190, M1463, M1649, M1656

Summary

This notice explains why fishing vessels need to maintain a proper navigational watch at all times, and defines the correct use of navigational equipment.

Key points:

- Watches must be properly manned by competent people who are fit for duty.
- A proper lookout must be kept at all times.
- Check the vessel's position by all available means. Do not rely only on a single piece of equipment.
- Other traffic must always be monitored.
- Do not use navigational aids for purposes for which they are not intended.

1. Why Should I keep a Watch on Fishing Vessels?

1.1 Investigations into collisions and groundings involving fishing vessels have continued to show that poor watchkeeping is a major cause. In many cases one or more of the following were important factors:

(a) an unqualified or inexperienced man in charge of the watch;

(b) only one man on watch (regardless of whether a watch alarm was fitted);

(c) a poor lookout being kept;

(d) divided command; and,

(e) fatigue.

The guidelines laid down by the International Maritime Organisation must be closely followed at all times. **A competent alert Watchkeeper, keeping a proper all round lookout at all times is absolutely essential.**

1.2 Failure to maintain a safe navigational watch will be and has been viewed very seriously by the Agency and the Courts.

2. What are the Arrangements of a Safe Navigational Watch?

2.1 The watch should always take into account the prevailing circumstances and conditions. Even where there is no statutory requirement for certificated officers, it is still essential that watchkeepers are always experienced, capable, and have been instructed in their

duties. This is especially vital if you are making a landfall, navigating close to the coast, in restricted visibility, severe weather conditions or in dense traffic.

2.2 When deciding the composition of the watch the following factors should be considered:

(a) the wheelhouse must not be left unattended at any time;

(b) the weather conditions, visibility and time of day. Although the size of the crew and the wheelhouse may not permit a continuous two person watch, two people should always be on watch during the hours of darkness and in poor weather conditions;

(c) the proximity of navigational hazards which may make it necessary for additional navigational duties to be undertaken;

(d) the use and operational condition of navigational aids such as radar, automatic pilot, and position-fixing equipment.

(e) any unusual demands on the navigational watch that may arise as a result of special operational circumstances.

3. Fitness for Duty

Both the skipper and the watchkeepers should take full account of the quality and quantity of rest taken when determining fitness for duty. Particular dangers exist when the watchkeeper is alone. It is all too easy to fall asleep, especially while sitting down in an enclosed wheelhouse. Watchkeepers should ensure they remain alert by moving around frequently, and ensuring good ventilation.

4. Navigation

4.1 The intended voyage should be planned in advance taking into account any relevant information. Courses should be checked before departure.

4.2 It is important that watchkeepers maintain a close watch on their own vessel and always know the position, speed and course steered. Many groundings occur when the position is not being monitored and the watchkeeper thinks that the vessel is in safe water.

4.3 The watchkeeper should know the location and operation of all safety and navigational equipment on board and their limitations.

4.4 The person in charge of a navigational watch should not undertake any other duties that would interfere with the safe navigation of the vessel.

4.5 Unfortunately it is not possible to rely on every give-way vessel to keep clear. It is therefore vital to monitor the movement of ALL traffic. Remember that a vessel engaged in fishing does not always have the right of way. In restricted visibility, even with gear extended, a fishing vessel has no special privileges.

4.6 Domestic radios, cassette players and television sets should never be used in the wheelhouse to the neglect of navigational duties. The proper place for such items, specifically television sets, is in the accommodation.

5. Navigational Equipment

5.1 Watchkeepers should make effective use of all available equipment and not hesitate to use the **helm, engines** and **sound signalling apparatus**. Use the **radar**, as an aid. There is no substitute for keeping a good visual lookout.

5.2 It is strongly recommended that any **automatic pilot** fitted should incorporate a **watch alarm**. It is good practice to extend the installation of a watch alarm to vessels not fitted with automatic pilot. It is advised that a watch alarm is fitted on board ALL vessels where there may be one person on navigational watch. The watch alarm will not only alert the watchkeeper but also other members of the crew.

5.3 Over-reliance on **video plotters** has been a factor in several recent collisions and groundings. Using an electronic system does not remove the need for proper passage planning and navigation, using appropriately scaled paper charts. Assessments or assumptions based on video plotters alone are dangerous and unreliable. A video plotter used for fishing purposes is not adequate for safe navigation.

5.4 If you use a video plotter, bear in mind the limitations of this type of equipment and always cross-check the accuracy of your position, course and speed. Equipment of this type may aid navigation, but it cannot replace the fundamental need to maintain a visual lookout.

5.5 Information, charts, routes and waypoints can be stored for future use. However, stored data should always be checked and used with caution, especially if transferred between vessels. Ensure it is applicable to the vessel's specific condition and voyage, and always keep this data upto date.

5.6 **Electronic magnetic compasses** may be unsuitable for use within a steel wheelhouse. Groundings have been caused by the improper functioning of this equipment linked to an auto-pilot. When a heading reference is required for navigational equipment such as an auto-pilot or radar, it is recommended that a **transmitting magnetic compass** (rather than an electronic magnetic compass) be fitted.

6. Navigational Duties and Responsibilities

6.1 The person in charge of the watch should:

(a) keep watch in the wheelhouse, which should never be left unmanned;

(b) continue to be responsible for the navigation of the vessel, despite the presence of the skipper, until it is mutually agreed the skipper has taken over;

(c) notify the skipper when in any doubt as to what action to take in the interest of safety;

(d) not hand over to someone who is obviously not capable of taking over the watch. The skipper should be advised accordingly.

(e) on taking over a watch establish the vessel's estimated or actual position and confirm the intended track course and speed. Any dangers to navigation expected during the watch should be noted;

(f) maintain a proper log of all movements and activities during the watch that relate to the navigation of the vessel.

7. Look-out

7.1 It is absolutely essential that a proper look-out is kept at all times. Casualties to fishing vessels, resulting in loss of life, continue to occur because of the lack of a look-out. In addition to assessing the situation and risk of collision, stranding and other navigation dangers, the duties of the look-out should include the detection of other vessels or aircraft in distress, shipwrecked persons, wrecks and debris.

7.2 The look-out must give full attention to keeping a proper look-out and no other duties should be undertaken which could interfere with that task. The duties of the look-out and helmsman are separate and the helmsman is not considered to be the look-out while steering except where an unobstructed all-round view is provided and there is no impairment of night vision or other impediment. The watchkeeper may only be the sole look-out during daylight hours provided that it is safe to do so and assistance is immediately available.

8. Weather Conditions

8.1 The watchkeeper should take early action to notify the skipper when adverse changes in the weather could affect the safety of the vessel, including the possibility of icing occurring.

9. Navigation with Pilot Embarked

9.1 The presence of a pilot on board does not relieve the skipper or watchkeepers from their duties and obligations. The skipper and pilot should exchange information regarding navigational procedures, local conditions and, the vessel's characteristics. The skipper should co-operate closely with the pilot. An accurate check of the vessel's position and movement should be maintained.

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