Report 07-202, fishing vessel, *Walara*-K flooding and sinking, 195 nautical miles off Cape Egmont, 7 March 2007

Report 07-202

fishing vessel
***Walara*-K**

flooding and sinking

195 nautical miles off Cape Egmont

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Photograph courtesy of the skipper of the *Altair III*

The *Walara-K*

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Abbreviations

2DTE	second class diesel trawler engineer certificate
EPIRB	emergency position indicating radio beacon
kW	kilowatt
m	metre(s)
Maritime NZ	Maritime New Zealand
MEC4	marine engineer class 4
MEC6	marine engineer class 6
MHz	megahertz
mm	millimetre(s)
nm	nautical mile
NZOM	New Zealand offshore master certificate
RCCNZ	rescue co-ordination centre of New Zealand
SSM	safe ship management
Tasman Tuna	Tasman Tuna Fishing Company Limited
UTC	co-ordinated universal time
v	volt(s)

Glossary

butterfly valve	uses a flat circular plate (the butterfly) positioned in the centre of a pipe to control the flow of a liquid
deckhead	a nautical term for ceiling
dropline	a method of fishing using a vertical line with a series of baited hooks attached by traces or snoods at regular intervals along its length
gate valve	has a round or rectangular gate that is screwed into the path of fluid to stop the flow
keel cooling	a closed-circuit cooling system that uses a grid of pipes welded to the external hull beneath the waterline. The closed-circuit cooling system eliminates the need for an inboard heat exchanger, salt water pumps and strainers, as well as the maintenance associated with them
longline	a method of fishing that uses a long, heavyweight, horizontal fishing line with a series of baited hooks attached by traces or snoods at intervals along its length. Can be used to fish close to the surface or along the sea bottom
Mayday	an internationally recognised distress signal used to indicate a life-threatening situation and that immediate assistance is required
non-return valve	a valve that allows liquid to pass in one direction only
shooting	the act of setting fishing gear
transom	the stern plating of a ship with a flat stern

Data Summary

Name:	*Walara-K*
Type:	fishing vessel
Safe ship management (SSM) company:	Survey Nelson
Limits:	offshore – within 200 nautical miles (nm) of the coast of New Zealand including Stewart Island and Chatham Island. Not to operate below 48° South
Length:	18.67 metres (m)
Breadth:	5.496 m
Gross tonnage:	66
Built:	1973
Propulsion:	a Caterpillar CAT 3406B 250 kilowatt (kW) diesel engine drove through a TwinDisk gearbox with a 5.16 to 1 ratio a fixed-pitch 4-bladed propeller, which was housed in a Kort or ducted nozzle
Service speed:	6.5 knots
Owner/operator:	Tasman Tuna Fishing Company Limited (Tasman Tuna)
Port of registry:	Tauranga
Crew:	3
Date and time:	flooding: Approx 0400 on 7 March 2007[1]
	sank: 0700 on 7 March 2007
Location:	195 nautical miles off Cape Egmont
Persons on board:	crew: 3
Injuries:	crew: nil
Damage:	total loss - vessel sank and was not recovered
Investigator-in-charge:	Captain Doug Monks

[1] Times in this report are New Zealand Daylight Time (UTC + 13 hours) and are expressed in the 24-hour mode.

Executive Summary

In the early morning of 7 March 2007, while fishing about 195 nm off the west coast of the North Island, the longline fishing vessel *Walara-K* took on water in its engine room and sank in 500 m of water within 3 hours. The 3 crew members were able to abandon ship into a liferaft from which they were rescued within 6 hours. The vessel was not recovered.

The loss of the vessel and the absence of key documents have resulted in the Transport Accident Investigation Commission (the Commission) being unable to determine the exact reason for the ship sinking. From interviewing key people and reviewing available documents, however, the Commission has been able to identify 3 possible causes:

- Intake of water through a modified bilge and water pumping system, either from incorrect valve settings or by debris jamming the valve open. These modifications had not been documented or advised to the SSM company so they had not been inspected. The modifications made unintentional flooding possible. The lack of documentation meant it could not be determined if the changes met the requirements of the Maritime Rules, particularly those concerning non-return valves.

- Corroded hull plating. The vessel was 33 years old and it is conceivable that the hull plating had wasted, even though when sandblasted in 2003 the hull appeared to be in good condition. The actual thickness of the hull was not known.

- Undetected hull damage from a strike by a broken stabiliser arm the previous month. The original stabiliser arm installation had not involved a surveyor as required by the Maritime Rules, and there was no hull inspection made after the breakage.

The vessel's crew did not meet the qualification standard required to operate beyond 100 nm of the coast. Had the crew been adequately qualified, they might have been able to respond better to the situation, including using the full bilge pumping capacity to slow the flooding. The skipper was the only person on board with engineering training and knowledge, and he was the sole operator of the engine room equipment. The crew had no duties in the engine room and had not received any training for the equipment, so they would have been unable to operate the vessel if the skipper had become incapacitated.

Maritime New Zealand (Maritime NZ) is currently reviewing crewing requirements for fishing vessels.

In addition, Maritime NZ has an active programme in place to address the issue of vessels operating without adequately qualified personnel on board.

Recommendations were made to the Director of Maritime NZ for her to address the safety issue of:

- major modifications being carried out without the knowledge of safe ship management companies.

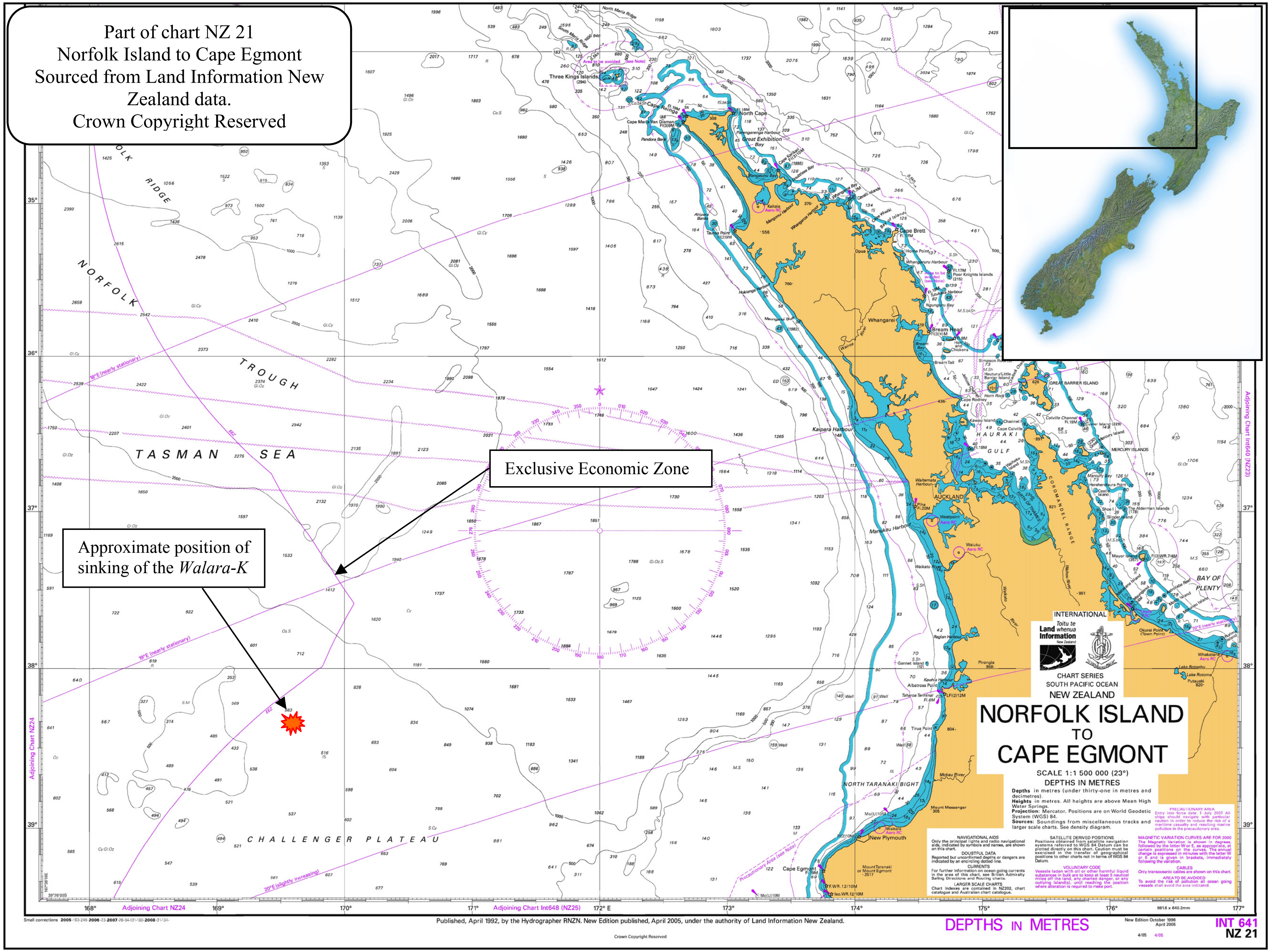

Figure 1
Tasman Sea and the west coast of the North Island

1 Factual Information

1.1 Narrative

1.1.1 The *Walara-K* arrived at Onehunga, Manukau Harbour on 2 March 2007, where its crew discharged the catch from the trip, bunkered, provisioned and took on fresh ice.

1.1.2 At about 2100 on 3 March 2007, the *Walara-K* departed from Manukau Harbour with a skipper and 2 deckhands and headed for the fishing grounds in the Tasman Sea to the west of New Plymouth (see Figure 1). The vessel arrived at an area the skipper wanted to explore for fish at about 1300 on 5 March. The crew set a couple of vertical drop lines to sample what, if any, fish were in the area, but the appearance of a pod of killer whales disrupted the fishing, so the skipper decided to move to another area before deploying the bottom longlines.

1.1.3 Between 0200 and 0600 on 6 March, the crew set 3 longlines. At about 0830, the crew started to recover the lines, finishing at about 1500. Once they had stowed the catch, the crew prepared the equipment for the next day's fishing. After dinner the crew slept for a few hours. As the *Walara-K* steamed to the first shooting position, between midnight and 0100 on 7 March, the skipper said that he pumped the engine room bilges, which he estimated had about 300 millimetres (mm) of water in them. He also pumped the melt water from the fish hold during this period. The crew started shooting the first longline at about 0100 and were partway through setting the third line shortly after 0400, when the engine room bilge alarm sounded.

1.1.4 In the engine room the skipper found that the water was almost up to the floor plates and was washing across them as the vessel rolled. He checked that subsequent to pumping the bilges after midnight he had returned all the bilge system valves to their correct positions and that the sea suction valve was closed. He also looked for any obvious entry point for the water, such as the propeller shaft stern gland, but found none. He engaged the engine-driven bilge pump and set the valves to draw directly from the engine room. On leaving the engine room he confirmed that bilge water was pumping overboard from the starboard side discharge.

1.1.5 So that they could concentrate on the flooding danger, the skipper instructed the crew to cut and buoy the partially set longline for later recovery. Next, they rigged a portable submersible pump using a length of hose cut from the deck hose as the discharge pipe. There was no permanent connection to join the hose to the pump, so one of the deckhands held the hose onto the submersible pump outlet. At about this time the skipper noticed water bubbling in at the forepart of the engine room, so deduced that the source of the flooding was in that area.

1.1.6 The depth of water continued to increase, indicating that the pumps were not keeping pace with the flooding. Soon after, the skipper told the deckhand who was holding the deck hose onto the submersible pump to leave the engine room and assist in the preparation of the life-saving equipment, so the submersible pump was no longer pumping. The skipper contacted another company vessel, the *Altair III*, which was fishing about 46 nm away and asked its skipper to come to their assistance. He also transmitted, unsuccessfully, a Mayday call to Maritime Radio on 2 frequencies on the 4 megahertz shortwave radio band. Getting no response to the Mayday, he activated the automatic emergency function on the Inmarsat Satcom-C system, a text-based satellite communication system.

1.1.7 At 0440, the rescue co-ordination centre in Canberra, Australia received a Satcom-C message, which gave the vessel's position as 38° 20.27'S 169° 35.3'E. The skipper also activated the 406 MHz emergency position indicating radio beacon (EPIRB), the signal from which was received by the rescue co-ordination centre of New Zealand (RCCNZ) at 0442, but this did not give a resolved position for the beacon. Less than an hour after the flooding was discovered, the *Altair III* was making its way to the stricken vessel, and other emergency agencies were mobilising other rescue assets.

1.1.8 On board the vessel, the crew was readying the emergency equipment such as liferafts, life jackets and warm clothing. When the skipper next went to the engine room he found that the water was over the floor plates and the gearbox, causing water to be sprayed around the engine room by the flywheel and propeller shaft. The skipper stopped the main engine and with it the engine-driven bilge pump.

1.1.9 At about 0530, when the water started to wash over the main deck, the skipper ordered the crew to abandon ship. The liferaft had been inflated and the crew had loaded the additional gear that they had collected into it, before clambering into it. They moved away from the *Walara-K*, but remained tethered to the vessel by a length of light rope. The auxiliary generator continued working until about the time that the crew abandoned the vessel.

1.1.10 At 0614, RCCNZ obtained a resolved EPIRB alert that gave a position of 38° 21'S 169° 36'E.

1.1.11 At 0700 the *Walara-K* rolled to port and sank by the stern, the crew releasing the rope attaching them to the vessel.

1.1.12 At 0832 a light fixed-wing search aircraft from New Plymouth located the liferaft. Soon after, a Royal New Zealand Air Force Orion aircraft from Whenuapai, Auckland arrived on site and took local command of the situation, releasing the smaller aircraft. The Orion dropped a rescue pack, including provisions and a portable radio. Over the radio, the pilot explained to those in the liferaft that a container ship would be on the scene at 1015 and the *Altair III* was due to arrive at 1100. The pilot of the Orion located an oil slick and other fishing equipment floating in position 38° 21.3'S 169° 36.1'E, which he reported to RCCNZ.

1.1.13 By 1053, the crew from the liferaft were on board the container ship *MSC Alpana*. When the *Altair III* arrived at about 1115, the crew were transferred to that vessel using the liferaft, which had been left floating alongside the ship. Once onboard the *Altair III* the crews recovered the *Walara-K*'s and *Altair III*'s fishing gear before they returned to Nelson.

1.1.14 The *Walara-K* sank less than 3 hours after the bilge high-level alarm sounded. The depth of water at the sinking position was about 550 m and the vessel was not recovered.

1.1.15 The crew were uninjured during the sinking and rescue.

1.2 Vessel information

1.2.1 The *Walara-K* was built in 1973 by Australian Ship Building Industries Proprietary Limited, South Coogee, Western Australia. Originally, the vessel was operated as a prawn trawler out of Fremantle by the Kaillis Group. In 2001 the *Walara-K* was sold to Chesham Investments, a New Zealand fishing company, which operated it out of Tauranga as a surface longliner. In late 2005 the vessel was sold to another company operating out of Gisborne, which in September 2006 sold it to Tasman Tuna, which modified it to be used as a bottom longliner.

1.2.2 The vessel was of steel construction and had 3 watertight transverse bulkheads giving 4 watertight compartments.

1.2.3 Tasman Tuna also owned the *Altair III,* also a bottom longliner, the vessel that rescued the crew of the *Walara-K*.

1.2.4 The *Walara-K* was powered by a model 3406B Caterpillar 6-cylinder 250 kW diesel engine and propelled by a nozzle-enclosed 4-bladed propeller through a 5.16 to 1 TwinDisc gearbox. The engine had keel cooling, which was an enclosed system isolated from the sea.

1.2.5 A 60-kilovolt-amperes auxiliary alternator powered by a Perkins 6-cylinder diesel engine was mounted on the port side of the engine room on a cradle higher than the main engine (see Figure 2). The alternator was relatively high powered for a fishing vessel of this size, and had been installed in the new vessel to supply power for the blast freezing plant used to freeze the prawns that the vessel was designed to catch. During the vessel's life, lead ingot ballast had been installed on the starboard side of the engine room to compensate for the imbalance caused by the alternator. Since operating in New Zealand the vessel had not used the blast freezer, but instead used ice to chill and preserve the fish.

1.2.6 The main and auxiliary engine exhausts were water cooled and passed along the engine room deckhead, through the after bulkhead of the engine room into the steering gear compartment and out through the vessel's transom. The cooling water for the exhausts was supplied by pumps that were directly driven by the respective main and auxiliary engines. The exhaust cooling water was drawn through one of only 2 sea suctions in the engine room, which was situated about midway along the length of the main engine and between it and the auxiliary engine.

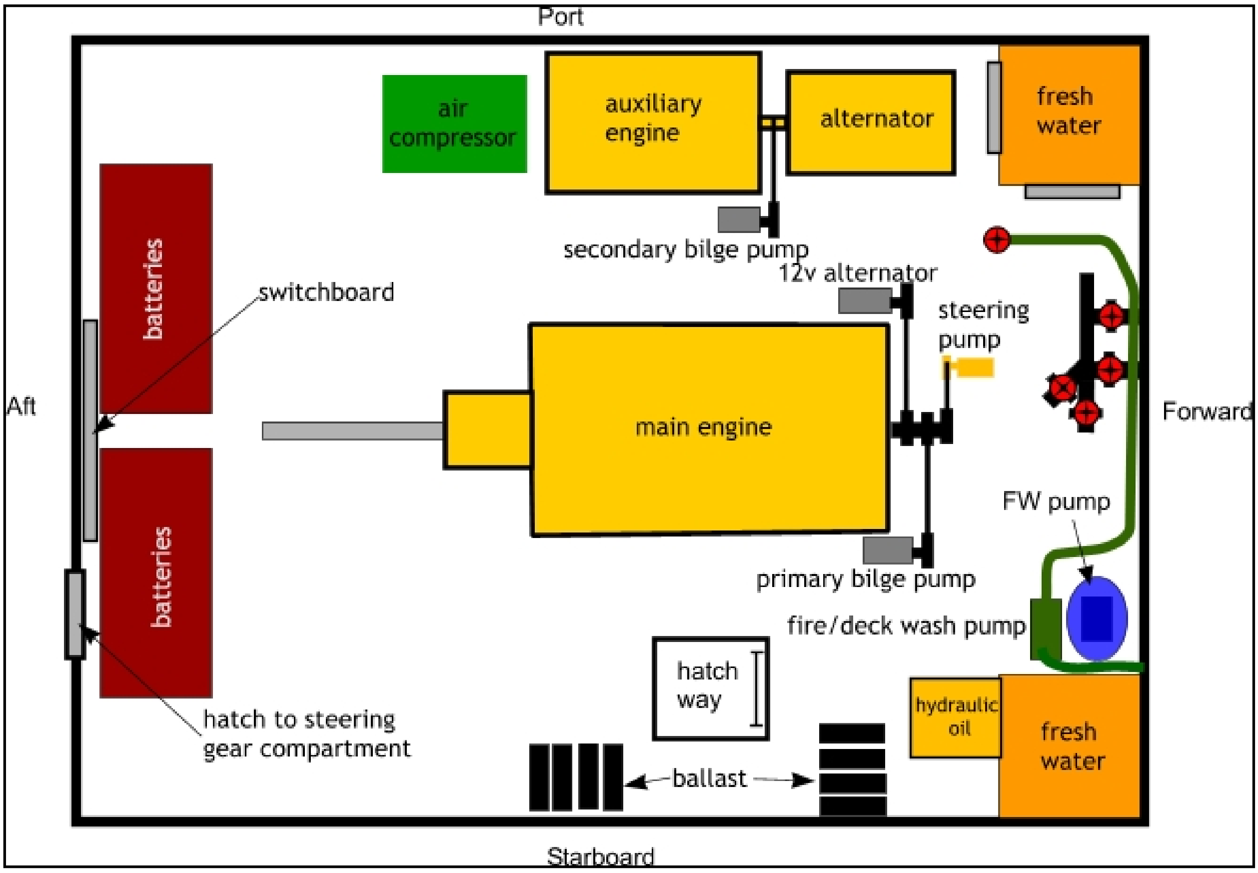

Figure 2
Schematic of the engine room

1.2.7 In 2004, there was a problem with the water-cooled exhaust on the main engine. When the vessel was stopped and lying stern to the sea, a small amount of seawater entered the main engine through the exhaust pipe. Although there was a flap on the outboard end of the exhaust pipe, specifically to stop water entering it, the lift of the waves had opened the flap on the main engine exhaust and allowed water to enter the pipe. Because the engine was stopped there was no back pressure from the exhaust gases and small amounts of water were progressively forced up the exhaust pipe until some entered the engine. On restarting the engine the non-compressible water in the cylinders caused major internal damage to the engine, requiring it to be rebuilt. To prevent a recurrence the owner fitted a drain valve at the engine end of the exhaust pipe, which could be opened to remove any water before the engine was restarted. In addition, he fitted a shroud around the flap on the exhaust pipe to prevent the sea slop lifting it.

1.2.8 The deep "V" of the hull beneath the main engine had been filled with concrete to ease cleaning and to prevent tools and debris falling into it. The forward extent of the concrete was the frame aft of the forward bulkhead, so leaving that forward section as a well for the bilge suction. This was the area in which the skipper saw water welling up.

1.2.9 In 2003, the vessel underwent an out-of-the-water survey and maintenance under the supervision of the Survey Nelson-appointed surveyor in Tauranga, during which the hull was sandblasted and repainted. At that time, there was no sign of hull pitting, and the owner at that time considered the hull to be in good condition.

1.2.10 The owner that brought the vessel to New Zealand had prepared a comprehensive operating manual that gave clear instructions with photographs on how to operate the main engineering systems of the vessel. The operating manual did not form part of the official SSM manual, but did provide clear instructions on the operation of the vessel's equipment. The manual and in particular the photographs were most useful during the investigation.

1.2.11 Between December 2006 and January 2007, the main engine gearbox failed and required a complete overhaul.

1.3 Bilge and pumping systems

1.3.1 Originally, the bilge system consisted of 2 completely separate pumping systems (see Figure 3):

- The first system used a Johnson 1.5-inch [38.1 mm] self-priming pump, that had a rubber impeller and an electromagnetic clutch, and was belt-driven directly off the main engine. The primary bilge system serviced the engine room, fish hold and forepeak, discharging the water through the ship's side above the water line on the starboard side of the engine room. A strum box was fitted between the bilge suctions and the pump to prevent foreign objects being drawn into the system and damaging the pump. This system had no sea connection so prevented the accidental flooding of the vessel.

- The second system was dedicated to the engine room, drawing from a single bilge suction situated below the main engine. It used a similar Johnson 1.5-inch pump that was belt-driven directly off the auxiliary engine and discharged the water through a ship's side valve on the port side above the water line. This system also had no sea connection.

1.3.2 In addition to the 2 bilge systems, there was a dedicated fire main and deck wash water system that was driven by a separate 230-v electric pump, which drew water through a sea suction, protected by a ship side gate valve, and discharged it through a valve (or hydrant) on the vessel's main deck.

1.3.3 The fish hold interior was coated in fibreglass and a small well had been moulded in the after end to catch any melt water. The fish hold suction for the primary bilge system drew from this well. Since the vessel had been in New Zealand and had been using ice to preserve the fish, a dedicated 12-v submersible pump had been fitted to pump the melt water from the fish hold directly over the side through a dedicated discharge. This pump was operated by a switch in the wheelhouse, thus simplifying the task of pumping the fish hold. The separate melt water pump also avoided the melt water contaminating the engine room bilge system. A warning light and audible alarm in the wheelhouse indicated when the submersible pump was running.

1.3.4 A portable 230-v submersible pump was provided to pump emergency water in the case of a fire and could be used to pump out a flooded compartment, as it did in this case.

1.3.5 In September and October 2006, before the vessel was put into service, Tasman Tuna made a number of modifications. It added a new bottom longline reel to the deck, moved the existing surface longline reel and added fishing float storage cages to the afterdeck. In the engine room, the pumping arrangements were modified so that the primary bilge pumping system could be used to provide water to the deck (see Figure 4). In order to achieve this, a pipe was connected between the sea suction for the fire main and deck wash water system and the pipeline between the strum box and the primary bilge pump. On the discharge side of that pump a 3-way valve was installed to allow the discharge to be directed either through the starboard ship side valve or through the fire and deck wash water line. With the correct valve settings, this modification also enabled the bilges to be pumped using the 230-v electric pump. The modifications were carried out by a Nelson engineering company to the specification of the owner and his engineering advisor. No drawings or plans were made of the modifications to the piping and there was uncertainty about which, if any, of the new valves were non-return. The engineers that made the modifications did have a copy of the invoice for materials and were able to draw a rough sketch of the bilge and deck wash water piping on the vessel, showing the approximate placement of the new butterfly valve and 3-way valve as shown on Figure 4. They had no recollection of any non-return valves being fitted.

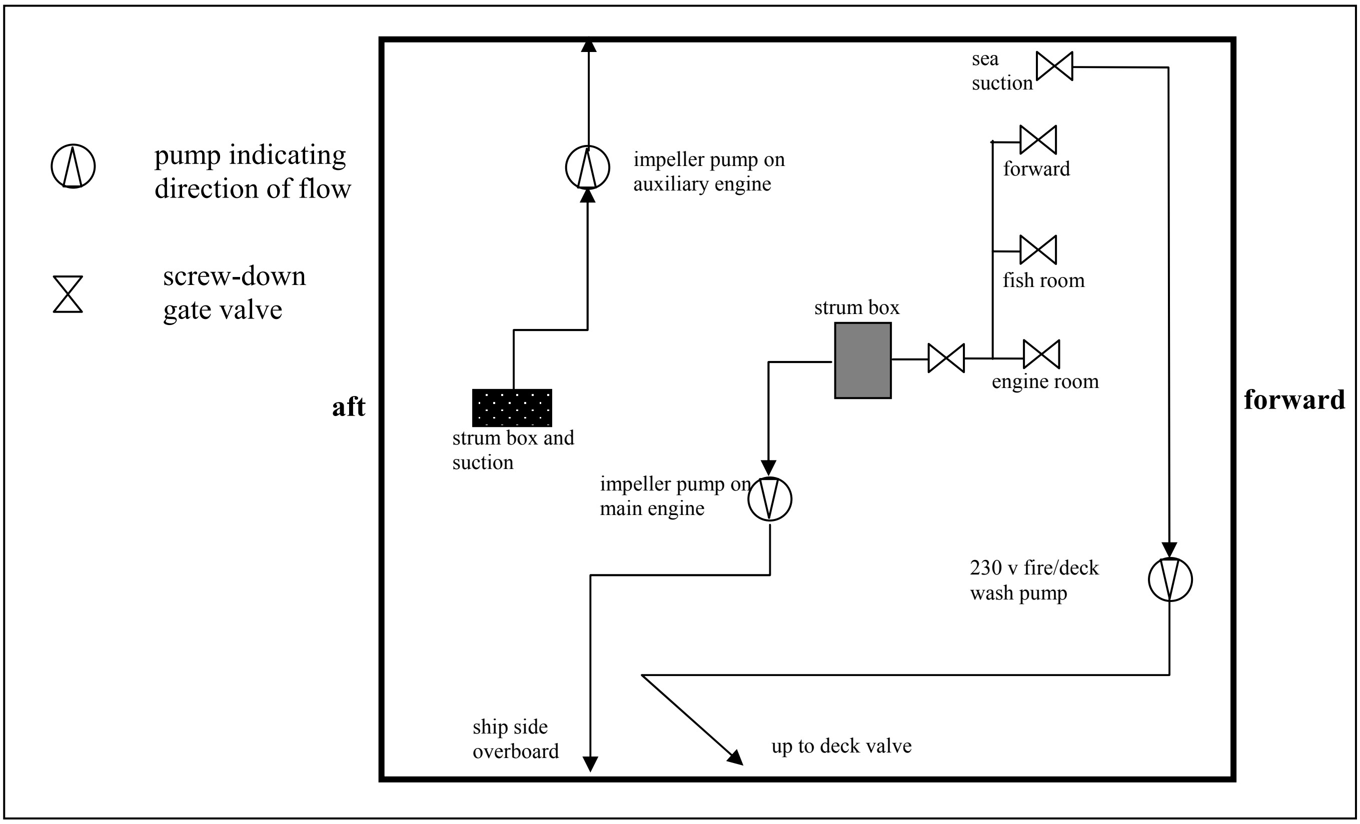

Figure 3
Pumping diagram pre-modification

1.3.6 Maritime Rules Part 40 D.28 (3) required that bilge systems be arranged so as to prevent water passing from the sea into the machinery space and from one watertight compartment to another. This required that a non-return valve or a cock that could not be opened simultaneously be fitted to the bilge connection of any pump that drew from the sea. When the modifications were carried out to the *Walara-K* bilge system, a butterfly valve was installed between the sea suction and the primary bilge pumping system. The "as-built" primary and secondary bilge systems were not connected to a sea water source, so the valves on their suctions were not required to be, nor were they, of the non-return type. There was no evidence that those valves were changed to non-return valves during the modifications. The modifications had not been approved, supervised or inspected by the SSM company or Maritime NZ.

1.3.7 Maritime Rules Part 40D.7c required an owner to ensure that:

> If the ship undergoes major alteration or permanently changes its operating limits, the ship's design is approved by a surveyor recognised by the Director for that purpose under rule 46.29 as –
>
> (i) fit for its intended service and intended operating limits; and
>
> (ii) complying with all the applicable maritime and marine protection rules.

A major alteration or modification was defined in Maritime Rules Parts 21.11 and 40D as:

An alteration or modification of a ship, including the replacement, removal or addition of any part of the ship, that is likely to –

(a) significantly affect the structural integrity, tonnage, freeboard, cargo or passenger capacity, crew or passenger accommodation, conditions of assignment of load line, watertight subdivision, stability, structural fire protection; or

(b) result in significant changes to the propulsion machinery, auxiliary machinery, steering or method of propulsion of the ship.

The modifications to the vessel's piping system did impact on the conditions of assignment of load line because they had the potential to affect the watertight integrity of the vessel. The modifications had not been notified to the SSM company.

1.3.8 Non-return valves and gate valves were relatively simple devices but they required regular maintenance, especially if liquids that could contain debris passed through them. There have been a number of accidents that have been attributed to gate and non-return valves being fouled by debris that allowed sea water to back flow into the vessel. In New Zealand 3 examples were:

- the loss of the *San Manukau* off Cape Karikari on 28 January 1996
- the flooding of the fishing vessel *Trial B* in Auckland on 29 April 2001
- the flooding of the commercial passenger vessel *Etosha* in Nelson on 22 May 2009.

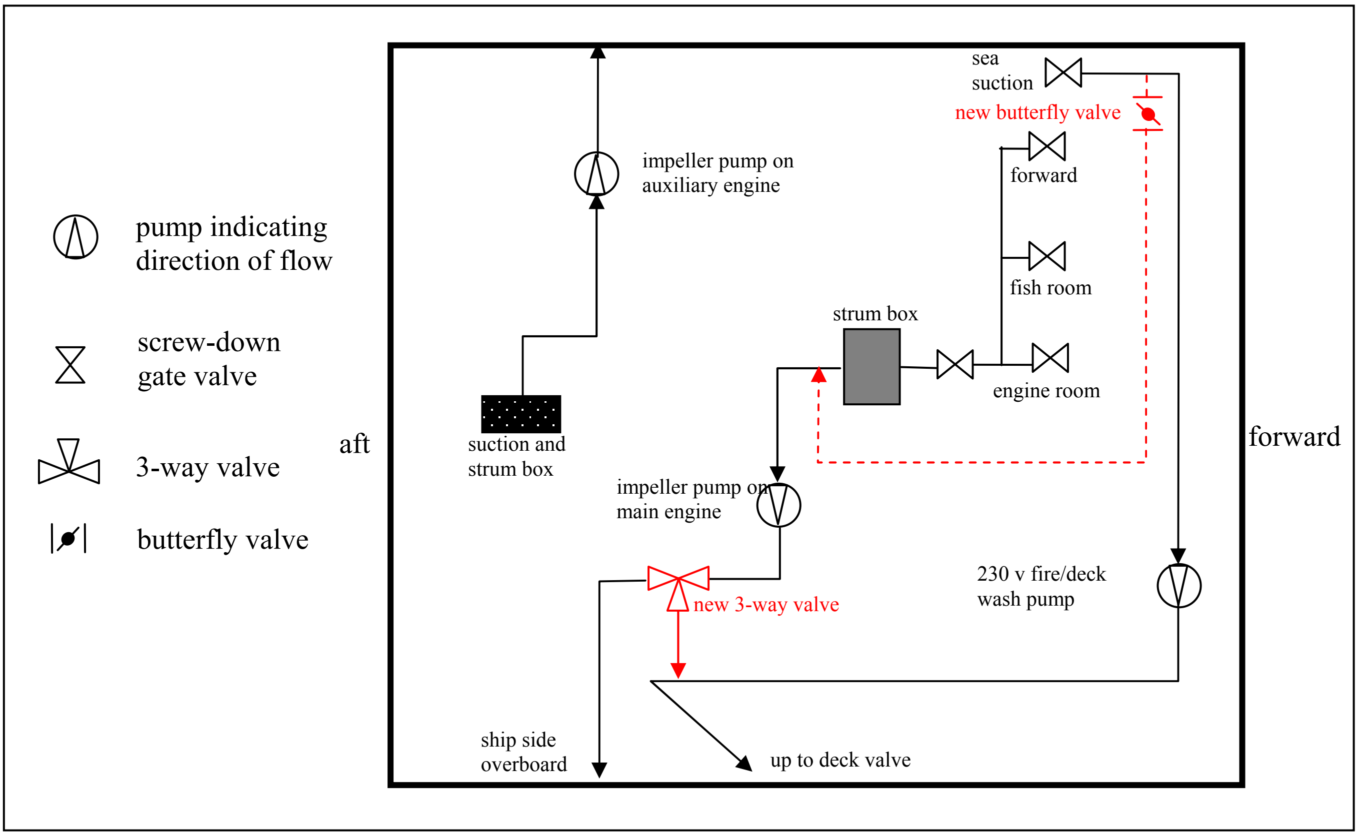

Figure 4
Pumping diagram post modification

1.3.9 The skipper indicated that the engine room bilges usually needed to be pumped every 2 or 3 days. The bilge alarm had 2 activators, the first at the after end of the engine room activated when the water level reached about 300 mm, and the second situated centrally on the forward engine room bulkhead and activated at about 500 mm. The skipper said that when he pumped the bilges at midnight the water cleared in about 10 minutes.

1.4 Stabiliser arm

1.4.1 In late 2005, the owner from Gisborne modified the vessel by fitting a rigid stabiliser arm on the port side of the vessel just aft of the wheelhouse, which was level with the forward part of the engine room. The stabiliser arm consisted of 3 main tubular steel members: a horizontal arm, a vertical arm and a hinged diagonal stay (see Figures 5, 6 and 7):

- The horizontal arm was an "A" frame shape constructed of a 6 mm thick 127 mm x 50 mm steel box section, with rungs made of 62 mm diameter steel pipe 6 mm thick. The "A" frame section was about 5 m in length with an additional 1.5 m long section to give the outhaul stay a lead. When deployed, the horizontal arm sat at an angle of about 10° above the horizontal. The inboard side of the "A" frame was hinged on the vessel's bulwark to allow the arm to be stowed vertically when not in use.

- The vertical arm was constructed of 80 gauge pipe of 89 mm diameter with "V" angle plates welded on the front and back of the pipe to improve its hydrodynamic properties. The vertical arm was attached by a universal joint about 1.5 m from the end of the horizontal arm. The foot at the bottom of the vertical arm was hexagonal in shape, approximately 1200 mm x 1200 mm in size and constructed of 12 mm steel plate. Two chain and wire stays attached just above the foot on the vertical arm led forward and aft to maintain its longitudinal position. Another chain stay, also attached just above the foot, led over the end of the horizontal arm to act as an outhaul to prevent the vertical arm swinging towards the hull of the vessel.

- The diagonal solid stay was secured between the gantry and the point about 1.5 m from the end of the horizontal arm. A hinge about two-thirds of its length from the gantry was locked to hold the arm in position and unlocked to allow the whole arm to be lifted to the vertical for stowage. A small block and tackle from high up on the gantry to the hinge was used to lift the arm for stowage.

Photograph courtesy of the skipper of the *Altair III*

Figure 5
The *Walara-K* with stabiliser arm deployed

1.4.2 The resistance on the foot of the stabiliser arm produced when the vessel rolled was transferred to the vessel and reduced the rate and extent of the roll. The rigid mounting of the arm caused it to work either when it was being drawn up through the water or when it was being pushed down into the water. This allowed that only one arm was needed to reduce the vessel rolling. Fishing vessels were commonly fitted with paravanes on chains (often called flopper stoppers) that only worked when they were being drawn up and through the water, requiring that one be fitted to each side of a vessel; flopper stoppers also needed the vessel to be making headway to operate efficiently. The solid stabiliser arm was particularly favoured by longline operators, because it allowed that one side of the vessel remained clear of obstacles, desirable when recovering the longline. In addition, the arm worked when the vessel was not making headway, so was ideal for the slow speeds used when hauling a longline.

1.4.3 The designer of the stabiliser arm indicated that it weighed less than 500 kilograms. The installation of the arm had not been approved by a surveyor in accordance with Maritime Rule 40.D.7(c), nor had the effect of the arm on the stability of the vessel been considered.

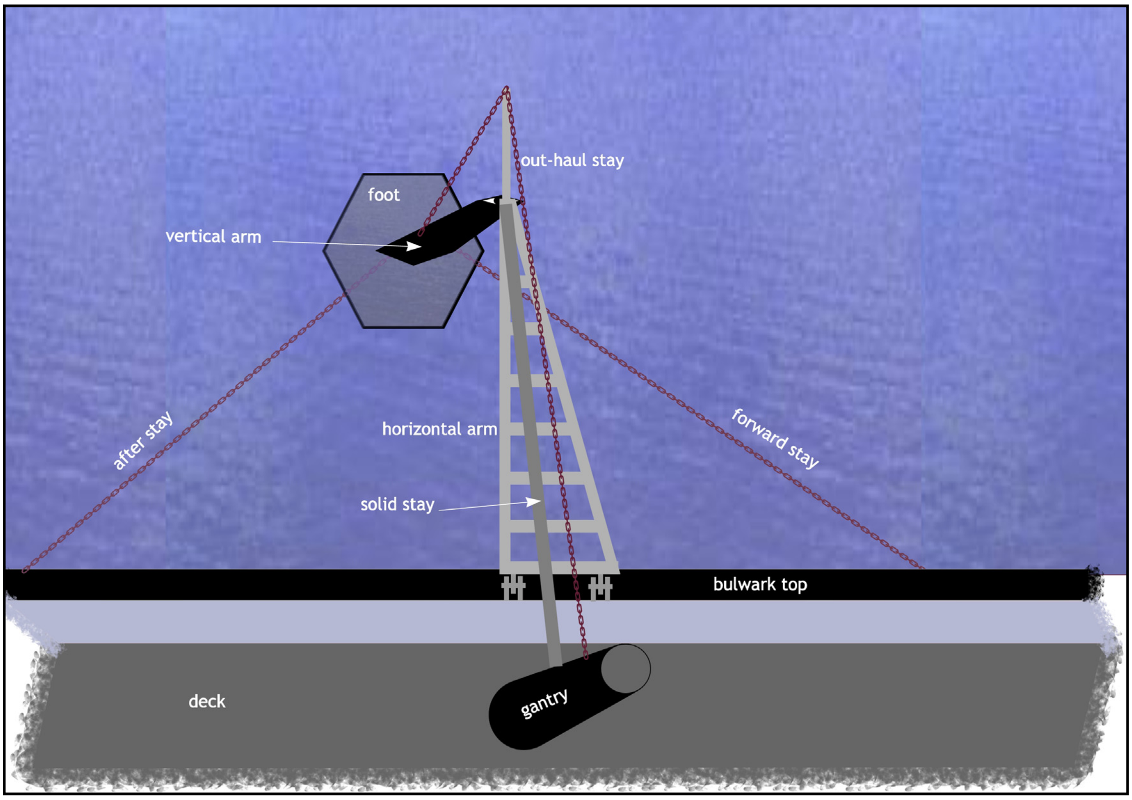

Figure 6
Diagram of the solid stabiliser arm

1.4.4 In late January 2007 while hauling the longline, the plate on which the diagonal solid stay and the out-haul stay were mounted came away from the gantry, causing the stabiliser arm to drop. The hinge on the bulwark where the horizontal arm was attached was such that it prevented the arm falling completely, but it did allow it to fall to about 35° below the horizontal (see Figures 8 and 9). The crew were able to recover the arm and return to Nelson, where an engineering company repaired and reinforced the gantry, and reconnected the solid stay and out-haul stay. The owner did not consider it likely that the arm had contacted the hull, so did not carry out an inspection of the underwater hull.

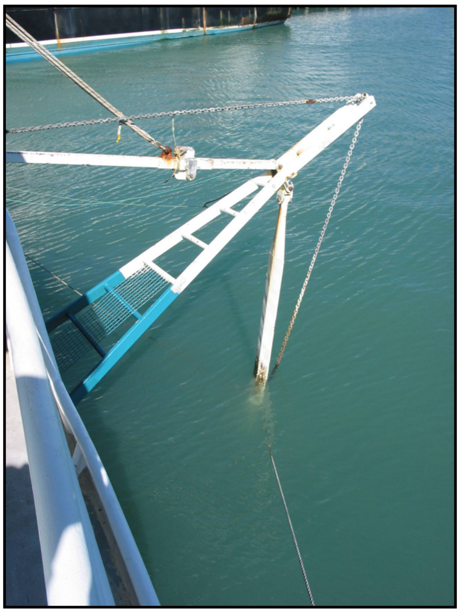

Figure 7
Stabiliser arm on the *Altair III*

Photograph courtesy of the skipper of the *Altair III*

Figure 8
The *Walara-K* with broken stabiliser arm

1.5 Personnel and minimum safe crewing information

1.5.1 The owner had been at sea for about 20 years and had been a skipper for the previous 14 years. He had owned and operated his own fishing vessels for the previous 10 years. He held a New Zealand offshore master's certificate (NZOM) and a second class diesel trawler engineer certificate (2DTE), which was equivalent to a marine engineer class 6 (MEC6).

1.5.2 The skipper had been at sea for about 18 years, starting work on a mussel farm in the Marlborough Sounds where he gained a commercial launchmaster certificate. He then moved to fishing vessels, where he gained a New Zealand coastal master certificate in 1994, which was equivalent to a NZOM but limited to within 100 nm of the coast. He also held a 2DTE that had been issued in 1996. In 2003, he had bought and operated his own fishing vessel, the *Challenger II*, but that had flooded and sunk off the west coast of the South Island on 19 August 2006. On that occasion the vessel took on water in the engine room at about 0100. The crew abandoned ship into a liferaft shortly before it sank at 0347, and were picked up by another vessel at 0600. No investigation was conducted into the loss of the *Challenger II*. Since the loss of that vessel, the skipper had worked on the *Walara-K*, initially as deckhand with the owner for one trip then as skipper on alternate trips to the owner. From January 2007 the skipper did all the following trips. Each trip was about 2 weeks in duration, the maximum length of time that fish could be kept on ice. Between each trip the crew normally had a couple of days to unload and store the vessel.

1.5.3 Deckhand A had been longline fishing for about 5 years. He had not undergone any formal training and did not hold any maritime qualifications. He had spent the previous 3 years on the *Altair III* before joining the *Walara-K* in January 2007.

1.5.4 Deckhand B had spent his first 10 years at sea on deep-sea trawlers, then worked in the inshore area for about 2 and a half years. He had not undergone any formal training and did not hold any maritime qualifications. In 2005, he had spent a year off work owing to an accident on a trawler that resulted in a broken and crushed arm. He had joined the *Altair III* in mid-2006 and had transferred to the *Walara-K* in January 2007.

1.5.5 The skipper and crew were self-employed share fishermen; that is, they were paid a percentage of the value of fish caught. When they were not fishing they did not receive any remuneration. The skipper was employed by the owner and the crew members were employed by the skipper.

1.5.6 Usually, there was a total crew of 4, but on the previous 2 trips one of the crew had needed medical attention, so the skipper and other crew members decided to sail and work with only 3 crew. This resulted in harder work, but would also result in their receiving a higher percentage of the catch.

1.5.7 The minimum safe crewing prescribed in Maritime Rules Part 31C for a vessel of less than 20 m operating in the offshore area out to 200 nm off the coast was:

Master – NZOM

Mate – New Zealand offshore watchkeeper

Deckhand – advance deckhand fishing

Chief Engineer – MEC4

Second Engineer – in accordance with the flow-chart (not required for the *Walara-K*)

A minimum number of 3 crew

The engineer qualification could be held by the master or other seafarer.

This information was also shown in the vessel's SSM manual issued by Survey Nelson in February 2006.

When operating within 100 nm of the coast, a vessel of less than 20 m was required to have:

Master – NZOM

MEC6 and may be Master or other seafarer

A minimum number of 2 crew.

1.5.8 The SSM manual required that crew members be properly trained in emergency and general procedures. Familiarisation training was the initial training given to new crew on a vessel, but neither of the deckhands had been given any familiarisation training on the *Walara-K*. Neither deckhand performed any engineering duties nor had they been shown any of the emergency pumping procedures.

1.6 Fishing technique

1.6.1 The *Walara-K* had been set up for bottom longline fishing. The usual procedure was for three 1000 m lines to be set before daybreak. The recovery of the lines started at about 0900 and continued into the early afternoon.

1.6.2 Each longline consisted of a down line with a large grapnel anchor at the bottom and large floats called windy buoys at the top. The backbone, a heavy gauge monofilament nylon line, was tied close to the bottom of the down line. As the backbone was paid out, baited hooks on nylon traces called snoods were clipped on to it every 4 to 5 m. After each set of 17 snoods a float was clipped to the backbone and about every third float a small weight was clipped on. The intention was for the backbone and hooks to be kept close to but slightly off the sea bottom.

1.6.3 Where the longlines were to be laid over a large area, transmitting beacons could be attached to the top of the down line to enable the vessel to home in on the end of the line.

1.7 Climatic conditions

1.7.1 The weather at the time of the flooding was moderate, with 10 to 15 knots of north-westerly wind that rose to about 20 knots at daybreak. The sea and swell was about one metre rising to 1.5 m as the wind freshened; sufficient for one of the deckhands to suffer sea sickness when they were in the liferaft.

1.7.2 Moonrise was at 2103 on 6 March 2007 and set again at 1014 on 7 March. With full moon having occurred on 4 March, the phase of the moon was waning gibbous with 92% of the moon's visible disc illuminated, so the crew would have had some natural light when they abandoned the vessel.

1.7.3 Sunrise was at 0729 on 7 March. The sky would have just been starting to lighten when the *Walara-K* sank.

1.8 Safe ship management and survey information

1.8.1 While operating as a trawler in Australia, the stability of the vessel had been calculated and that data was supplied with the vessel. However, as the vessel was used for longlining in New Zealand, there was no requirement for the stability to be recalculated. The existing certificate of survey issued by Marine Safety Western Australia was the only other documentation supplied with the vessel.

1.8.2 Chesham Investments was required to have the vessel surveyed for the delivery voyage from Australia to New Zealand. Following the survey and registration of the vessel, a voyage dispensation was issued by Maritime NZ.

1.8.3 On its arrival in New Zealand, the *Walara-K* was entered into the SSM system with SGS M&I SSM company. Part of that process was to record the vessel's details and enter them into the SSM company's database. Following an out-of-the-water survey and the remedy of a small number of minor deficiencies, a fit for purpose certificate was issued on 21 September 2001 and on 9 October 2001, a SSM certificate was issued.

1.8.4 In July 2003, the owner changed to Survey Nelson as the SSM provider. As part of that process the owner became a member of Survey Nelson's SSM system and entered into a memorandum of understanding that outlined the obligations and responsibilities of each of the parties. A survey was carried out in July 2003 and a fit for purpose certificate was issued on 22 July 2003. Soon after, the vessel left New Zealand to commence fishing out of the Cook Islands. On the vessel's return to Auckland, New Zealand in November 2004, it was subjected to an in-water survey and issued with a fit for purpose certificate on 17 November 2004. Owing to a small number of outstanding maintenance items, a SSM certificate was not issued until 26 April 2005. This certificate was only valid until 28 July 2005, the date that the vessel was due to have its hull valves and propeller shaft surveyed.

1.8.5 Owing to congestion, the slipping of the vessel was delayed until the period between 24 August 2005 and 3 September 2005, during which time a surveyor inspected the *Walara-K,* checking its structure, fittings and equipment. On 26 September 2005 a new SSM certificate was issued which, subject to periodic audits and inspections, was valid until 28 August 2009.

1.8.6 In December 2005, the vessel was sold to a fishing interest in Gisborne. When a vessel changed ownership the SSM certificate would lapse and needed to be re-issued to the new owner. Despite numerous communications from Survey Nelson, the Gisborne owner had not completed that process before he on-sold the vessel to Tasman Tuna in October 2006.

1.8.7 On 17 October 2006, Survey Nelson conducted an audit of the vessel for the new owner. Survey Nelson issued a draft SSM manual to the owner for him to customise for the specific operations and procedures on the *Walara-K*. On 30 November 2006 Maritime NZ issued an exemption certificate (from having a SSM certificate and a SSM initial audit, which was an audit conducted by Maritime NZ of the ship's operation against its SSM manual), valid for 3 months up to 28 February 2007. On 27 February 2007, because the necessary initial audit had not been carried out, Maritime NZ granted a further 3-month extension for the exemption. Consequently, at the time of the accident the vessel did not hold a SSM certificate, but was exempted from doing so.

1.8.8 Prior to the conduct of a survey or an audit, the SSM company prepared a checklist to assist the surveyor or auditor. The survey checklist contained details of the vessel, the expiry dates of time-sensitive equipment and the surveyor's notes from the previous survey. The audit checklist contained details of procedures and accompanying documentation against which the vessel was to be audited. All SSM companies had different, but similar, checklists.

1.8.9 The modifications carried out to the engine room pipework were not mentioned to the auditor during the SSM system audit on 17 October 2006, so the SSM company was unaware of those modifications.

2 Analysis

2.1 The *Walara-K* sank quickly for a vessel that from the available drawings and photographs appeared to have good watertight subdivision.

2.2 There were only 2 openings to the sea below the waterline; one was the fire and deck wash water suction and the other was the cooling water suction for the main and auxiliary engine exhaust pipes. A fracture or failure in either of these systems could have resulted in the flooding of the engine room. If there had been a failure in the exhaust cooling system, the skipper would have been expected to notice water coming from the area around the exhaust pipe cooling sea suction, which was halfway down the length of the engine room on the port side. However, the skipper described water bubbling into the forepart of the engine room, so the failure of the exhaust pipe cooling system was discounted.

2.3 Soon after the skipper discovered water in the engine room, he shut what he thought was the sea suction valve on the fire and deck wash system. If the sea suction valve had been operating correctly, such an action would have isolated the fire and deck wash system and prevented water entering the vessel through that system. There does remain the possibility that the sea suction valve was fouled or that in the urgency of the situation the skipper mistook which valve he did close.

2.4 The modifications carried out on the bilge and water pumping systems had not been notified to the SSM company, so it had not inspected them. No documentation of the revised piping or valves was made and therefore it could not be determined whether the piping system met the provision of Maritime Rules Part 40D in respect to bilge systems and in particular non-return valves. The original separate bilge, and fire and deck wash water systems had given a measure of safety by removing the possibility of unintentional flooding while using the bilge system. The modifications to the pipework removed that defence.

2.5 The number of non-return valves, if any, and the condition of any strum boxes or strainers in the modified bilge system were unknown. It is not uncommon for gate valves or non-return valves to become fouled and allow water to back-flow into the vessel. Pre-modification, such an event would have been impossible as the bilge systems had no sea suctions, but by connecting the bilge and the fire and deck wash systems the defence against the possibility of back-flowing was lost.

2.6 The skipper was the only person on board with any engineering training and knowledge and he was the sole operator of the engine room equipment. The crew had no duties in the engine room and had not received any training for the equipment, so if the skipper had become incapacitated they would have had extreme difficulty operating the vessel. When faced with the flooding of the engine room the crew's ability to assist or suggest alternative courses of action that may have stemmed the flow of water or improve the pumping was limited.

2.7 Had the skipper used all the pumping equipment at his disposal, he should have been able to reduce the rate at which the vessel flooded. There were 2 other pumps, the self-priming impeller pump on the auxiliary engine and the 230-v fire and deck wash pump that he did not attempt to use. In addition, the portable submersible pump was not used to its full potential because the discharge hose could not be securely attached to it. Failing to use all available pumps was an indication of the lack of depth of the skipper's engineering knowledge. A more experienced or better qualified engineer might have been able to identify where the water ingress was and stem its flow, or been able to optimise the pumping.

2.8 The keel cooling was an enclosed system that could not have accounted for the flooding experienced in this accident. Had there been damage to the piping on the outside of the hull, sea water would have entered and contaminated the fresh water in the cooling system, but could not have entered the vessel. Had any of the internal cooling system pipes fractured, they would have lost the contents of the circulating cooling water into the hull, but that would only have been a few hundred litres and not enough to flood the vessel.

2.9 The ancillary engine systems on less than 24 m fishing vessels were usually simple, with single bilge suctions and discharges. The systems on the *Walara-K* were more complicated, similar to those found on larger vessels, and therefore the crew needed a higher degree of technical knowledge and experience, such as they would have had if they had held the requisite MEC4.

2.10 In February 2006 the stabiliser arm broke as the vessel was rolling to starboard, causing the arm, which was under load, to drop violently. The haul-out stay was attached to the plate that parted from the gantry and became slack, while the fore and aft stays remained in place, attached between the main deck and the head of the vertical arm. When the arm dropped, the effect would have been for the head to be drawn inwards towards the vessel's hull. Measurement suggests (see Figure 9) that it was possible for the foot to make contact with the hull. However, the dynamic nature of the vessel and arm motion meant that contact between the

2 could not be positively established. Had there been contact, the edge of the plate foot could have cut into the hull in way of the forward part of the engine room, possibly in the area where concrete was lining the inside of the hull. The concrete might have initially prevented any major ingress of water, but could have failed later, allowing water to flood the hull. Unfortunately, damage to the hull was not considered at that time so no underwater inspection was conducted. Consequently, the opportunity to eliminate hull damage as the source of the ingress was lost.

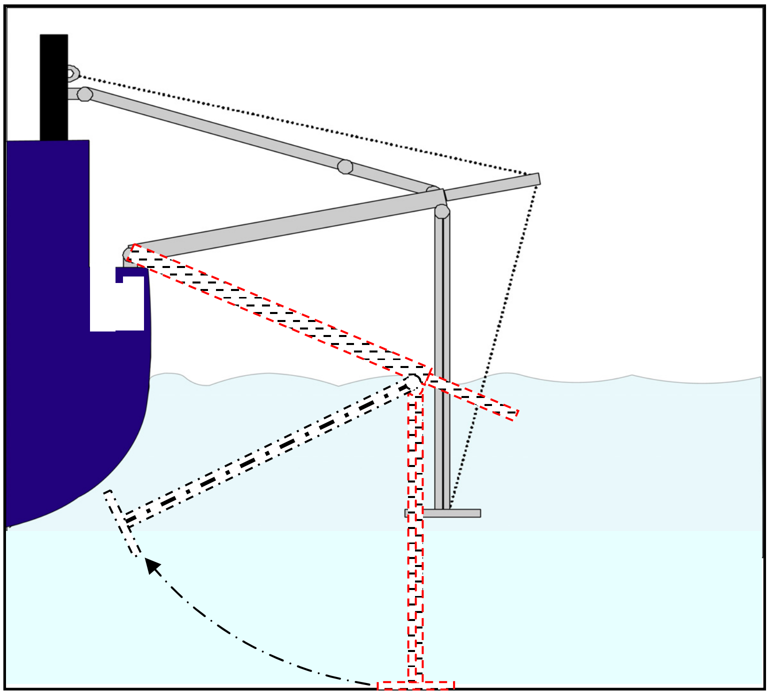

Figure 9
Elevated view of the stabiliser arm showing position when it dropped

2.11 The vessel was 33 years old and it is conceivable that the hull plating had wasted, even though when sandblasted in 2003 the hull appeared to be in good condition. Non-destructive thickness testing was not required and had not been carried out, so the actual thickness of the hull was not known. Corrosion is likely in areas where there are dissimilar metals and moisture. The area where the skipper said that he saw water bubbling was at the forward end of the engine room, the section where there was no concrete lining the hull, and also where the bilge suction was situated, so corrosion in this area was a possibility.

2.12 There were many theories regarding the use of concrete against steel plating. Much of the concern over the use of concrete existed because of the uncertainty over the condition of the hull plating under the concrete. Surveyors and boat builders had opinions both for and against the use of poured concrete in the hulls of vessels.

Some of the advantages were:

- concrete is alkaline and therefore a natural rust inhibiter
- it was unlikely to shift in heavy weather
- concrete dissipates the heat so it can be safer to weld the hull plating
- it reduces build-up of water in that part of the hull.

Some of the disadvantages were:

- concrete can mask the presence of a hole or cracked seam in the hull plating
- it is difficult to inspect the hull by traditional means, visual and hammering
- corrosion can occur at the margin of the concrete, particularly where water is allowed to stand in those areas
- concrete is difficult to remove
- people are suspicious of what is hidden by the concrete.

For those reasons it has to be considered that corrosion could have occurred on the hull plating of the *Walara-K,* so it remains a possible cause of the flooding.

2.13 The owner and skipper were both responsible for ensuring that the vessel was operating within its assigned area and that the crew on board the vessel met the minimum safe crewing requirements specified by the Maritime Rules for that area. The *Walara-K* was certified to operate in the offshore area, out to 200 nm from the coast, providing it was appropriately crewed. However, the skipper's nautical and engineering qualifications were restricted to 100 nm from the coast for this class of vessel. The deckhands were unqualified so, while also meeting the requirement to operate out to 100 nm from the coast did not fulfil the minimum safe crewing requirements for a fishing vessel of this size operating out to 200 nm from the coast. Had the crew held the qualifications prescribed by the Maritime Rules they might have been able to respond better to the situation in which they found themselves. The owner indicated that it was almost impossible to get appropriately certified engineers. Those with MEC4 or 1st class diesel trawler engineer certificates were usually employed on larger factory trawlers, or upgraded to marine engineer class 3 where they could work on deep-sea cargo vessels or super yachts. Maritime NZ indicated that there had been poor attendance at courses for the MEC4 certificate, possibly because of the cost and the time lost from fishing. Similar logic was used for owners to justify the employment of unqualified deck crew.

2.14 The owner held the same engineering certificate as the skipper, so if the owner had operated outside 100 nm off the coast, he too could have been operating in contravention of the Maritime Rules.

2.15 The operating manual designed and prepared by the previous owner gave clear instructions, both written and photographic, of how to perform the major functions on the vessel. This was not part of the vessel's safety management system, but did provide excellent reference material for skippers and crews, but had not been updated since 2002.

2.16 Since the survey in 2004, despite changing hands twice, the vessel had not been subject to a survey. After the current owner purchased the vessel in September 2006, an audit was conducted by the SSM company. The audit was a compliance audit against the SSM manual and was not intended to, nor did it, identify the major modifications that had taken place in the intervening 2 years. It was the duty of the respective owners to inform the SSM company when modifications were made to their vessels. SSM providers commented that changes to vessels were often not notified to them, so alterations often remained unapproved and un-surveyed, depriving the system of an important defence against changes that could reduce the safety of the vessels.

2.17 Because the skipper was the only person on board with training in radio procedures and the operation of the life-saving appliances, he had to devote the majority of his resources to calling for assistance and ensuring that he and his crew could safely abandon the *Walara-K,* at the expense of concentrating his efforts on stemming the flow and using all the bilge pumps available to him.

2.18 Inconsistencies in the SSM system had been noted in previous Commission reports and on 2 April 2007 in occurrence report 05-212 the Commission recommended to the Director of Maritime NZ that she:

009/07 Undertake a full review of the Safe Ship Management system and make changes to ensure the system promotes and effectively regulates a safe and sustainable maritime industry consistently throughout New Zealand.

As part of the response to the safety recommendation, on 1 September 2008 Maritime NZ initiated a fundamental change to the SSM system, as detailed in paragraph 4.2. Many of the changes concerned the improvement and standardisation of the survey function. The principal change was for Maritime NZ to start issuing all full-term SSM certificates instead of the SSM companies. To facilitate this, surveyors were required to produce all supporting documentary evidence to accompany an application for a SSM certificate; this included survey checklists, photographs, drawings and other remedial and maintenance records. The provision of comprehensive documentation to the regulator ensured that a continuous record of a ship's survey and maintenance history was maintained.

3 Findings

Findings are listed in order of development, not in order of priority.

3.1 Without a vessel and without detailed plans and drawings, particularly of the recent modifications, it is impossible to determine accurately how the *Walara-K* took on water and sank. However, a number of possible causes and contributing factors can be deduced:

1) The vessel could have taken on water through the modified bilge system, either from incorrect valve settings or through valves being jammed in the open state by debris.

2) The integrity of the hull might have been breached by corrosion of the hull plating in way of the forward bilge recess of the engine room.

3) The hull might have been damaged in way of the concrete beneath the main engine when struck by the foot of the stabiliser arm when it fell the previous month. Any ingress of water could have been contained by the concrete until that dislodged and allowed water to flow freely into the hull.

3.2 The vessel sank more quickly than would be expected of a vessel with good watertight subdivision and multiple bilge pumps. The use of only part of the bilge pumping capacity would have contributed to the speed at which the vessel sank.

3.3 The installation of the stabiliser arm and the modification to the engine room piping without the involvement of a surveyor were contrary to the Maritime Rules, and compromised the vessel's fitness for purpose.

3.4 After the modifications to the bilge and fire/deck wash system, it should have been critically appraised for watertight integrity. Because a review was not conducted, the watertight integrity of the vessel was not assured.

3.5 The vessel was undermanned for the area in which it was working, but even had it been operating within the allowable limit of 100 nm from the coast, the crew were under-prepared to respond effectively to the flooding of the vessel.

3.6 Contingent hull damage following the breakage of the stabiliser arm could not be ruled out as a possible cause of the flooding because no hull inspection had been conducted.

3.7 The format and information in the vessel's operating manual as prepared by the previous owner was easy to follow and was a user-friendly complement to the vessel's SSM operating manuals.

4 Safety Actions

4.1 In early 2008 Maritime NZ issued for comment a draft amended Maritime Rules Part 31C – Crewing and Watchkeeping, Fishing Vessels. The date for the closure of submissions was 11 April 2008, and at the time of writing those submissions were being considered. One of the suggested amendments was that the qualification for an engineer of an offshore vessel, out to 200 nm off the coast, could be reduced to a MEC6 if the vessel were less than 750 kW and had fewer than 4 systems.

4.2 On 1 September 2008 Maritime NZ implemented a number of improvements to the SSM system to tighten up Maritime NZ's oversight and survey requirements. The changes were:

- Maritime NZ started issuing all full-term SSM certificates instead of the SSM companies
- the issuing of exemption certificates was discontinued
- SSM companies were required to submit to Maritime NZ all evidence upon which the issue of reissue of a SSM certificate was based
- Maritime NZ recruited a marine surveying technical advisor to mentor and train SSM surveyors
- Maritime NZ recruited a technical trainer to conduct workshops with owners and lift the owners' level of knowledge and understanding of the requirements of SSM and health and safety legislation
- Maritime NZ worked with SSM company surveyors to compile a common check sheet for ship surveying and introduced training in the use of the common check sheet
- Maritime NZ introduced training for SSM company surveyors and auditors in the new requirements.

4.3 In response to the preliminary report, the Director of Maritime NZ indicated that it had an active programme in place to address the issue of vessels being operated with personnel who do not meet the minimum safe crewing requirement for the size and type of vessel and its proposed area of operation.

> Since 2000, MNZ has prosecuted 12 skippers either for operating vessels beyond the limits of their certification, or for operating without having the proper documentation in the first place. In September 2007 and March 2009 articles were published in MNZ's Safe Seas Clean Seas' advising operators that MNZ is taking a hard line on this issue. Ultimately, the Maritime Transport Act is based on the premise that operators are responsible for their actions and behaviour. MNZ can issue warnings and then take action if the evidence proves noncompliance with the rules, but cannot be held responsible for the actions of skippers that deliberately breach rules.

In view of the action taken by the regulator, no further safety recommendations were made to address this issue.

5 Safety Recommendations

Safety recommendations are listed in order of development, not in order of priority

5.1 On 21 May 2009 the Commission recommended to the Director of Maritime New Zealand that she address the following safety issue:

(023/09) The major alteration and modification of fishing vessels without approval, survey and certification. Other classes of vessel may also be a risk from unapproved modifications.

5.2 On 11 June 2009 the Director of Maritime New Zealand replied to the recommendation:

(023/09) Maritime New Zealand has amended its survey certification and monitoring processes to introduce the common survey checklists which require surveys to assess all aspects of a vessels, including reviewing its design approval at each survey. The vessel as survey is compared with the design and construction as approved and any unapproved modification isolated and addressed at that stage. These checklists are currently in trial and an implementation date has been agreed as 1 September 2009. Additionally, the current form for the application for the issue of an SSM certificate requires design approval to be reviewed by the SSM company as part of the vessel's application.

Approved on 21 May 2009 for publication

Hon W P Jefferies
Chief Commissioner

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Price $26.00 ISSN 0112-6962