

MARINE OCCURRENCE REPORT

M96M0144

INJURY

FISHING VESSEL "S.S. BROTHERS"

OFF YARMOUTH, NOVA SCOTIA

08 OCTOBER 1996





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 Occurrence Report

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### *Synopsis*

The "S.S. BROTHERS" was hauling in the scallop rake in good weather conditions. Two deck-hands were positioned, one at the winch controls and the other to guide the incoming wire onto the winch barrel. No guard was fitted to the winch. Once the hauling process had started, the deck-hand at the winch controls left the controls unattended to begin the task of washing down the deck in preparation for the return to Yarmouth. When the deck-hand who was engaged in guiding the incoming wire saw the 25-fathom warning mark on the wire, he left his post and attempted to climb over the winch to reach the controls. He slipped and fell to the deck. His right leg was drawn into the winch and crushed between the incoming wire and the winch barrel.

The Board determined that the accident was caused by the deck-hand attempting to step over the winch to gain access to the controls. Factors contributing to the accident were: the deck winch was uninspected and not fitted with a machinery guard; the deck-hand was operating the winch alone; the deck and the surfaces of the winch were slippery. It is also likely that the deck-hand's ability to make a reasoned decision on the safe operation of the winch was adversely affected by fatigue caused by his work/rest schedule.

*Ce rapport est également disponible en français.*



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## 1.0 *Factual Information*

### 1.1 *Particulars of the Vessel*

	"S.S. BROTHERS"
Official Number	396113
Port of Registry	Yarmouth, Nova Scotia
Flag	Canada
Type	Fishing and/or Scallop Dragger
Gross Tons	40.05 <sup>1</sup>
Length	13.7 m
Built	1981, Wedgeport, Nova Scotia
Propulsion	260 kW <sup>2</sup> Diesel
Crew	4
Owner(s)	Yarmouth Sea Products, Yarmouth, Nova Scotia

#### 1.1.1 *Description of the Vessel*

The "S.S. BROTHERS" is a traditional east coast, Cape-Island style, wooden-hulled vessel with the wheel-house and accommodation forward and the work deck aft, above the hold.

The dump table is located on the starboard side of the vessel and the winch is located at the forward end of the work deck. A covered shucking house extends along the port side of the work deck and houses the winch control station at the forward end.

### 1.2 *History of the Voyage*

On 08 October 1996, the vessel was hauling in the scallop rake for the last time before returning to Yarmouth. Winds were southerly at about five knots with a low swell. The vessel was neither rolling nor pitching and there was no snag on the wire. At the commencement of the haul, one deck-hand (deck-hand No. 1) was positioned inboard of the winch to guide the wire onto the winch barrel while another deck-hand (deck-hand No. 2) was positioned outboard of the winch to operate the winch controls. The skipper was on the bridge navigating the vessel and the mate was resting in his bunk.

<sup>1</sup> 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) of units.

<sup>2</sup> See Glossary at Appendix C for all abbreviations and acronyms.

Once the hauling process had started, deck-hand No. 2 left the winch controls unattended to begin washing down the deck in preparation for the return to Yarmouth. Deck-hand No. 1 continued to guide the wire on to the winch drum until, at about 0730,<sup>3</sup> he saw the 25-fathom warning mark on it. At that point, he decided to climb over the after end of the winch to handle the controls; he neither went around the winch to gain access to the controls nor did he call out to deck-hand No. 2 to return to the controls. He put his left foot on the after barrel shaft bearing housing in the vicinity of the grease nipple and when his weight came on the housing, his left foot slipped and he fell to the deck. His right foot was drawn into the winch and caught between the incoming wire and the turns already on the winch barrel. As his foot was being dragged on to the winch barrel, he called out to the deck-hand No. 2 who immediately returned to the controls and stopped the winch.

The skipper, hearing a commotion on the after-deck, left the bridge and assisted the injured deck-hand as the winch was being reversed. After a quick assessment of the deck-hand's injuries, he returned to the bridge and at about 0745, called Yarmouth Marine Communications and Traffic Services Centre (MCTS) to request assistance.

After receiving medical advice, the injured deck-hand was carefully moved out of the way of the winch and the scallop rake was recovered. The vessel then headed back to Yarmouth, approximately 15 miles away. During the return voyage, communications were maintained between the vessel, Yarmouth MCTS Centre and the hospital in Halifax.

At about 1000, the vessel secured at Yarmouth and the injured deck-hand was removed from the vessel. He was transported by ambulance to a local hospital, stabilized and then transferred by air ambulance to a hospital in Halifax.

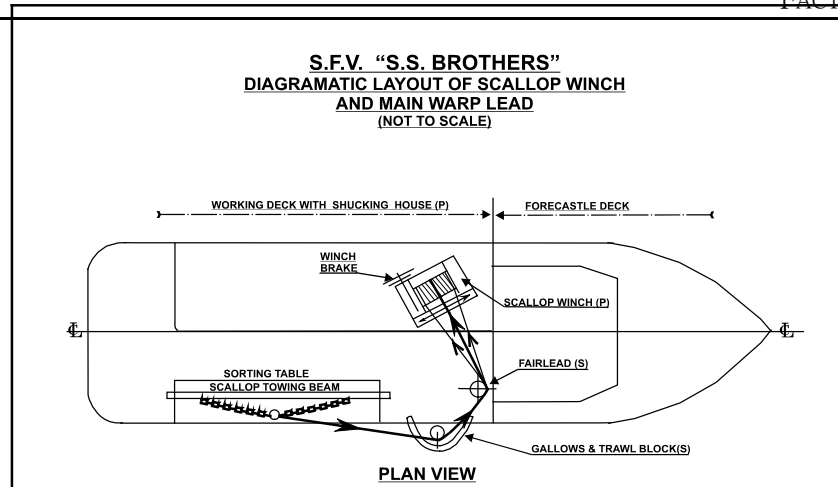
### *1.3 Fishing Equipment and Operation*

#### *1.3.1 Description of the Winch*

The winch, used to raise and lower the scallop rake, is located on the port side of the after-deck, angled slightly forward. One end of the warp is secured to the rake and the other end to the winch. The warp is led through a single roller fairlead situated forward of the winch on the starboard side. The controls are located on the outboard forward end of the winch, above the hydraulic motor. The winch is not fitted with an automatic spooling system. Instead, a round steel bar, stepped in one of seven holes in a plate attached to the winch bed plate, is used to manually guide the incoming wire in even layers on to the barrel of the winch. When not in use, the bar is retained in the aftermost of the holes in the plate and secured by a ring attached to the shucking house forward, inboard bulkhead.

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<sup>3</sup> All times are ADT (coordinated universal time (UTC) minus three hours) unless otherwise noted.



### 1.3.2 Winch Operation Procedure and Shipboard Practice

The winch was fitted with neither winch guards nor a spooling mechanism. It requires a minimum of two persons to operate safely, with one person at the controls and a second spooling the wire onto the drum.

The general practice on board the vessel was to have a “two-person operation” when the scallop rake was hauled in, as described in Section 1.2. For this operation, both persons need to remain at their stations until the task is completed. However, there were occasions when the operation was carried out by one person. Also, deck-hands, including the one who was injured, have in the past climbed over the winch to gain access to the controls when they were in a hurry.

### 1.3.3 Winch Operation and Safety

Safe winch operation has been an ongoing concern for Transport Canada Marine Safety (TCMS). Over the years a number of initiatives have been taken, including the issuing of Ship Safety Bulletins and distribution of the publication *Manual of Safety and Health for Fishermen*. This manual suggests that all winches should be properly guarded (Section 6.2.1), that operating instructions be posted close to the controls (Section 6.2.10) and that winch operators should not leave winches unattended with power on or with load suspended (Section 6.2.15).

## 1.4 *Work Schedule and Work Environment*

### 1.4.1 *Work/Rest Schedule*

The vessel departed Yarmouth on 05 October 1996 at approximately 0040, with a crew of four. Throughout the trip the crew worked a nine-hours-on, three-hours-off schedule. During the three-hour period the crew was off-duty, they were expected to have their meals, attend to personal needs and sleep.

The scheduled off-duty periods for deck-hand No.2 were 2100–2400 and 0900–1200. He began work at 0000 on the day of the occurrence and had been working for approximately seven and a half hours at the time of the accident.

The scheduled off-duty periods for deck-hand No. 1 were 0000–0300 and 1200–1500. He began work at 0300 on the day of the occurrence and had been working for approximately four and a half hours at the time of the accident.

The accident occurred after three days of working a rotating cycle of nine hours on and three hours off. As such, the crew's normal circadian rhythm was disrupted and a sleep debt would have been accumulating—particularly as time off could not be completely dedicated to sleep.

### 1.4.2 *Sleeping Accommodation*

The sleeping accommodation was located in the cuddy in the fore part of the vessel, below main deck level. A glass skylight provided an emergency exit from the accommodation to the main deck. A wooden bulkhead separated the accommodation from the engine-room, with some engine noise filtering into the accommodation.

## 1.5 *Fatigue*

Fatigue<sup>4</sup> may be described as a physiological state characterized by impaired performance and diminished alertness. Two well-documented causes of fatigue are inadequate sleep (quantity or quality) and disruption of circadian rhythm. Lack of sleep, poor-quality sleep and circadian disruption can result from irregular work schedules.

### 1.5.1 *Performance Degradation as a Result of Fatigue*

Performance degradation as a result of fatigue manifests itself in many ways, including falling asleep against the will of the individual (micro-sleeps), failure to respond, slowed reactions (physical reaction and the speed of thought processes), incorrect actions, flawed logic and judgement, increases in false responses, increases in memory errors, vigilance decrement, reduced motivation, laxity and an increased propensity for risk taking.<sup>5</sup>

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<sup>4</sup> See Appendix A for detailed information on these factors.

<sup>5</sup> The material in this paragraph is paraphrased from David F. Dinges, *Performance Effects of Fatigue*,

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Fatigue Symposium Proceedings, November 1995, National Transportation Safety Board and NASA  
Ames Research Center.

## 1.6 *Injuries to Persons*

	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Missing	-	-	-	-
Serious	1	-	-	1
Minor/None	3	-	-	3
Total	4	-	-	4

## 1.7 *Vessel Certification—Fishing Vessels*

### 1.7.1 *Ship Inspection Requirement and Safety*

TCMS, pursuant to the *Canada Shipping Act (CSA)*, is responsible for the overall safety of fishing vessels and inspection certificates are issued for vessels over 15 gross tons. The “S.S. BROTHERS” was in possession of a valid ship inspection certificate SIC29 due to expire on 18 September 1998. The winch, which formed part of the vessel’s work deck space, was not inspected; according to TCMS, fishing equipment (such as winches) is not subject to inspection nor do regulations require that it be inspected.

### 1.7.2 *Canada Shipping Act Regulations and Fishing Operations*

Two regulations, the *Safe Working Practices Regulations (SWPR)* and the *Tackle Regulations*, made pursuant to the CSA, cover issues with respect to the work deck space and loading/discharging equipment aboard vessels. The *Tackle Regulations* do not apply to fishing vessels.

However, section 3 of the SWPR states that:

These regulations apply to and in respect of the employment of persons in any working area associated with a ship in Canada or any Canadian ship outside Canada.

And section 20 states that:

The moving parts of the machinery of power-operated equipment shall be fitted with winch guards .  
..

TCMS provides guidance to Marine Surveyors for regulatory enforcement by way of Notices To Surveyors (NTS). NTS No. X-32 entitled “Fatal Accidents Involving Winches and Warming Drums” highlights the high incidence of fatalities where seamen have become entrapped in the

winches/warping drums. It makes specific reference to section (s.) 20 of the SWPR and goes on to state that “marine surveyors, when inspecting fishing vessels, should pay special attention to the safety of work areas where winches, warping drums, leads, and warping wires are involved.”

### 1.7.3 *Transport Canada Marine Safety Position—Interpretation and Application of Regulations*

It is the position of TCMS that:

- the CSA and the regulations made pursuant thereto do not apply to the “the business of commercial fishing” or to specific working areas associated with fishing operations;
- the machinery and deck work areas associated with fishing operations fall within the exclusive competency of the provinces and as such are subject to provincial jurisdiction;
- with the exception of work deck areas associated with fishing operations, all other areas of the vessel are subject to the regulations under the CSA, including the SWPR to ensure “operational and structural safety” of the vessel;
- notwithstanding the above, when Marine Surveyors conduct inspections of fishing vessels and deficiencies in the aforementioned work deck areas are observed, owners and operators are strongly encouraged to comply with the recommendations contained in the NTS X-32. Reportedly, this information is passed verbally to the owners/operators and no written record is maintained.

In this instance, the vessel had been in service for some 15 years, during which period she underwent four TCMS inspections. The written records of these inspections mention neither the work space areas nor the equipment used in the “business of fishing” and TSB investigators were unable to determine if deficiencies in this area were discovered or discussed orally. It is known that the vessel operated the scallop rake winch, which was not fitted with a winch guard, during this period.

## 1.8 *Jurisdictional Issues and Safety*

### 1.8.1 *Canada Shipping Act and Canada Labour Code Application*

Traditionally, the SWPR made pursuant to the CSA was the primary legislation governing factors which affected safety in the marine workplace for all ships in Canadian waters and Canadian ships in any waters. However, with the advent in 1987 of the *Marine Occupational Safety and Health Regulations* (MOSH) made pursuant to the *Canada Labour Code* (CLC) [under Labour Canada, now Human Resources Development Canada (HRDC)], the application of Part II of the CLC was extended to include ships where the working activity aboard the ship is federally regulated and where an employer-employee relationship exists. The administration of Part II of the CLC aboard ships has been transferred to TCMS.

Recent Labour Relations Board and court rulings on the issue of union certification have ruled that the federal legislation is restricted to the protection and preservation of fisheries as a public resource and does not extend to the regulation of the “business of fishing.”<sup>6</sup> Furthermore, provincial labour relations legislation applies to

<sup>6</sup> Decision No. 319/89. In the matter of 504578 Ontario Ltd. et al v. Great Lakes Fishermen and Allied Workers’ Union.

commercial fishing vessels, since the regulations of employment do not advance the protection and preservation of fisheries. According to the B.C. Court of Appeal ruling, “the fact that some fishing may be conducted outside of the territorial waters of Canada does not render inapplicable provincial laws, regulations, and terms and conditions of employment. [Also,] the *Canada Shipping Act* .... provides for cases in which a seaman is to be paid by a share of the profits of an adventure. By definition, such a share of profits is wages. So the seaman who is paid a share of the profits remains an employee.”<sup>7</sup>

The position of the Labour Division of HRDC is that federal *labour* legislation does not apply to the fishing industry and that the responsibility of TCMS concerning “operational” safety in the fishing industry under the CSA has not been affected by the transfer of Part II of the CLC.

### 1.8.2 Nova Scotia Labour Law and Inspection

According to the Nova Scotia Department of Justice, a fishing vessel falls within provincial jurisdiction, including workplace health and safety acts. Thus, the *Occupational Health and Safety Act* of Nova Scotia and the regulations made pursuant thereto applied to the work deck space aboard the “S.S. BROTHERS”. The regulatory requirements called for proper guards to be fitted on moving parts of the machinery to prevent injury to workers and for every lifting device to be thoroughly examined, at least annually, by a competent person and a record of such inspection maintained by the employer. The onus is:

- on the employer/supervisor of fishermen to take every reasonable precaution to ensure their safety and to ensure that regulations are complied with,<sup>8</sup> and
- on workers to take reasonable precautions to ensure the health and safety of themselves and other persons.

The Act permits the Nova Scotia Department of Labour to conduct an “inspection concerning health and safety of employees” and includes the work deck space aboard fishing vessels.

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<sup>7</sup> Mark Fishing Co. Ltd. et al v. United Fishermen & Allied Workers' Union et al. *British Columbia Court of Appeal, Davey, C.J.B.C., Maclean and Robertson, J.J.A. - March 3, 1972.*

<sup>8</sup> S. 9 of the *Occupational Health and Safety Act, 1986*, of Nova Scotia in force at the time of the occurrence and S. 13 of the *Occupational Health and Safety Act, 1996*, of Nova Scotia commencing 01 January 1997.



Inspections of the workplace by the Provincial Ministry of Labour are carried out as follows:

- shore-based industrial establishments are inspected at random (although certain industries and organizations may be targeted for more frequent inspection);
- fishing vessels are inspected on a reactive basis when an occurrence has taken place.

No inspection was carried out on the “S.S. BROTHERS”.

### *1.8.3 Comparison of Provincial Statutes*

Provincial governments were contacted and, according to provincial authorities and a review of the provincial acts and regulations, it was revealed, inter alia, that:

- two provinces have sector-specific legislation that covers fishing operations and includes the deck workplace aboard fishing vessels. British Columbia has regulations in place while Newfoundland has regulations before the Legislative Assembly;
- all other provinces/territories have generic labour legislation. In different jurisdictions, provincial regulations apply either to all fishing vessels, or to certain fishing vessels, or to none at all;
- the enforcement mechanism for the generic provincial labour legislation varies extensively among provinces/territories and the primary instrument is self-enforcement. Some provinces also use the Workers’ Compensation Board sanction system, and the courts, to achieve enforcement;
- British Columbia carries out inspections on a periodic basis; and
- the criteria used to determine the frequency of inspections vary among provinces/territories. With the exception of one province, which takes a pro-active approach, most provinces, for the most part, take a reactive approach to inspections.

### *1.8.4 Introduction of New Provincial Initiatives*

Currently fishing vessels are subject to inspection by a number of bodies, including TCMS, marine underwriters, the Department of Fisheries and Oceans, and provincial labour ministries. Some sector-specific provincial legislation (in place, or before the provincial legislature) dovetails with CSA regulations; however, to date, there is no formal agreement among provincial and federal authorities as to how this dovetailing is to take effect. Labour ministries in some provinces are taking initiatives to “professionalize” the fishing industry; these initiatives may include the following:

- A requirement that each fisherman maintain a record of sea service in a Fishermen’s Booklet.
- An apprenticeship programme to train new fishermen entering the fishing industry.

- A diploma course in Professional Fishing (after a minimum sea service), including fishing technology, navigation safety and maintenance of vessel and gear.

### 1.9 *Personnel Certification and History*

The skipper held a Fishing Master—Class IV certificate and had been involved in the fishery since 1971. He had been a skipper on different types of fishing vessels since 1983.

Deck-hand No. 1 held a Fishing Master—Class IV certificate. He had served some ten years on different types of fishing vessels, some of which had similar deck machinery.

Deck-hand No. 2 had been involved in the fishery for about five years on various types of fishing vessels including ones with similar deck machinery.

### 1.10 *Accident Statistics*<sup>9</sup>

Following the occurrence, a review of the TSB records over the last five years revealed the following:

- There were 157 reportable accidents on board fishing vessels.<sup>10</sup>
- There were 26 fatalities, of which:
  - more than half were attributable to falls, and
  - 3 involved fishing gear and moving machinery.
- There were 130 injuries reported, of which:
  - 32 percent involved fishing gear and moving machinery, and
  - 19 percent were attributable to falls.

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<sup>9</sup> Marine Safety Statistical Report No. M97-39 entitled *Fishing Vessel Occupational Accident Statistics*.

<sup>10</sup> This is the number of *reportable* accidents as defined by TSB reporting criteria. The *total* number, including accidents that are not required to be reported to the TSB, is probably substantially higher.



## 2.0 *Analysis*

### 2.1 *Introduction*

Fishing vessels like the “S.S. BROTHERS” are subject to a combination of federal and provincial regulations and one reason the TSB investigated this occurrence was to determine the extent to which safety could have been compromised in this respect by regulatory gaps or overlaps. The accident involved a fishing activity where the vessel was engaged in the operation of catching fish and transporting the fish to port. A serious injury or death of a crew member aboard a vessel at sea, particularly a fishing vessel with a small crew, can jeopardize the safety of the vessel by removing that crew member from watchkeeping, emergency and other duties. When a mishap occurs at a delicate stage of a fishing operation, even though the injury sustained may be minor, there is a potential for the situation to compound such that it can seriously jeopardize the safety of the vessel and the crew. Instances are on record where vessels have capsized when the process of hauling in their catch has been interrupted. The analysis section therefore focusses on those issues relating to the jurisdictional aspects, the behaviour of the crew member and the work environment on board the vessel, which put at risk the ability of the crew to safely perform their operational duties.

### 2.2 *Impact of Working and Environmental Conditions on Safety*

Because the winch used to retrieve the scallop rake is not fitted with an automatic spooling device, a member of the crew ensures that the wire is guided onto the winch drum. Due to the position of the winch controls, it is not possible for one person to operate the winch and to simultaneously guide the wire. While two crew members began the operation of hauling in the rake, the person at the controls left his position to begin washing down the deck. Consequently, he was not in position to perform his operating duties when the 25-fathom warning mark appeared and he did not have ready access to the controls in the event of an emergency.

When the deck-hand guiding the wire onto the drum saw the 25-fathom mark on the wire (which serves as a warning that the rake is close to the surface), he attempted to climb over the winch to reach the controls. Data collected during the investigation established that deck-hand No. 1. was in a hurry and that although he considered climbing over the winch a dangerous thing to do (particularly given that the deck was wet and his rubber boots were slippery), he was willing to accept the risk and that this was not the first time he had climbed over the winch to access the controls.

Time pressure is a common stress factor influencing human performance.<sup>11</sup> When people are in a hurry, they tend to accept higher levels of risk than they would normally. The deck-hand's willingness to accept the self-acknowledged risk of climbing over the winch is consistent with the behaviour of someone who is in a hurry.

People who successfully perform risky acts on the job often change their attitudes or opinions about the personal risk involved. They tend to discount the risk and come to believe that the activity is not risky, or they tend to develop a sense of their own invulnerability. The more often they are successful at the dangerous act, the more likely they are to believe that, although the practice may be dangerous in a general sense, nothing bad will happen to them. This attitude can lead them to repeat the act, and a vicious circle can be set up. The more often they do it, the more they feel justified in their sense of invulnerability. The more comfortable they become with the sense of invulnerability, the more likely they are to reduce the margin for safety and engage in riskier behaviour.<sup>12</sup> In the context of this occurrence, because the deck-hand had climbed over the winch in the past without being injured, he was willing to accept the personal risk involved.

Deliberate decisions to act against rules occur everyday as people regularly modify, or do not strictly comply with, work procedures. "Two factors, in particular, appear to be important in shaping habitual [routine] violations: (a) the natural human tendency to take the path of least effort; and (b) a relatively indifferent work environment (i.e., one that rarely punishes violations or rewards observance)."<sup>13</sup> In this case, the deck-hand was not only taking the quickest and most convenient path to reach the winch controls, he was taking a familiar path; one where he had suffered neither negative consequences nor punitive action in the past.

The factual information gathered during this investigation suggests that both deck-hands were suffering from fatigue. The irregular work/rest schedule maintained throughout the voyage was in conflict with their circadian rhythms and did not allow the deck-hands to obtain either the quantity or quality of sleep required. At best, they slept 18 hours in the 72 hours prior to the accident. In addition, because one of the three-hour scheduled off-duty periods (during which the deck-hands had an opportunity to sleep) coincided with a circadian rhythm period of wakefulness, it is probable that the quality of sleep obtained was poor and non-restorative.

Both deck-hands exhibited behaviour which appears to have been based on flawed logic and/or poor judgement and an increased propensity for risk-taking. Despite safety procedures to the contrary, the deck-hand assigned to operate the winch left his position to perform the non-essential task of washing down the deck. The deck-hand who was guiding the incoming wire onto the winch chose to climb over the winch to reach the controls even though other options were available to him.

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<sup>11</sup> David Embrey and Tom Kontogiannis, *Guidelines for Preventing Human Error in Process Safety* New York: Center for Chemical Process Safety of the American Institute of Chemical Engineers, 1994, p. 110.

<sup>12</sup> S. E. Taylor and J. D. Brown, "Illusion and Well Being: A Social Psychological Perspective on Mental Health," *Psychological Bulletin* 1988, pp. 103,193-210.

<sup>13</sup> James Reason, *Human Error* Cambridge: Cambridge University Press, 1990, 196.

Because the accident occurred near the end of a voyage during which the deck-hands had worked a nine-hours-on/three-hours-off cycle, the disruption of normal circadian rhythms and the accumulation of a sleep debt would have reduced the deck-hands' normal perception of risk. It is likely that fatigue had an impact on the decision-making processes of both these persons. One deck-hand decided that washing down the deck was a more important task than controlling the winch and the other did not appreciate the risk in climbing over the winch.

### *2.3 Effectiveness of Provincial Labour Legislation and Safety*

The inspection requirement in the labour legislation is consistent with the principle that the health, safety and well-being of workers is achieved through the participation of the workers, the employers and, where applicable, their associations by establishing their accountability. The mechanism for enforcement is, for the most part, *self-enforcement*. The application of the self-enforcement principle presupposes that the employer has in-depth knowledge of complex labour legislation and the operational environment, and has sufficient resources and the appropriate skills to educate the workers. This principle works well in many shore-based industrial establishments, but there are few operators of fishing vessels whose scale of operation is sufficiently large that resources can be allocated to meet these objectives. For the most part, fishing vessels, particularly small fishing vessels (some 27,500 across Canada) are operated by individuals who may own and operate the vessel with a few employees.

There is no requirement for the owner to possess in-depth technical/operational knowledge of fishing operations or for the operator to possess academic qualifications, nor is a competency test required before a person can engage in fishing activities. The complexity of the regulations does not lend them to being readily understood by those to whom they apply. The need has been recognized (for example, by the CSA regulations, the CLC Part II and some provincial industry-specific regulations) for labour regulations, specific to the shipping industry, that also address fishing vessel operations.

Simplicity of regulations in the fishing industry is crucial to help ensure self-enforcement. Only the province of British Columbia has recognized this need for simplicity in the regulations, as reflected in the (B.C.) *Fishing Vessel Operations Regulations*; the existing legislation in most other provinces does not reflect this need. The complexity of the current (non-sector-specific) labour legislation calls into question the practicality of self-enforcement as an enforcement tool for fishing vessels.

## 2.4 *The Jurisdictional Issue and its Impact on Safety*

The fishing vessel is subject to both federal and provincial regulations which, in aggregate, do not provide a comprehensive level of regulatory oversight locally or across Canada.

TCMS provides fishermen with a national regulatory system that applies to the structural and operational safety of the vessel, and compliance with which ensures that the vessel can be navigated safely.<sup>14</sup> TCMS also administers the *Safe Working Practices Regulations* which provide direction and guidance to a vessel's crew. However, the national regulatory system does not establish standards for those parts of the vessel employed in the "business of fishing" nor does it establish standards for how a fisherman is to use those parts. TCMS does have expertise in this area. Inspectors apply the *Tackle Regulations*, which apply to equipment on vessels other than fishing vessels. TCMS has published bulletins and booklets to advise fishermen on safe working practices.

Provincial governments, on the other hand, have the responsibility to ensure that the "business of fishing" is conducted in a safe manner. However, the level of provincial safety legislation and regulations—as applicable to fishing vessels—varies among provinces and territories, from the minimal to the comprehensive. Provinces and territories, for the most part, do not regularly conduct inspections of working areas, and primarily tend to react to accidents rather than adopt a pro-active, preventative role.

The result of this division of responsibility is that only part of a fishing vessel is subject to TCMS regulations and inspection. Given the current level of provincial safety legislation, regulation and inspection of fishing vessel deck work spaces and equipment used in "the business of fishing", these spaces and equipment are not effectively monitored to establish reasonable safety standards.

TCMS has established guidelines that encourage inspectors to provide advice on fishing equipment and its use; the operator is not required to implement the suggested advice. Furthermore, there is no official understanding or undertaking that TCMS notify provincial ministries of labour when such advice is given. The lack of a coordinated approach, involving the two jurisdictions, has the potential to compromise the overall safety of the vessel; fishing activity in these circumstances may be in conflict with the safe operation of the vessel, to the detriment of the safety of the vessel and the crew.

Although some provincial governments are implementing programs to train operators/crews in the safe use of fishing equipment, there is at present no such program in place.

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<sup>14</sup> The term "navigated" includes all activities that are essential for the vessel to remain in a seaworthy condition to complete the voyage safely.

## 3.0 *Conclusions*

### 3.1 *Findings*

1. The winch used to haul in the scallop rake was fitted with neither a spooling mechanism nor machinery guards.
2. As the scallop rake was being recovered, one deck-hand was at the controls of the winch while another guided the incoming wire onto the winch drum.
3. While the scallop rake was being winched up, the deck-hand at the controls left his post to wash down the deck and consequently no longer had easy access to the winch controls.
4. Upon sighting a mark on the wire which indicated that the scallop rake was nearing the surface, the deck-hand guiding the wire decided to climb over the winch to reach the winch controls.
5. The deck-hand lost his footing on the slippery surfaces of the winch and fell to the deck; his right foot was drawn onto the drum and crushed by the wire.
6. The work/rest schedule in force aboard the vessel most probably caused fatigue in the deck-hands and affected their capacity to make reasoned decisions.
7. *The Canada Shipping Act* and its regulations set safety standards relating to the structural and operational safety of all vessels, irrespective of type, except for that equipment and work space used in the “business of fishing.”
8. During her 15 years of operation the vessel had been issued a Transport Canada Ship Inspection Certificate. There is no written record that either the vessel’s scallop rake hauling winch or its operation was ever inspected by the federal authority, as this was not a requirement for certification.
9. Provincial authorities are responsible for the regulatory oversight of the “business of fishing,” work deck space and equipment, but there is no written record that the scallop rake hauling winch was ever inspected by the provincial authorities.
10. The self-enforcement principle of some provincial labour legislation, in the context of small fishing vessel safety, is difficult to apply, due to the volume and complexity of the non sector-specific legislation.



11. The lack of a coordinated approach between Transport Canada and provincial ministries of labour results in each operating in isolation, and may result in potentially unsafe conditions and practices going undetected.
12. As of June 1999, with the exception of British Columbia and Ontario, provinces do not regularly inspect either the work deck space or the machinery used for “the business of fishing” but, for the most part, tend to react to accidents rather than to adopt a pro-active, preventative role.
13. Although some provincial governments are implementing programs to train operators/crew in the safe use of fishing equipment, there is at present no such program in place.

### *3.2 Causes*

The accident was caused by the deck-hand attempting to step over the winch to gain access to the controls. Factors contributing to the accident were: the deck winch was uninspected and not fitted with a machinery guard; the deck-hand was operating the winch alone; and the deck and the surfaces of the winch were slippery. It is also likely that the deck-hand’s ability to make a reasoned decision on the safe operation of the winch was adversely affected by fatigue caused by his work/rest schedule.

## 4.0 *Safety Action*

### 4.1 *Action Taken*

#### 4.1.1 *Nova Scotia Department of Labour Orders*

Once informed of the TSB investigation, the Nova Scotia Department of Labour (NSDL) contacted the fishing company and initiated its own industrial safety investigation. Under the authority of the *Occupational Health and Safety Act* (OHSA) of Nova Scotia, the NSDL issued two safety orders (260365-01 and 02).

The first order dealt with Regulation 10 117-A, *Industrial Safety Machinery and Machinery Guarding*. The NSDL ordered Yarmouth Sea Products Ltd. to ensure that:

...scallop drag cable winches are properly guarded to ensure that no one could get caught in the cable and/or winch. And the employer shall ensure that cables and blocks on the booms are equipped with a safety block or bar to prevent the block and/or cable from falling to the deck.

The vessels involved are “S.S. BROTHERS”, “VINNA & SHANE”, “LADY SARAH IV”, GAIL & TROY” and “RYCO”.

A few days after receiving the orders, a machinist of Yarmouth Sea Products Ltd. “installed a guard at the front of the winch and a cage over the cable at the winch” of the “S.S. BROTHERS” to provide a barrier between the attendant and the winch. Similar guards have also been fitted on other vessels managed by the fishing company.

The NSDL inspector also recommended that “hydraulic valves for the winches should be equipped with a centring device to ensure whenever the winch is engaged if the lever is released the valve goes back to centre.”

The second order was made under OHSA Regulation 63 1-A, *Notice of Accident at the Workplace*: “The employer shall ensure that the NSDL is notified within seven days of any accident that occasions bodily injury to an employee.”

Following the occurrence and discussions with NSDL, the TSB provided statistical data: an overview of the occupational accidents aboard fishing vessels. The NSDL issued a “Hazard Alert” concerning the guarding of the winches. The alert was distributed through the fishing sector in the province and NSDL’s occupational health and safety contacts in other jurisdictions.

#### 4.1.2 *Pro-active Inspection by Provinces*

Since the occurrence, Ontario has taken measures to initiate some level of pro-active inspection program for fishing vessels; the 1998/99 target was set at inspecting 154 vessels.

#### 4.1.3 *Other Safety Initiatives by Provinces*

The Ontario Ministry of Labour is developing a partnership with the Ontario Commercial Fisheries' Association to communicate health and safety information to its membership and promote self-reliance to further safety.

#### 4.1.4 *Jurisdictional Overlap in the Inspection of Commercial Fishing Vessels*

In spring of 1998 the representatives of TC and the Ontario Ministry of Labour met to discuss areas of jurisdictional overlap in the inspection of commercial fishing vessels. Also, Quebec Ministry of Labour representatives established contact with representatives of TC, the Department of Fisheries and Oceans and the Canadian Coast Guard in the spirit of co-operation. However, to date, there is no formal agreement in place between TC and the provincial/territorial departments of labour.

### 4.2 *Action Required*

#### 4.2.1 *Workplace Safety on Fishing Vessels*

Safety of fishing vessels and their crews is governed by both federal and provincial regulations. Transport Canada Marine Safety (TCMS) provides fishermen with a national regulatory framework that applies to the structural and operational safety of the vessel. TCMS also administers the *Safe Working Practices Regulations*, which provide direction and guidance to a vessel's crew on safe operating practices and procedures. The workplace safety of crews, while they are engaged in the "business of fishing," is not within federal jurisdiction.

Provincial governments have the responsibility to ensure that the "business of fishing" is conducted in a safe manner. However, provincial regulatory framework—as applicable to fishing vessel safety—is not consistent across the country, and some provinces still do not have adequate fishing-sector-specific provisions in place. In addition, due to the lack of resources, the provinces do not routinely conduct preventative safety inspections of work areas and practices, but generally rely on self-enforcement by the employer and/or employees. In the fishing industry, most provinces apply generic labour legislation, which is often complex and not easily understood by the fishermen to whom it applies.<sup>15</sup> As a result, the legislation is not effective as a self-enforcement mechanism; work spaces and equipment aboard fishing vessels are not being effectively monitored, nor are unsafe conditions being effectively targeted for corrective action.

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<sup>15</sup> B.C. is an exception. It has specific legislation targeted at the fishing industry.

The occurrence on the “S.S. BROTHERS” is not an isolated incident; the absence of an effective enforcement mechanism has permitted unsafe conditions to exist for several years. Indeed, as indicated in the report, there were over 150 reportable accidents on board fishing vessels for the period 1992–1996.<sup>16</sup> Over 40 injuries, and at least 3 fatalities, resulted from accidents involving fishing gear and moving machinery.<sup>17</sup>

The Board believes that the overall safe operation of a vessel (which is within federal jurisdiction) often depends on the level of safety in the “business of fishing” (which is within provincial jurisdiction.) Typically, fishing vessels are crewed with a small complement, working long hours and performing multiple tasks. Hence, in the event of the injury or incapacitation of any of the crew, the overall safe operation of the vessel is adversely affected.

The TSB database contains information on several accidents where practices associated with fishing operations have resulted in the loss of the vessel. In 1994, while salmon-fishing off Quadra Island, B.C., the seiner “LOUVEL III” capsized when the net being hauled on board became hung-up on the starboard side vertical roller, causing the vessel to acquire a large list and to downflood (TSB Report No. M94W0069). Again in 1994, the “SHAUNA-CHRISTI”, while fishing for mackerel off Rocky Harbour, Newfoundland, capsized suddenly when the amount of fish in the net pursed and secured to the starboard side was underestimated, which caused the vessel to heel and downflood through an open hatch (TSB Report No. M94N0020). In 1995 in Johnstone Strait, B.C., the “INSKIP” suddenly capsized when the weight of a large catch was transferred to the derrick head, which raised the vessel’s centre of gravity and resulted in a loss of stability (TSB Report No. M95W0121). In 1996 the fishing vessel “BOUNTY HUNTER” capsized and sank off Estevan Point, B.C., when the port warp parted. With the engine set at full power, the vessel heeled and the deck flooded (TSB Report No. M96W0062).

The Board understands that periodic inspections are routinely carried out by TCMS, while inspections under the provincial labour legislation are infrequent. As such, the jurisdictional division between the two levels of government over regulatory provisions and enforcement may allow unsafe acts and conditions on fishing vessels to persist. The Board believes that enhanced workplace safety and overall operational safety of fishing vessels could be better achieved through an approach that is co-ordinated and harmonized between the federal and provincial authorities. The Board therefore recommends that:

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<sup>16</sup> This is the number of *reportable* accidents as defined by TSB reporting criteria. The *total* number, including accidents that are not required to be reported to the TSB, is probably substantially higher.

<sup>17</sup> In 1994 a crew member lost his life in an almost identical accident on the Canadian fishing vessel “RYAN ROYALE” (TSB Report No. M94M0037).

The Department of Transport coordinate with appropriate provincial authorities to conduct a review of existing safety regulations administered by both levels of government to help ensure that the regulatory provisions pertaining to workplace safety on fishing vessels and overall operational safety are harmonized and enforced to achieve their intended objectives.

M99-01

The provinces' generic labour legislation is complex and may not be easily understood by those to whom it applies. Given that the provinces rely heavily on self-enforcement, the Board is concerned that the complexity of the legislation hinders effective compliance by fishermen to achieve the legislation's intended safety objectives. Therefore, in the interim, the Board recommends that:

The provinces review their workplace legislation with a view to presenting it in a manner that will be readily understood by those to whom it applies, to help ensure that the enforcement mechanism and the regulatory regime complement each other.

M99-02

### 4.3 *Safety Concern*

#### 4.3.1 *Hours of Rest for Crews on Fishing Vessels*

The Board has expressed concern previously about the number of marine occurrences involving Canadian fishing vessels in which crew fatigue has been an issue (TSB Report Nos. M90N5015, M92W1066, M93M0008). The Board notes with concern that the work schedule and working practices on the "S.S. BROTHERS" were conducive to crew fatigue, and very likely contributed to this occurrence. It is a well-established fact that fatigue impairs judgement, reduces concentration, slows reaction time and leads to errors due to a lack of attention, alertness, and vigilance.

The current regulations affecting hours of rest (the *Crewing Regulations*) do not apply to personnel employed on Canadian fishing vessels of less than 100 gross tons—such as the "S.S. BROTHERS" and smaller vessels—which constitute the majority of vessels involved in similar occurrences. It is hoped that effective implementation of such regulations will reduce the likelihood of similar occurrences involving fishing vessels over 100 tons.

While it is recognised that prescribing and enforcing mandatory rest periods on fishing vessels would be difficult, the Board hopes that this will not preclude a full exploration of other means of influencing behaviour. For instance, there are currently no programs to make fishermen aware of the effects that fatigue can have on job performance and safety, nor of the effects that inadequate work/rest schedules, off-duty activities, eating and drinking habits, sleep

environment and scheduling, and exercise can have on fatigue. The Board is concerned that crew members on the majority of small fishing vessels continue to work excessive hours, negatively affecting their own safety and that of others.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard, and members Maurice Harquail, Charles Simpson and W.A. Tadros, authorized the release of this report on 11 June 1999.*



## *Appendix A - Fatigue*<sup>18</sup>

There are five identifiable stages that together form one cycle of sleep. Each cycle lasts approximately 90 minutes. In order for sleep to be restorative, several uninterrupted sleep cycles must be completed.

An important factor affecting sleep is the time of day during which sleep is obtained. Virtually every function in the body, including sleep and wakefulness, is timed according to a day–night cycle. Such cycles (approximately 24 hours long) are described as circadian rhythms. Although circadian rhythms are influenced by external cues, like sunrise and sunset, they are basically controlled by “biological clocks” located in the brain. People function best when they are awake during the day and asleep at night. When people sleep at times when their biological clocks indicate that it is time to be awake, not only do they find it difficult to sleep, but the sleep they *do* achieve will not have the same restorative value.

Research indicates that, on average, people need 7.5 to 8.5 hours of sleep per day. A person obtaining less than the required sleep develops a “sleep debt” and will be subject to performance degradation. Sleep debt is cumulative. It is not possible to store sleep.

Quality of sleep is as important as quantity. Sleep may be disrupted by such things as the use of stimulants (e.g., caffeine), drugs (including alcohol), awakenings due to noise, light, temperature, uncomfortable sleep surface, and sleep pathology. Research indicates that “people tend to experience poor sleep in surroundings different than their normal place of rest”<sup>19</sup> (e.g., aboard a ship where the mattress, noise level and tone, vibration, temperature and humidity are different than one’s home environment).

Researchers at the Defence and Civil Institute of Environmental Medicine found that a 30 per cent decrement in performance on cognitive tasks can be expected after 18 hours of wakefulness.<sup>20</sup> Breaks, or periods of low workload, had no effect on performance levels. The only intervention that maintained or restored levels of performance was sleep.

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<sup>18</sup> Information in this section, unless otherwise footnoted, has been paraphrased from *The CANALERT Guide for Locomotive Engineers and their Families, Living in a 24-Hour World*, Circadian Technologies, Inc., 1996.

<sup>19</sup> Richard M. Coleman, *Wide Awake at 3:00 AM*, Stanford, Calif.: Stanford Alumni Association, 1986.

<sup>20</sup> R. G. Angus, R. A. Pigeau and R. J. Heslegrave, “Sustained Operations Studies: from the Field to the Laboratory,” *Why We Nap: Evolution, Chronobiology, and Functions of Polyphasic and Ultrashort Sleep*, C. Stampi (ed.), Boston: Birkhauser.





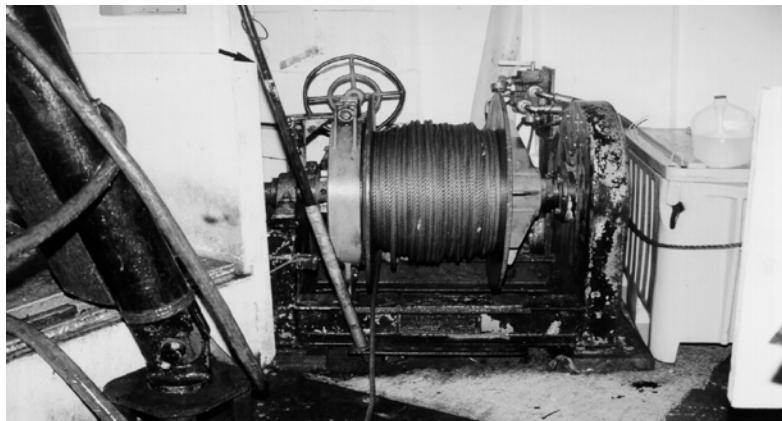
*Appendix B -*

*Photographs*



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## *Appendix C - Glossary*

ADT	Atlantic daylight time
B.C.	British Columbia
Ĉ	centre-line
CLC	<i>Canada Labour Code</i>
CSA	<i>Canada Shipping Act</i>
HRDC	Human Resources Development Canada
kW	kilowatts
m	metre
MCTS	Marine Communications and Traffic Services
MOSH	<i>Marine Occupational Safety and Health Regulations</i>
NSDL	Nova Scotia Department of Labour
NTS	Notices to Surveyors
OHSA	<i>Occupational Health and Safety Act</i>
(P)	port
(S)	starboard
(s.)	Section
SI	International System of Units
SWPR	<i>Safe Working Practices Regulations</i>
TC	Transport Canada
TCMS	Transport Canada Marine Safety
TSB	Transportation Safety Board of Canada
UTC	coordinated universal time