Transportation Safety Board of Canada

Bureau de la sécurité des transports du Canada

MARINE INVESTIGATION REPORT

M02W0089

CAPSIZING — TWO FATALITIES

LOG SALVAGE VESSEL *BRUCE BROWN*

ATREVIDA REEF, MALASPINA STRAIT, BRITISH COLUMBIA

11 JUNE 2002

Canada

Marine Investigation Report

Capsizing — Two Fatalities

Log Salvage Vessel *Bruce Brown*
Atrevida Reef, Malaspina Strait, British Columbia
11 June 2002

Summary

During the night of 10/11 June 2002, the 8 m log salvage vessel *Bruce Brown* was towing a 37 m float from Barnes Bay, on Sonora Island, to Blind Bay, off Malaspina Strait. During the passage, when the *Bruce Brown* was northwest of Powell River, B.C., the vessel took on water and sank. The two persons on board were found some distance from the tug, one had succumbed to hypothermia and the other to drowning.

Ce rapport est également disponible en français.

Other Factual Information

Particulars of the Vessel

	Bruce Brown			
Licence	14K17621			
Port of Registry	Powell River, B.C.			
Flag	Canada			
Type	Log salvage (LS 1600)			
Length	7.97 m			
Draught	Forward:	0.3 m	Aft:	1.2 m
Built	1967			
Propulsion	Detroit Diesel 6V-53, 159 kW, marine diesel engine, single propeller			
Crew	2			
Owner/Operator	Private owner			

Description of the Vessel

The *Bruce Brown* is a vessel less than 5 gross registered tons (GRT), of open construction. The deep v-shaped hull is constructed of moulded glass-reinforced plastic. An enclosed wheelhouse is located at the vessel's mid-length with an aft-facing door to starboard, leading to the open well deck. A cuddy cabin below the forward deck is accessed from the wheelhouse, but this is not, by definition, considered as "berthed accommodation." The well deck is contained by solid bulwarks approximately 0.5 m in height. Immediately aft of the wheelhouse on the centre-line of the well deck is the engine compartment of plywood construction. The forward end of the engine compartment is fitted with a non-watertight transverse bulkhead that does not extend vertically to the well deck. The engine compartment extends aft and has a raised coaming above the well deck to the height of the bulwarks. Aft and to each side of the engine compartment, in the form of a 'U' between the bulwarks, is deck space approximately 0.5 m wide. A 15 cm diameter towing post, forward of and extending 35 cm above the engine compartment, is located on the centre-line aft of the wheelhouse.

Photo 1. *Bruce Brown* 1987

The vessel's navigation equipment included a magnetic compass, a VHF radio and two depth sounders.

Vessel History and Licensing

In January 1968, as a vessel of closed construction, the vessel entered government service for hydrographic duties, was named *Petrel*, and received its licence number. The Comox Valley Marine Rescue Society acquired the *Petrel* in April 1988, and re-named the vessel *Bruce Brown*. On 16 February 1998, the licence was transferred to the owner/operator, who purchased the vessel as a project for use in his retirement. The owner/operator modified the vessel with the intention of utilizing it for commercial log salvage. These modifications included replacing the enclosed after deck with an open well deck; extending the vessel's superstructure significantly above that of its initial construction; fabricating an enclosed wheelhouse; adding a control station above the wheelhouse; and fitting a metal arch and mast for navigation lights, deck lights, and radio antennae, with a resulting air draft above 6 m.

Photo 2. *Bruce Brown,* 2002. Note the addition of an enclosed wheelhouse, upper control station, and mast arch.

History of the Voyage

The owner/operator based the *Bruce Brown* at Westview, two miles south of Powell River, B.C. He had used the *Bruce Brown* for two separate towing opportunities. The first, on the outward passage, towing steel dock flotation from Westview to Big Bay, on Stuart Island, followed by a return passage towing a 37 m long float from Barnes Bay on Sonora Island, to Blind Bay on Nelson Island, off Malaspina Strait. The owner/operator was assisted by his son in these tasks.

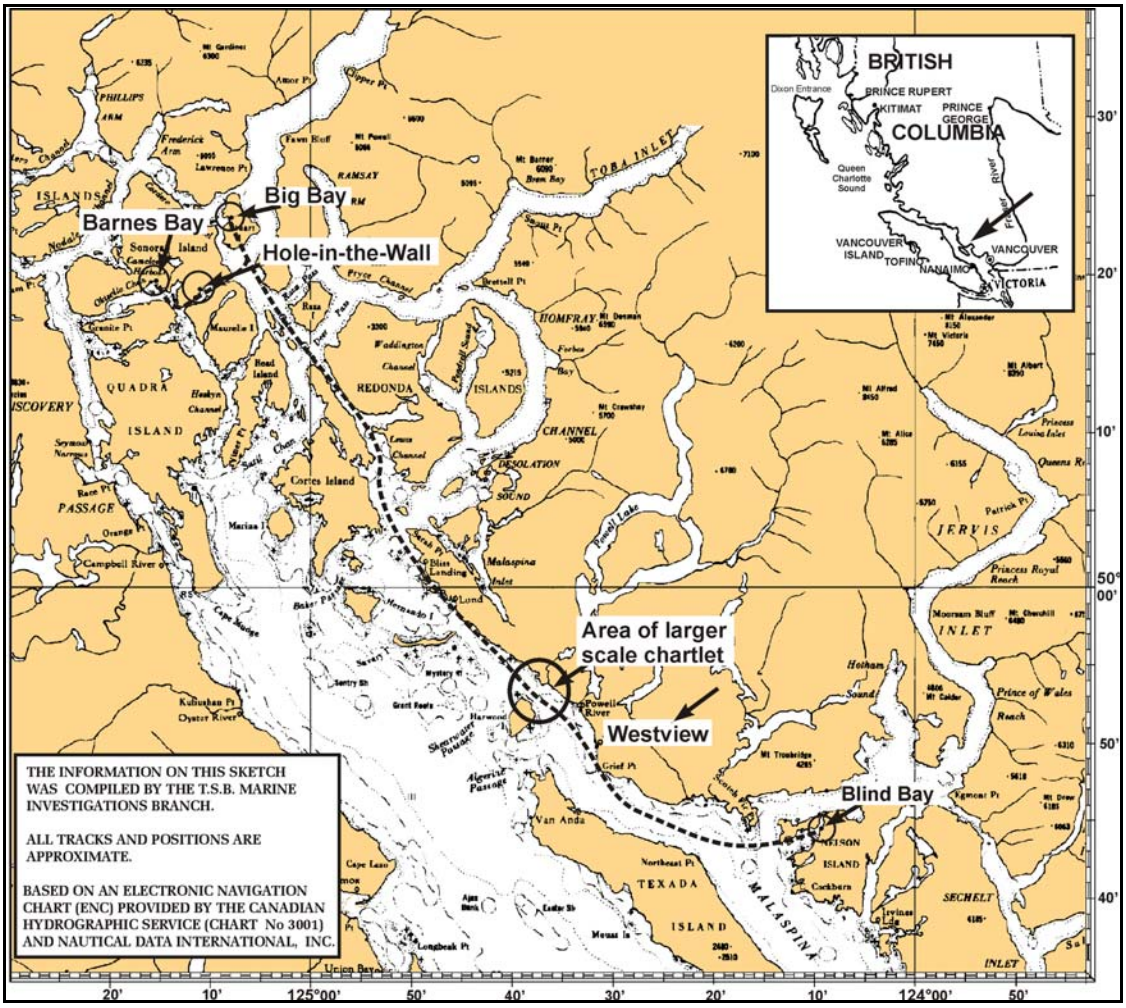

Figure 1. Intended and actual route of the *Bruce Brown*

The *Bruce Brown*, with the owner/operator and his son on board, departed Westview for the tow to Big Bay on June 9. They arrived at Big Bay at approximately 1900[1] that evening, secured their tow, and spent the night aboard the *Bruce Brown*. The route from Big Bay to Barnes Bay, where they were to pick up the next tow, was through the 4-mile-long Hole-in-the-Wall passage, where tidal currents can reach 12 knots. High water slack at the west end of Hole-in-the-Wall passage, 8 miles distant, was predicted to be at 0430, June 10, with Barnes Bay another 3 miles further. To allow for safe passage, the *Bruce Brown* departed Big Bay at 0500.

At Barnes Bay they took in tow a wooden floating dock, measuring 37 m x 3.1 m, supported by foam flotation. This was secured with a 20 mm polypropylene tow line, 42 m in length. The free end of the tow line was formed into a spliced eye, which was placed over the towing post on the *Bruce Brown*. The deck of this dock was 45 cm above the water and the dock was not fitted with a boarding ladder. There was no means of access to the deck of the float for a person in the water. The *Bruce Brown* and tow departed Barnes Bay and headed toward Blind Bay, 60 miles to the southeast. Their routing took them again through Hole-in-the-Wall passage. Twenty miles into

[1] All times are Pacific daylight time (Coordinated Universal Time minus seven hours).

their southward passage, off Teakerne Arm, the *Bruce Brown* met a northbound boat operated by a friend. Both vessels stopped for a few minutes to chat. The time was approximately 1600.

At 1930, the *Bruce Brown* overtook the southbound tug *Regent* off Hurtado Point, 11 miles northwest of Westview. The master of the *Regent* last noticed the *Bruce Brown* at approximately 2315, just beyond Atrevida Reef, close to shore.

On June 11, the pleasure craft *Just Coastin* discovered a vessel 8 m in length, capsized, with 1 m of the bow above water off Atrevida Reef, Malaspina Strait. No persons were sighted. The operator reported this to Comox Marine Communications and Traffic Services (MCTS) at 0720.

Search and Rescue Operations

Upon receipt of this information, Comox MCTS advised the Joint Rescue Co-ordination Centre (JRCC) in Esquimalt, B.C., at 0726 and resources were dispatched to the scene. These included the Canadian Coast Guard (CCG) vessel *Mallard*, based at Westview, 6.5 miles southeast; the CCG vessel *CG 509,* based at Cortes Bay, 15 miles to the northwest; and a Search and Rescue (SAR) helicopter based at Comox, 15 miles to the southwest. Both surface vessels were on-scene at 0756, with the helicopter arriving at 0842. As search communications were conducted on VHF radio frequencies, others contributed information that assisted in the following:

- identifying the vessel, later confirmed to be the *Bruce Brown*;
- identifying the crew of the vessel;
- determining that the vessel was bound for Big Bay, intending to use Hole-in-the Wall passage; and
- determining that the vessel carried a white skiff, survival suits and flares but was not equipped with an emergency position indicating radio beacon (EPIRB).

At 0817, the *Mallard* advised the JRCC of the position of the capsized vessel by the relay of Global Positioning System coordinates. At that time, the vessel was located nine cables southeast of Atrevida Reef light (List of Lights No. 477.5). Five minutes later, the *Mallard* reported that the vessel was the *Bruce Brown*. At 0901, the *Mallard* reported to the JRCC that it had the *Bruce Brown* in tow for Scuttle Bay. The *Bruce Brown* was recovered by trailer from Scuttle Bay later that same day.

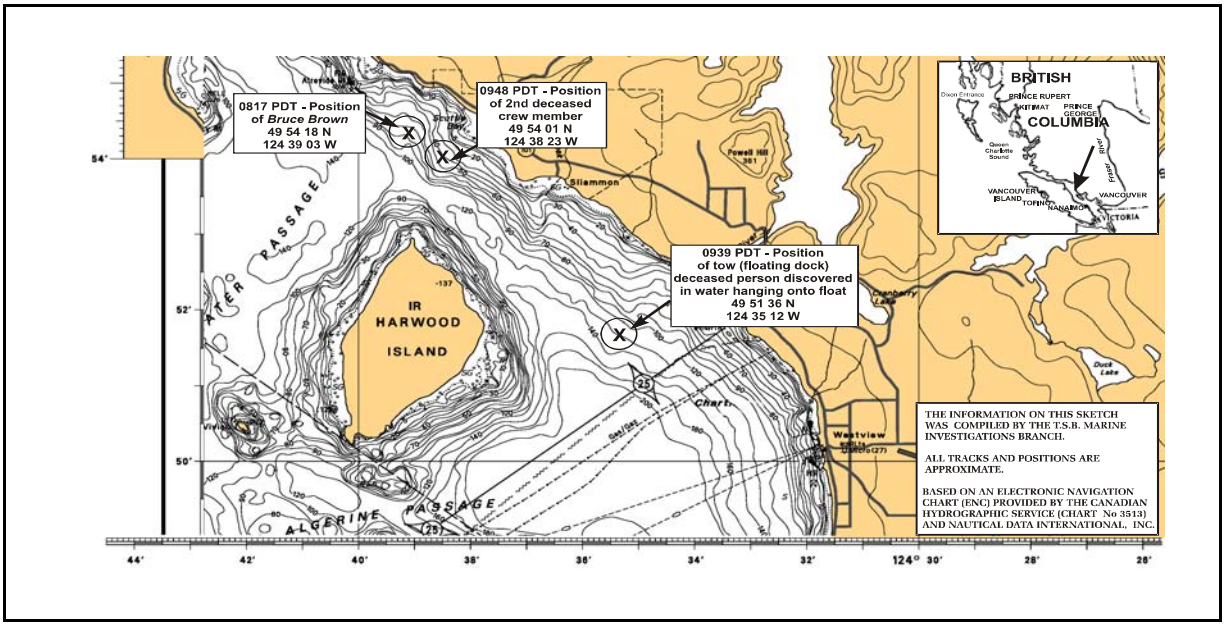

Figure 2. Locations pertaining to the search and recovery operation

At 0926, the JRCC received information that the float had been spotted from the air 20 minutes earlier off the Powell River mill, 4 miles to the southeast of the *Bruce Brown*. At 0939, within minutes of the JRCC receiving this information, a surface vessel assisting in the search reported locating the float and discovering a deceased person in the water. The person, later identified as the owner, was wearing a Personal Flotation Device (PFD) and was found hanging onto the float. Shortly afterward, his body was recovered by the *Mallard* and transferred to Emergency Health Services care ashore.

At 0948, the JRCC was advised that a surface vessel assisting in the search had located the body of the deckhand in the same area, wearing a PFD. The jacket was un-zippered. This body was recovered by the *Mallard* and transferred to Emergency Health Services care ashore at Westview.

Condition of the Vessel on Recovery

The *Bruce Brown* sustained water damage to machinery and electronics as a result of capsizing, but the hull was undamaged. The engine throttle was found in the idle position. A clock, subsequently found to be in working order at the time of the accident, had stopped at 12:12:29. A hose joint in the engine's cooling water system was observed to have failed.

The *Bruce Brown* and its tow line were not connected when discovered by SAR resources. The polypropylene tow line with its spliced eye was found intact, attached to the float.

Log Salvage Licence Requirements

The owner/operator of the *Bruce Brown* first applied to the B.C. Ministry of Forests for a log salvage licence in June 1970; he was issued licence LS 1600. By payment of the annual fee, this licence was kept valid until May 1982. In February 1995, he re-applied for his licence and, upon payment of the annual fee, was re-issued LS 1600. This licence, subject to annual renewal, remained valid until May 2003.

The main criterion for the issue of a log salvage licence is a favourable screening by police. There are no marine-specific requirements for issuing the licence. The log salvage licence is an administrative document and not a safety assessment of the vessel.

Vessel Inspection and Certification

The *Small Vessel Regulations*, section 3. (1)(*c*), made pursuant to the *Canada Shipping Act*, apply to power-driven vessels that do not exceed 15 GRT, that do not carry passengers, and are neither pleasure craft nor fishing vessels. The *Bruce Brown* was subject to the *Small Vessel Regulations*. Such vessels are not required to be inspected by Transport Canada. However, the *Canada Shipping Act* does require that owners ensure that such vessels comply with the provisions of the *Small Vessel Regulations* related to construction standards, safety, and navigation equipment requirements.[2] Further, under the regulatory regime, any modifications carried out to the vessel that affect its compliance with the regulations are to be reported to Transport Canada.

Crew Experience and Qualifications

The owner/operator of the *Bruce Brown* had previous small vessel experience on the B.C. coast. This included both commercial log salvage, with his log salvage licence being first issued in 1970, and pleasure use.

The second crew member had previous marine experience on the B.C. coast that included both pleasure use and commercial fishing. Neither crew member had received formal marine-related instruction, nor had either obtained a Transport Canada marine certificate. At the time of the accident, the crew of vessels under 15 GRT, not carrying passengers, did not require Transport Canada certification.

Recognizing that most marine accidents resulting in loss of life occur on small non-pleasure-use vessels, Transport Canada has developed two new Marine Emergency Duties (MED) courses; MED A-3 and MED A-4. The MED A-3 course is designed for crew members on vessels under 150 tons, operating not more than 20 miles offshore, and passenger vessels under 150 tons, with unberthed accommodations only, operating on Minor Waters and Home Trade, Class IV voyages.

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[2] *Small Vessel Regulations*; Construction Standards for Small Vessels.

As a small commercial log salvage vessel, the *Bruce Brown* typifies the trade that the MED A-3 course was developed for. Neither the owner/operator nor his crew member had taken MED training, nor was there a requirement for such training.

Weather

The weather conditions at the time of this occurrence were favourable; the winds were reported as light and the sea rippled.

Navigation Lights

Pursuant to the *Canada Shipping Act*, the *Collision Regulations* stipulate that the navigation lights are to be displayed when towing between sunset and sunrise, both by the towing vessel and by the tow. The *Bruce Brown* was fitted with permanently mounted towing lights, but the tow was not equipped with lights.

Marking of Vessels

The *Small Vessel Regulations* stipulate that no person shall operate a vessel that is licenced unless that vessel is marked with its licence number in block characters not less than 75 mm high and in a colour that contrasts with the background.

The vessel's name and home port were marked on the transom of the *Bruce Brown*, and the log salvage number was marked on each side above the wheelhouse; but the vessel's licence number was not displayed. This made initial positive identification of the vessel difficult.

Bilge Pumping Arrangements

The *Construction Standards for Small Vessels* (TP 1332)[3] indicates that there should be a means of pumping or bailing each watertight compartment when the vessel is in its operating condition. Vessels over 6 m should have at least one automatic bilge pump of at least 0.91 L/s (litres per second). Such vessels that have bilges that are not readily observed, should be provided with audible bilge alarms or visual indicators at the operating station to indicate:

- a high bilge level in a normally unattended machinery space or other space having an underwater through-hull connection, and

- when an automatic bilge pump is operating.

In addition, where overnight sleeping accommodation is provided, the high bilge level alarms should be audible (84 dBA) to persons sleeping.

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[3] Section 9.

The *Bruce Brown* was equipped with one electric bilge pump. This pump was rigged for manual control only. The vessel was not fitted with a bilge high level alarm, either visual or audible, nor was it required to by regulations. However, sound management practices suggest that such equipment be fitted to provide further safety.

Cooling and Exhaust System

The engine of the *Bruce Brown* is cooled by means of a heat exchanger. Engine coolant is circulated within a closed system. The temperature of the engine coolant is lowered within the heat exchanger where the engine coolant is cooled by (raw) seawater. After passing through the heat exchanger, the seawater is carried through two 28.5 mm-diameter, wire-reinforced rubber hoses to through-hull fittings. These fittings are above the waterline, on the starboard side of the vessel from where the seawater is discharged overboard. All hose connections were secured by hose clamps. Reportedly, the stream of these raw water discharges extended approximately 1 m from the vessel's side and would, during daylight, be visible from the wheelhouse. When the engine was operating, the presence of these discharges provided a handy indication to the operator of the status of the flow of engine cooling water.

After the vessel was recovered it was observed that, within the engine compartment, a hose connection on the discharge side of the raw water cooling system had failed.

Radio Communications

The *Bruce Brown* was equipped with a VHF radio but had not been issued a Radio Inspection Certificate. As a non-pleasure vessel of less than 8 m, a VHF radio is not a carriage requirement of the *Ship Station (Radio) Regulations, 1999*. However, where such equipment is fitted, Industry Canada *Radiocommunication Regulations*[4] require a person in charge of the radio watch to hold, as a minimum, a Restricted Operator Certificate–Maritime (ROC–M) qualification. The operator did not hold this certificate.

The *Vessel Traffic Services Zones Regulations* require every ship engaged in towing or pushing any vessel or object, where the combined length of the ship and object towed is 45 m or more, or where the length of the object under tow is 20 m or more, to communicate with the MCTS. The combined length of the *Bruce Brown* (8 m), tow line (42 m) and tow (37 m) was 87 m. By virtue of the combined length of the vessel and tow, the *Bruce Brown* was required to communicate with the local MCTS Centre but did not.

The operator had not filed a sailing plan with the MCTS but had informed family members of his intentions for this passage.

A VHF radio distress message was not received, suggesting that the vessel capsized suddenly. As the vessel did not carry an EPIRB, the transmission of an electronic post-accident distress signal did not occur, and the authorities could not be promptly notified for SAR assistance.

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[4] *Radio Regulations*, Part 4, section 33.

Survival in Cold Waters

The operator of the *Bruce Brown* and his son died as a result of their immersion in the sea after their vessel capsized. Both were found wearing PFDs. The operator was found, fully clothed, in the water clinging to the tow, and the cause of death was hypothermia. His son was recovered, his PFD un-zippered, adrift in the vicinity. The cause of death was drowning.

Year-round sea temperatures in the area range between 7°C and 10°C.

Analysis

Failure of the Raw Water Cooling System

After the vessel was recovered, it was discovered that one of the two 28.5 mm, wire-reinforced rubber hoses on the discharge side of the raw water cooling system had parted. This failure was located in the section between the heat riser and the through-hull fitting at the side of the vessel, within the engine compartment. The hose parted where two lengths of hose of the same diameter had been joined with a metal connector. Examination of this connector revealed that, in place of a straight connector, a reducer had been used. One end of this reducer matched the 28.5 mm inside diameter of the rubber hose, while the other end was 25.4 mm in diameter. This smaller diameter had been built up to match the 28.5 mm inside diameter of the hose by the application of plastic electrician's tape. Two hose clamps had then been secured over each hose end at the reducer.

The raw cooling water, its temperature raised by heat drawn from the engine, warmed the electrician's tape and softened its adhesive. The wire reinforcing within the rubber hose limited the ability of the hose clamps to compress the hose against the reducer. The pressure of the cooling water, as supplied by the circulating pump, was sufficient to elongate the warmed adhesive of the electrician's tape until the connection failed and the hose parted (see Photo 3).

The engine's raw water circulation pump continued to supply cooling water to the system. Where the hose had parted, that water now flowed into the vessel's bilges instead of overboard. Because this hose failure occurred during darkness, it is unlikely that the operator would have been able to observe that the cooling water discharge was now reduced to a single stream. The accumulation of water in the bilges would have served to trim the vessel by the stern. A vessel's change of trim can often be detected when referenced to the horizon. This, however, would be more difficult to detect during darkness.

Photo 3. Electrician's tape protruding from failed joint in engine cooling hose

The noise generated by the engine would most probably have obscured the sound of the accumulating water moving within the vessel – an additional warning that a dangerous situation had developed.

The strain astern on the towing post caused by the load of the tow line, coupled with the force of the propeller driving the vessel ahead, would have quickly resulted in the stern sinking even lower in the water. This would have allowed the cooling water accumulating in the bilges to shift aft, further exacerbating the situation.

The rate at which the engine's raw water circulating pump supplies seawater is proportional to the operating speed of the engine. Information supplied by the engine's manufacturer indicates that the pump fitted on the *Bruce Brown* had a maximum flow rate of 173 litres per minute (L/min.) with the engine operating at a maximum of 2100 RPM. With the engine operating at an estimated service speed of 1700 RPM, it is reasonable to assume a supply rate of 140 L/min., supplying 70 L/min. to each discharge hose.

It has been determined by measurement that the volume of the vessel's bilge in way of the engine is approximately 3.5 m^3, and seawater filling that space would have a mass density of approximately 3.6 tonnes. By calculation, at 70 L/ min., the bilge would fill in 50 minutes. However, given the low freeboard of the vessel, it can be estimated that the addition of approximately 1.8 metric tons of seawater would cause the stern to become submerged to the point where seawater would downflood into the vessel's after well deck and eventually flow forward over the partial transverse bulkhead into the accommodation space. Without corrective action, the vessel would capsize. By calculation, this sequence would take approximately 25 minutes from the time of the hose failure.

Complexity of Regulatory Safety Requirements

Regulatory compliance for small non-passenger vessels of 15 gross tons and under is based on enforcement by owners. The application of the self-enforcement principle presupposes that the owner/operator has an in-depth knowledge of marine legislation and the operational environment, and has sufficient resources and appropriate skills to educate the operator or crew. This principle may work well in large corporations; however, few operations within the small vessel sector engaged in carrying passengers, fishing activity, or other commercial activity have a scale of operation sufficiently large to allocate resources to meet these objectives. The majority of the over 30 000 small vessels operating in Canada are operated by small companies, or individuals who may own and operate a vessel with a few employees.

There is no requirement for the owner/operator to possess an in-depth knowledge of marine regulations or for the operator to possess academic qualifications, nor is a competency test required before a person can engage in marine activities. As the regulations are involved and require knowledgeable interpretation and application, they may not be readily understood by those who must apply them.

Simplifying regulations in the small vessel industry is central to supporting self-enforcement. This need has been recognized by Transport Canada, which in other marine sectors has published guides and manuals to assist owners or operators to operate their vessels safely.[5] Until 2003, there was no such publication for the small passenger or non-pleasure vessel sector.[6] The difficulty in interpreting and applying current marine legislation calls into question the practicality of self-enforcement as a compliance tool for small vessels.

The issue of self-enforcement of complex legislation and regulations has been discussed in the 1996 TSB report on an occurrence involving *S.S. Brothers* (TSB Report M96M0144) and the 2001 TSB report on an occurrence involving *Wasca II* (TSB Report M01W0116). In the report involving *S.S. Brothers,* the Board recommended that legislation be presented in a manner readily understood by those to whom it applies.[7] While the recommendation addressed provincial labour legislation as it applies to fishing vessel safety, the principle equally applies to any legislation that uses self-enforcement as a means of enforcement.

To address this deficiency, Transport Canada has extended the application of the Interim Small Vessel Monitoring and Inspection Program to cover all small commercial vessels. Under the program, the first inspection requirement will help ensure that existing vessels meet the regulatory requirement and that they are safe to operate. It is envisioned that this will provide owners/operators with the appropriate information and guidance to operate their vessels safely.

Operator Certification and Safety

A minimum level of skill and knowledge is required of those who operate an automobile or aircraft, whether for commercial or recreational purposes. In the marine environment, there is no such proficiency or competency requirement for operators of small commercial vessels, whether these vessels are used for carrying passengers, fishing activities, or other commercial operations.[8] However, there is a proficiency requirement for some pleasure craft operators, which will apply to all operators by September 2009.[9]

The need for formal training of vessel operators has been recognized by Transport Canada, as well as by the Canadian Coast Guard. *Crewing Regulations* for commercial vessels and the *Competency of Operators of Pleasure Craft Regulations* are intended to address this need. Nevertheless, operators of small vessels, such as passenger vessels of 5 gross tons and under that

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5 *Guide to Inspection Regulations for Small Fishing Vessels,* TP 782*; Small Fishing Vessel Safety Manual,* TP 10038.

6 *Small Commercial Vessel Safety Guide,* TP 14070.

7 TSB Report M96M0144, *S.S. Brothers*, Recommendation M99-02.

8 *Crewing Regulations*, s.29.

9 *Competency of Operators of Pleasure Craft Regulations, Canada Shipping Act.*

do not carry more than 12 passengers, small commercial vessels of 15 gross tons and under, and fishing vessels 60 gross tons and under are not required to demonstrate a minimum level of knowledge to operate their vessels. As a result, many small commercial vessel operators continue to operate in Canadian waters without demonstrating a minimum knowledge.

The lack of a requirement for operators to demonstrate their qualifications and knowledge has been identified as a finding in a number of TSB reports. To address this deficiency, Transport Canada, in consultation with stakeholders, is considering Small Vessel Operator Proficiency requirements that will apply to all commercial vessels currently excluded from the regulations. The new proficiency requirements are being examined as part of the reform of the *Crewing Regulations* and *Marine Certification Regulations*.

Drowning

TSB statistics record 70 marine fatalities for the period 1992–2001, where crew either fell overboard or were carried overboard. An additional 26 fatalities occurred during the same period, a portion of which can be attributed to vessels that foundered or capsized. In British Columbia, Workers' Compensation Board statistics in the fishing industry for the period 1991–2001 record 50 drowning fatalities. Many of these fatalities can be attributed to sudden immersion in cold water (i.e. below 15°C).

In light of the number of cold-water fatalities, Dr. C. J. Brooks prepared the report *Survival in Cold Waters* (TP 13822) for Transport Canada. This report defines the four clear stages of immersion in which death can occur: cold shock (kills within 3–5 minutes after immersion); swimming failure (kills within 30 minutes after immersion); hypothermia (kills after 30 minutes of immersion); and post-rescue collapse (kills at the point of rescue or up to several hours afterward). The report underscores the fact that entry into water below 15°C, even with the aid of flotation, sharply increases the risk of death and should be avoided. Even a lifejacket, if not properly worn or without a spray hood, does not guarantee the victim protection from drowning. Among the report's recommendations are that Transport Canada introduce new regulations for the carriage of liferafts on vessels sailing on waters 15°C and below, and approval of modern inflatable lifejackets in view of the fact that flotation devices are only of benefit when they are worn.

Small commercial vessels vary in size. In addition, they may be of open construction and may be used in a wide range of activities such as whale-watching, where they carry passengers, and log salvage, where they are used to tow logs. The carriage of an inflatable liferaft is not always practical. Hence, personal life-saving equipment that provides both flotation and thermal protection capabilities is essential to maximize survival time for persons in the water. Bearing in mind the need to overcome the most critical phase of cold shock, it is essential that the personal life-saving equipment has the capability to turn the person face-up in the water. A review of available equipment indicates that full-length PFDs equipped with flotation collars provide these capabilities.

The two crew members aboard the *Bruce Brown* were both wearing PFDs, yet the death of one was attributed to hypothermia and the other to drowning. The accident took place close to shore but during darkness. The vessel capsized so rapidly that a radio distress call could not be made and there was little time to prepare for evacuation. The dock under tow would have made a suitable rescue platform; however, without a means of boarding, the cold water rapidly demobilized the victims to the point where this was not possible.

Marine Emergency Duties (MED) Training

Under the *Canada Shipping Act*, *Crewing Regulations*, section 21, all marine crew members, including those on fishing vessels, are required to complete MED training within six months of joining a vessel's crew.

MED training has been required on large commercial vessels since the late-1970s. This training requirement was extended to all small commercial vessels, including small fishing vessels, by Transport Canada in 1997, following findings by the TSB that most marine accidents resulting in loss of life occur on small fishing vessels. The department agreed that a formal training regime was required to create a higher level of safety awareness within the fishing community and to help reduce the number of fatalities.

The training requirement for small commercial vessels applies to crew members on:

- fishing vessels under 150 tons; and

- non-passenger vessels and passenger vessels under 150 tons, with unberthed accommodations only, operating on Minor Waters and Home-Trade voyages, Class IV.

The MED A-3 and MED A-4 courses were developed for crew members on vessels operating no more than 20 miles from shore. These courses provide basic safety-at-sea awareness and are tailored specifically for crew members of smaller vessels and for the environment of near-shore operations.

Transport Canada is currently working with approved safety training providers and industry associations to enhance awareness among mariners about the MED training requirement and to make the training available in remote areas.

Mariners who do not yet have training available in their area of operation were required to demonstrate, before 30 July 2003, or within a reasonable period after the training becomes available in their area, that they have registered to take the appropriate MED course.

Transport Canada will enforce the requirement without exception after 01 April 2007.

Findings as to Causes and Contributing Factors

1. An improper hose connection on the discharge side of the engine's raw water cooling system failed. This failure allowed seawater, supplied by the engine's raw water pump, to quickly fill the vessel's bilges and engine compartment at the after end of the vessel.

2. The vessel's bilge pump was rigged for manual operation and was not fitted with a bilge high level alarm, either visual or audible, nor was this a mandatory requirement.

3. The vessel was not required to carry an emergency position indicating radio beacon (EPIRB), nor did it do so, and the rapidity of the capsize precluded any broadcast of a VHF radio distress call to alert the authority.

4. The personal flotation devices used by the crew of the vessel did not provide adequate flotation and thermal protection capabilities. The vessel was not equipped with an inflatable liferaft, nor was it required to by regulations.

Findings as to Risk

1. The owner/operator converted the vessel for commercial log-salvage operations without informing Transport Canada.

2. Due to the length of the tow, the operator was required to communicate with the Marine Communications and Traffic Services, but did not do so.

3. Transport Canada has developed Marine Emergency Duties (MED) training courses, MED A-3 and MED A-4, specifically for crew members on vessels operating no more than 20 miles from shore to provide basic safety-at-sea awareness training. Neither crew member had taken this training.

Other Findings

1. The object under tow was not lit.

2. The vessel was not appropriately marked with the vessel license number, which delayed identification.

3. There are no marine-specific criteria for the issue of a log salvage licence.

4. The vessel was fitted with a VHF radio, but the operator was not trained or certified in the use of the VHF radio as required by regulations.

Safety Action

In August 2002, Transport Canada issued Ship Safety Bulletin No. 09/2002, *Bilge Pumping Systems: Early Detection Saves Lives*, to communicate to the industry the importance of bilge pumping systems and the early detection of any leakage into the hull compartments of any vessel.

In 2004, Transport Canada issued the *Small Commercial Vessel Safety Guide* (TP 14070).

Transport Canada is in the process of incorporating the *Construction Standards for Small Vessels* (TP 1332) as a Standard, by reference, into the *Small Vessel Regulations*. When this is done, the bilge high level alarm will become mandatory.

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