Report 01-212

fishing vessel *Hans*

grounding and sinking

Tory Channel

19 August 2001

Abstract

On Sunday 19 August 2001 at about 0710, the fishing vessel *Hans* ran aground on West Head at the entrance to Tory Channel while on passage from the fishing grounds in Cook Strait to Picton. The skipper was able to transmit a mayday call before he and the 5 crew boarded the life raft. They were rescued uninjured shortly after by another vessel before the *Hans* sank.

Safety issues identified included:

- the inadequate watchkeeping arrangements aboard the *Hans*
- the manning level of the *Hans* for the operation undertaken
- the operator, skipper and crew not implementing Maritime Rule Part 31C
- the lack of procedures and guidelines regarding fitness for duty and fatigue in the Safe Ship Management manual
- the lack of a watchkeeper monitor alarm for a single-handed wheelhouse operation.

Safety recommendations were made to the managing director of Pegasus Bay Fishing Limited, the principal surveyor of Lloyd's Register of Shipping and the general manager, trade and education, of the Seafood Industry Council to address the safety issues.

Hans

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Abbreviations

EPIRB	emergency position indicating radio beacon
GPS	global positioning system
IMO	International Maritime Organization
kW	kilowatt(s)
m	metre(s)
MSA	Maritime Safety Authority
QFDH	Qualified Fishing Deck Hand
rpm	revolutions per minute
SSM	safe ship management
STCW-F	International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel, IMO
t	tonne(s)
UTC	universal time (co-ordinated)
VHF	very high frequency

Glossary

bilge	space for the collection of surplus liquid
by the head	said of a ship when its draught forward is greater than its draught aft
class	category in classification register
dog	cleat or device for securing watertight openings
draught	depth in water at which a ship floats
gross tonnage	a measure of the internal capacity of a ship; enclosed spaces are measured in cubic metres and the tonnage derived by formula
head to weather	keeping the course of a vessel into the weather
knot	one nautical mile per hour
list	angle of tilt caused by internal distribution of weights
log	instrument to determine the speed of a vessel
mayday	radiotelephone distress signal requesting immediate assistance
monkey island	deck above the wheelhouse or bridge
port	left hand side when facing forward
starboard	right-hand side when facing forward
track	the path intended or actually travelled by a ship

Data Summary

Vessel Particulars:

Name:	*Hans*
Type:	stern trawler
Length (overall):	22.25 m
Breadth:	7.2 m
Gross tonnage:	194 t
Maximum draught:	5.2 m
Class:	✠ 100 A1 Stern Trawler LMC
Port of registry:	Lyttelton, New Zealand
Propulsion:	one 578 kW Caterpillar diesel engine driving a single variable pitch propeller
Service speed:	10 knots
Built:	1988 by Esbjerg Oilfield Services A/S, Denmark
Owner:	Windward Fishing Company Limited
Operator:	Pegasus Bay Fishing Company Limited, Lyttelton
Minimum manning:	coastal fishing: 4
Crew:	6

Date and time:	Sunday 19 August 2001 at about 0710[1]
Location:	Tory Channel entrance
Injuries:	nil
Investigator-in-charge	Captain W A Lyons

[1] All times in this report are New Zealand Standard Time (UTC + 12 hours) and are expressed in the 24-hour mode.

1. Factual Information

1.1 History of the voyage

1.1.1 The *Hans* departed from Picton at about 1700 on Saturday 18 August 2001, with the skipper and a crew of 5 aboard. It arrived at the hoki fishing grounds in Cook Strait at about 2100 and the skipper started searching for fish using electronic fish-finding equipment.

1.1.2 At about 2200 the net was shot and recovered with about 15 t of fish. While the 5 crew members started stowing the catch the skipper kept the *Hans* steaming slowly, head to weather, while he searched for more fish.

1.1.3 At about 0200 the net was shot again and recovered with about 20 t of fish. The skipper decided that the fish they had caught in the 2 shots would fill the boat so at about 0400 he headed the *Hans* back to Picton to discharge the fish.

1.1.4 The *Hans* was due south of Wellington and the skipper recalled following the undersea canyons back towards the north-west, searching for schools of fish as he went, before setting the autopilot on 305 degrees magnetic to head for Tory Channel entrance (see Figure 1). He kept the speed to about 7 knots so as not to arrive in Picton before the crew had stowed the catch, which usually took about 5 hours.

1.1.5 The skipper remained in the wheelhouse while the 5 crew members worked in the factory deck and fish hold. While the vessel was steaming the skipper drank frequent cups of coffee, ate a snack and smoked several cigarettes. As the crew were all busy stowing the catch, nobody else visited the wheelhouse after departing from the fishing grounds.

1.1.6 The *Hans* was being steered by autopilot on magnetic compass courses. The skipper was using the radar and global positioning system (GPS) plotter to navigate. He was sitting in what he later described as a comfortable chair with his feet up on the console. The wheelhouse door was shut, but one of the windows was slightly open. Weather conditions at the time were light winds, calm sea, no swell and good visibility.

1.1.7 The skipper later recalled that he made a cellular telephone call as the *Hans* approached Tory Channel entrance. When he finished the call he put the cursor of the GPS plotter on the entrance and saw that there were about 11 minutes to run before the *Hans* reached the entrance (see Figure 2). The last thing the skipper remembered was thinking that he would wait about a minute before giving the required 10-minute call on the very high frequency (VHF) radio to inform other shipping that the *Hans* would be entering Tory Channel, and then he fell asleep. The *Hans* continued towards Tory Channel entrance at about 7 knots.

1.1.8 About this time the mate went up to the galley with the intention of taking the skipper a cup of coffee but he did not get to the wheelhouse before the *Hans* ran aground.

1.1.9 The next thing the skipper remembered was being woken by the noise and motion as the vessel hit submerged rocks. The skipper immediately reduced the engine revolutions to idle and the propeller pitch to neutral. He could feel the *Hans* "bouncing" on the rocks, so to avoid more damage he put the propeller pitch astern and increased the engine revolutions.

1.1.10 The *Hans* moved astern and once clear of the rocks the skipper again reduced the engine revolutions and put the propeller pitch to neutral. He considered trying to beach the boat but the nearest suitable place was inside the entrance to Tory Channel. He felt that manoeuvring the boat ahead would force water into the boat through the damaged bow, possibly sinking it in the entrance.

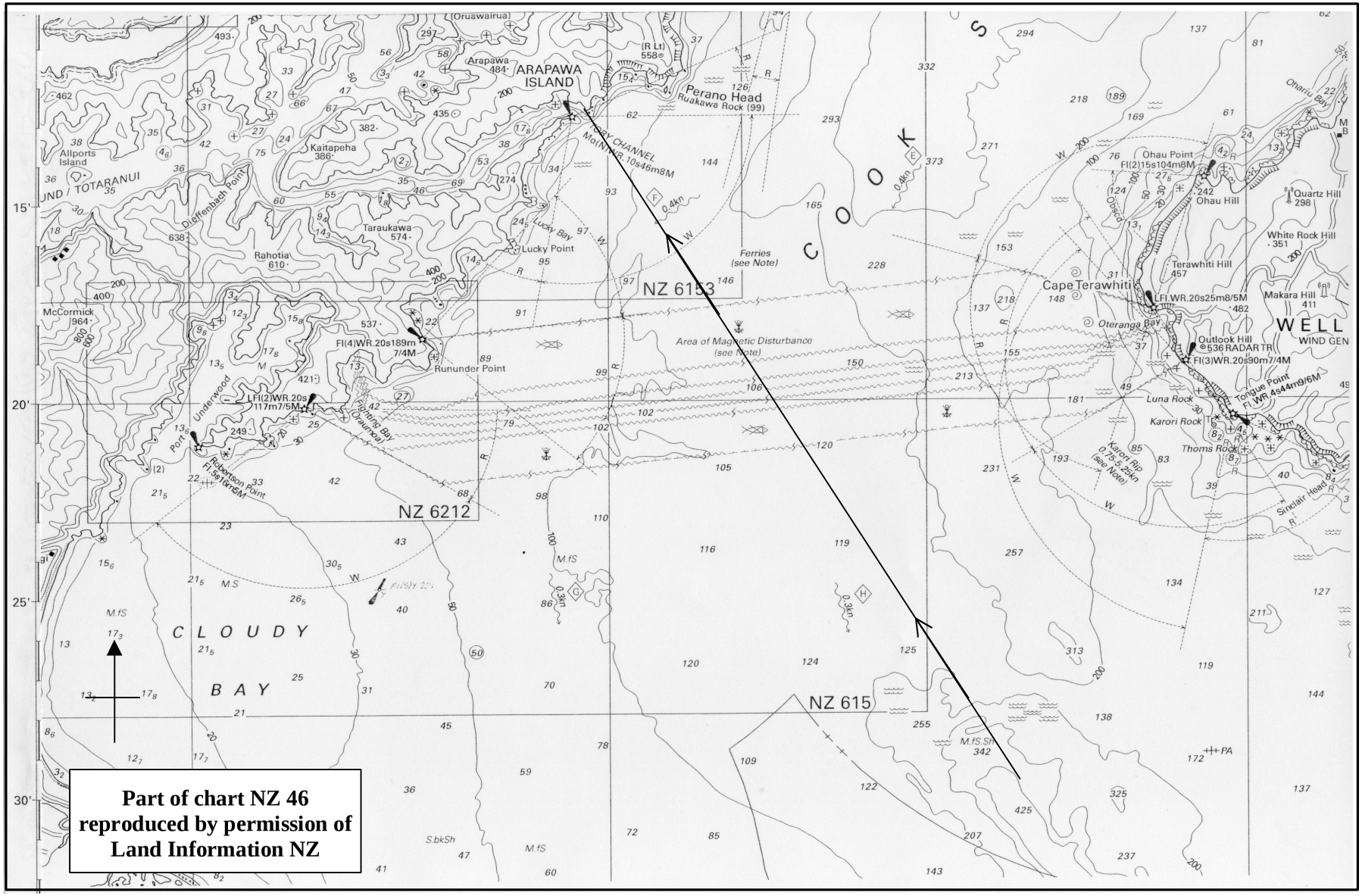

Figure 1
Part of chart NZ 46 showing Cook Strait and the intended track of the *Hans*

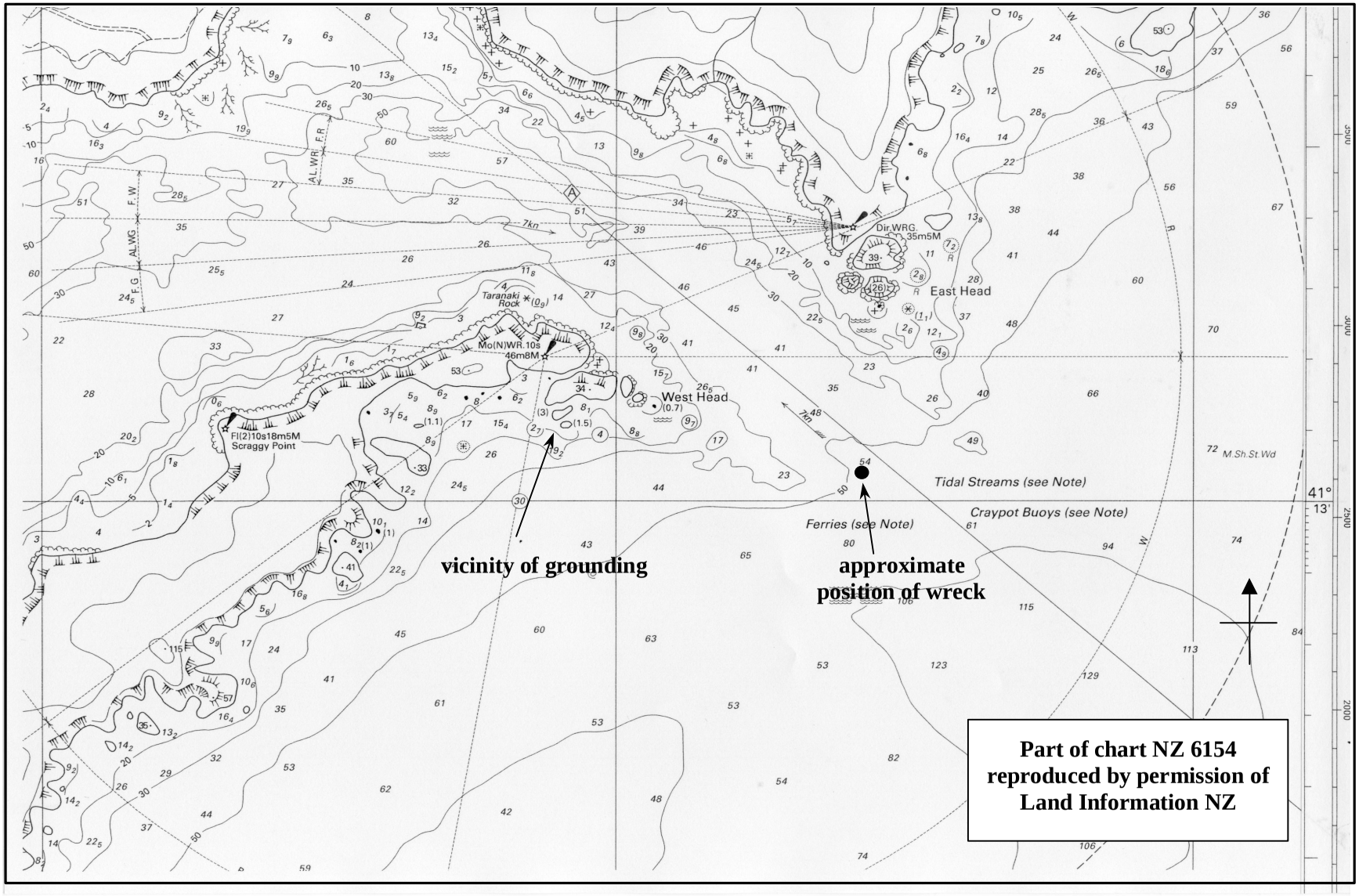

Figure 2
Part of chart NZ 6154 showing Tory Channel entrance

1.1.11 Meanwhile, the crew arrived in the wheelhouse. The skipper instructed them to check for ingress of water. Some of the crew returned to the fish hold and could see it was flooding so they closed and dogged down the watertight hatch before returning to the deck. Others went to the bow and looked over the side but could see no damage above the waterline. By now the *Hans* was down by the head and listing to starboard. The engineer went to the engine room and found it was dry so he started the forward bilge pumps before returning to the deck.

1.1.12 The skipper realised that the *Hans* was in imminent danger of sinking so he transmitted a mayday call on VHF channel 16, which was immediately answered by Wellington Maritime Radio and timed at 0710. The Cook Strait cable tender *Sea Surveyor* was close by and was instructed to proceed to the *Hans* to assist. Two small crayfish boats that were exiting Tory Channel were also standing by.

1.1.13 The *Hans* was taking on water fast so the skipper ordered the life raft be launched and lashed alongside. The crew had time to return to their cabins and get lifejackets and some personal belongings. The engineer went forward to the transformer room, where he saw smoke, so he returned to the engine room and shut down all the machinery.

1.1.14 The skipper instructed the crew to board the life raft. The engineer took the emergency position indicating radio beacon (EPIRB) from the monkey island and once they were all aboard the raft, it was let go from the *Hans* and drifted clear. The *Hans* continued to sink by the head with a slight starboard list.

1.1.15 The *Sea Surveyor* soon arrived and the crew boarded it from the life raft. The crew later estimated that after the grounding they were aboard the *Hans* for about 20 minutes before boarding the life raft. The *Hans* sank bow first about 10 minutes later.

1.2 Boat information

1.2.1 The *Hans* was a 22.25 m deep-sea stern trawler that was built in Denmark in 1988. It was purchased by the owner in 1995 and brought to New Zealand, where it underwent modifications to the accommodation and fish-handling areas to suit local fishing conditions.

1.2.2 The wheelhouse was equipped with the standard equipment necessary for navigation and fishing, which included:

- magnetic compass
- autopilot
- 2 radar sets
- GPS and chart plotter
- echo sounder.

1.2.3 There was no "dead man"[2] alarm fitted in the wheelhouse. There was no statutory requirement for such an alarm to be fitted but they were being promoted by the Maritime Safety Authority (MSA) and the MSA convened Fishing Industry Safety and Health Advisory Group (FISHgroup) as part of measures to counter the effects of fatigue on fishing vessel crews. The radar had a proximity alarm but this was not activated at the time of the grounding.

1.2.4 The engine room was capable of being operated unmanned, with an alarm system that was monitored from the wheelhouse.

[2] An alarm in the wheelhouse that is set to activate at a predetermined time interval that has to be manually cancelled.

1.2.5 The *Hans* operated under a safe ship management (SSM) system with Lloyd's Register of Shipping (Lloyds). The certificate was issued on 17 October 2000 and, subject to periodical inspections, was valid until 18 October 2005. An MSA flag state inspection was carried out on 19 October 2000 and Lloyd's inspected the boat on 20 October 2000. There were no deficiencies noted at either inspection.

1.2.6 A copy of the SSM manual for the *Hans* obtained from Lloyd's included the following:

> **Master's Authority**
>
> The Master has complete authority and responsibility for taking all necessary actions for safety, pollution prevention and the efficient operation of his ship.
>
> **Master** is responsible for:
>
> ...Ensuring sufficient crew are available to man the vessel to the required numbers…
>
> **Resources and Personnel - Manning**
>
> Responsibility: DPA [Designated Person Ashore], Master
>
> Detailed Procedure:
>
> 1. The DPA ensures that the vessel is adequately manned with medically fit, competent, qualified ship staff in accordance with The Shipping (Manning of Fishing Boats) Regulations 1986, and they are fully conversant with the vessel's SSMS.
>
> 2. The Master ensures that his vessel is adequately manned in accordance with stated manning levels…
>
> The manual did not detail any information with regard to fitness for duty or fatigue.

1.3 Crew

1.3.1 The skipper was 24 years old and had been employed on fishing vessels for about 7 years. He obtained a Second Diesel Trawler Engineer certificate in 1995 and a Coastal Master certificate in 1996. He had been employed on the *Hans* for about 5 years; the first 3 years as engineer and the last 2 years as skipper.

1.3.2 The engineer had been employed by the operator for about 10 years as a shore-based maintenance engineer. He had no maritime engineering qualifications but had completed numerous trips, including a continuous 11-month period aboard the *Hans* as a relieving engineer.

1.3.3 The mate had been employed on fishing vessels for about 7 years, the last 2 aboard the *Hans*. He held a Qualified Fishing Deck Hand (QFDH) certificate. The other 3 deckhands had been employed aboard the *Hans* for varying periods. Two held QFDH certificates. The syllabus for this qualification covered basic watchkeeping.

1.4 Remuneration and routines

1.4.1 The crew on most New Zealand fresh fish vessels were self-employed contractors; the crew of the *Hans* were similarly engaged. They were not paid wages or salaries but received a percentage share of the catch value. Each person's percentage was dependent on their position on board. Their earnings were therefore directly proportional to the amount of fish caught. The skipper and his relief were paid a percentage of the total catch of the vessel rather than a percentage of that caught during their particular work periods, as the other crew members were paid.

1.4.2 The crew comprised a skipper, mate, engineer and 3 deckhands. While the boat was fishing the skipper remained in the wheelhouse and the crew were all required on deck to handle the fishing equipment and stow the catch.

1.4.3 The company provided the boat, trawling gear and fuel. There were 2 skippers who, by mutual agreement, broadly worked a roster of 2 weeks on, 2 weeks off. The crew worked about 3 weeks on and one week off.

1.4.4 The Cook Strait hoki season lasted about 10 weeks from July to September, when the fish congregated to spawn in the deep canyons in Cook Strait. During this time trawlers attempted to catch as much fish as possible within the restraints of weather and quota.

1.4.5 Aboard the *Hans*, the trawl was hauled up the stern ramp to the main deck where the fish were transferred to the factory deck via the fish locker. On the factory deck, the fish were placed in fish bins and iced before being stowed in the fish hold. The factory deck and fish hold were totally enclosed and without portholes, making it impossible to observe what was occurring outside (see Figure 3).

1.4.6 The *Hans* was capable of carrying about 40 t of fish. The minimum time it could take to depart Picton, catch a full load of fish and return was about 15 hours. This time would increase depending on the availability of fish and the weather. The skipper later stated that if a trip went for more than about 24 hours he would cease fishing and get some rest.

1.4.7 When the boat arrived in port the mate and the 3 deckhands took turns, on a trip-by-trip basis, to discharge the catch. After other essential duties were completed, the skipper, engineer and the crew members not required for discharge of fish were able to sleep. The length of time the boat was in port varied but the shortest stay would have been about 5 hours. When the discharge of fish was completed the crew member responsible for the discharge would call the skipper, engineer and another deckhand for departure.

1.4.8 After the *Hans* departed from the berth the skipper would navigate through the Marlborough Sounds to the fishing grounds. The rest of the crew were able to sleep provided that there were no other work or maintenance requirements. The person who supervised the discharge of the fish was always allowed to sleep during the passage to the fishing grounds.

1.4.9 Other than when the boat was in port for an extended period there were no set meal times. Each crew member helped themselves to food and refreshments as required and as work permitted. Company policy was for no alcohol to be on board.

1.5 Previous trips

1.5.1 The skipper had joined the *Hans* on Sunday 12 August after having 2 weeks' leave. The precise movements of the boat from that date could not be fully determined. As the boat was not salvaged the logbooks were not recovered and the crew's recollections of its movements were vague. The operator kept no records of the boat's movements other than the fish landing dockets, which gave only the date that fish were landed. The Picton Harbour Radio log indicated arrival and departure times, but was not complete. Figure 4 shows the probable movements of the boat, as far as could be established.

1.5.2 From about 0640 on Monday until about 0930 on Thursday the *Hans* remained in Picton owing to bad weather in Cook Strait. Apart from discharging fish on Tuesday and general maintenance the crew were able to rest and sleep each night.

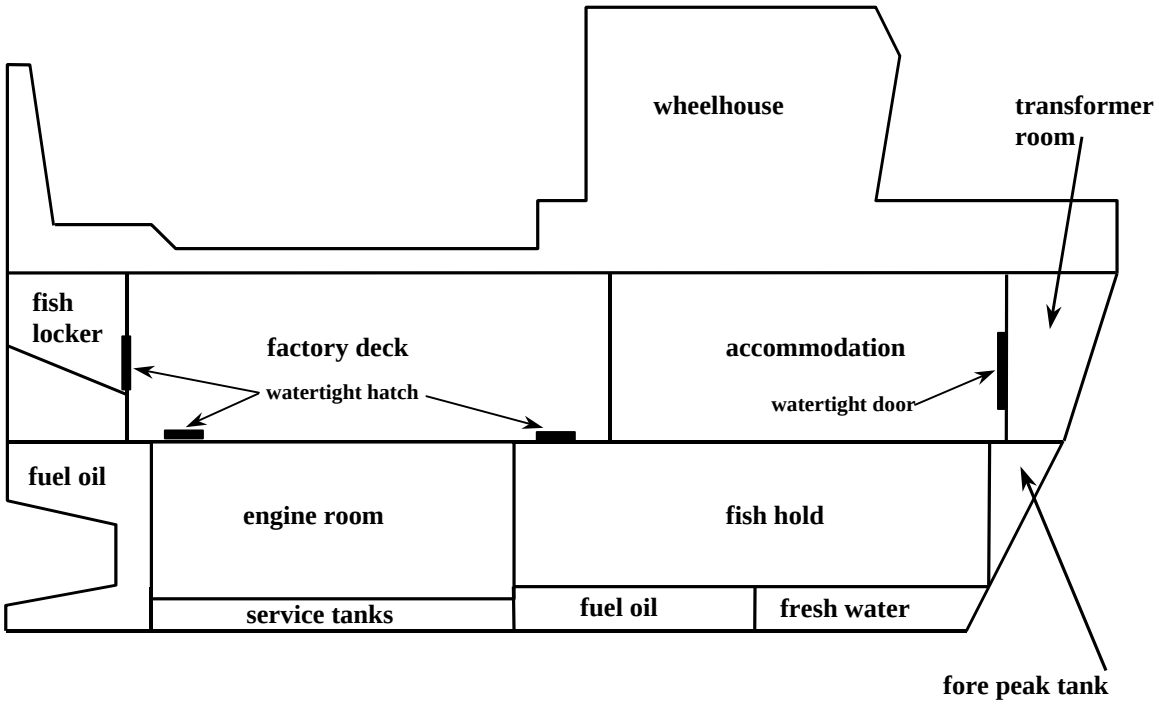

Figure 3
Plan of the *Hans* (not to scale)

1.5.3 From the time the *Hans* left Picton on Thursday at 0930 until the grounding on Sunday at 0710 it returned to Picton twice, the first time for about 7 hours and the second for about 5 hours 40 minutes. During these periods the skipper was able to rest. While the boat was at sea the skipper was working continuously, except before entering Tory Channel on the second trip when he asked the engineer to relieve him for about an hour so he could get some rest before navigating the boat through the sounds to Picton. From the time the *Hans* sailed on Saturday at 1640 until about 11 minutes before it grounded at 0710 on Sunday morning the skipper was awake continuously.

1.6 Fatigue

1.6.1 There are many definitions of fatigue but no universally accepted one. The extent to which individuals may be affected by a given set of circumstances will vary. The definition most widely accepted by the shipping industry was that used by the International Maritime Organization (IMO), namely:

> A reduction in physical and/or mental capability as the result of physical, mental or emotional exertion which may impair nearly all physical abilities including strength; speed; reaction time; co-ordination; decision-making or balance.

1.6.2 The IMO International Convention on Standards of Training, Certification and Watchkeeping, 1995 (STCW-95) prescribes specific minimum hours of rest for watchkeepers. STCW-95 does not apply to fishing vessels. However, the IMO International Convention on Standards of Training, Certification and Watchkeeping for Fishing Vessel Personnel, 1995 (STCW-F) recommends watchkeeping in the deck department to be arranged so that personnel are not impaired by fatigue, but no minimum hours of rest are prescribed.

1.6.3 On 1 February 2001 Maritime Rule Part 31C, Crewing and Watchkeeping Fishing Vessels, came into force, replacing the Shipping (Manning of Fishing Boat) Regulations 1986. Part 31C took account of STCW-F and introduced new requirements that supported an awareness of fatigue issues and their countermeasures.

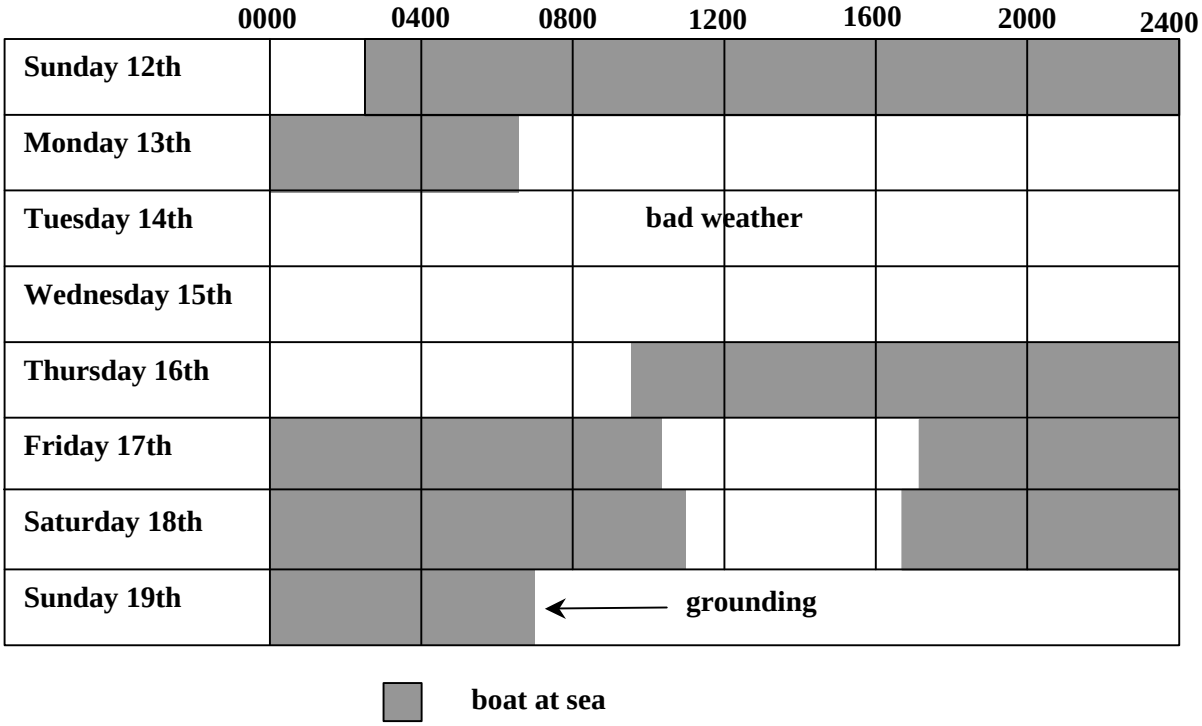

Figure 4
Probable movements of the *Hans* prior to grounding

1.6.4 Section 4 of Part 31C was entitled Watchkeeping and stated in part:

31C.14 Fitness for Duty

(1) The owner and master of a fishing vessel must establish and implement procedures in respect of the vessel's crew, taking into account the requirement in 31C.15(1), to ensure that all crew are fit for duty when keeping a watch.

(2) The crew of a fishing vessel must ensure, taking into account the requirement in rule 31C.15(2), that they are fit for duty at all times when keeping a watch.

31C.15 Fatigue

(1) When the owner and the master of a fishing vessel establish and implement procedures for ensuring a seafarer's fitness for duty, they must take into account that-

(a) the level of alertness of a person keeping a navigational or engine-room watch may be affected by fatigue; and

(b) whenever alertness is affected by fatigue, performance can be impaired.

(2) A seafarer on a fishing vessel, when considering his or her fitness for duty, must take into account-

(a) the signs, symptoms, and effects of fatigue, and

(b) that fatigue will affect his or her level of alertness, and

(c) that the performance of any person whose alertness is affected by fatigue can be impaired.

31C.16 Watchkeeping Standards

(1) The owner and the master of a fishing vessel must establish and implement watchkeeping procedures addressing-

(a) for navigational watchkeeping-

(i) the composition of the watch; and

(ii) the fitness of duty of the watchkeepers; and

(iii) navigation planning and duties; and

(iv) the use of navigational equipment; and

(v) look-out duties; and…

(2) The crew of a fishing vessel must comply with watchkeeping procedures established under rule 31C.16(1).

1.6.5 The advisory circular that accompanied Part 31C stated that owing to the diverse range of vessels covered by the rule, actual hours of work or rest could not be prescribed. However, it had a table of the signs and symptoms of fatigue and a section titled Fitness for Duty, which stated:

> The watch system should be such that the efficiency of watchkeeping personnel is not impaired by fatigue. Duties should be so organised that the first watch at the commencement of a voyage and the subsequent relieving watches are sufficiently rested and otherwise fit for duty.

1.6.6 When fishing, the skipper required all the crew to be either handling the trawl equipment or stowing the fish, which did not allow him to have a spare crew member resting while fishing operations were in progress.

1.6.7 Work-related fatigue has three main causes:

1. excessively long and/or hard work (time-on-task fatigue and workload)
2. inadequate, irregular or poor-quality sleep
3. working and resting at inappropriate times in the circadian rhythm[3], which leads to reduced task performance and impaired sleep quality respectively.

1.6.8 To be alert and able to function well, each person requires a specific amount of nightly sleep, the average for an adult being 7 to 8 hours. If the individual "sleep need" is not met, the consequences are increased sleepiness and impaired performance. For most people, getting 2 hours' less sleep than they need on one night produces an acute sleep loss and is enough to consistently impair their performance and alertness the next day. The reduction in performance is particularly marked if fewer than 5 hours' sleep are obtained.

1.6.9 Short sleep would usually mean long periods of time awake. Laboratory studies consistently show that the longer a person stays awake, the sleepier they become and the more slowly and inaccurately they perform any type of work.

1.6.10 The effects of several nights of reduced sleep accumulates into a "sleep debt", with sleepiness and performance becoming progressively worse. Recovery of the lost hours of sleep need not be on an hour-for-hour basis, but it typically takes 2 good nights' sleep to return to normal after sleep loss.

[3] The inherent pattern of physical and mental characteristics related to a 23 - to 25-hour internal central nervous system activity cycle.

1.6.11 Sleep is not equally possible across the 24-hour day. How quickly a person can fall asleep and how long they remain asleep are regulated by their circadian body clock. This can be visualised in terms of competing sleep and wake "drives". The sleep drive is highest in the early hours of the morning when the urge to fall asleep is most overwhelming and can be completely uncontrollable. There is a secondary increase in the sleep drive in the mid-afternoon. The wake drive is highest towards noon.

1.6.12 Not only the amount of sleep but also the quality of sleep can have important effects on wake-time functioning. Sleep that is restless and fragmented by frequent awakenings leaves a person sleepy and at increased risk of making errors. Sleep can be disrupted by a wide variety of factors including physical sleep disorders and other health problems, changing work and rest schedules, poor sleep habits and ill-informed attitudes about increasing wake-time activities by cutting back on sleep.

1.6.13 Environmental factors can have an important effect on sleep quality. For crew sleeping on board, such factors as noisy or cramped quarters and rough sea conditions can be expected to reduce sleep quality.

2. Analysis

2.1 As the *Hans* sank in deep water and initial attempts to locate the wreck were unsuccessful, a detailed inspection of the wreck and the damage it sustained was not possible. All shipboard records of the accident and preceding trips were lost. As a result this report was based mainly on interviews with the crew and the operator.

2.2 Tory Channel was used by numerous recreational, fishing and other commercial vessels as well as conventional and high-speed passenger ferries. Owing to the narrowness of the entrance and the "blind" corners caused by the steep cliffs, all vessels were required to transmit a message on VHF radio 10 minutes before transiting the entrance to notify other vessels of their intentions. The *Hans* was not a small fishing vessel and was capable of causing serious damage to other vessels in a collision, including the inter-island passenger ferries. The potential risk to maritime safety the *Hans* posed by approaching Tory Channel unannounced and effectively uncontrolled was high.

2.3 Owing to the inherently irregular and prolonged nature of work during fishing operations and the harsh, uncomfortable and noisy conditions often experienced aboard fishing vessels, fatigue is common among fishing vessel crews. This fact has been identified and new legislation requires that the owner, skipper and crew take responsibility for recognising and managing the problem.

2.4 The Cook Strait hoki season lasted for about 10 weeks during which time the earning capacity of the crew was greatly enhanced owing to the abundance of fish close to the discharge port. Provided the weather was favourable and the skipper could locate the fish, the *Hans* could depart Picton and return with a full load in about 15 hours.

2.5 As the skippers worked a 2-week roster, there was commercial incentive for them to make as many trips as possible in that time. Time lost owing to bad weather or other circumstances prevented them from achieving this goal and consequently would reduce the potential earnings of the whole crew. As the *Hans* had been delayed in Picton earlier in the week for about 76 hours owing to bad weather the crew would have been keen to complete as many trips as possible to make up this shortfall. In the absence of clear instructions from the owner, the loss of revenue for the crew would have been a strong deterrent to employing extra crew or taking extra time between trips for rest.

2.6 The grounding occurred during the return passage to Picton on the third trip after the bad weather. During the bad weather the crew had been able to sleep at night for 3 consecutive nights. This sleep pattern would have compensated for any sleep debt from previous trips but in the 69 hours since resuming fishing the skipper had not had adequate rest.

2.7 The unpredictable working hours while fishing meant that the skipper and crew could not plan a regular work/sleep pattern. Continuous work periods were prolonged and unpredictable with inadequate rest periods in between. When working a regular shift, an individual's circadian rhythm and ability to sleep may adjust to changed sleep patterns after a period of time, but continually changing hours of work and rest accentuates the effects of fatigue.

2.8 From the time the *Hans* resumed fishing until it grounded was about 69 hours. During this time the skipper was able to get 2 rest periods, both in the afternoon, one of about 7 hours and the other of about 6 hours. Allowing one hour from each of these in-port periods for essential duties and personal tasks, the skipper could have potentially had 2 sleeps of about 6 and 5 hours' duration. He also slept for the hour the engineer relieved him before entering Tory Channel during the second trip. The skipper therefore had a maximum of 12 hours' sleep in a 69-hour period, leaving him awake for at least 57 hours, over 3 consecutive work periods.

2.9 It was not established exactly how long the skipper slept or what quality of sleep he had during the 2 visits to Picton. The 2 rest periods he had were both during the daytime phase of his circadian rhythm, and the skipper was awake during the night; that is, he was trying to sleep during his "awake time" and trying to stay awake during his "sleep time". This would mean the sleep he did get would not have been of high quality or normal sleep structure. In addition, the tendency to drowsiness and microsleeps during night operations would be increased.

2.10 The skipper had being working long hours, had irregular and probably poor-quality sleep and was resting at inappropriate times of his circadian rhythm, which individually are the 3 main causes of work-related fatigue. Combined they would accentuate the effects of fatigue to the point where the skipper was probably experiencing critical fatigue.

2.11 During the previous trip the skipper asked the engineer to relieve him for about an hour before entering Tory Channel. Although it was appropriate for the skipper to have a nap before entering Marlborough Sounds in order to reduce fatigue at a critical point of the voyage, it may be taken to indicate that he had previously noticed the tendency for fatigue to develop during that trip. Had a nap been taken during the grounding trip, it may have reduced his overall drowsiness and assisted him to remain awake.

2.12 The skipper recalled observing that the *Hans* had 11 minutes to run before reaching Tory Channel entrance and was aware that he had to make a radio call one minute later, but in that minute he fell asleep before he could make the planned call. At 0700 in the morning the circadian rhythm of alertness and tendency to sleep would be approaching the "wakeful phase" but any benefits would have been offset by fatigue. The skipper would have been suffering from extended wakefulness, having been working continuously for 14 hours after only about 5 hours' sleep, leading him to fall asleep unintentionally.

2.13 The skipper's level of alertness should have been heightened by his knowledge that he had to shortly complete a safety-critical task and enter Tory Channel. Falling asleep at this point of the voyage also indicates that the skipper was critically fatigued. In the case of critical fatigue it is likely that microsleeps or unplanned longer sleeps might occur after such prolonged hours of work.

2.14 The manning level of the *Hans* was 2 above minimum legislative requirements for coastal fishing. Owing to the intensive labour required for hoki fishing and the proximity of the fishing grounds to the discharge port, the skipper, in consultation with the operator, had elected to employ a total crew of 6. Subsequent experience suggests that this was a minimum for the operation undertaken, as all 6 persons were required to operate the boat.

2.15 As the crew were all required on deck for fishing operations and stowing the catch there was no facility for anyone to be resting and available to relieve the skipper or other crew members if required while the boat was at sea. There was no watch system in place aboard the *Hans*. The skipper relied on everyone being awake while fishing, with rest periods for the crew taken while the boat was steaming to and from the fishing grounds or alongside the berth, and for himself only while the boat was alongside.

2.16 During each trip the skipper elected to stay alone in the wheelhouse virtually from the time the boat departed from the berth in Picton until it returned, unless the trip exceeded 24 hours. Owing to the unpredictable nature of fishing, trips could regularly exceed 24 hours. If this were the case, the whole crew could have been awake for that period of time, leaving the person relieving the skipper arguably more tired than the skipper himself owing to the physical nature of the work on deck previously undertaken.

2.17 Although the mate was required to stow fish during the inward passage to Picton, the skipper could have used him to navigate the *Hans* from the berth to the fishing grounds. This would have allowed the skipper at least 4 hours' extra rest each trip.

2.18 Maritime Rule Part 31C came into force on 1 February 2001, but neither the operator nor the skipper had implemented its requirements nor did the SSM manual outline any procedures to manage fatigue or include information about fatigue and its effect on fitness for duty. If the rule had been implemented and the required measures undertaken, the crew and operator would have been better informed of the symptoms and dangers of fatigue and could have taken appropriate measures to manage it and avert the grounding.

2.19 The system of remuneration provided incentive for the crew to work long hours and catch the maximum amount of fish possible during a work cycle. The crew were paid a percentage of the catch value of the fish that was caught during their work cycle and therefore had direct financial reasons to maximise the time spent fishing.

2.20 The skipper and his relief shared a percentage of the value of the vessel's total catch throughout the year rather than the catch taken on their respective trips. The skipper was therefore not under direct pressure to maximise his catch effort. Nevertheless, he was trying to attain his proportion of the overall catch and he would have been under pressure from his crew and the other skipper to maximise their earnings.

2.21 As they had already lost about 3 days owing to bad weather there would have been pressure on the skipper to minimise the turnaround times and increase time on the fishing grounds.

2.22 As the earnings of each crew member were dependent on a percentage of the catch value, the employment of an extra deckhand would have the effect of reducing the earnings of all. Such a situation encourages the skipper and crew to work longer and harder. While this may have a benefit in terms of productivity, it causes a significant safety risk as a direct consequence.

3. Findings

3.1 The *Hans* struck rocks and sank near the entrance to Tory Channel because there was nobody monitoring its progress. The skipper who was in the wheelhouse fell asleep because he was probably suffering the effects of critical fatigue.

3.2 The number of crew aboard the *Hans* exceeded the stipulated minimum crewing level by 2. However, the way the fishing operation was organised meant there were not enough crew to work the vessel and still have a well rested person available to navigate the vessel back to port, as recommended by STCW-F and stipulated by New Zealand Maritime Rule Part 31C.

3.3 The SSM system under which the *Hans* was operating did not adequately address the responsibilities for preventing fatigue on board as required by Rule 31C.

3.4 The operator's policy for remuneration of the crew created an incentive to under-man the *Hans* and other vessels in its fleet, and in the absence of appropriate measures to prevent fatigue, may have contributed to the *Hans* grounding.

3.5 A vessel the size of the *Hans* operating with fatigued crew on board created a significant risk to itself and other maritime traffic at any time, and in this case created an extreme risk to other users of Tory Channel, including high-speed and conventional passenger ferries.

4. Safety Recommendations

4.1 On 5 April 2002, the Commission recommended to the managing director of Pegasus Bay Fishing Limited that he:

4.1.1 Implement the requirements of Maritime Rule 31C for all vessels operated by his company and update the Safe Ship Management manuals as necessary. (008/02)

4.1.2 Ensure that the manning of fishing vessels operated by his company is adequate to enable at least one crew member capable of watchkeeping to be sufficiently rested at all times. (009/02)

4.1.3 Fit watchkeeping alarms to the wheelhouse of all vessels operated by his company. (010/02)

4.2 On 5 April 2002, the Commission recommended to the principal surveyor of Lloyd's Register of Shipping that he:

4.2.1 Implement the requirements of Maritime Rule Part 31C for all vessels under its safe ship management system. (011/02)

4.3 On 3 April 2002, the principal surveyor of Lloyd's Register of Shipping advised in part:

4.3.1 On Tuesday 2 April 2002, Lloyd's Register sent a letter to their clients advising them of the need to comply with Maritime Rule Part 31.

4.3.2 I can confirm that our standard format SSM Manual has been changed accordingly to incorporate Maritime Rule Part 31.

4.3 On 5 April 2002, the Commission recommended to the general manager trade and education of the Seafood Industry Council that he:

4.3.1 Include an article in the Seafood New Zealand magazine featuring this report, the intent of Maritime Rule Part 31C together with its advisory circular and the work of the Maritime Safety Authority convened Fishing Industry Safety and Health Advisory Group (FISHgroup). (012/02)

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Hon. W P Jeffries
Chief Commissioner