MARINE INVESTIGATION REPORT
M01W0253

FOUNDERING

SMALL FISHING VESSEL *KELLA-LEE*
QUEEN CHARLOTTE SOUND, BRITISH COLUMBIA
25-26 OCTOBER 2001

Marine Investigation Report

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Summary

While returning from the fishing grounds, the *Kella-Lee* encountered heavy seas off Cape Scott, British Columbia. It heeled to starboard, progressively down-flooded and sank shortly after 2352 on 25 October 2001. Its three crew members and the owner/operator abandoned the vessel for a liferaft. A search and rescue operation rescued two crew members and recovered the bodies of the third crew member and the owner/operator, both of whom had succumbed to hypothermia and drowned.

Ce rapport est également disponible en français.

Other Factual Information

Particulars of the Vessel

	Kella-Lee ex. *Shannon Mist*
Official Number	393992
Port of Registry	Victoria, British Columbia
Flag	Canada
Type	Small fishing vessel
Gross Tonnage[1]	35
Length	14.2 m
Built	1980
Propulsion	One marine diesel engine, 130 kW
Crew	4
Owner(s)	Newson Fisheries Limited.

Description of the Vessel

The *Kella-Lee* was built as a small fishing vessel of closed construction, with an all-welded double chine steel hull and an aluminium-alloy deck-house. The wheelhouse, crew accommodation and engine-room space were located forward of midships, while an insulated fish hold, a small freezer compartment and the lazarette were located aft. The fish hold was divided into nine sections by portable pen-boards. It had a fibreglass weather-tight hatch cover, which had two small access hatch covers set into it. All covers could be battened down, however the two smaller covers were not secured.

Below the main deck the hull was sub-divided by three transverse watertight bulkheads into the following compartments: forward crew accommodation space; engine-room; fish hold, and lazarette space (see Appendix A).

The deck-house was accessed through the starboard side wheelhouse weather-tight door and through a dutch door fitted at the after end of the superstructure. The dutch door gave direct access to the starboard side of the after working area of the main deck (see Appendix A and Appendix C). Access to the engine-room was by way of two flush-fitting, lift-out hatches, fitted into the wheelhouse and galley decks. Oil fuel tanks were located at the port and starboard sides of the engine-room and the lazarette space. The potable water tank was located under the forward crew compartment.

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[1] Units of measurement in this report conform to International Maritime Organization (IMO) standards or, where there is no such standard, are expressed in the International System (SI) units.

The wheelhouse was equipped with navigation and communications gear which included two radar sets and video plotter; two very high frequency (VHF) radios; global positioning system (GPS); auto pilot and depth sounders. The radar sets were interfaced with an electronic chart display system.

Rigging and Fishing Gear

The *Kella-Lee*, originally rigged for salmon trolling, had been modified with additional gear over the years. At the time of the occurrence, it was rigged to fish for halibut with a hydraulically- driven drum winch located on the main deck abaft the fish hold hatch.

The vessel was rigged with a steel mainmast and cargo boom, fitted with hydraulic lifting and vanging winches. The mainmast had a crosstree and rigging for the vertical stowage and deployment of a pair of steel outrigger booms equipped with roll reducing paravanes (see Appendix A). The vessel was also equipped with a riding sail, some five square metres in area, which was occasionally rigged from the after side of the main mast when required.

Main engine mounted power take-offs serviced the vessel's electrical and hydraulic service systems and the steering gear hydraulic system, located in the lazarette.

An auxiliary diesel engine, for emergency use, was capable of driving the electrical generator and hydraulic pump for supplying electrical and hydraulic power for the ship's lighting, refrigeration, fishing gear and bilge pumping services.

History of the Voyage

The *Kella-Lee* arrived at Port Hardy, British Columbia, on 22 October 2001 to off-load 9980 kg (22 000 lb) of halibut. The boat was cleaned-up and prepared for its next trip.

The auxiliary diesel engine was inoperative, and on the morning of 23 October 2001, the owner/operator tried, unsuccessfully, to repair it. After loading seven tons of crushed ice into the fish hold and with the fuel/hydraulic tanks fully replenished, the *Kella-Lee* departed in the afternoon for the fishing grounds, located some 50 miles southeast of Cape St. James, in Queen Charlotte Sound, British Columbia.

On the evening of 23 October 2001, the Pacific Weather Centre forecast southwesterly winds at 20 knots, shifting to westerly 25 knots, with three- to four-metre seas for Queen Charlotte Sound. At 0400[2] the following morning, the weather outlook was for winds rising to gale force southeast, then shifting to strong gale force southwesterly. A further update at 1030 gave the outlook as winds rising to storm force southeasterly. It was reported that the owner/operator had closely monitored the weather forecasts since departing Port Hardy.

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[2] All times are Pacific standard time (Coordinated Universal Time [UTC] minus eight hours).

The vessel had an uneventful passage en route to the fishing grounds. Fishing for halibut commenced on the morning of 24 October 2001, in seasonably poor weather conditions, fishing continuously until the following afternoon. At approximately 1400 on 25 October 2001, the *Kella-Lee*, with a catch of about 1800 kg (4000 lb) of fish departed the fishing grounds, for Port Hardy. The main cargo boom was lowered and secured and the riding sail and paravanes deployed. The weather had deteriorated progressively with southeasterly winds of 35 to 40 knots, rough seas and heavy swells. The vessel was on a course of about 110° True (T) and making a speed of approximately four knots for Queen Charlotte Strait.

It was variously reported that during the passage the *Kella-Lee* experienced problems with the steering gear, and that the owner/operator inspected the gear in the lazarette space but was unable to repair it.

The owner/operator and the two most experienced deckhands shared the wheelhouse watches. The owner/operator took over the conduct of the vessel at 2200 on 25 October 2001. The three deckhands rested in their quarters.

Shortly afterwards, the crew awoke to a loud banging noise and found the vessel was rolling and pitching heavily. Two of the deckhands donned immersion suits that were stowed in their cabin and with great difficulty, due to the vessel's movement, made their way to the wheelhouse. Green seas were breaking over the vessel and water was entering the galley area through the open top half of the dutch door. Water was down-flooding into the engine compartment through the non-watertight deck hatches in the galley and wheelhouse. One of the small flush-fitting access hatch covers in the main fish hold hatch had been swept away.

The *Kella-Lee* fell off course and, with the wind and seas on the port side, heeled over quickly to starboard. In this condition, the violent seas and heavy swells continued to toss the vessel about. The owner/operator who was at the helm feared the ingress of water through the starboard wheelhouse door, and tried to turn the vessel's head into the wind, however, the rudder did not respond to the helm and the vessel continued to pitch and roll violently. He dispatched a deckhand to the engine compartment to check the steering gear hydraulic pump and also the condition of the main engine, as heavy smoke was observed to be coming from the stack. The sail remained deployed at this time but due to the weather conditions none of the crew members ventured out on deck to lower it.

The deckhand found heavy traces of hydraulic oil on the rungs of the ladder into the engine-room directly below the solenoid valves in the steering gear hydraulic piping system. He also noticed water rising in the bilges and reported this to the wheelhouse. Green seas continually swept over the vessel resulting in more down-flooding through both the unsecured access hatches located on the main fish hold hatch cover and also into the galley area.

The third deckhand donned the last and only immersion suit that was stowed in the owner's cabin. The owner/operator then gave the order to abandon the severely listing vessel, now rolling between the vertical and close to her beam ends on the starboard side. The crew was being thrown against the wheelhouse bulkheads during each roll. The main engine spluttered, smoked and almost stalled with each roll.

The owner/operator ordered the liferaft to be deployed and sent out a MAYDAY distress call on VHF radiotelephone channel 16 at 2352 indicating that they were abandoning ship into a liferaft (see Appendix B). The position given was as shown on the global positioning system (GPS) as 51° 01' N 128° 37' W (13 miles north of Cape Scott).

The call was received by Prince Rupert Coast Guard Radio, who in turn broadcast a Mayday Relay and immediately notified the Joint Rescue Coordination Centre (JRCC) in Victoria. An extensive air and sea search lasting 17 hours ensued. Rescue resources included two Buffalo fixed wing aircraft and a Labrador helicopter from Canadian Forces Base (CFB) Comox, the Canadian Coast Guard ship (CCGS) *John P. Tully*, the fishing vessel *Frosty* and the South Korean-registered freighter *CSX Anchorage*.

The crew members made their way to the wheelhouse top, bracing themselves against whatever support the vessel could afford. The *Kella-Lee* was, by now, lying on its starboard side, occasionally rolling to the vertical and then flopping back to starboard.

The liferaft, when launched from the stowed position on the starboard side, was immediately swept under the vessel. Some moments later it cleared the underside of the vessel, floated free, and inflated allowing two deckhands and the owner/operator to climb in. The third deckhand did not manage to climb on board and clung onto the outside of the liferaft. The liferaft painter then became entangled with the rigging of the paravane boom. The boom came down on the raft and its occupants with every roll of the vessel. The raft eventually overturned leaving the crew members clinging to it, and attempting to shield themselves from the boom. To avoid the boom, the owner/operator and one deckhand let go of the liferaft and were immediately swept away by the wind and the waves. Later, one of the two deckhands remaining with the liferaft managed to right it and climb on board. The other deckhand also, in trying to protect himself from the boom, eventually let go of the liferaft and was swept away. Subsequently, the vessel sank and the liferaft with the one deckhand on board floated free.

The winds at this time were estimated to be 80-90 knots from the south, with 8-10 metre seas and swells.

Two crew members survived. The first survivor was rescued from the water by the CCGS *John P. Tully* at 0725 on 26 October 2001, some 7 ½ hours after the MAYDAY was broadcast, and the second survivor was hoisted from the vessel's liferaft onto a Labrador helicopter at 1712 some 17 ½ hours after the distress call.

Stability Data Approval

As a small fishing vessel of closed construction and not engaged in fishing for herring or capelin, the *Kella-Lee* was not required to comply with the intact stability requirements of Section 29 of Part 1 of the *Small Fishing Vessel Inspection Regulations* (SFVIR), nor was it required to meet the criteria of the 'Stability, Subdivision & Load Line Standards' STAB 4 as detailed in Transport Canada (TC) publication TP 7301.

At the request of the first owner, the vessel (then named *Shannon Mist)* was the subject of an inclining experiment on 28 July 1980, and the related *Trim and Stability Booklet* was duly stamped 'approved' by the Canadian Steamship Inspection (CSI) Branch of the Department of Transport (DOT)[3] on 20 January 1981. The booklet indicated that the vessel was fitted with 8.38 tons of permanent ballast, located in the engine-room and fish hold bilges and also noted that stability approval was "For Salmon Trolling Only."

Compliance with the minimum stability criteria of STAB 4 ensures that small fishing vessels maintain an adequate margin of intact transverse stability throughout a range of standard loading conditions related to the vessel's intended service.

The criteria are such that the margin of reserve intact transverse stability ensures that a vessel is able to withstand adverse weather conditions and other detrimental influences expected during its service. Reserve intact transverse stability depends on the continued maintenance of the watertight integrity of a vessel's hatch covers and openings. If this watertight integrity is jeopardised, the vessel's stability is negatively affected and it may capsize.

Stability History

The *Kella-Lee*, originally rigged for salmon trolling, was modified with additional gear over the years. The vessel was first modified shortly after the ownership changed in 1984, when additional gear was installed on the weather deck and wheelhouse top to suit the intended fishing operations of the new (and current) owner. The modifications also included the removal of some of the permanent ballast from the engine-room bilges. The actual quantity of ballast removed was not recorded and the vessel's transverse stability was not formally re-assessed at that time.

At different times between 1984 and the day of the occurrence, the *Kella-Lee* was equipped with various types of gear to suit different fisheries. In order to maintain operational versatility and the ability to quickly respond to changing fisheries and fishery quotas, redundant gear was not always removed when the operational requirements of the vessel changed.

At the time of the occurrence the vessel was engaged in the halibut fishery. In addition to the hydraulically-powered self-winding net drum and long-lining gear associated with this kind of fishing, the vessel had sundry other gear (related to other fisheries) which was located on the main deck and the wheelhouse top.

The cumulative effect of the ballast removal and the on-going fishing equipment modifications raised the vessel's centre of gravity and detrimentally affected its transverse stability. The vessel was not employed in the herring or capelin fisheries, consequently, the submission of revised stability data was not a mandatory, regulatory requirement. However, regardless of the mode of fishing, the vessel's stability and seaworthiness is the responsibility of the owner.

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[3] Now known as Transport Canada Marine Safety (TCMS)

The partial removal of ballast was not formally reported to TC, nor were the later additional and modified changes to the weight of the fishing gear called to the attention of the TC ship inspectors at any subsequent routine inspection. Since the *Kella-Lee* was not required to comply with the intact stability requirements of the SFVIR and the TP 7301, the owner was not required to report the ballast removal to TC.

Vessel Stability

On departure, the *Kella-Lee* was loaded with seven tons of crushed ice stowed in the fish hold for catch preservation. Subsequently, approximately 1800 kg (4000 lb) of fish caught prior to the sinking were packed with the crushed ice in the fish hold.

Reportedly, the vessel's fuel tanks were filled to capacity for the intended voyage. The total weight of the fuel and its distribution within the vessel can thus be deduced from its fuel tank capacities data. However, the sequence of fuel consumption from the various tanks is not known and the fuel weight distribution at the time of the sinking cannot be determined.

The rate of fuel consumption due to the rough sea conditions encountered during the voyage is unknown. While the fuel weight reduction is compensated to some extent by the additional weight of the fish catch, the cumulative effect of this weight change and the effect of free surface caused by melting ice and water downflooding into the vessel make it difficult to calculate the vessel's vertical centre of gravity with precision.

Due to the uncertainty of the vessel's deadweight and trim condition, as a result of the significantly increased weight of additional and redundant fishing gear located above the weather deck and the unknown weight of the ballast removed from the bottom of the engine-room, an accurate estimate of the vessel's intact transverse stability characteristics at the time of the occurrence is not possible.

The cumulative effect of the above factors would have significantly reduced the vessel's self righting ability in rough weather. They also rendered the *Kella-Lee* vulnerable to the detrimental free-surface effects of sea water which was shipped and retained on board, when the rough weather was encountered.

Vessel Inspection and Certification

The SFVIR made pursuant to the *Canada Shipping Act* require every small fishing vessel between 15 and 150 GRT, less than 24.4 m in length, to be inspected once every four years by TC. TC records show the *Kella-Lee* as having had underwater hull and machinery inspections in 1984, 1989,1993 and 1997.

The vessel was certificated as a Home Trade Class 3 vessel and a Steamship Inspection Certificate (S.I.C. 29),[4] was issued on 18 October 1984, with an expiry date of 07 October 1988, on satisfactory completion of that quadrennial inspection. However, there are no records of any subsequent S.I.C. 29 having been issued as required under the provisions of the SFVIR.

The next quadrennial inspection was due in June 2001 but had not been carried out at the time of the occurrence on 25 October 2001.

Personnel Certification and Experience

The Owner/Operator held a Canadian Fishing Master Class Four (CFV4) Certificate of Competency issued on 02 February 2001 and valid until 01 February 2005. He was issued a Radio Operator Certificate (Maritime Commercial - ROC-MC), by Industry Canada on 06 February 2001. This Certification included qualification for the Global Maritime Distress and Safety System (GMDSS) as set out by the International Maritime Organization (IMO).

One of the deckhands, who was on his second fishing trip with this owner, had all relevant Marine Emergency Duties (MED) training. The other two, both experienced fishermen, had worked with the owner/operator for the last five years but did not have any formal MED training.

Machinery Malfunction

The vessel had experienced problems with the steering system prior to this occurrence. The owner/operator carried out his own repairs and no records are available regarding the nature of the problems.

At the time of the occurrence when the vessel was experiencing steering problems, the owner/operator reportedly had gone down into the lazarette to examine the rudder stock and hydraulic steering ram, but was not able to restore steering control.

Prior to sailing, the auxiliary engine was not operational and attempts by the owner to fix it were unsuccessful. Consequently the vessel sailed with only the main engine available to provide power for all on-board services.

Survival/Distress Equipment

TC regulations require a vessel of the size, type and crew complement such as the *Kella-Lee,* when on a Home Trade Class 3 Voyage, to carry one approved lifejacket for each person on board; two approved lifebuoys, one fitted with 27 m of line and the other with an approved lifebuoy light, and a liferaft which may be carried in lieu of a lifeboat or skiff. Further, the Workers' Compensation Board of British Columbia's *Fishing Operations Regulations* require the vessel to carry one immersion suit for each crew member.
It is not possible to verify the actual equipment carried, however, it was reported that there were no standard lifejackets on board. The vessel was equipped with a six person inflatable liferaft, stowed at the starboard after end of the flying bridge and secured in chocks by senhouse slips, and a fibre-glassed dinghy. During the

[4] S.I.C. 29 Inspection Certificate for a Commercial Fishing Vessel not exceeding 150 tons gross tonnage.

accident, only three extra-large-sized immersion suits were readily available.

Although not required, the vessel was also equipped with one Emergency Position Indicating Radio Beacon (EPIRB), of the Class B type, transmitting on 121.5 MHz emergency frequency. Such an EPIRB transmits an audible sweep tone but no user identification. The last inspection date as noted on the EPIRB was March 1992, with an annual inspection due date of March 1993. The battery, which was due to be replaced in December 1994, had not been replaced. The EPIRB was recovered with the owner's body. It was not switched on and no signal had been received from it.

Weather forecasts

At 1600, 24 October 2001 the Weather Centre of Environment Canada issued a gale warning for Queen Charlotte Sound predicting southeasterly gale force winds of 30 to 40 knots and three-metre seas for the following afternoon. The outlook was for winds rising to storm force southeast then veering to storm force southwest and easing to strong westerly. At 2118 on 24 October 2001, the Pacific Weather Centre issued a Storm Warning for Queen Charlotte Sound with predictions for southeasterly storm force winds of 50 to 60 knots and four-metre swells for the evening of 25 October 2001.

The weather, as experienced at the time of the occurrence, was consistent with the marine weather forecast for the area. These forecasts were reportedly being monitored by the owner/operator, however the *Kella-Lee* continued fishing until 1400, 25 October 2001, some 16 ½ hours after the storm warning. The CCGS *John P. Tully* reported winds of 45-50 knots and gusting to 80 knots and seven-metre seas when it arrived on the scene.

Search and Rescue Operations

Both the Canadian Forces (CF) and the Canadian Coast Guard (CCG) have search and rescue (SAR) responsibilities under the National Search and Rescue Program.

Air and marine rescue operations in British Columbia are controlled by a team consisting of CF and CCG personnel under the authority of the CF commander at the Regional Coordination Centre in Victoria. The primary CF air facility available for SAR in the Victoria region is provided by 442 Transport and Rescue Squadron based at Canadian Forces Base (CFB) Comox, British Columbia.

The distress call was received by Prince Rupert CGRS at 2352, 25 October 2001 and soon after JRCC Victoria tasked the CCGS *John P. Tully* at 2356 and the Buffalo aircraft, *R452*, from CFB Comox at 2358. Other units tasked included the South Korean freighter *CSX Anchorage* and the Canadian fishing vessel *Frosty.* The Labrador helicopter, *R318,* from CFB Comox was tasked at

0007 on October 26 but was unable to respond for some time due to bad weather. The CCGS *John P. Tully*, which was on primary SAR standby patrolling Fitzhugh Sound, provided an estimated time of arrival (ETA) at the scene of 7.5 hours.

The Buffalo aircraft, *R452,* was on the scene at 0207. Two lights were sighted in the water at 0241, but due to weather conditions the crew was unable to determine if the lights were from a liferaft or from persons in the water. At 0314, *R452* which would soon have to refuel, requested that JRCC task a relief Buffalo aircraft. The Buffalo aircraft kept the lights in sight till 0428 and then dropped a datum marker buoy (DMB) prior to departing to refuel at Port Hardy.

The second Buffalo aircraft, *R465,* was on the scene at 0651. There was no air coverage between 0428 and 0651. The Labrador helicopter, *R318,* departed Comox at 0640 with an ETA of 0725 at Port Hardy. It refuelled and was then on scene at 1247.

The CCGS *John P. Tully* sighted a light close off the bow at 0708. Due to adverse weather and poor visibility, it was not possible to launch the vessel's Fast Rescue Craft (FRC) until 0725, when the first surviving crew member from the *Kella-Lee* was picked up. The bodies of the owner/operator and a deckhand were recovered in the interim. While the deckhand had donned an immersion suit, the owner/operator wore a floater jacket and pants. The activating switch of the EPIRB found strapped to his right leg was in the off position. The last surviving crew member was hoisted aboard *R318* at 1712 on 26 October 2001. Both survivors wore immersion suits.

CF/SAR Aircraft Response and Readiness

R452 was tasked at 2358, 25 October 2001, was airborne at 0123, and arrived on the scene at 0207, 26 October 2001. At 0314, *R452* requested a relief aircraft and at 0428 departed the scene to refuel. Some time was required to dispatch the replacement Buffalo aircraft, *R465,* and it arrived on the scene at 0651.

As per CF Publication 209, *National Search and Rescue Manual*, the CF is mandated to have one Buffalo aircraft and one Labrador helicopter crewed and ready for SAR operations 24/7. Once these are tasked by JRCC, CF readiness for the aircraft is waived until the aircraft returns to the home base. However, should another incident occur which requires the urgent deployment of an additional SAR aircraft, the Commanding Officer of the squadron works on a "best effort" basis to provide additional crews and craft.

General Requirements for Insurance of Fishing Vessels

The *Kella-Lee* was insured at the time of the occurrence. Fishing vessel insurance is not mandatory, and if so desired, it is the owner's responsibility to have his vessel(s) surveyed by a marine surveyor, prior to being accepted for insurance.

The owner obtains insurance for his vessel, from an underwriter, via an insurance broker. This process involves the submission to the underwriters, of a 'report of a marine survey', carried out by a marine surveyor. Any deficiencies found during the survey are duly noted. It is usual

practice for the owner to agree to rectify any deficiencies identified within a stipulated period of time. However, seldom do underwriters follow up to ensure that these defects are actually corrected.

Common defects include substandard life-saving and fire-fighting gear, poor maintenance and poor housekeeping. Other important defects often include insufficiently watertight and improperly secured hatch covers and manhole covers. Underwriters in general do not have requirements specific to fish hold hatch covers and their means of securement, nor do they have criteria specific to continued seaworthiness and safety critical items often go uncorrected.

Workers' Compensation Board of British Columbia Requirements for Fishing Operations and Immersion Suits.

Section 24.97(1) of the *Fishing Operations Regulations* made pursuant to the *Workers' Compensation Act* state that "Every fishing vessel must carry, for each crew member, one immersion suit meeting standards acceptable to the Board." The *Kella-Lee,* with a crew of four, had three immersion suits on board. All three suits were extra large size and were too big for the crew members wearing them.

The Workers' Compensation Board of British Columbia *Occupational Health and Safety Regulations* under the heading "Fishing Operations" list the general requirements, applicable to all owners, masters and crew members of licensed commercial fishing vessels relating to the seaworthiness of the vessel, the maintenance of machinery and equipment, the assigning of emergency duties and the owner's responsibility after major modifications.

Location of Liferaft

The liferaft was located on top of the wheelhouse, on the starboard after end, thus placing it abreast and inboard of the boom and rigging. During the occurrence, as the liferaft was deployed, the painter became entangled with the boom and its rigging. This prevented the immediate inflation of the raft and its accessibility to the crew.

Analysis

Introduction

Since 1992, the TSB has systematically identified a number of safety deficiencies and issued over 30 safety recommendations with a view to mitigating risk in the Canadian fishing industry. The most commonly encountered safety deficiencies stem from shortcomings in training and knowledge, poorly maintained vessels and inadequate survival equipment. Poor maintenance can lead to down-flooding through unsecured hatch covers or deck and bulkhead openings, while lack of knowledge can result in vessel modifications which adversely affect stability, or give rise to unsafe loading and operational practices.

The TSB Macro-Analysis Project MAP-M99-43, developed in support of the TSB investigation into the sinking of the *Brier Mist*,[5] provides a review of the general situation of Canadian fishing vessel safety. While it focuses on the particular safety issues raised in the course of that investigation, these are equally relevant to the many other occurrences that happen each year. The executive summary of the project states that "TSB statistics continue to indicate a relatively high number of fishing vessel accidents and casualties in relation to other commercial vessels. Improper loading and progressive flooding continue to be the primary factors in the capsizing and foundering of fishing vessels" (see Appendix D).

Since the publication of the MAP-M99-43 in November 1998, the frequency of vessels capsizing and foundering on the West Coast of Canada has not significantly decreased and many of the common safety deficiencies mentioned in this introduction are applicable to the loss of the *Kella-Lee* (see Appendix E). These deficiencies include: questionable stability due to alterations to the vessel; the consequences of free surface effects; the failure to understand the significance of storm warnings; improperly secured deck openings; and, the lack of training in the use of survival equipment.

Sinking Sequence

In preparation for the return voyage, the main cargo boom was lowered and secured along the centre line of the vessel, in a nearly horizontal position, some 4 m above the main deck. A riding sail was rigged from it to the after side of the main mast. The riding sail, in conjunction with the deployed paravane booms, was intended to reduce the rolling of the vessel in rough sea conditions.

However, a riding sail is most effective when the vessel is stopped and maintained head to wind, either by lying to drift-nets or a sea anchor or by balancing with other sails. To be efficient, roll reduction, boomed-out paravanes require that the vessel maintains a relatively high forward speed. Given the circumstances, neither of these methods to reduce the vessel's rolling or maintain her head to wind were effective.

In this occurrence, the malfunction of the steering gear and the sporadic partial loss of propulsion meant that the vessel's directional control was lost. Neither the riding sail nor the paravanes were effective in maintaining the vessel's head to wind, and the vessel became vulnerable to the prevailing heavy seas and high winds.

The force of the wind acting on the combined wind surface of the hull, superstructure, mainmast, rigging, riding sail and deployed paravane booms, heeled the vessel to starboard, reduced its righting ability and retarded the vessel's recovery to the upright condition.

While in this vulnerable state, some of the water shipped and retained on the main deck entered the superstructure through the open dutch door. It then down-flooded into the engine-room through the non-watertight hatches in the main deck, inside the galley area. Seawater also down-flooded into the fish hold through the small unsecured access openings in the main hatch cover. Because the vessel was already heeled to starboard by the force of the wind, the seas shipped and retained on the main deck, in combination with the down-flooded water below the main deck, which had gravitated to the starboard side, increased its angle of

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[5] TSB Report No. M98L0149.

heel, preventing the vessel's recovery toward the upright.

In general, few fishermen appreciate the substantial fluctuation and reduction of initial transverse stability, caused when water, even a few inches deep, is shipped and retained on deck, or contained below deck in tanks, bilges or holds. The fluctuation in statical stability in conjunction with the dynamic heeling and rolling effects of rough seas, combined to overcome the *Kella-Lee's* initial righting ability, causing the extreme angle of heel from which it was unable to recover.

Vessel Inspection

TC inspectors are required to ask the owner to advise them of any alterations or modifications done to the vessel since the last inspection, and rely on the accuracy of such information regarding any work or changes carried out. The onus is on the owner to fully inform TC of any significant alterations/modifications that have been carried out between inspections in order that an informed review and assessment of the vessel's condition may be made.

The SFVIR require small fishing vessels to be inspected once every four years. In the case of the *Kella-Lee,* TC carried out quadrennial inspections in 1984, 1989, 1993 and 1997. However, TC did not follow up to ensure that the owner completed all outstanding items resulting from these quadrennial inspections. A follow-up inspection, confirming satisfactory completion of such work, would have resulted in the issuance of a S.I.C. 29. The absence of S.I.C. 29s from previous quadrennial inspections was not questioned by successive TC inspectors at subsequent inspections, and this practice continued up to the time of the occurrence.

Such inspections would have encompassed the *Kella-Lee's* hatch covers and weather-tight openings, the life-saving equipment and the status of the battery-powered distress equipment.

The carriage of an EPIRB is not a mandatory/regulatory requirement for vessels such as the *Kella-Lee*. When activated, an EPIRB transmits a distress call which is picked up or relayed by satellites and transmitted via land earth stations to rescue services. The EPIRB was found strapped to the owner/operator's right leg. Its activating switch was in the off position. The due date for the replacement of the battery was December 1994. It is not known if the EPIRB was functional.

Steering Gear Malfunction

The vessel had experienced problems with the steering system prior to this occurrence. The loss of hydraulic fluid from a leaking solenoid valve rendered power and hand stand-by
hydraulic systems inoperative. The rudder could have been turned by means of a jury-rigged hand tiller from outside the lazarette, however this was not an option given the prevailing weather conditions.

Generally, in small fishing vessels, the lazarette houses the rudder stock and hydraulic steering ram along with hydraulic lines and valves. Atmospheric conditions within the lazarette are conducive to condensation and moisture and consequent corrosion of valves and hydraulic lines.

Life-saving Appliances

The WCB regulations require that an immersion suit, meeting standards acceptable to the WCB, be carried for each crew member on board, however, no specific standards are formalised.

During the course of random inspections of fishing vessels, WCB prevention officers occasionally insist on the crew donning immersion suits. All three immersion suits on board the *Kella-Lee* were extra large size and differed from the actual physical sizes of the crew on board. One of the survivors, who spent considerable time in the water, reported ingress of water through the suit collar because the suit was too large for him.

Ship Safety Bulletin (SSB) No. 03/2001, refers to the stowage requirements of liferafts and inflatable rescue platforms. It recommends that all vessels, irrespective of size, stow liferafts (other than davit launched rafts) and inflatable rescue platforms so that they float free in the event of the vessel sinking. This can be achieved in two ways, by stowing liferafts in deep chocks without lashing, or by securing the liferaft with a lashing fitted with a hydrostatic release unit. The stowage of the liferaft on the *Kella-Lee* did not meet either of these requirements.

The liferaft on the *Kella-Lee* was placed on top of the wheelhouse because of space limitations and to avoid obstruction during fishing. However, fishing industry operators report that this location, when close to the paravane booms and rigging, may interfere with the safe deployment of the raft. In this occurrence, the painter became entangled with the boom and its rigging, and increased the risk of damage to the liferaft, injury to the crew and the danger of the liferaft and crew being dragged down with the vessel.

Decision to Fish in Queen Charlotte Sound

Although aware of the weather forecast predicting gales and storms, the owner/operator decided to fish at a location some 14 hours from the nearest shelter, fished in adverse sea conditions and did not stop fishing in sufficient time to allow a safe passage to Port Hardy.

General Requirements for Vessel Insurance

During the process of vessel insurance, the insurance companies operate on the assumption that the owner will correct the deficiencies noted on the report and keep the vessel operationally safe.

Surveys and consistency in follow-up to surveys by insurance companies would encourage owners to correct identified deficiencies and also help ensure safety-critical items are taken care of and would complement the inspection regime of TC and the WCB.

This procedure would enhance safety within the fishing industry.

Fish Hold Hatch Covers

Although the main hatch to the fish hold of the *Kella-Lee* was properly secured, the two small flush-fitting access openings within the main hatch cover, though fitted with means of securement, were not. Section 23 of the SFVIR states that, "...hatchways on a fishing vessel shall be provided with efficient means for battening them down and making them watertight."

During TC inspections, these hatches are not tested for water-tightness but are subjected to a visual inspection to ensure adequate lashing arrangements are available. Generally hatch covers on vessels such as the *Kella-Lee* are not constructed to be watertight and can be, though only when covered and held down with tarpaulins and strongbacks. Most hatch covers sit atop and overlap raised deck coamings. Moreover, the small lift-out access hatches atop the main hatch cover are not normally lashed down. The general, though mistaken, assumption within the fishing fleet is that in inclement weather, the loss of these covers is unlikely.

Due to its workload it is not possible for TC to inspect all small fishing vessels for this requirement. It is therefore very important that fishermen are aware of the importance of securing hatch covers. TC has issued numerous SSBs on maintaining the watertight integrity of fishing vessels,[6] some as a result of TSB recommendations.

The following TSB Recommendation (see TSB Reports M93M4004, M90L3034) was made in an effort to prevent accidents due to hatch openings:

> The Department of Transport develop and implement measures to ensure that owners, operators and masters of vessels under its jurisdiction have effective training and procedures for securing all exterior openings sufficient to preserve the watertight integrity of the hull for the environmental conditions being encountered. (M93-01)

SSBs were issued to the industry, however, training for owners/operators was not addressed.

Search and Rescue Operations

One fixed wing Buffalo aircraft and a Labrador helicopter[7] were tasked from CFB Comox. The Labrador helicopter is capable of taking off and landing in winds of up to 45 knots and once airborne, is able to fly in winds greater than 45 knots. However, high winds of 78-88 knots together with low cloud ceilings, poor visibility and icing in cloud precluded the aircraft from responding. The helicopter could not respond until conditions improved.

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[6] See TSB Reports M97W0236, M98L0149, SSBs 1/83, 4/87, 16/92, 06/98.

[7] As of 25 July 2002, five SAR Cormorant helicopters have entered service replacing Labrador helicopters.

The fixed wing Buffalo aircraft, when tasked, normally carries one SKAD (Survival Kit Air Droppable) and one pump unless the occurrence warrants otherwise. Due to the severity of the prevailing weather and poor visibility on the scene, the crew of the Buffalo aircraft could not ascertain if the two lights sighted were those of the liferaft or of persons in the water, and anticipating the ineffective use of the only SKAD unit on board, it was not dropped.

There was a period of approximately 2.4 hours with no air coverage when the Buffalo aircraft, *R452,* had to return to Port Hardy to refuel. Before doing so, it dropped a datum marker buoy to mark the area for surface vessels proceeding to the scene. The second tasking was within the limits outlined in the *National SAR Manual*. It is not known if survivors would have been found earlier with constant air coverage. Shortly after arriving on the scene, the second tasked Buffalo aircraft, *R465,* dropped flares which allowed the CCGS *John P. Tully* to sight the liferaft, however, the visibility was so bad that sight of it was lost when the flares were spent.

Findings as to Causes and Contributing Factors

1. The belated departure from the fishing grounds some 16.7 hours after receiving a storm warning and possible hurricane force winds in the area in which the *Kella-Lee* was fishing exposed the vessel to extreme sea and wind conditions.

2. The malfunction of the steering gear and the sporadic partial loss of propulsion caused the loss of steerage way and directional control, leaving the vessel highly vulnerable to the full force of the high winds and heavy seas.

3. The partial removal of permanent ballast from the engine-room, and the weight of additional fishing gear installed above the main deck, raised the centre of gravity of the vessel and reduced the original as-built (and approved) transverse stability characteristics.

4. The weight and free-surface effects of the water shipped and retained on deck, together with the heeling effect of the riding sail and dynamic rolling effects of the high winds and heavy seas, combined to overcome the vessel's righting ability and caused the extreme angle of heel from which she was unable to recover.

5. The open top half of the weather-tight door to the accommodation area, the unsecured flush-fitting access hatches to the engine-room, and the unsecured access panels in the main fish hold hatch cover compromised the watertight integrity of the vessel. The vessel down-flooded, lost all reserve buoyancy and sank.

Findings as to Risk

1. Current regulations only require initial and on-going stability data approval for small fishing vessels engaged in the herring or capelin fisheries. For other small fishing vessels, the onus for maintaining stability rests with vessel owners.

2. The *Kella-Lee's* stability data was initially submitted by the owner and approved by the (then) CSI. After approval however, the removal of some of the permanent ballast was neither formally reported to TC nor brought to the attention of TC inspectors at several successive quadrennial inspections. A reassessment of the vessel's stability after the removal of ballast and the addition of fishing gear was not carried out by a competent person.

3. Regulatory inspections by TC, and routine vessel operation by the owner, did not identify or ensure remedial action was taken with regard to safety-related factors, including: the absence of standard regulatory life-saving equipment (lifejackets & lifebuoys); and the insufficient number and inappropriate sizes of immersion suits.

4. The location of the inflatable liferaft stowage, abreast and inboard of the starboard side paravane boom and rigging, obstructed and prevented safe deployment of the liferaft.

5. The inspection and battery replacement dates of the recovered EPIRB were March 1993, and December 1994, respectively, and in the event, no signal was received from it.

Other Findings

1. TC records show that SIC 29s, signifying the successful completion of the regulatory ship safety inspection process, were not issued following hull and machinery inspections in 1989,1993 and 1997, and at the time of the occurrence the vessel was operating without a completed SIC 29.

2. The routine quadrennial inspection, due in 2001, had not been carried out at the time of the loss of the vessel.

3. The on-scene arrival of the Labrador helicopter was delayed due to local wind speeds, low cloud ceiling, poor visibility and icing in cloud.

4. Surveys and follow up by insurance companies would complement TC and WCB inspection requirements and foster safety.

5. The atmospheric conditions within the lazarette may have fostered the deterioration of the valves and hydraulic lines of the steering system which likely caused the steering failure.

Safety Action

Action Taken

The Board, concerned about the safety of small commercial fishing vessels has, over the years, initiated safety communications including recommendations. The following summarizes initiatives and progress made to date:

1. Safety Awareness Promotion: During the period 01 January 2001 until the loss of the *Kella-Lee* on 26 October 2001, the TSB assessed a total of 24 occurrences on the Pacific Coast, including that of the Kella-Lee; 21 involved 26 small fishing vessels, and the other 2 involved small tugs. These occurrences included fires, capsizings, sinkings, floodings and groundings.

   As a result of these occurrences 9 lives were lost and a number of seamen were seriously injured, 3 vessels were declared constructive total losses, 8 vessels sank and others sustained extensive damage. Most of these vessels were under 15 gross tons and most of the re-occurring deficiencies found were common to all.

   In light of these happenings, and after the loss of the *Kella-Lee,* an Inter-Agency Marine Action Group (MAG) was created with the mandate to promote safety awareness, provide safety education and foster safe operating practices within the marine community. The group's objective is to reduce the high accident rate in the fishing/marine industry. These occurrences often result in death or injury to crews.

   At present these agencies include: Transport Canada (TC); the Transportation Safety Board of Canada (TSB); the Workers' Compensation Board of B.C. (WCB); the Department of Fisheries & Oceans, Fisheries Management (DFO); the Canadian Coast Guard, which represents the Coast Guard Auxiliary (CGA), the Marine Communications and Traffic Services (MCTS) and the Office of Boating Safety (OBS); and the B.C. Seafood Alliance.

   TC has recently revised and reprinted the *Small Fishing Vessel Safety Manual* (TP 10038). This manual addresses many of the factors which have contributed to small fishing vessel occurrences. The manual is especially useful in that it describes in very simple, easy to understand terms, complex factors that can have serious consequences to the safety of small fishing vessels, providing simple solutions to avoid such consequences. TC is presently in the process of distributing this manual to the general fishing community.

2. Follow-up on Vessel Inspections: TC is now using a new "Ship Information Reports" system to keep track of vessel inspections. This system incorporates enhanced auditing functions that will ensure follow-up on vessel inspections. It will aid in ensuring that owners complete all the outstanding items resulting from quadrennial inspections and that TC subsequently issues a valid S.I.C. 29.

3. Modification to Vessels: The failure of the fishing vessel owners/operators to report these modifications to the nearest TC Marine Safety office, even though it is required by regulation, has been an ongoing problem. Realizing that a more effective method has to be found to address this problem TC, along with the Canadian Marine Advisory Council Standing Committee on Fishing Vessel Safety, is investigating the feasibility of enhanced enforcement methods regarding the reporting of modifications to fishing vessels.

4. Stability Requirements: As part of the *Canada Shipping Act* 2001 Regulatory Reform Fishing Vessel Safety Regulations Project, a sub-project has been initiated to evaluate and establish mandatory stability requirements that would be applicable to all fishing vessels less than 24 metres in length overall, regardless of the type of fish they are engaged in catching.

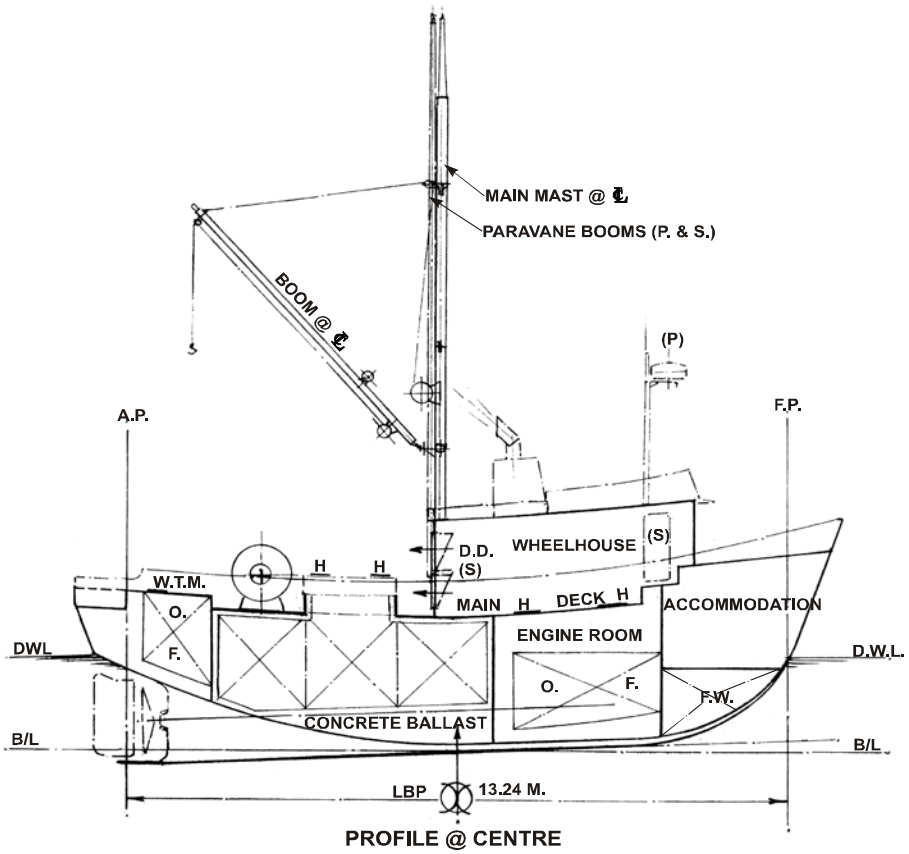
5. Coordination between TC and DFO: TC has acknowledged the need to have better coordination between the issuance of fishing licences and ship inspection certificates. Towards that end, TC has initiated discussions with the Department of Fisheries and Oceans to explore the feasibility and possible methods whereby such coordination could be achieved. These discussions are ongoing.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 29 January 2004.

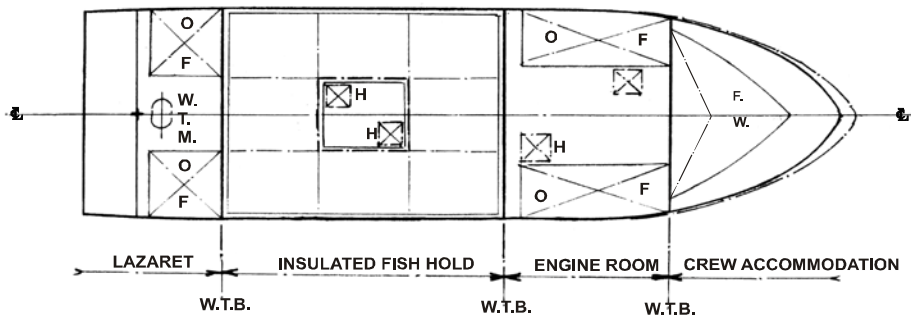
Visit the Transportation Safety Board of Canada web site(www.tsb.gc.ca) for information about the TSB and its products and services. There you will also find links to other safety organizations and related sites.

Appendix A – Outline General Arrangement of Kella-Lee

OUTLINE GENERAL ARRANGEMENT



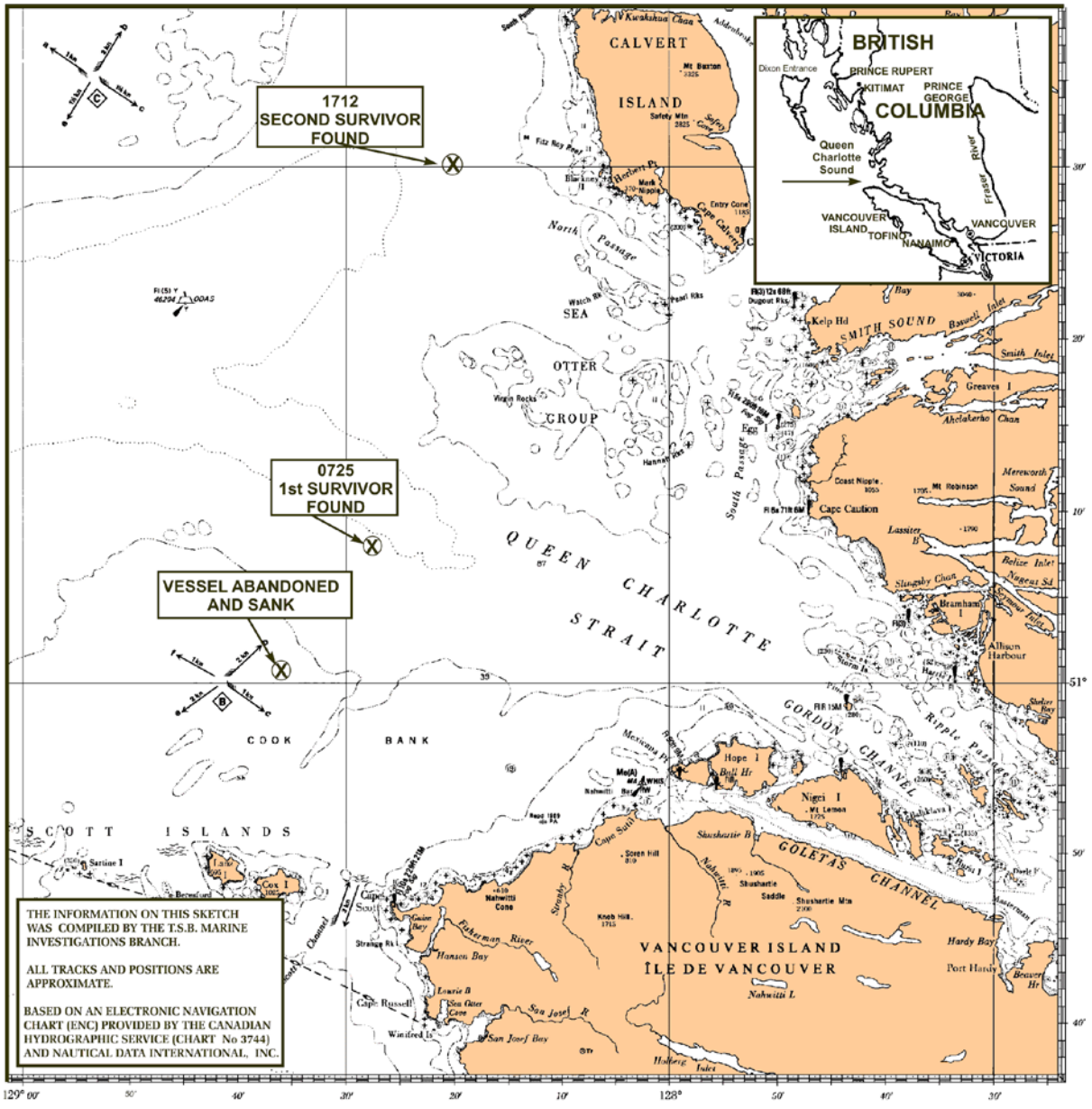
PROFILE @ CENTRE



PLAN VIEW BELOW MAIN DECK

LBP	LENGTH BETWEEN PERPENDICULARS	W.T.B.	WATERTIGHT BULKHEAD
F.P.	FORWARD PERPENDICULAR	W.T.M.	WATERTIGHT MANHOLE
A.P.	AFTER PERPENDICULAR	H.	NON-WATERTIGHT HATCH
D.W.L.	DESIGN WATERLINE	D.D.	DUTCH-DOOR
℄	CENTRE LINE	O.F.	OIL FUEL
B/L	BASELINE	F.W.	FRESH WATER
P.	PORT SIDE	S.	STARBOARD SIDE

Appendix B – Sketch of the Occurrence Area



Appendix C - Photographs

The *Kella-Lee* - after deck looking aft

Appendix D – Excerpts from TSB Macro-Analysis Project MAP -M99-43

MACRO-ANALYSIS PROJECT PROJET DE MACRO-ANALYSE	MAP - M99-43
FILES / DOSSIERS	M98L0149 / 522-5-4
Overview of Canadian Fishing Vessel Accident Statistics and Examination of Safety Concerns Raised by the 1998 Swamping and Sinking of the Small Canadian Fishing Vessel "BRIER MIST".	

1.0 Executive Summary

TSB statistics continue to indicate a relatively high number of fishing vessel accidents and casualties in relation to other commercial vessels. Improper loading and progressive flooding continue to be the primary factors in the capsizing and foundering of fishing vessels.

2.0 Introduction

This report has been developed to support the small Canadian fishing vessel (CFV) "BRIER MIST" investigation. It focuses on the overall situation of CFV safety and looks into particular issues raised by this fatal accident.

5.0 Canadian Fishing Vessel (CFV) Accidents Reported

A total of 10,832 CFVs were involved in 9,854 shipping accidents and 463 accidents aboard ship reported over the past 25 years 1975-1999. These resulted in 675 fatalities, 659 injuries and 2,450 total losses. Overall, the number of fatalities and injuries has increased from 1980 to 1990 and has been declining ever since. Prior to 1980, investigation units had a limited capacity to deal with and limited access to fishing vessel accident reports.

DFO licensed about 36,000 fishing vessels in 1987 compared to some 26,000 in 1998. This evident decrease of licensed vessels can explain part of the decline in the number of accidents reported; however, there are other factors at play. Occurrence data suggest that other factors, to name a few, include economic conditions, standards of training, standards of construction, manning conditions, atmospheric conditions, the changing fishing industry safety culture and occurrence reporting practices.

Despite the declining numbers, commercial fishing in Canada continues to be a hazardous occupation. As the number of marine accidents overall (involving all commercial vessels) is declining, fishing vessels continue to represent half of the vessels involved in accidents. Generally, more than half of the fatalities in the marine

industry involve Canadian fishermen. Occurrence data suggest that there have been some improvements in marine safety as fatalities and total losses reported in the last five years have been cut by about half from 1985 to 1989.

5.1.2 Fatal Capsizing and Foundering Accidents

A total of 604 CFVs capsized, foundered or went missing since 1975. These accidents resulted in the loss of 344 lives or an average of 14 fatalities per year. More than half of the fatalities occurred from fishing vessels under 15 gross tons. The remaining fatality proportions decrease as fishing vessels' gross tonnage increases.

Foundering and capsizing accidents represent more than half of the grand total of CFV deaths on record. Since 1975, 125 fatal fishing vessel capsizing or foundering accidents resulted in 260 fatalities (see Table 1). Almost three-quarters of these vessels were below 15 gross tons and caused over 60% of the fatalities. However, inspected small fishing vessels (15 to 150 GRT) had more than their fair share of accidents when we compare the accident and fatality numbers against their numbers within the Canadian fishing fleet.

Physical changes to vessels without consideration for their effect on stability and watertight integrity are of major concern in many of these accidents. In addition, we should consider other factors such as design features which are desirable from a stability point of view but may be a hindrance to fishing on a day-to-day basis; shorter seasons for various fisheries often resulting in economic pressures on the master to overload the vessel to maximize the catch during the limited fishing season; and modifications to vessels in service which are necessitated by a change of service or fishing practice, resulting in degradation of vessel stability.

Many past investigations revealed that several fishing vessel operators do not have an appreciation for the factors affecting the stability of their vessels, particularly those factors which can be significantly influenced by their operating practices.

6.1 Watertight Closures

Defective or poorly secured hatch covers, scuttle covers or scuppers rank a close second to unsafe loading conditions amongst the accidents of interest over a 25-year period. The distribution amongst 3 vessel categories of 99 accidents associated with this unsafe condition illustrates that such deficiencies were readily identified in most LFVs [large fishing vessels] while it could be identified in about 1 of 2 accidents involving small fishing vessels where loading and structure factors are more significant. Further attention to such issues in past investigations may have revealed more occurrences.

Most recent data on 86 accidents investigated since 1990 show that no LFV and fewer UFV [uninspected fishing vessels] accidents were investigated after 1994 within the scope of this research. This could be because the number of vessels in this segment of the fleet had diminished significantly or simply because of the unavailability of key occurrence data in variables extracted.

Over the past 5 years, at least one vessel per year has been identified as having defective or poorly secured hatch or scuttle covers. Most of them, as per the occurrences listed below, resulted in the loss of the vessel and/or loss of life.

The TSB issued the following recommendations on this topic:

- Recommendation M92/05 (report M90M4020): The Department of Transport amend the pertinent regulations to ensure that bilge drainage systems are effective for all watertight compartments, including refrigerated spaces on fishing vessels, where below freezing temperatures may occur.

- Recommendation M92/04 (report M90M4020): The Department of Transport promote awareness among the operators, officers, and crews of fishing vessels of the serious consequences associated with leaving access or other watertight doors open at sea.

- Recommendation M93/01 (report M90L3034): The Department of Transport develop and implement measures to ensure that owners, operators and masters of vessels under its jurisdiction have effective training and procedures for securing all exterior and interior openings sufficient to preserve the watertight integrity of the hull for the environmental conditions being encountered.

6.2 Survival Craft

More deficient liferafts have also been identified in the last 5 years suggesting that there are a significant number of inadequate life-saving survival craft aboard small fishing vessels. So far, the TSB has issued the following safety communications:

- Recommendation M93/03 (report M90L3034): The Department of Transport ensure that liferafts on all federally approved or inspected vessels are stowed in such a manner as to permit easy manual launching under any conditions likely to be encountered by that vessel.

6.3 Anti-Exposure Suits and Emergency Position Indicating Radio Beacons (EPIRBs)

The list of small fishing vessel accidents with insufficient or inadequate anti-exposure suits for the number of persons on board and lack of a functional EPIRB is similar to that of inadequate life-saving survival craft. Investigators have noted that both of these survival equipment had an impact in these accidents. Beyond these, many fatalities resulting from falls overboard, which represent the majority of fatalities in accidents aboard fishing vessels, could have been prevented if fishermen had been wearing anti-exposure/floater suits. Further, the TSB issued a number of safety communications on these topics, such as:

- Recommendation M92/07 (report M90N5017): The Department of Transport expedite its revision of the *Small Fishing Vessel Safety Regulations* which will require the carriage of anti-exposure worksuits or survival suits by fishermen.

- Marine Safety Advisory 07/91 (report M90N5017): No Immersion Suits worn. The three who died were in the water and the first body was recovered within some 18 hours of the sinking; those in the liferaft were recovered within some 8 hours. The use of the enhanced sighting capability of the wearing of an immersion suit, and the thermal protection of the suit may have saved those in the water. There were no immersion suits aboard the "STRAITS PRIDE II", nor is there regulatory requirement for them to be carried on this class of vessel. It is appreciated the effort, past and present, made by Coast Guard to improve this situation.

- Marine Safety Concern 99/43 (issued in May 1995, report M93W0003): A proposed amendment to the *Canada Shipping Act* (CSA) now being developed would require uncertificated persons to undergo recommended training. In the interim, the Canadian Coast Guard (CCG) will issue a Ship Safety Bulletin (SSB) with a recommendation to masters respecting such training.

- Marine Safety Concern 99/20 (issued in October 1993, report M91W1075): The Board is concerned that inexperienced or inadequately trained crew members on fishing vessels contribute to the frequency and severity of marine occurrences, whether these crew members are on watch, handling a catch or operating emergency and safety systems. At present, there are no regulatory requirements for personnel to acquire professional competency in such areas as navigation, seamanship, safety, vessel stability and survival skills to operate fishing vessels of less than 100 gross registered tons (GRT). . . . Further, it is understood that, under the new regulations, it will become mandatory that, on accumulation of six months' sea service, all seafarers seeking further employment at sea complete Marine Emergency Duties (MED) training module A1 and A2. . . . The Board will monitor the effectiveness of the new regulations with a view to examining the possibility of extending them to smaller vessels.

- Marine Safety Concern 99/34 (issued in May 1995, report M93W0003): In 1993, the CCG produced a video entitled "A Matter of Minutes" to promote the benefits of a newly designed commercial fisherman anti-exposure worksuit. The CCG also distributed 100 such worksuits to fishermen who are members of the Canadian Marine Rescue Auxiliary (CMRA) for evaluation. It is hoped that this group of CMRA members will play an important role in shaping the safety attitudes of other fishermen, particularly toward the use of anti-exposure worksuits. The Board will monitor the effectiveness of such initiatives with a view to assessing the need for further safety action on this issue.

- Marine Safety Concern 99/28 (issued in December 1993, report M92M4032): By operating year-round off the eastern seaboard, Canadian fishermen are constantly exposed to some of the most hostile conditions of sea, wind, ice, frigid air and water temperature in the world. Thus, the Board is concerned that, in spite of the demonstrated value of anti-exposure worksuits in survival situations involving abandonments in the past, many fishermen continue to work at risk in the absence of such thermal protection and flotation devices. . .

Appendix E1 – Marine Occurrence Statistics 1975-1990

Western Region

	1975	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Total Number of Marine Accidents	**44**	**127**	**124**	**150**	**198**	**213**	**209**	**226**	**244**	**225**	**248**	**250**	**239**	**238**	**239**	**236**
Shipping Accidents by Type	**44**	**123**	**116**	**146**	**193**	**207**	**205**	**224**	**243**	**221**	**243**	**247**	**230**	**226**	**226**	**221**
Collision	1	4	5	8	5	6	8	7	8	7	4	12	6	9	13	14
Capsizing	4	2	6	2	6	8	2	3	4	10	7	8	10	7	8	8
Foundering/Sinking	12	14	21	15	20	25	13	15	16	14	23	15	18	11	11	17
Fire/Explosion	4	22	17	18	18	38	30	38	50	44	28	30	30	24	15	28
Grounding	15	60	52	73	88	80	89	100	100	85	100	106	87	109	115	94
Striking	4	9	4	9	8	10	22	19	23	29	28	25	25	12	18	24
Ice Damage	0	0	0	1	0	0	0	1	2	0	1	0	0	0	0	0
Propeller/Rudder/Structural damage	0	2	0	2	3	3	5	7	2	2	4	7	2	5	10	5
Flooding	1	9	9	15	40	35	25	26	25	21	37	31	31	32	28	27
Other	3	1	2	3	5	2	11	8	13	9	11	13	21	17	8	4
Accidents Aboard Ship	**0**	**4**	**8**	**4**	**5**	**6**	**4**	**2**	**1**	**4**	**5**	**3**	**9**	**12**	**13**	**15**
Vessels Involved in Shipping Accidents																
By Vessel Flag	**44**	**126**	**120**	**148**	**196**	**212**	**211**	**226**	**248**	**225**	**256**	**259**	**241**	**234**	**237**	**239**
Canadian (Fishing)	43	125	115	137	187	199	200	214	240	211	245	249	231	219	223	226
Foreign	1	1	5	11	9	13	11	12	8	14	11	10	10	15	14	13
Vessels Lost by Gross Tonnage	**26**	**38**	**34**	**32**	**29**	**54**	**49**	**47**	**63**	**73**	**59**	**57**	**47**	**29**	**29**	**41**
1,600 grt and over	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0
150 to 1,599 grt	2	0	0	2	1	0	0	0	0	1	0	1	1	0	0	1
60 to 149 grt	2	3	1	1	1	2	1	0	0	1	4	1	3	0	3	2
15 to 59 grt	9	9	10	6	6	13	11	20	17	14	13	6	5	2	10	6
Less than 15 grt	10	22	20	19	18	27	30	26	42	49	38	44	29	27	15	29
Unknown tonnage	3		3	4	3	12	7	0	4	8	4	4	9	0	1	3
Fatalities	**19**	**14**	**15**	**20**	**16**	**13**	**13**	**7**	**5**	**20**	**9**	**15**	**15**	**9**	**6**	**8**
Shipping Accidents	19	11	11	17	12	7	10	5	4	16	6	14	11	5	0	4
Accidents Aboard Ship	0	3	4	3	4	6	3	2	1	4	3	1	4	4	6	4
Injuries	**0**	**3**	**13**	**10**	**5**	**4**	**4**	**7**	**14**	**8**	**17**	**19**	**19**	**30**	**19**	**26**
Shipping Accidents	0	3	6	9	4	4	3	7	14	8	15	17	12	22	11	15
Accidents Aboard Ship	0	0	7	1	1	0	1	0	0	0	2	2	7	8	8	11
Reportable Incidents by Type	**3**	**37**	**1**	**5**	**6**	**7**	**15**	**24**	**11**	**12**	**17**	**21**	**20**	**26**	**26**	**16**
Close-quarters situation	0	0	0	2	3	1	1	2	3	1	0	6	7	5	13	9
Engine/Rudder/Propeller	0	31	0	1	0	2	12	7	1	2	0	0	3	2	0	0
Cargo Trouble	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Personal Incidents	0	0	0	0	1	0	1	1	0	0	4	1	0	2	4	0
Other	3	6	1	2	2	4	1	14	7	9	13	14	10	17	9	7

Appendix E2 – Marine Occurrence Statistics 1991-2001

Western Region

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Total Number of Marine Accidents	**228**	**220**	**191**	**228**	**193**	**151**	**134**	**129**	**110**	**104**	**106**
Shipping Accidents by Type	**221**	**215**	**183**	**215**	**188**	**141**	**125**	**125**	**102**	**93**	**93**
Collision	16	6	15	18	3	2	4	3	0	1	3
Capsizing	12	7	5	6	10	5	3	4	2	3	2
Foundering/Sinking	15	12	12	14	19	11	10	5	4	6	5
Fire/Explosion	22	29	26	21	30	20	21	19	11	16	19
Grounding	70	85	73	88	64	69	41	44	45	40	30
Striking	37	30	20	21	14	8	18	18	11	5	12
Ice Damage	0	0	1	0	0	1	0	0	0	0	0
Propeller/Rudder/Structural damage	9	7	7	8	4	1	1	6	6	6	0
Flooding	27	26	18	32	35	23	18	19	21	13	21
Other	13	13	6	7	9	1	9	7	2	3	1
Accidents Aboard Ship	**7**	**5**	**8**	**13**	**5**	**10**	**9**	**4**	**8**	**11**	**13**
Vessels Involved in Shipping Accidents											
By Vessel Flag	**239**	**223**	**195**	**234**	**194**	**142**	**133**	**128**	**102**	**93**	**98**
Canadian (Fishing)	220	215	185	217	177	128	122	121	97	87	89
Foreign	19	8	10	17	17	14	11	7	5	6	9
Vessels Lost by Gross Tonnage	**39**	**45**	**35**	**32**	**32**	**23**	**16**	**19**	**16**	**10**	**16**
1,600 grt and over	1	0	0	0	0	0	0	0	0	0	0
150 to 1,599 grt	0	2	0	0	0	1	0	0	0	0	0
60 to 149 grt	4	3	0	2	1	1	1	2	2	2	4
15 to 59 grt	5	9	5	6	8	5	4	3	2	2	5
Less than 15 grt	23	20	22	14	14	11	7	8	10	6	5
Unknown tonnage	6	11	8	10	9	5	4	6	2	0	2
Fatalities	**7**	**3**	**12**	**13**	**11**	**5**	**5**	**2**	**2**	**3**	**6**
Shipping Accidents	5	1	11	9	11	2	3	2	1	0	3
Accidents Aboard Ship	2	2	1	4	0	3	2	0	1	3	3
Injuries	**14**	**11**	**16**	**17**	**17**	**11**	**9**	**8**	**15**	**10**	**21**
Shipping Accidents	9	8	9	8	12	4	2	4	4	2	10
Accidents Aboard Ship	5	3	7	9	5	7	7	4	11	8	11
Reportable Incidents by Type	**18**	**21**	**40**	**36**	**26**	**15**	**13**	**19**	**24**	**41**	**61**
Close-quarters situation	13	9	22	18	13	10	7	4	3	9	17
Engine/Rudder/Propeller	2	3	9	11	8	2	2	7	15	25	28
Cargo Trouble	0	0	0	0	0	0	0	0	0	0	0
Personal Incidents	0	1	3	0	1	0	1	1	1	0	1
Other	3	8	6	7	4	3	3	7	5	7	15

Appendix F - Occurrences Reported 1975-2002