

Transportation Safety Board
of Canada



Bureau de la sécurité des transports
du Canada

MARINE INVESTIGATION REPORT
M14P0110



MAN OVERBOARD AND SUBSEQUENT LOSS OF LIFE

SMALL FISHING VESSEL *DIANE LOUISE*
QUEEN CHARLOTTE SOUND, BRITISH COLUMBIA
06 JUNE 2014

Canada

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Marine Investigation Report M14P0110

Man overboard and subsequent loss of life

Small fishing vessel *Diane Louise*

Queen Charlotte Sound, British Columbia

06 June 2014

Summary

On 06 June 2014, at approximately 1045 Pacific Daylight Time, a crew member on the fishing vessel *Diane Louise* went overboard while setting prawn traps 9 nautical miles west of Calvert Island, British Columbia. Although the crew member was recovered within minutes, he was unresponsive upon recovery. The crew, along with medical professionals, performed cardiopulmonary resuscitation (CPR). The crew member was then transported to Port Hardy Hospital where he was later pronounced deceased.

Le présent rapport est également disponible en français.

Factual information

Particulars of the vessel

Name of vessel	<i>Diane Louise</i>
Official/Licence number	383428/VRN 23686
Port of registry	Vancouver, British Columbia
Flag	Canada
Type	Fishing, trap
Gross tonnage	16.15
Length ¹	12.37 m
Draught	1.46 m
Built	1977, Fred Crosby Marine, Madeira Park, British Columbia
Propulsion	1 Volvo Penta - D9 diesel engine (221 kW) driving a single fixed-pitch propeller
Cargo	3000 kg of frozen boxed prawns
Crew	4
Registered owner	EMP Fishing Inc., Chilliwack, British Columbia

Description of the vessel

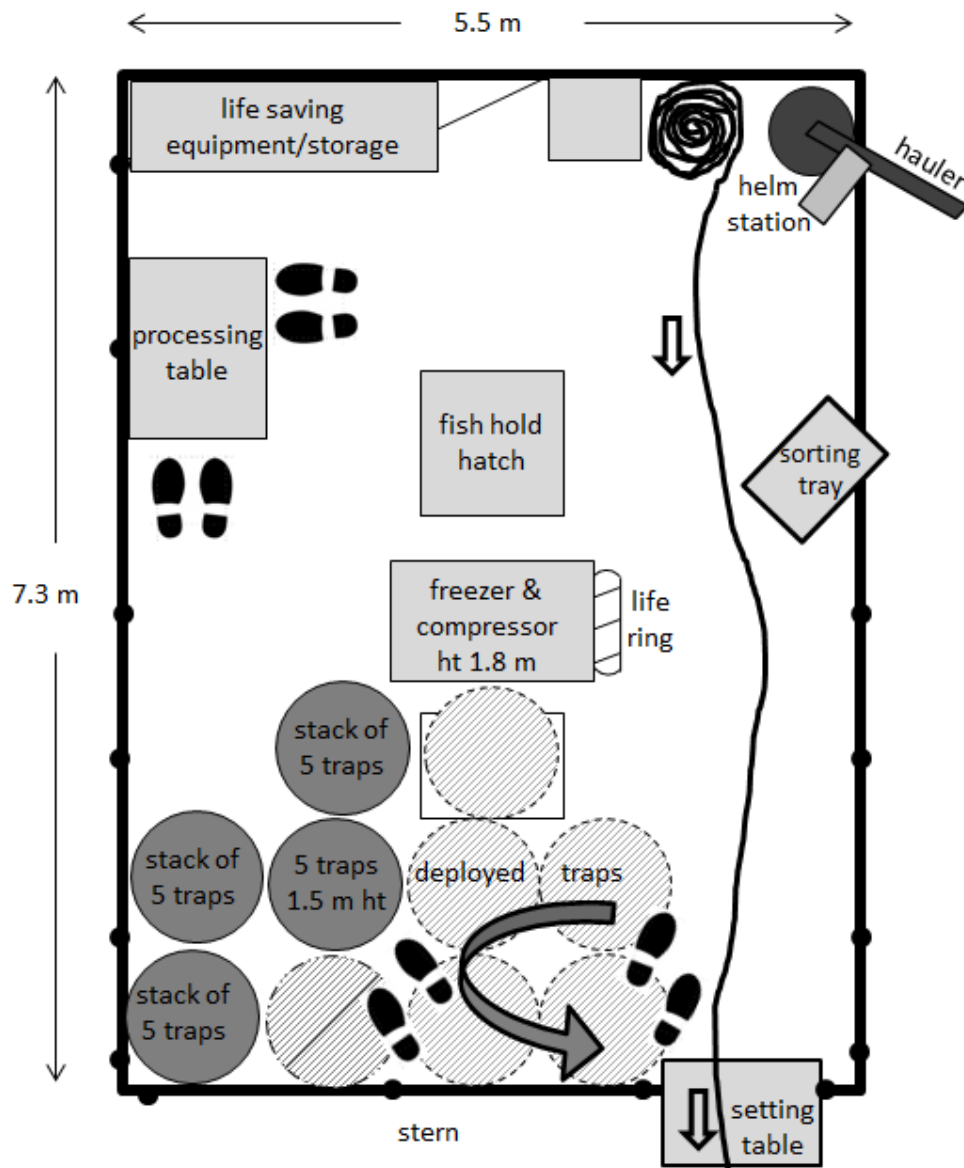
The *Diane Louise* is a small fishing vessel of closed construction, made of fiberglass and used for prawn fishing (Photo 1). The deckhouse is located forward and includes a galley, dinette, raised wheelhouse and accommodation spaces for 3 persons. The hull is subdivided by 3 transverse bulkheads into 4 compartments: a forward, the engine room, an insulated fish hold and a lazarette, which includes the freshwater and fuel tanks. The engine compartment can be accessed through a hatch in the galley floor.

Photo 1. *Diane Louise* moored at Port Hardy, British Columbia



¹ Units of measurement in this report conform to International Maritime Organization Standards or, where there is no such standard, are expressed in the International System of Units.

Figure 1. *Diane Louise* deck layout



The working deck is surrounded by solid bulwarks of 0.9 m in height; an aluminum railing of 1.1 m in height is attached to the top of the bulwarks, except for the hauling and setting stations, where the middle bar is removed. The working deck contains a helm station, the trap hauler, a lifesaving equipment storage cupboard, a prawn processing table, a blast freezer and a compressor, access hatches, and a setting table (Figure 1). The forward half of the working deck is covered with a tarp that protects the prawn sorting area from the weather but obstructs the visibility of the setting table from the wheelhouse.

The wheelhouse is fitted with navigation and electronic equipment including a very high frequency (VHF) radiotelephone², a radar, a chart plotter, a GPS (global positioning system), and echo sounders.

The vessel is equipped with 4 immersion suits, 4 standard lifejackets³, a life raft, and lifebuoy.

History of the voyage

The 2014 prawn fishery took place from May 8 to June 16, the shortest season on record. This was the first time the *Diane Louise* participated in the fishery using 500 traps (stacked licence⁴) throughout the season, calling into Port Hardy to offload catch and replenish stores. Its crew of 4 set and hauled prawn traps near Calvert Island, British Columbia, about 45 nautical miles north of Port Hardy.

On the morning of 06 June 2014 at approximately 1040⁵, in favourable weather conditions, the 4-man crew of the *Diane Louise* began routine operations for setting the third string of traps. The master was in the wheelhouse steering the vessel, which was making way at 4 knots. Two crew members were sorting and boxing the previous haul's catch while the newest crew member⁶, dressed in lightweight oilskins and a hooded sweatshirt made of cotton, attached traps onto the free-running groundline and set them off the setting table into the water. Each string of traps is intended to consist of the maximum allowable number of traps (50), equally spaced out on a groundline.

About halfway through setting the traps, the crew members processing the catch heard a call for help. At that time, the newest crew member was overboard, in the water, and about 10 m off the stern of the vessel, in position 51°28.7' N, 128°20.2' W (Appendix A). One crew member immediately notified the master while the other crew member deployed the lifebuoy. However, the throwing line of the lifebuoy became entangled in the railing and did not reach the overboard crew member. The master reduced speed, went to the helm station on the working deck and began to turn the vessel around. The master and other crew lost sight of the overboard crew member from their position on deck. The master returned to the wheelhouse to relocate him. Once he was spotted again, the master returned to the helm

² The on-board VHF radio is capable of connecting to an external speaker (used to communicate with crew) and monitoring received audio from a remote speaker.

³ Standard lifejackets will turn individuals onto their backs in order to keep their faces out of the water and are intended to be worn in a marine emergency, whereas personal flotation devices (PFDs) have limited turning capability but are designed for constant wear.

⁴ The owner had been permitted to stack 2 prawn licences on the *Diane Louise*. Stacking licences enables a vessel owner to increase the allocated number of traps from 300 to 500.

⁵ All times are Pacific Daylight Time (Coordinated Universal Time minus 7 hours) unless otherwise noted.

⁶ Hired just prior to the season and having the least fishing experience of all the crew members.

station on deck. The overboard crew member remained visible at the surface of the water until the vessel began to approach him, at which time he disappeared under the surface of the water.

When the crew members could no longer see the overboard crew member, they placed the groundline in the hauler and began to retrieve the traps. Within seconds, a trap broke the surface of the water followed by the overboard crew member, now untangled from the prawn trap bridles, but still attached to the groundline. The crew member had been in the water for approximately 3 minutes and, at around 1048, all 3 crew lifted him over the railing and onto the working deck. He was unresponsive and CPR was started immediately.

The master returned to the wheelhouse and made a Mayday call. The Mayday call was responded to by the U.S. tug *Western Titan* and the passenger ship *Crown Princess*. An automated external defibrillator (AED) was supplied by the tug at approximately 1115, and medical professionals who arrived from the passenger ship at about 1200 applied the AED and continued cardiopulmonary resuscitation (CPR). At 1224, Department of National Defence search and rescue technicians arrived and prepared the crew member for transit. At 1257, the crew member was airlifted to Port Hardy and arrived at Port Hardy Hospital at 1330. He was later pronounced deceased.

Environmental conditions

At the time of the occurrence, there were light winds from the south at 8 knots and a low to moderate 1 m swell from the southwest. The air and sea temperatures were 12°C.

Vessel certification

As a small fishing vessel exceeding 15 gross tonnage (GT), the *Diane Louise* was subject to quadrennial inspections carried out by Transport Canada (TC), and held a valid Ship Inspection Certificate. In April 2013, TC approved the inclining and stability book for the *Diane Louise*; the stability calculations in the book are based on the vessel carrying a load of 300 prawn traps.

Personnel certification and experience

The master had a total of 29 years of fishing experience, including 18 years of prawn fishing, mostly operating the *Diane Louise*. The master possessed a Fishing Master Class 4 and Radio Operator's and Marine Emergency Duties A3 (MED) certificates. He also participated in Fish Safe's⁷ Safest Catch Program⁸ in April 2014, but had not completed the documentation part of the program at the time of the occurrence.

⁷ Fish Safe is an industry-designed and implemented fishing safety organization formed in 2005. Its mandate is to provide safety programs and tools relevant to fishing so that fishermen can take ownership of safety.

⁸ The Safest Catch program is an introduction to safety management systems for fishing vessels and includes facilitation on safety equipment, drills, and safety procedures.

The most experienced crew member of the 2 who were sorting and boxing prawns had 30 years of fishing experience (including several prawn fishing seasons) and possessed Bridge Watchman, MED, and first aid certificates. He also participated in the Safest Catch program with the master. The other experienced crew member held no certification, but had 6 years of fishing experience gained mostly with the master of the *Diane Louise* (including the past 3 prawn fishing seasons).

The newest crew member on the vessel, who was assigned to set the traps, had part-time fishing experience over the last 4 years, but had no prawn fishing experience and held no certification.

Crew familiarization

All new crew members are required by WorkSafeBC and TC⁹ to be given an orientation when they join a fishing vessel. The purpose of this orientation is to provide crew members with adequate basic safety training to effectively and safely perform their assigned duties and tasks. According to WorkSafeBC regulations, the orientation must address general safety as well as safe working practices associated with the tasks to be performed on board.

WorkSafeBC also has specific regulations addressing young or new workers¹⁰ that focus on workplace orientation and training. An employer (master, in the case of fishing operations) must document that a young or new worker is given a health and safety orientation, and ensure that training specific to that young or new worker's workplace includes the following topics:

- workplace health and safety rules (including types of controls such as work procedures and use of personal protective equipment);
- hazards to which the young or new worker may be exposed, including working alone or in isolation; and
- emergency procedures (awareness of potential emergency situations that could occur in the workplace and training in the procedures to follow during emergencies).

The new crew member who was setting traps on the *Diane Louise* received on-the-job training that included the identification of hazards in the operation (e.g., the groundline, entanglement, going overboard) and the location of the lifesaving appliances. At the beginning of the season, the new crew member was responsible for re-baiting the prawn traps during fishing operations; this task requires the least experience and is usually assigned to the newest crew member. But once he became more familiar with the overall

⁹ *Marine Personal Regulations, Canada Shipping Act 2001, Part 2, Division 2, Training and Familiarization, subsection 205(1).*

¹⁰ *WorkSafeBC, Occupational Health and Safety Regulations, Part 3 Rights and Responsibilities (section 3.23).*

fishing operation, the more experienced crew members showed him how to set traps and continued to supervise as they slowly introduced the practice of snapping the traps on the groundline. During one supervised trap setting session, the new crew member experienced the danger of entanglement as the groundline became snarled, came close to wrapping around his hand, and nearly entangled him. He continued to perform the task part-time until such time as the other crew members were comfortable with his abilities and then he was permitted to set the prawn traps unsupervised, when the weather conditions were favourable.

Safe work practices

In British Columbia, masters are responsible for identifying existing and potential hazards and establishing safety procedures to mitigate risks¹¹. TC has similar regulations that place the responsibility on the authorized representative to develop procedures for the safe operation of the vessel¹². The resulting safe work practices help ensure that masters and crew have the knowledge as well as the necessary information to make sound decisions in any operating condition – including both routine and emergency operations.

Some guidance is available to help develop safe work practices. In 2013, the Pacific Prawn Fishermen’s Association (PPFA) developed and distributed a best practices document for the prawn fishery entitled *Best Industry Recommended Practices*. Some of the recommended practices included :

- ensuring that suitable personal flotation devices (PFD) are available for all on board,
- remembering to wear a PFD on the working deck,
- always having a knife nearby while setting traps,
- conducting a crew orientation, and
- participating in Fish Safe’s Safest Catch Program.

As well, WorkSafeBC’s booklet, *Gearing up for Safety*, emphasizes the requirement to have procedures to address identified hazards, document and communicate these procedures to crew, to wear PFDs, have a knife available, and conduct crew orientation. However, the master was not aware of the existence of this booklet or that of the PPFA.

On-board hauling and trap setting practices

The fishing operation on board the *Diane Louise* includes setting and hauling prawn traps, as well as processing the catch. The hauling and setting of traps is carried out by 4 crew members (Figure 1). During this practice, the master operates the hauler, while one crew

¹¹ WorkSafeBC, *Occupational Health and Safety Regulations*, Part 3 Rights and Responsibilities [paragraph 3.16(2)(b)] Part 24, Diving, Fishing, and Other Marine Operations, Fishing Operations: General Requirements, (section 24.72).

¹² *Canada Shipping Act 2001*, Part 4 subsection 106(1).

member releases the traps off the groundline and sorts the catch. As the traps are retrieved, one crew member coils the groundline on the working deck¹³ while the new crew member re-baits the empty traps in preparation for setting. After all the traps are retrieved, the master returns to the wheelhouse and prepares to set the traps in the next location while the crew begins to process the catch¹⁴ and arrange the traps on deck. During favourable weather conditions, the new crew member was assigned to set traps. The *Diane Louise* is similar to most prawn vessels in that it is not equipped with a drum, there was therefore no emergency means to stop the free-running groundline other than to attempt to stop the forward momentum of the vessel¹⁵. The groundline can occasionally develop kinks and snarls depending on the age and material of the line, how and where the line is coiled, the motion of the vessel, and how the line gets from the coil to the setting table. On the *Diane Louise*, the line ran vertically to a ring of 10 cm in diameter above the coil and then horizontally to the setting table usually guided by the crew members hand.

It was the practice on board that the pace of setting traps is constant: as the groundline pays out freely and continuously according to the speed of the vessel (needed for steerage), the individual traps are snapped on pre-determined marked positions on the groundline. In some situations, the crew member setting traps manually slows the groundline pay out (by tightening his grip as it runs through his hand), to help ensure that the maximum number of traps is attached to the groundline. After the slowed groundline is released, the line can recoil, causing kinks and snarls to form. The arrangement of the pre-baited traps on the *Diane Louise* was such that the first trap to set was the closest to the setting table and the last trap to set was the furthest away for the setting table (Figure 1). This arrangement resulted in the crew member being exposed to the risk of entanglement and the need to work more quickly as the distance between the setting table and the next trap increased; at the same time, he attempted to ensure that the 50 traps were snapped on the pre-determined marked positions on the groundline. There were no standard procedures with regard to avoiding entanglement with the groundline.

Personal flotation devices

In Canada, falling overboard is the second highest cause of fatality in the fishing industry¹⁶. Falling into water below 15°C involves an initial cold shock, which is most dangerous and

¹³ Other prawn fishing operations coil the groundline into a bucket or over turned prawn trap to contain the line for setting.

¹⁴ Processing the catch involves separating the prawns by size, boxing them and loading the deck freezer with the catch.

¹⁵ The normal practice for prawn fishing vessel is to set gear so it free-falls off the deck and not off of a drum, allowing the traps to be set at the desired location and depth.

¹⁶ Transportation Safety Board of Canada, Safety Issues Investigation Report No. M09Z0001, *Safety Issues Investigation into Fishing Safety in Canada*, p. 31.

potentially lethal when a person is suddenly immersed in water¹⁷. This can be quickly followed by exhaustion while the person attempts to stay afloat. This exhaustion increases rapidly without the assistance of a PFD.

Requirements

TC's minimum requirement for individual flotation devices is the carriage of lifejackets, which are designed for use when the vessel must be abandoned and provide a higher level of protection than most PFDs in such cases. WorkSafeBC Occupational Health and Safety (OHS) regulations require a PFD or lifejacket to be worn by "a worker who is employed under conditions which involve a risk of drowning¹⁸." TC's proposed new Fishing Vessel Safety Regulations¹⁹ prohibit anyone from operating a fishing vessel in environmental conditions or circumstances that may cause a risk to personal safety unless a lifejacket or PFD is worn. Both WorkSafeBC regulations and TC's proposed regulations place the onus on fishing vessel masters to determine whether or not a risk is present. Therefore, PFDs are not mandatory in all fishing operations. However, WorkSafeBC considers that PFDs are required in most fishing operations due to the risk of drowning being present. There are some parts of fishing operations that may be excluded, such as working in the wheelhouse or working on deck at the sorting table, if guardrails are in place to protect the worker from falling overboard.

Since 2001, in Quebec, the Commission de la santé et de la sécurité du travail (CSST) has been enforcing the OHS provisions of *An Act Respecting Occupational Health and Safety* (CQLR, chapter S-2.1, division II, subsection 2-51) "Every employer must take the necessary measures to protect the health and ensure the safety and physical well-being of his workers." Recently, the CSST has sent letters to all masters on lobster fishing vessels explaining the regulations pertaining to the mandatory use of a lifejackets on board fishing vessels and has met with 150 vessels to ensure compliance.

Usage

The TSB's *Safety Issues Investigation into Fishing Safety in Canada* (SII)²⁰ showed that many fishermen still resist wearing a PFD, which is a widespread challenge in the fishing community. In many cases, fishermen have accepted the known risk of falling overboard while not wearing a PFD and, since 2004 the lack of a PFD usage has been present in 44% of

¹⁷ Dr. C.J. Brooks, K.A. Howard, et.al., "Chapter 10 - Drowning is Not a Helpful Diagnosis Written on the Death Certificate," *Survival at Sea for Mariners, Aviators and Search and Rescue Personnel*, North Atlantic Treaty Organization and Research and Technology Organization (February 2008) [http://ftp.rta.nato.int/public//PubFullText/RTO/AG/RTO-AG-HFM-152//\\$\\$AG-HFM-152-ALL.pdf](http://ftp.rta.nato.int/public//PubFullText/RTO/AG/RTO-AG-HFM-152//$$AG-HFM-152-ALL.pdf). Last accessed 22 December 2014.

¹⁸ WorkSafeBC, *Occupational Health and Safety Regulations*, Personal Clothing and Equipment, Part 8.26(1). These are non-specific to fishing but are applied to the fishing industry.

¹⁹ The proposed regulations are planned to be released in the first quarter of 2015.

²⁰ Transportation Safety Board of Canada, *Safety Issues Investigation Report No. M09Z0001, Safety Issues Investigation into Fishing Safety in Canada*.

fishing-related fatalities in British Columbia. As a result, there are several education and awareness programs and initiatives within the community that attempt to change behaviours and promote the use of PFDs. In British Columbia, Fish Safe's Real Fishermen campaign uses posters, brochures and mugs featuring fishermen wearing PFDs. In Nova Scotia, a fishing safety working group²¹, in consultation with fishermen and suppliers, uses initiatives such as wharf visits, family pledges, an elementary school poster contest, advertising, and design testing to increase awareness of the importance of wearing PFDs.

Research on changing work practices has shown that, in part because of the contextual factors of the physical and economic environments in which they are practiced, unsafe work practices can be difficult and slow to change²². Crews may routinely work without experiencing accidents, which reinforces any unsafe work practices that are relied on regularly²³. One recent study evaluated the perceptions of commercial fishermen towards different PFD designs as a means of understanding why fishermen traditionally fish without wearing a PFD; it found that PFD designs better suited for different fishing operations may increase PFD usage²⁴.

In this occurrence, 4 standard lifejackets, as required by TC, were available to crew members but were not intended to be worn on board while working, nor were they designed for that purpose. The crew were not wearing PFDs while working on deck, nor were there any available. This was a normal on-board practice.

Safety Issues Investigation into Fishing Safety in Canada

In August 2009, the TSB undertook an in-depth safety issues investigation into fishing vessel safety in Canada. The resulting SII report was released in June 2012 and provides an overall, national view of safety issues in the fishing industry, revealing complex relationships and interdependencies among these issues. The Board identified the following significant safety issues requiring attention: stability, fisheries resource management (FRM), lifesaving appliances, training, safety information, cost of safety, safe work practices, regulatory

²¹ The group consists of representatives from Nova Scotia Fisheries Sector Council, Fisheries Safety Association of Nova Scotia, Nova Scotia Department of Labour and Advanced Education and Workers Compensation Board of Nova Scotia.

²² D.M. Dejoy, Behaviour change versus culture change: Divergent approaches to managing workplace safety, *Safety Science* Volume 43, 2005, pp. 108.

²³ S. Dekker, Drift into failure: from hunting broken components to understanding complex systems, 2011, pp. 14.

²⁴ D. Lucas, D. Lincoln, J Somervell and P. Teske, Worker satisfaction with personal flotation devices (PFDs) in the fishing industry: Evaluations in actual use, 2012, *Applied Ergonomics*, Volume 43, pp. 747-752.

approach to safety, fatigue, and fishing industry statistics²⁵. These 10 issues form part of the work context of commercial fishing in Canada.

Previous recommendations

In 2003, following the *Cap Rouge II*²⁶ occurrence, the Board recommended that:

The Department of Transport, in collaboration with the fishing community, reduce unsafe practices by means of a code of best practices for small fishing vessels, including loading and stability, and that its adoption be encouraged through effective education and awareness programs.

TSB Recommendation M03-07

Regional fishing communities, supported by government infrastructure and TC initiatives, are making strides towards the adoption of a code of best practices for small fishing vessels. Fishermen are becoming more aware of the complex nature of their environment and of the risks inherent with their operations. Regional codes of best practices have begun to emerge locally but are not yet in place across all the regions. The response to Recommendation M03-07 was assessed in 2015 as Satisfactory Intent²⁷. The recommendation remains active.

Previous occurrences

The following recent occurrences were reported to the TSB, but no investigation reports were issued:

On 21 May 2011, a fisherman on board the *L'Echo des Mers I* drowned after he was pulled overboard by the lobster traps that he was setting near l'Étang-du-Nord, les Îles-de-la-Madeleine, Quebec. The unresponsive body was subsequently recovered (TSB occurrence number M11L0111).

On 27 April 2013, a deckhand on a herring punt was setting crab traps near the mouth of the Fraser River, British Columbia, when his leg was caught in the rope and he was dragged overboard. Although the deckhand was recovered and received medical attention, he was later pronounced deceased (TSB occurrence number M13W0061).

On 20 June 2014, a crew member on the fishing vessel *Lady Jenna II* was hauled overboard while setting turbot gillnets off of Cape Bonavista, Newfoundland and Labrador. Although the crew member was recovered, he later succumbed to his injuries (TSB occurrence number M14A0263).

²⁵ Transportation Safety Board of Canada, Safety Issues Investigation Report No. M09Z0001, *Safety Issues Investigation into Fishing Safety in Canada*.

²⁶ Marine Investigation Report M02W0147 and TSB Recommendation M03-07.

²⁷ A Satisfactory Intent rating is assigned if the planned action, when fully implemented, will substantially reduce or eliminate the safety deficiency, and meaningful progress has been made since the recommendation was issued.

TSB Watchlist

In November 2014, the Board released its third *Watchlist*, which identifies critical safety issues investigated by the TSB that pose the greatest risks to Canadians. One of these critical safety issues is the loss of life on fishing vessels, given that there continues to be approximately 1 fishing-related fatality per month in Canada. The Board remains concerned about the use and availability of lifesaving appliances on board and unsafe operating practices. Although regulations have been proposed by TC to address several deficiencies with respect to fishing safety, there have been significant delays in their implementation.

The *Watchlist* highlights the need for concerted and coordinated action by federal and provincial authorities and by leaders in the fishing community to improve the safety culture in fishing operations, recognizing the interaction of safety deficiencies.

Analysis

Events leading to the man overboard and loss of life

On the morning of 06 June 2014, at approximately 1040, the crew of the *Diane Louise* began setting the third string of prawn traps near Calvert Island. The master was in the wheelhouse navigating the vessel at 4 knots and 2 crew members were sorting and boxing the previous hauls. Given the favourable weather conditions, the previous success at performing the task unassisted after training, and the need for efficiency, it was determined that the new crew member could set the traps without assistance. Neither the master nor the crew processing the catch assisted with or monitored the setting of traps.

The investigation was unable to determine, the circumstances that resulted in the crew member going overboard. While the crew member was setting traps, the distance between the setting table and the next trap to attach to the groundline gradually increased as his supply of traps lessened. This increasingly longer distance required the crew member to work more quickly and turn his attention away from the groundline to retrieve traps. The TSB investigation concluded that the most plausible scenario was that, during this process, the crew member became entangled in the groundline and attached to it. The forward momentum of the vessel and the drag from the already submerged traps then pulled the crew member overboard.

Once overboard, the crew member, although not wearing a personal flotation device (PFD), managed to stay afloat in the 12°C water long enough to call for help and attempt to free himself from the groundline. The vessel turned around to retrieve him but lost sight of him. Attempts to provide a lifebuoy also failed, delaying the retrieval. The crew member was unable to free himself from the entanglement and he was drawn under the water. The crew on board used the hauler to retrieve the traps and crew member. Although he was recovered within minutes and cardiopulmonary resuscitation (CPR) was performed, the crew member was subsequently pronounced deceased.

Managing work practice risks

Fishing operations, such as those that involve the setting of any kind of fishing gear, have a particular set of hazards and risks that must be managed. One common risk for operations involving setting traps is the risk of becoming entangled.

In this occurrence, the crew demonstrated that they were aware of the risk of entanglement, but did not manage it consistently. Instead, each crew member developed their own informal strategy for managing the risk, based on their individual experience. This inadequately addressed the risk of entanglement, especially for those on board with minimal experience. For example:

- In poor weather conditions, where there is increased vessel movement, increased chance of the groundline becoming snarled, and possible movement of the traps, a crew member could take it upon himself to assist with trap setting.

- If the groundline became snarled or tangled, or the crew member was experiencing difficulty ensuring that the maximum number of traps were attached to the groundline, each crew member would determine individually when to miss a mark and attach the trap only when it was safe to do so.
- To alert the other crew members when assistance was needed, a crew member would call out verbally. There was also no means for a crew member to stop the groundline or the vessel while setting traps from the setting table. The only means to stop the vessel from the working deck was from the helm station located at the forward end of the working deck.
- To alert the master when assistance was needed, a crew member would need to verbally call out to the master in the wheelhouse. The master's view of the setting table was obstructed, which made it difficult for him to be aware of any dangerous situation developing since he had no other means to monitor the crew member's well-being.
- One of the crew members carried a knife on his person, as a means of freeing himself should he become entangled. The benefits of carrying a knife were discussed amongst crew members. Knives were available to crew but not required to be carried.

All of the above were ways in which the risk of entanglement was addressed on an informal, ad-hoc basis and mostly based on experience.

Although it was required by WorkSafeBC that masters identify potential risks and establish safety procedures to mitigate them, the operational practices and behaviours on board the *Diane Louise* had become routine and the vessel operated this way during 18 accident-free prawn fishing seasons. Despite the existence of safety regulations, inspection programs, and participation in safety programs by the crew, some of the fishing practices on the *Diane Louise* posing risks to crew were not changed.

Fishermen are often aware of the risks present in their fishing operations. However, few conduct full and formal risk assessments, which are crucial to the safety of fishing operations. This form of assessment involves the identification of safety-critical tasks, equipment, and situations that may pose a risk to the operation and also the implementation of process or means for addressing those risks on an ongoing basis. During an assessment, master and crew can go through steps to more effectively identify and mitigate the risks and hazards in their operations (Figure 2).

Recently, the safety research community began encouraging the use of safety management as a modern approach to managing operational hazards and risks, formally, while paying particular attention to the commercial fishing environment. The TSB's *Safety Issues Investigation into Fishing Safety in Canada* (SII) also advocates that fishermen recognize the physical and environmental hazards present in their operations, understand the risks, and develop habits to make their operations safer²⁸. Any efforts to improve safety in commercial fishing have to be made in consideration of the difficult operating environment and must be tailored to work within that context.

Figure 2. Cycle of risk assessment



If fishermen do not conduct comprehensive risk assessments, despite being aware of many workplace hazards and risks, unsafe work practices may persist or develop.

Personal flotation device usage

Of the several unsafe practices on fishing vessels that have been identified by the TSB over the years, not wearing personal flotation devices (PFD) is a significant one. In the fishing community, the reasons provided by fishermen for the resistance to use PFDs include discomfort, the risk of entanglement, and the perception that it is not practical or normal to wear a PFD. Furthermore, risks such as falling overboard, drowning and entanglement, are perceived to be low or accidental, with the result that fishermen see little benefit to protecting themselves from these risks while they focus on the day-to-day business of fishing²⁹. As well, unsafe behaviours that are rooted in traditional values, attitudes, practices, and the perception of efficiency prove the most difficult to change³⁰. Recently, research and safety efforts have focused on commercial fishing and the behaviours involved. The resulting statistics about the high risks of the commercial fishing industry are being analysed^{31, 32}.

²⁸ Transportation Safety Board of Canada, Safety Issues Investigation Report No. M09Z0001, *Safety Issues Investigation into Fishing Safety in Canada*, p. 16.

²⁹ Transportation Safety Board of Canada, Safety Issues Investigation Report No. M09Z0001, *Safety Issues Investigation into Fishing Safety in Canada*, Life Saving Appliances and the Cost of Safety, pp.63-66.

³⁰ D.M. Dejoy, Behaviour change versus culture change: Divergent approaches to managing workplace safety, *Safety Science* Volume 43, 2005, p. 108.

³¹ M.E. Davis, Perceptions of occupational risk by US commercial fishermen, *Marine Policy*, 36, 2012, pp. 28-33.

³² P.H. Lindoe, Safe offshore workers and unsafe fishermen – a system failure? *Policy and Practice in Health and Safety*, 2007, pp. 25-39.

In this occurrence, there were no PFDs available on board, nor was it the practice for the crew to wear PFDs during fishing operations. When the crew member went overboard he was not wearing a flotation device. The investigation could not determine, given that the crew member was entangled, whether or not the absence of a PFD played a contributory role in this occurrence. However, the crew member was treading water for period of time: a PFD would have assisted him to stay afloat while he attempted to free himself. The wearing of PFDs is also recommended by regulators and fishing associations.

Despite industry initiatives to change behaviours and create awareness about the importance of wearing PFDs, and the regulations that require their use when there is a risk of drowning the non-use of PFDs remains a particular challenge, consistent across the fishing community.

If fishermen continue to not wear PFDs or lifejackets while working on deck, despite the industry awareness initiatives and regulations requiring their use, then there is an increased risk of drowning when overboard.

Safety issues in the fishing industry

The SII categorized actions impacting safety into 10 significant safety issues and found that there are complex relationships and interdependencies among them. These safety-significant issues are further analyzed in the SII³³. In this occurrence, 4 of these 10 safety-significant issues were present and are reflected in the on board practices and procedures of the *Diane Louise*.

Lifesaving appliances

Safety issues investigation findings	Relationship to this occurrence
Fishermen resist wearing PFDs because many have accepted the risk.	It was the perception on board the <i>Diane Louise</i> that falling overboard and drowning was highly unlikely and they chose to accept the risk.
Fishermen do not always conduct drills.	The crew did not participate in emergency drills on board the <i>Diane Louise</i> prior to the season.

Training

Safety issues investigation findings	Relationship to this occurrence
Fishermen assess and manage risk based on experience.	Although the risk of entanglement was known, there had never been a crew member previously entangled on board the <i>Diane Louise</i> ; this was one factor that contributed to the risk not being fully addressed.

³³ Transportation Safety Board of Canada, Safety Issues Investigation Report No. M09Z0001, *Safety Issues Investigation into Fishing Safety in Canada*.

Safety information

Safety issues investigation findings	Relationship to this occurrence
Safety information does not always reach those in the fishing community who need it.	The master on board the <i>Diane Louise</i> was not aware of available safety information, such as the Pacific Prawn Fishermen's Association's publication of its Best Industry Recommended Practices and the WorkSafeBC <i>Gearing up for Safety</i> booklet.

Cost of safety

Safety issues investigation findings	Relationship to this occurrence
Fishermen generally see the likelihood of an accident happening as very low.	A possible fatality from falling overboard off the <i>Diane Louise</i> was considered very unlikely and low risk.

Interdependency of safety issues

The safety of fishermen is compromised by numerous issues which are interconnected. The following safety issues share a complex relationship and contributed to this occurrence:

- Unsafe work practices – the practice of not wearing PFDs, not conducting drills after hiring new crew members, and the trap setting practice on board.
- Training – the risks of falling overboard and entanglement were known but not fully addressed.
- Safety information – the master was unaware of available guidance regarding best practices.
- Lifesaving appliances – drills were not conducted after hiring new crew members and the risks of not wearing a PFD were accepted.

In this occurrence, there were a number of interrelated unsafe conditions and safety issues. Within the fishing industry, past attempts to address these safety issues on an issue-by-issue basis have not led to the intended result: a safer environment for fishermen. The SII emphasized that in order to obtain real and lasting improvement in fishing safety, change must address not just one of the safety issues involved in an accident, but all of them, recognizing that there is a complex relationship and interdependency among those issues. Removing a single unsafe condition may prevent an accident, but only slightly reduces the risk of others. The safety of fishermen will be compromised until the complex relationship and interdependency among safety issues is recognized and addressed by the fishing community.

Findings

Findings as to causes and contributing factors

1. It is likely that the crew member became entangled in the groundline and attached to it. The forward momentum of the vessel and the drag from the submerged traps then pulled him overboard.
2. The crew member was setting traps alone. The other crew members were not aware that he went overboard until they heard him calling for assistance.
3. The crew member was not wearing or using any means of flotation to help him stay at the surface of the water while he attempted to untangle himself from the groundline.
4. The crew member was unable to free himself from the entanglement and was pulled underwater and drowned.

Findings as to risk

1. If fishermen do not conduct comprehensive risk assessments, despite being aware of many workplace hazards and risks, unsafe work practices may persist or develop.
2. If fishermen continue to not wear PFDs or lifejackets while working on deck, despite the industry awareness initiatives and regulations requiring their use, there is an increased risk of drowning when overboard.
3. The safety of fishermen will be compromised until the complex relationship and interdependency among safety issues is recognized and addressed by the fishing community.

Other findings

1. The *Diane Louise* was fishing with 500 traps; however, the carriage of 500 traps was not assessed in its stability book.

Safety action

Safety action taken

Use of personal flotation devices – Marine Safety Information Letter 04/14

On 27 June 2014, the Transportation Safety Board of Canada (TSB) issued a Marine Safety Information Letter addressed to WorkSafeBC to advise them that the crew on board were not using personal flotation devices (PFDs) while working on deck, nor were there any on board available for use. The letter also notes that the Workers Compensation Board *Occupational Health and Safety regulations* regarding PFD usage currently place the onus on the vessel masters to determine whether they or their crew members are at risk of drowning if not wearing a PFD.

This report concludes the Transportation Safety Board's investigation into this occurrence. The Board authorized the release of this report on 10 June 2015. It was officially released on 15 June 2015.

Visit the Transportation Safety Board's website (www.tsb.gc.ca) for information about the TSB and its products and services. You will also find the Watchlist, which identifies the transportation safety issues that pose the greatest risk to Canadians. In each case, the TSB has found that actions taken to date are inadequate, and that industry and regulators need to take additional concrete measures to eliminate the risks.

Appendices

Appendix A – Area of the occurrence

