Report 08-205: fishing vessel, San Cuvier, dragged anchor and grounded, Tarakeha Point, Bay of Plenty, 27 July 2008

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fishing vessel
San Cuvier

dragged anchor and grounded

Tarakeha Point, Bay of Plenty

27 July 2008

The *San Cuvier* aground at Tarakeha Point

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Executive Summary

At about 0300 on 27 July 2008 the fishing vessel *San Cuvier* dragged its anchor and grounded on rocks close to Tarakeha Point to the east of Opotiki in the Bay of Plenty. The skipper drowned and another crew member was missing presumed drowned after they attempted to abandon the vessel. Another 2 crew members survived by scaling the rocks close to the stricken vessel.

The forecast for the area was for storm-force winds and a heavy swell from the north. Awaawakino, where the vessel was anchored, was not a suitable anchorage for the predicted and actual weather conditions.

No anchor watch was being maintained at the time. Had it been, the grounding might have been prevented. Anecdotal evidence suggests that anchor watches are not routinely maintained in a large number of inshore fishing vessels in New Zealand.

The anchor fitted to the *San Cuvier* was estimated to be smaller than required by maritime rules, but it is doubtful whether a fully compliant anchor would have held in the conditions at the anchorage.

Safety recommendations have been made to the Director of Maritime New Zealand to gather data on the number of deaths and injuries within New Zealand caused or contributed to by not maintaining effective anchor watches, and to compare this with overseas data and use the information to educate the New Zealand fishing industry on the prudence of keeping an effective anchor watch.

This executive summary summarises the main points contained in this report to provide the reader with a high-level overview of the circumstances and causes of the accident, and the Transport Accident Investigation Commission's findings and recommendations. For a full description, readers should refer to the main part of this report and its appendices.

Abbreviations

ACC	Accident Compensation Corporation
CLM	commercial launch master certificate
EPIRB	emergency position indicating radio beacon
hPa	hectopascal(s)
kg	kilogram(s)
m	metre(s)
mg	milligram(s)
MHz	megahertz
mm	millimeter(s)
nm	nautical mile(s)
RCCNZ	Rescue Co-ordination Centre of New Zealand
Sanford	Sanford Limited
SSB	single side band (radio)
UTC	universal co-ordinated time
VHF	very high frequency (radio)

Glossary

fresh	with regard to tidal flow, is the out flowing of fresh water from a river. The fresh water is lighter than the seawater and remains on the surface
longline	a method of fishing that uses a long, heavyweight, horizontal fishing line with a series of baited hooks attached by traces or snoods at intervals along its length. Can be used to fish close to the surface or along the sea bottom

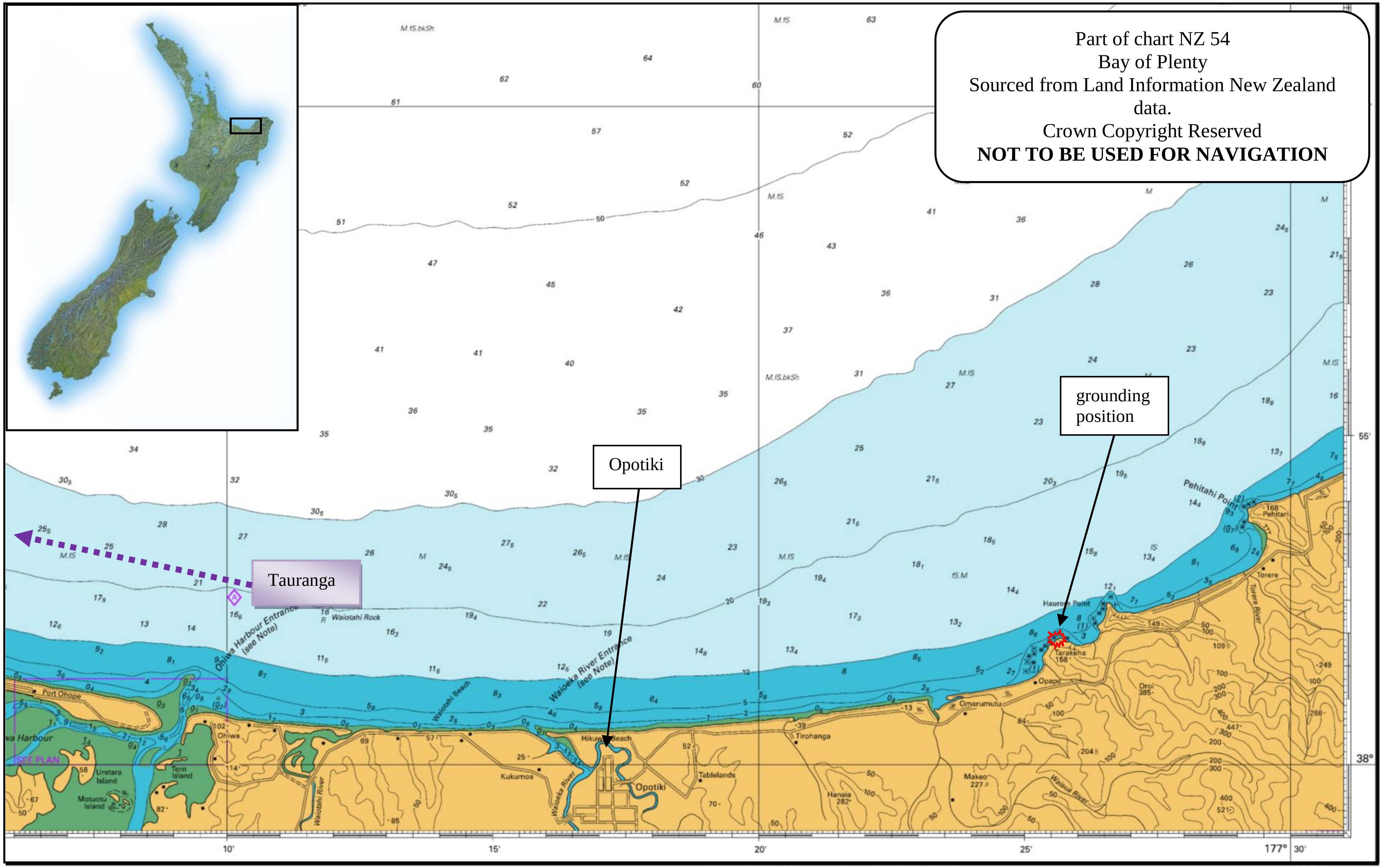
Data Summary

Vessel particulars:

Name:	*San Cuvier*
Type:	fishing vessel
Safe ship management :	SGS M&I
Limits:	Offshore Limit; within 100 miles of the coast of New Zealand including Stewart Island and the Chatham Islands
Length:	18.21 metres (m)
Breadth:	5.79 m
Gross tonnage:	77.06
Built:	1980
Propulsion:	Gardiner 8L3B, 8-cylinder diesel engine that produced 230 brake horsepower. Propulsion was via a TwinDisk MG 514 gearbox with a 3:1 ratio to a 4-bladed fixed-pitch propeller encased in a nozzle
Service speed:	10 knots
Owner/Operator:	Sanford Limited (Sanford)
Port of registry:	Auckland
Crew:	4

Date and time:	about 0300[1] on 27 July 2008	
Location:	Tarakeha Point, Bay of Plenty	
Persons on board:	crew:	4
Injuries:	crew:	2 fatal, 2 serious
Damage:	vessel badly damaged and driven hard aground. declared a constructive total loss and was dismantled on site and removed	
Investigator-in-charge:	Captain Doug Monks	

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


Part of chart NZ 54
Bay of Plenty
Sourced from Land Information New Zealand data.
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NOT TO BE USED FOR NAVIGATION
grounding position
Opotiki
Tauranga
Pehitahi Point
Hauroa Point
Tarakeha
Opape
Omarumutu
Torere
Tirohanga
Tablelands
Kukumoa
Hikuwai Beach
Waiotahi Beach
Waiotahi Rock
Ohiwa Harbour Entrance (see Note)
Waioeka River Entrance (see Note)
Port Ohope
Uretara Island
Motuotu Island
Tern Island
Ohiwa
Makeo
Hanaia
Oroi
Pehitari
10'
15'
20'
25'
177° 30'
55'
38°

Figure 1

Part of chart NZ54 Bay of Plenty

1 Factual Information

1.1 Narrative

1.1.1 At about 1400 on Friday 25 July 2008, the bottom-longline fishing vessel *San Cuvier* with a skipper and 3 deckhands departed Tauranga to fish in the Bay of Plenty (see Figure 1).

1.1.2 At about 1800, that evening the crew started to set the bottom longline. Figure 2 shows the general area and vessel positions extracted from Sanford vessel tracking data. By about 1936 they had finished setting the longline and the vessel had been anchored to allow the crew to rest.

1.1.3 At about 0730, the following day the crew arose and steamed back to the beginning of the longline while they prepared the deck for handling the fish. At about 0800 they started to haul the longline, a process that took between 5 and 6 hours. By about 1400 the longline was on board and the crew were stowing the fish and preparing for the next set while the skipper steered the vessel eastwards towards the next fishing ground.

1.1.4 At about 1800, just to the north of Opotiki, the crew started to set the longline. The crew completed setting the line and by about 2100 the vessel was anchored in position 37° 57'.564 S 177° 25'.764 E, as recorded by the vessel tracking system of the operator. This position was a little over half a nautical mile (nm) off the shore in what is locally known as Awaawakino or Morrison's Bay (see Figure 3).

1.1.5 The crew had dinner and cleaned up the galley, then relaxed. Deckhands B and C talked on their mobile phones or played electronic games, while the skipper and deckhand A watched DVDs in the messroom.

1.1.6 By 2230, the skipper and deckhand A had gone to their bunks, while the other 2 deckhands were on the bridge playing electronic games. The skipper had left the main engine running to charge the ship's batteries. By about 0030 on 27 July 2008 deckhands B and C had also gone to their bunks.

1.1.7 At about 0240, the boat took several severe rolls. At the same time, one of the crew, who was sleeping in the top bunk on the port side of the cabin under the foredeck, heard the anchor wire drumming above his head.

1.1.8 The skipper and crew got up to find that the after deck was a mess, with the canvas awning ripped to shreds and fishing equipment strewn all over the deck. Heavy waves were hitting the port side of the boat, causing it to roll heavily, and there was torrential rain. During one of the rolls to starboard deckhand C slid across the galley and crashed into a cupboard, injuring his ribs. A wave washed into the accommodation through the after port door and soon smoke and then flames were seen coming from an electric switch high up on the bulkhead. One of the deckhands slapped the area with his hand, which was sufficient to extinguish the fire.

1.1.9 The crew donned lifejackets. The skipper told deckhand B to heave up the anchor, so he went into the engine room to start the auxiliary engine, which as well as powering the main alternator was usually used to drive the hydraulic pump for the winches. While he was in the engine room, a wave washed through the open door into the engine room, so he engaged the engine room bilge pump that was also driven off the auxiliary motor.

1.1.10 When he returned to the deck, deckhand B together with the other 2 deckhands tried to haul on the anchor, but the anchor winch did not have sufficient power to overcome the weight on the anchor warp. The crew members attempted, without success, to cut the wire anchor warp with bolt crops. It was at about this time that the crew saw rocks close on the port side and realised that they were aground. The boat was still rolling violently and sustaining damage to the topsides as it rolled against the rocks.

1.1.11 The life raft ended up in the water, but it was unclear whether it was washed from its cradle by a wave or whether one of the crew had launched it. Nevertheless, none of the crew members was able to reach the life raft before its painter parted, and the life raft drifted away towards the shore; where it was later recovered by local residents.

The rescue

1.1.12 The first alert that the *San Cuvier* was in distress was received from the 406 megahertz (MHz) emergency position indicating radio beacon EPIRB by the Rescue Co-ordination Centre of New Zealand (RCCNZ) at 0329, from which 2 possible positions, one 45° 57'S 177° 26'E (1350 nm east-southeast of the Chatham Islands) and another 37° 57'S 177° 26"E (7 nm east of Opotiki and 1 nm offshore) were identified. From the information logged with the EPIRB registration, RCCNZ was able to confirm quickly which of these positions was most likely to be the *San Cuvier*.

1.1.13 The operators at RCCNZ and the radio operators at the Marine Operations Centre continued to try, without success, to contact the ship by telephone and radio. Once the probable position was confirmed to be near Opotiki, RCCNZ informed Police search and rescue, put a helicopter on standby and tasked a fixed-wing aircraft.

1.1.14 By 0458 the vessel manager from Sanford was able to confirm that the company tracking system had also placed the vessel close to the EPIRB position about 7 nm east of Opotiki. Shortly after, at 0503, a second pass of the satellite confirmed the Opotiki position from the EPIRB.

1.1.15 The fixed-wing aircraft was able to home in on the 121.5 MHz signal from the EPIRB and at 0636 reported that the fishing vessel had been sighted close to the cliffs near Tarakeha Point. The aircraft was also able to report seeing a couple of lights, probably lifejacket lights on the cliffs behind the vessel.

1.1.16 The helicopter was tasked with going to the scene, and shortly after 0730 the first crew member was rescued from the rocks and landed in the small settlement of Opape, where he was tended by local residents until ambulances from Whakatane arrived. The second crew member was rescued shortly after 0800 and he was also landed at Opape. Both deckhands were taken to Whakatane hospital; deckhand B was treated for cuts and bruises and discharged, deckhand C was admitted to treat a punctured lung.

1.1.17 The helicopter crew were able to recover the body of the skipper quickly from the beach close to the east of the vessel. At about 0900, the body of deckhand A was seen to the eastern side of the bay, but before the paramedic could secure the body in a harness, a large wave washed deckhand A out to sea. Further aerial and ground searches in the subsequent days were unable to relocate the body.

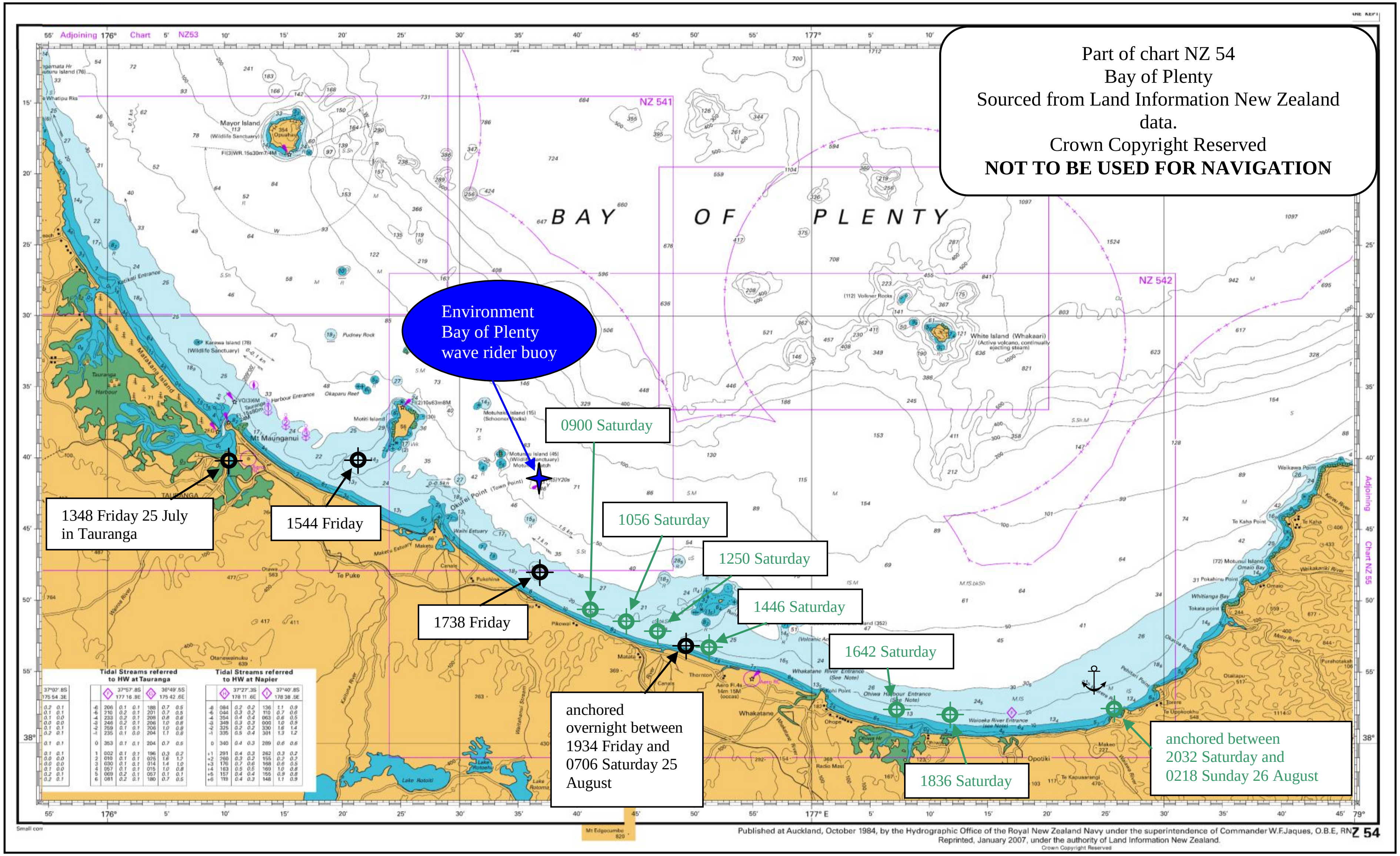


Figure 2

Route of the *San Cuvier* (positions and times from the Sanford tracking system)

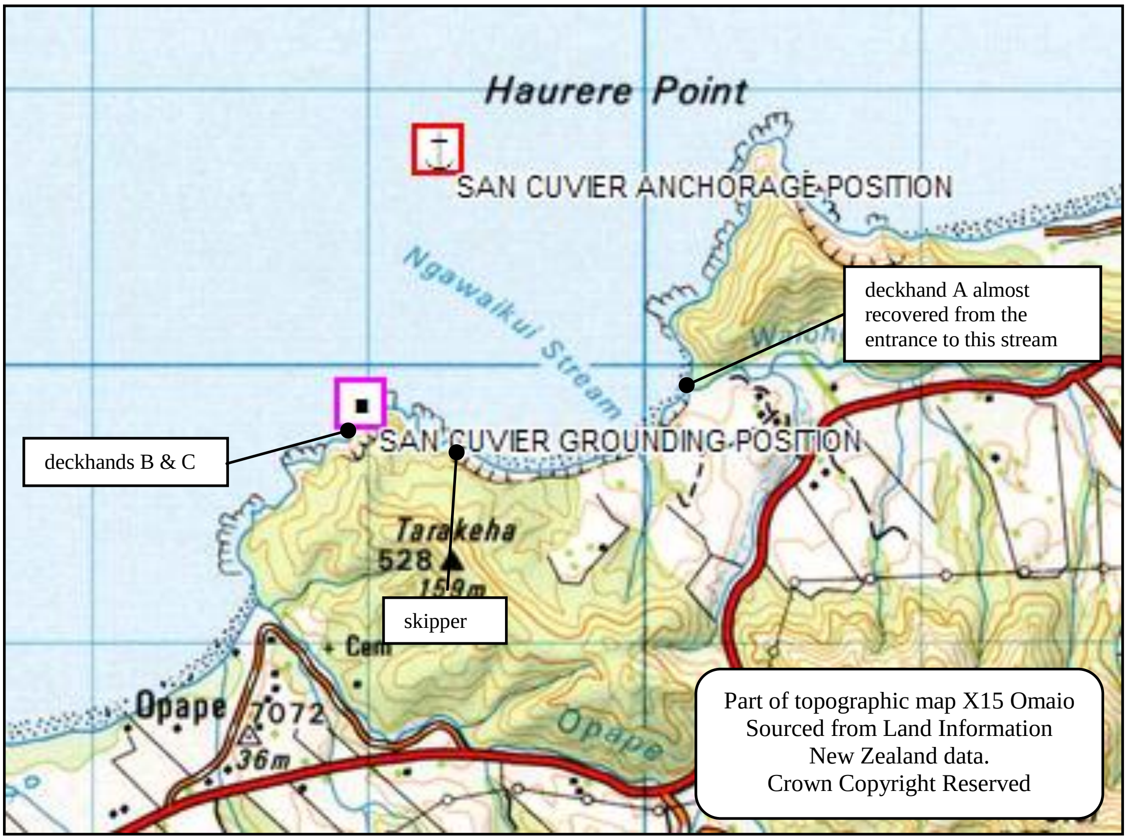


Figure 3
Topographic map showing positions of vessel and people

1.2 Vessel information

1.2.1 The *San Cuvier* was owned and operated by Sanford. It had been built in the Vos and Brijs yard in Auckland in 1980. The vessel was constructed of steel and had a length overall of 18.21 m, a breadth of 5.79 m and a depth of 3.37 m. It had a gross tonnage of 77.06.

1.2.2 Initially it was designed as one of 2 pairs of inshore pair-trawlers.[2] Each of the 4 fishing vessels was identical except that the accommodation of one of each pair was the mirror image of the other vessel in that pair. On the *San Cuvier* the wheelhouse door was on the starboard side and the messroom and exit to the main deck were on the port side. In the late 1990s the *San Cuvier* was converted to fish using a bottom longline.

1.2.3 The vessel was in safe ship management with SGS M&I and was certified to operate in the Offshore Limit; within 100 miles of the coast of New Zealand including Stewart Island and the Chatham Islands.

1.2.4 The main engine was a Gardiner 8L3B, 8-cylinder diesel engine that produced 152 kilowatts. Propulsion was through a TwinDisk MG 514 gearbox to a 4-bladed, fixed-pitch propeller encased in a nozzle, giving a service speed of about 10 knots.

1.2.5 The auxiliary engine was a Gardiner 6LX, a 6-cylinder diesel engine that drove a 100-ampere alternator. The hydraulics system could be powered from either the main engine or the auxiliary engine. Usually the hydraulic system was set for the main engine to run the deck machinery, while the auxiliary was set to run the anchor winch.

1.2.6 There was a small alternator driven by the main engine, which charged the ship's batteries. On the bridge there was the following navigational and fishing equipment:

[2] Pair-trawling is a method of fishing where a large trawl net is towed by and between 2 fishing vessels

Radar	Furuno FR1832
Single sideband (SSB) radio	ICOM 710
Very high frequency (VHF) radio	Uniden
Autopilot	Wagner MK4
Chart plotter	C Plot Voyager
Sounder	Furuno FCV 1150
Global positioning system (GPS)	Furuno GP 30

A weather facsimile machine was on the vessel, but it could not be established if it had been operational or whether the skipper had used it to receive weather charts.

1.2.7 At the time of the accident the vessel was bottom longlining for snapper. The catch was solely for the fresh export market. The boat worked the northeast coast of North Island New Zealand from the Bay of Islands down to the Bay of Plenty, the exact location being dependent on the season and the availability of fishing quota.

1.2.8 Originally, the vessel had landed its catch weekly, which allowed the skipper to fish areas more remote from their home port. But more recently, to ensure the quality of the fish, the company had required that the catch be landed every 3 days. Consequently, to reduce travelling time between the port and the fishing grounds, the skipper had elected to operate out of Tauranga when fishing in the Bay of Plenty.

1.3 Personnel information, including medical information and survivability

1.3.1 The skipper had been fishing for about 21 years and had been skipper for about 14 years. He held a commercial launch master certificate (CLM), which had been issued in November 1984. He had worked for Sanford since 2004, and had been skipper of the *San Cuvier* since January 2005.

1.3.2 Deckhand A had been fishing commercially for about 20 years. He held a CLM, which had been issued on 22 December 1998. He was usually skipper of his own fishing vessel, but had offered to relieve as deckhand on the *San Cuvier* because the usual deckhand was not available.

1.3.3 Deckhand B had worked for Sanford since October 2003, initially on the *Happy 1*, also a bottom-longline vessel, and on the *San Cuvier* since November 2004. He had no formal marine qualifications, but did have first-aid training.

1.3.4 Deckhand C had joined the *San Cuvier* in March 2008. He had no formal marine qualifications.

1.3.5 Sanford had 2 inshore longline vessels; the other one, the *San Kaipara*, was a sister ship of the *San Cuvier*. There were 2 crews on the *San Kaipara*, who worked on alternate weeks. Initially, the *San Cuvier* had operated the same roster, but in the middle of 2005, it had reduced to one crew working a 3-week-on and one-week-off roster, with the boat being laid up while the crew were on leave.

1.3.6 The skipper had injured his back while lifting fish bins on 26 May 2008. He went to the doctor, by whom he was given pain relief and declared unfit to work for 14 days. The injury was accepted by the Accident Compensation Corporation (ACC) as a work-based injury, so his medical expenses were covered together with the possibility of claiming recompense for any income lost due to the injury. However, his work records showed that he continued to work on the *San Cuvier* between the following dates:

27 May and 4 June,

13 June and 8 July, and

16 July and 27 July (the day of the accident).

Consequently, the only periods in which the skipper was off the vessel were 4 June to 13 June, and 8 July to 16 July.

1.3.7 The skipper had further consultations with the doctor on 23 June and 21 July, at which he was given further pain relief in the form of tramadol hydrochloride 50 milligrams (mg) and diclofenac sodium (Voltaren) 75 mg. He was given crutches to assist his mobility. The surviving deckhands reported that the skipper had been suffering chronic back pain, often severe, which restricted his ability to move freely about the vessel. However, deckhand B said that the skipper had appeared to be in less pain during the accident voyage than he had on the previous voyages. Toxicology tests confirmed the presence of tramadol in the skipper's blood system. No performance-impairing substances were detected other than traces of alcohol consistent with naturally occurring alcohol following death.

1.3.8 The post-mortem results showed that the skipper had drowned, but had sustained heavy blows to the head and lacerations to his back, chest and abdomen. The body of deckhand B was never recovered, so the cause of death could not be identified. However, the paramedic who had been lowered from the helicopter to recover deckhand B from the stream was able to confirm that he had been dead when found.

1.3.9 The 2 deckhands who survived were tossed about in the vessel before they entered the rough seas. They were swept towards the shore, where they were able to cling onto the cliff side and wedge themselves into small crevices just above the sea water level. Both of the deckhands sustained multiple superficial cuts and lacerations to their limbs from the rocky shore. In addition, one of the deckhands sustained a punctured lung, possibly caused by impact with the galley cupboard before they abandoned the vessel.

1.4 Meteorology and environment

1.4.1 The adverse weather conditions experienced on the day had been forecast for at least 2 days previously (refer to the full meteorological report in Appendix 1). The coastal marine forecast for the meteorological area Plenty issued at 0005 on 25 July 2008 had an outlook of southeast winds of 30 to 40 knots with a rough sea and heavy northeast swell developing late Saturday. By 1233 on 25 July the forecast had been upgraded to a storm warning, with high seas and 4 m high northeast swell. By 1234 on 26 May, easterly winds of 40-50 knots were forecast with high seas and a northerly swell of 6 m.

1.4.2 The Transport Accident Investigation Commission had a consultant meteorologist provide an after-cast of the wind and waves in the Bay of Plenty. To reconstruct the wind sea and swell conditions in the vicinity of Whakatane, White Island and Te Kaha, the following information was used:

1. Significant wave direction and height information recorded by the Environment Bay of Plenty wave buoy[3]
2. Computed wave analyses from the ECMWF[4] ocean wave forecasting system
3. MetService analysis charts, and wind observations at White Island.

[3] This data was provided by the Data Services Manager, Environment Bay of Plenty, and is produced here by permission.
[4] The European Centre for Medium-range Weather Forecasting runs global numerical weather prediction systems and distributes analysis and forecast data by arrangement. Data received at MetService from the ocean wave forecasting system are rendered on maps for weather monitoring and forecasting.

A synopsis of the findings is tabulated below:

Period	*Waves*			*Wind*		*Notes*
	combined significant height	combined maximum height	direction	speed	direction	
26 July 2008 1200 to 1800	2-3 m	3 m	ENE	30-50 knots (50 knots recorded at 1500)	E	Wind would have been less close to the coast
26 July 2008 1800 to 2200	3-4 m	some 5-6 m and isolated waves higher still, in an increasing trend	ENE	35-45 knots (50 knots recorded at 1900)	E	The change in the direction in which the significant waves were travelling towards the end of this period was the result of the predominant wave component (in the combined waves) changing from wind waves travelling from the east to swell waves travelling from the north.
2200 to midnight			NNE	eased to 5 knots	NE	
27 July 2008 midnight to 0600	5-6 m	occasional 7-8 m and isolated waves higher still	NNE	15-20 knots	E becoming SE	Gradually the significant wave height decreased to about 4 m with occasional waves about 6 m

Table 1
Summary of sea and weather conditions from 1200 26 July to 0600 27 July

1.4.3 The above information used the raw data from the Environment Bay of Plenty wave buoy (see Figure 4) that was located about 13 kilometres off Pukehina Beach, about halfway between Tauranga and Whakatane, which was about 42 nm from the accident location (see Figure 2). Of note, the average wave height rose steadily from 1800 on 26 July to peak at 3.43 m at 0200 on 27 July 2008. The maximum wave height rose more erratically and peaked at 9.1 m at 2300 and again at 0300, but only fell to just under 8 m between the 2 peaks. The mean wave period increased from about 6 seconds at 1800 to just over 8 seconds at midnight and did not reach its peak of 9.2 seconds until 0700 on 27 July. The direction of the waves was predominantly from the northeast, but at about midnight they turned through north to north-northwest.

1.4.4 The barometric pressure measured at Whakatane town wharf showed that the pressure dropped rapidly to 972 hectopascals (hPa) shortly before 0400 on 27 July. This indicated that the centre of the severe depression of 964 hPa passed over the Bay of Plenty in the early hours of 27 July.

1.4.5 Waves (Waves from the Water Encyclopedia, 2007-2009; Swell, 1999 - 2010) are characterised by 3 measurements:

- wave height is the distance from the top of a crest to the bottom of a trough
- wavelength is the distance between 2 successive crests (or troughs)
- wave steepness is the relationship between wave height and wavelength.

1.4.6 Waves are a combination of wind-driven waves and swell waves. Wind waves are formed locally by the prevailing wind blowing over water; they usually follow the direction of the wind and increase in size with the strength of the wind. Swell waves are long, smooth-crested waves that have relatively long and regular wavelengths. They are formed by a weather system some distance away before they move outside their area of origin in the direction of their developing wind. Waves with longer wavelengths move faster than those with short wavelengths.

1.4.7 Waves diffract or deflect as they approach a shoreline; this can cause waves to bend around and follow a coast. For example, near the accident site the easterly wind waves would refract toward the coast line to meet it more from a northeast direction.

1.4.8 As a wave approaches the coast, its base begins to contact the sea bottom and the wave's profile begins to change. The base of the wave slows, but the upper part continues at the same speed; in effect the wave starts to lean forward. When the wave's steepness ratio exceeds 1 to 7 the wave collapses on itself and spills forward, forming a breaker. Even before a wave breaks, the gradient can increase to the extent that an approaching wave can form a near-vertical face, which can cause problems for small, less well-found vessels.

1.4.9 The skipper of the *San Cuvier* had several options for obtaining weather forecasts and weather warnings. He could have received them over the VHF or SSB radios. Maritime Radio broadcast the maritime weather forecasts on VHF radio daily at 0533, 0733, 1333, 1733 and 2133. If the weather forecast for one or more areas was upgraded, that was broadcast as it came to hand. In addition to the foregoing, the vessel was often sufficiently close to the coast for television reception, so it was possible that the skipper watched the weather on that. Weather charts could have been received on the weather facsimile machine, if it was working at the time of the accident.

1.4.10 It could not be established what, if any, weather forecasts were received by the skipper, but his wife had told him in a telephone conversation at lunchtime on Saturday that she was experiencing a storm with very heavy swell at their home close to Whangarei. The skipper had said that he should be safely at anchor by the time the storm reached their position. In a later conversation, he mentioned that he thought his anchorage was safe even if the wind changed.

1.4.11 High tide at Haurere Point was at 0052 on 27 July, with low water at 0705 the same day (Land Information New Zealand Hydrographic Services,2008).

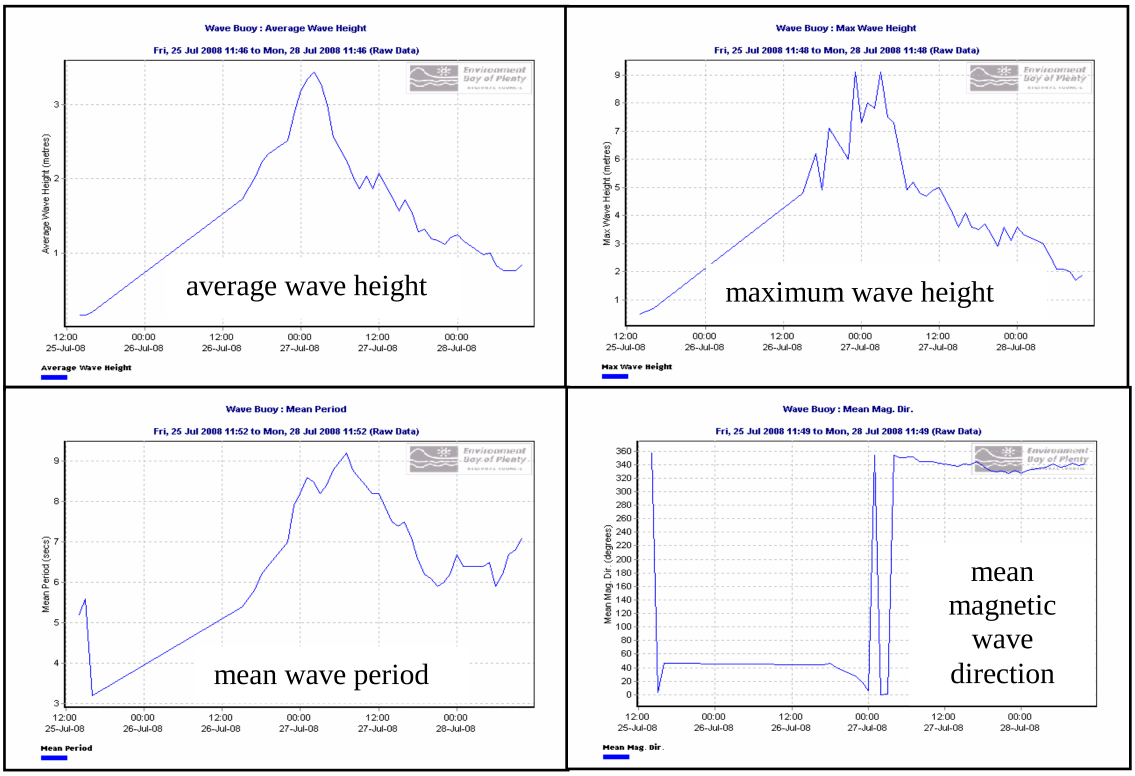


Figure 4
Environment Bay of Plenty wave rider buoy data

1.5 Damage

1.5.1 The damage to the vessel was largely superficial:

- the lower part of the hull was dented from being rolled on the reef, but remained intact

- the fishing equipment on the afterdeck was strewn around the deck or washed overboard, and the canvas awning was in tatters
- the bulwark on the starboard side was stove-in and there was severe denting on the upper part of the hull where the vessel had been rolled onto the rocks
- the gantry and mast on top of the deckhouse was bent with the topmost section missing probably from where it had made contact with an adjacent rock when the vessel rolled to starboard
- the anchor warp fairlead on the bow was damaged, with the port cheek torn and bent through more than 90 degrees (°) (see Figure 5), almost certainly from the extreme weight that had come onto the anchor warp
- the vertical arm of the stabiliser was bent at right angles, from the vessel rolling to port during the grounding.

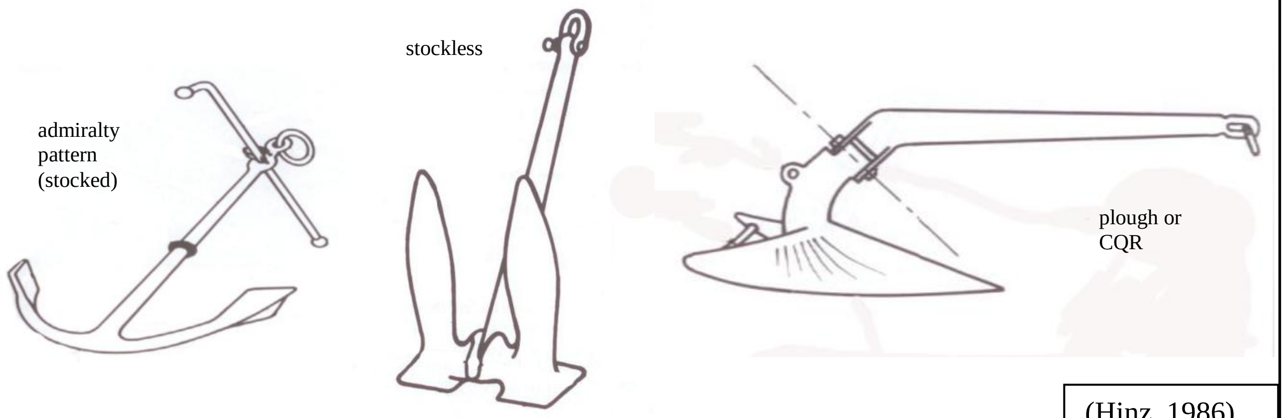
1.5.2 Ultimately, it proved impossible to refloat the vessel and it had to be broken up in-situ and removed by helicopter.

Figure 5
Damaged forward fairlead

1.6 Anchors and anchoring

1.6.1 There are various types of anchor, but almost all of them have one or more pointed blades or flukes that bury into the seabed as the anchor is set by being drawn horizontally along the sea bottom. All anchors have a mechanism to turn the anchor so that the pointed part of the fluke(s) is directed into the seabed. In some anchors, such as the admiralty pattern anchor (see Figure 6), a bar or stock is fixed to the shank at right angles to the plane of the blades, which tips the anchor as it is set so that one of the flukes becomes embedded in the sea bottom. In other anchors, such as the patent stockless anchor, the flukes pivot to about 45° either side of the shank, so are always pointing at the seabed. Lastly, some anchors, such as the plough anchor, are designed so that the blade will dig into the seabed even when the anchor is lying on its side.

1.6.2 Maritime Rules Part 40D – Design, Construction and Equipment – Fishing Ships, sections 40D.70 to 40D.75 (Maritime New Zealand, 2009) specified the requirements for the anchors and cables for fishing vessels. Under Part 40D.75.1 the *San Cuvier*, being an existing ship with a certificate of survey, was allowed to maintain its existing anchors and cables as specified in the red book[5] (Ministry of Transport, ND), provided they remained in a condition satisfactory to a surveyor. Had the *San Cuvier* been a new construction (or had changed its anchors after being accepted into the safe ship management system) and operating in the offshore area, it would have been required to meet the requirements of table 2(A) of Appendix 4 of Part 40D, which for a ship of 18 m length and a height of 3.5 m above the waterline, prescribed an anchor of 111 Kilograms (kg) with a prescribed length of anchor chain of 96 m of 15 millimetres (mm) diameter short-link chain. The prescribed weights for anchors in the Maritime Rules assumed a stockless anchor with a holding power of 3 times its weight. Where a recognised high-holding-power anchor, one with at least twice the holding power of a stockless anchor, was used, a 30% reduction (25% under the red book) in anchor weight was permitted.



(Hinz, 1986)

Figure 6
Types of anchor

1.6.3 Table 3(A) of Maritime Rules Part 40D allowed for an anchor weight in the range of 89-100 kg for rope to replace all or some of the anchor chain. The red book and guidelines for marine surveyors allowed wire to be used instead of chain, providing the wire had a breaking strain equal to or greater than that of the tabulated anchor cable; the Maritime Rules did not have a similar allowance. In the case of the *San Cuvier* there were 40 m of chain at the anchor, with inboard of that 162 m of 19 mm wire rope.

1.6.4 The safe ship management documentation showed that the *San Cuvier* had been fitted with 2 anchors, a 115 kg stockless anchor and a spare 81 kg stocked anchor (see Figure 6). The spare stocked anchor was still stowed on the foredeck of the *San Cuvier* after the accident. When the vessel was being broken up, the anchor wire, chain and anchor shank were recovered. The head of the anchor had parted from the shank and was not recovered. The recovered anchor shank (see Figure 7) was that of a plough or CQR type anchor and not that of the documented stockless anchor. There was no documentation concerning the change of anchor nor could the operator confirm when the new anchor had been fitted to the vessel. On its recovery, the anchor shank was photographed by an insurance assessor before being transported, together with the wire warp, and chain to a rope warehouse in Auckland. On its arrival there, the warp and chain were measured and tested before being stored in the warehouse yard. A sample of the 19 mm 6 x 19 galvanised wire rope was tested to destruction, breaking at 28 000 kg. The 24 mm regular link chain of the anchor cable was tested to 23 000 kg, where it stretched but did not break.

1.6.5 Before the Commission was able to inspect the anchor shank physically, it disappeared from the yard. Some of the photographs taken by the insurance assessor of the recovered anchor shank had a standard AA battery included to give a measure of scale. The photographs of the anchor shank were given to makers of plough anchors to estimate the size and weight of the anchor.

[5] The red book was the common name for the Requirements for the Construction and Equipment of Fishing Boats issued by the Ministry of Transport, Marine Division.

Determining the size of an object from a photograph is more complex than might first appear, and does involve some estimation and allowance for the parallax of the object in the camera lens. The estimation of the weight of the anchor did vary considerably, with one maker estimating between 48 kg and 64 kg.

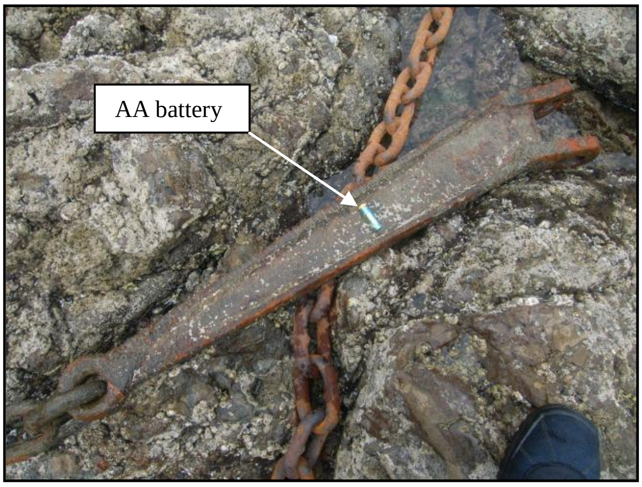


Figure 7
The recovered anchor shank

1.6.6 Successful anchoring is dependent on a number of factors; the type and weight of the anchor, the type, weight and length of the rode (the chain, wire or rope attaching the anchor to the vessel), the depth and nature of the seabed, the movement of the vessel in the seaway, and any other forces acting on the vessel (such as wind). Each anchor has a nominal holding power, with certain types being classified as high-holding-power anchors with approval from classification societies.

- **The type and weight of the anchor:** the weight is only part of the holding power of an anchor; the ability of the fluke(s) to dig into the seabed is of equal or greater importance. The anchor of the *San Cuvier* was of the plough type that had the designation of being a high-holding-power anchor. The estimated maximum weight of the anchor used on the *San Cuvier* was less than 64 kg. Allowing for the 30% reduction in weight due to it being a high-holding-power anchor, the prescribed weight for an anchor on a vessel similar to the *San Cuvier* should have been a minimum of 80.5 kg (16.5 kg heavier than the estimated maximum weight of the *San Cuvier*'s anchor). Plough anchors are most efficient in sand and mud bottoms. Many tests have been conducted on the various holding powers of anchors, often by the designers of new types of anchor as a method of showing the advantages of their anchors. In The Complete Book of Anchoring and Mooring (Hinz, 1986), Earl R Hinz quotes tests conducted by the NAV-X Corporation, conducted in both sand and mud. An original 47 pound [21kg] CQR anchor is quoted as having a holding power of 1451 kg (68 to 1) in sand and 218 kg (10.2 to 1) in mud.

- **The type, weight and length of the rode:** for an anchor to work effectively, the direction of pull on it needs to be close to horizontal so that the fluke(s) is drawn down into the seabed. To achieve this, sufficient rode is required to allow the vessel to sit at a distance from the anchor and to give sufficient catenary in the rode to result in it connecting to the anchor almost horizontally. An adequate length of rode will obviously depend on the depth of water, but the expected weather conditions, which can straighten the catenary by pushing the ship away from the anchor, also need to be taken into account. Typically a ratio of 6 m of rode to one metre water depth (6 to 1) is sufficient in benign weather conditions. Where chain is used, its weight can contribute to the overall static weight of the anchor. Wire rope, because of its inability to stretch when a shock load is applied to it, is not a recommended material for an anchor rode. However, it does have the advantage of being suitable to be wound onto a fixed winch drum. In his book, Boat Mechanical Systems Handbook (Gerr, 2008), Dave Gerr suggests that wire is a good material for deep-water anchoring provided chain is used between the wire rope and the anchor as a spring to prevent shock loads and maintain a suitable angle at the anchor. Smaller vessels often use nylon rope as an anchor rode because of its elasticity. The *San Cuvier* was anchored to a rode of 40 m of chain and 50 m of 19 mm wire, a total of about 90 m giving a ratio of rode to water depth of about 9 to 1.

- **The depth and nature of the seabed:** the vessel was anchored close to the 10 m contour on the chart and the bottom was a mixture of fine sand and mud. The type of bottom will have a major influence on the holding powers of various types of anchor. There have been many studies into the relative holding powers of anchors and sea bottoms, and all have produced various results. One of those conducted by the United States Navy and quoted in Complete Book of Anchoring and Mooring by Earl R Hinz (ibid) gave the conclusions in Table 2:

Sea bottom material	Relative holding power	Comment
Firm sand	1	
Still-dense clay	1.5	
Sticky clay of medium density	0.66	
Soft mud	0.33	
Loose coarse sand	0.33	
Gravel	0.33	
Hard bottom (rock, shale, boulders)	0	Unless anchor hooks under massive rock

Table 2
Anchor holding power in various types of seabed

- **The movement of the vessel in the seaway:** A vessel in a seaway is moved by the wind and waves. The principal destabilising motions on an anchor are where a vessel experiences yaw and surge, and rise and fall due to pitching and heaving. Surge can straighten the catenary from the anchor rode, so impart a vertical force on the anchor. Yaw tries to tear the anchor from the seabed by changing the direction of pull. The rise and fall of the vessel will impart more vertical force on the rode and through it to the anchor. The surviving crew members said that when the *San Cuvier* was initially anchored, it was lying quietly to its anchor. However, after midnight, as the weather deteriorated and the sea conditions worsened, it could have been expected to pitch and yaw more.

1.6.7 Over the years there have been many accidents where the failure to maintain an adequate anchor watch has been adjudged a contributing factor. These accidents have often resulted in the regulator distributing advice to the industry, often in the form of a marine notice or similar publication. The 2 most recent marine notices were 12/1996 Anchor Watches (Appendix 2) and 01/1999 Anchor Watches on Fishing Vessels (Appendix 3). The latter of these notices is specifically addressed to fishing vessels and lists the factors that need to be taken into account when deciding on a place to anchor. The notice includes a reminder to owners and masters of the need to maintain a continuous anchor watch.

1.6.8 Maritime Rules Part 31C: Crewing & Watchkeeping – Fishing Vessels (Maritime New Zealand, 2001) contained the requirement for vessels to maintain an anchor watch (see 1.8.2 below). The Advisory Notice that accompanied Part 31C also mentioned anchor watches:

> **Anchor Watch**
> The skipper should ensure, with a view to the safety of the vessel and personnel, that a proper watch is maintained at all times from the wheelhouse or the deck on fishing vessels at anchor.

1.6.9 Through discussions with skippers on similar-sized fishing vessels, the *San Kaipara* and the *Sandra-K*, it seemed that within the inshore fleet it was unusual to maintain anchor watches unless the skippers expected adverse weather.

1.7 Employment of fishermen

1.7.1 As owner and operator of the *San Cuvier*, Sanford paid for the operation of the vessel, its maintenance, its provisions, the majority of its fuel and the compliance costs. The skipper paid for the consumable fishing gear and the hooks, line and floats. The company held the quota for the fish and managed which areas the skippers were to fish.

1.7.2 Like almost all company-owned and operated fresh fish vessels in New Zealand, the skipper and crew on the *San Cuvier* were engaged as self-employed contractors. This type of contract meant that they were not paid wages or salaries but received a percentage of the value of the total catch, dependent on their position within the crew. The wages were directly proportional to the amount of fish caught. Sanford administered the accounts and paid each of the crew members directly.

1.7.3 The company appointed the skipper, who was employed under a contract called "Skipper's Declaration and Instructions to Masters". Under that contract, the skipper was responsible for the safe and legal operation of the vessel, which included;

- the selection and employment of appropriate crew
- the notification of any vessel or equipment repairs and maintenance required
- complying with legal requirements, both maritime and fisheries
- maintaining safe practices on board.

The instructions to masters contained detailed information on those responsibilities.

1.7.4 On this occasion, the skipper had selected and employed the usual crew, but one of them needed time off so deckhand A had been asked to take his place.

1.7.5 The vessel manager indicated that the longline fresh fish vessels were an uneconomic form of fishing, but were part of the overall fishing strategy of the company. However, there had been a steady decrease in the number of longline fresh fish vessels in the previous few years. The skipper's wife said that he had been concerned that the company might lay-up the *San Cuvier*.

1.8 Organisational and management information

1.8.1 The safe ship management documentation was not recovered from the vessel, but a computer file copy of Part B of the Policy and Procedures Manual was made available. That Manual was of a generic form issued by SGS M&I safe ship management company, which could be adapted for a specific vessel. The copy provided used the name of another vessel, the *Waihola*, in parts of the Manual. A second example of a safe ship management manual for another Sanford vessel, the *Brac*, was also provided; this version included both Part A and Part B of the Policy and Procedures Manual.

1.8.2 Neither manual specifically addressed the keeping of anchor watches or the factors that should be taken into account when deciding to sail in actual or forecast adverse weather. However, maintenance of an anchor watch was referred to in the *Brac* manual Part B section 1.3 under the heading "Manning" where Maritime Rule Part 31C.18[6] Watchkeeping Standards was quoted:

[6] This appears to be an incorrect or superseded reference, in the current rule Part 31C16 refers.

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

- For navigational watchkeeping, -

    1. the composition of the watch; and
    2. the fitness for duty of watchkeepers; and
    3. navigation planning and duties; and
    4. the use of navigational equipment; and
    5. look-out duties; and
    6. the notification of the master of any change in weather conditions; and
    7. the protection of the marine environment; and
    8. navigation with a pilot on board; and
    9. **keeping an anchor watch; and [emphasis added]**
    10. radio watchkeeping; and
    11. For engine-room watchkeeping –

        - the composition of the watch; and
        - taking over the watch; and
        - performing the watch; and
        - keeping the watch in restricted visibility; and
        - keeping the watch in congested waters; and
        - keeping the watch at anchor.

(2) The crew of a fishing vessel must comply with watchkeeping procedures established under rule 31C.18(1)[7].

1.8.3 The "Skipper's Declaration and Instructions to Masters" was out of date and included references to superseded legislation. The contract did require masters to comply with all relevant laws for a vessel's operation, but did not have any specific instructions or guidelines for masters in relation to adverse weather or maintaining an anchor watch.

1.8.4 Sanford also supplied each ship with a copy of Safety Guidelines for Small Commercial Vessels (FishSAFE)[8]. The guidelines were not recovered from the *San Cuvier*, but a sample document for another vessel, the *Sea Hunter II*, was made available. Section 4.2 of the Guidelines recommended "always maintain anchor watches. Make sure your position is checked regularly. In adverse weather keep a bridge watch while at anchor". The Guidelines also mentioned the legal requirement of Maritime Rules Part 22 that a proper look-out be maintained at all times by all available means in the prevailing circumstances.

1.8.5 Section 7 of the FishSAFE Guidelines gave advice on weather conditions, but it was restricted to where weather forecast information could be found and how the terminology used in forecasts should be interpreted. It did not contain advice on a vessel's operation in adverse weather, or what limitations should be placed on the vessel's operation.

1.8.6 Also carried on board the *San Cuvier* were the Admiralty Sailing Directions NP51, the New Zealand Pilot (United Kingdom Hydrographic Office, 2007), which contained advice for masters when operating in the coastal waters of New Zealand. However, the information for the immediate area in which the *San Cuvier was* operating was sparse, not mentioning Awaawakino at all. It did mention that anchorage might be found in Omaio Bay, in position 37° 47'S 177° 38'E, about 15 nm northeast of the anchorage position of the *San Cuvier*; this was the bay in which the *Sandra-K* had anchored on the night of the accident.

[7] This appears to be an incorrect or superseded reference, in the current Maritime Rules Part 31C16.1 refers.
[8] FishSAFE is a fishing industry led, industry/government partnership with the aim of developing strategies to improve the safety performance of the New Zealand commercial fishing sector

1.9 The geographical area

1.9.1 The Bay of Plenty covered a large area, from the Coromandel Peninsula in the west to East Cape in the east. General shipping usually passed directly from Tauranga to East Cape, so the shore between those 2 points was less well documented than some other areas of coastline. The coast in the Whakatane and Opotiki area was generally sandy beaches with the occasional rocky point in between. This type of feature continued to the east of Opotiki, but the rocky promontories became more frequent and the shore steeper.

1.9.2 Awaawakino was to the east of Opape past a rocky double point with steep cliffs down to the water. The reef in that area extended several hundred metres from the cliff face. The *San Cuvier* was washed over the reef and came to rest 40 to 50 m from the cliff face on the most eastern of those 2 points.

1.9.3 Local fishermen and elders treated Awaawakino with caution because of its poor protection from wind and sea from the north or north-easterly quarter. The horseshoe shape and the shelving bottom caused onshore waves to steepen rapidly and start to break a good distance off the shore. In addition, the Motu River reached the sea to the northeast of Awaawakino and the fresh tended to flow down the coast towards the southwest. After heavy rain many logs were washed down the Motu River and often became waterlogged and sank along the coast, many coming to rest in Awaawakino. The sea bottom in the bay was sand and mud, a generally good holding ground for anchoring, but it was also reported that there was an isolated patch of rocky bottom in the middle of the bay.

1.9.4 The coast of the Bay of Plenty between Tauranga and Hicks Bay in the east provided few places where shelter from northerly weather could be found. Whakatane was difficult to enter because of a shallow bar that stretched across the entrance and broke heavily in any weather from the northerly quarter. Opotiki was too shallow for vessels of the size of *San Cuvier*. The only bay that gave any shelter was the one mentioned in the New Zealand Pilot, Omaio Bay, where it was possible to anchor behind and close to a small island on its northern side. The skipper of the *Sandra-K* had anchored in Omaio Bay on Saturday evening and said that he had been woken at 0200 on Sunday when his vessel started to roll to the increasing sea conditions, but his anchor held in the protected anchorage. He left that anchorage at about 0600 and he experienced seas of up to 6 m outside the bay.

2 Analysis

2.1 The *San Cuvier* departed Tauranga on Friday afternoon despite a severe weather forecast for the Saturday and Sunday. The deepening depression coming from the northern Tasman Sea had been forecast for many days prior to it reaching New Zealand and the weather conditions in the Bay of Plenty over those days were close to what had been forecast.

2.2 The weather on the Friday night and into Saturday daytime and evening was reasonable and did not cause any concern to those on board the *San Cuvier* or the *Sandra-K*, the other vessel operating in the same area. However, the severe weather had continued to be forecast, with a gale warning being issued at 0005 on Friday, which by midday on Friday was replaced with the more severe storm warning with 4 m swells. At midday on Saturday the warning was further increased to 40-50 knot winds from the east with a 6 m northerly swell and high seas.

2.3 The swell and wind wave conditions that occurred in the Bay of Plenty were typical of what was forecast, and were predictable for a mariner who understood the difference between swell waves and wind waves, and the mechanisms that created them.

2.4 A low-pressure system with its high wind speeds will generate swells that will travel outwards from its centre and will be felt many kilometres away for a time long after the depression has moved on, in much the same way that waves travel out from a stone that is thrown into a pool. With this depression tracking from the north in a southeast direction close outside the Bay of

Plenty, it was highly predictable that swell waves generated by it would have a northerly component to them that would be felt in the Bay of Plenty where this accident occurred. Mariners who are familiar with reading weather systems from mean-sea-level analysis charts can predict the combined effect of the local wind waves and these swell waves that often come from different directions; they do not often need to though, because this work is done for them by weather experts and made available through various reporting mechanisms. What then is left for the mariner to do is consider the local effects that the topography in the area of operation might have on sea conditions. This information can be found in publications such as nautical pilots, but more often comes down to local knowledge of the area.

2.5 Assuming that the skipper was aware of the forecast, he might have decided that working in the eastern side of the Bay of Plenty would afford him some shelter from the predicted easterly quarter winds. It could not be established what forecasts the skipper received, or how he analysed them, but there was sufficient predicted weather information available to alert him that there was a significant swell forecast from the northerly sector, which would make anchoring anywhere in the eastern part of the Bay of Plenty hazardous, with the exception of Omaio Bay where another fishing vessel successfully rode out the storm at anchor. The decision to anchor in Awaawakino on the Saturday evening was, therefore, not a good one.

Decision to sail and anchor

2.6 Having decided to sail on the Friday the skipper would have known that in order to make more than one set of the longline his boat would have to stay out over Saturday night, when the weather was forecast to turn bad.

2.7 Having decided to set the longline on Saturday afternoon, the skipper committed to remaining in the general area of where it had been set. Had the skipper recognised the risk of anchoring in Awaawakino, an option would have been to steam to seaward and heave to for the night, possibly sheltering behind White Island, but this would have required the crew to maintain watches and the vessel to ride out the storm using the vessel’s engine.

2.8 The company and ship documentation did not provide skippers with guidance for the operating limitations of their vessels, nor did it specify any operational maxima for weather conditions. This left the entire decision to sail from port or remain out in inclement weather in the hands of the skipper, so allowed the possibility of one-man error into the system. While it was difficult for a company to monitor the operation of each vessel in a fleet operating over a wide geographical area, particularly with regard to local weather conditions, some guidance on placing the vessel and crew at unnecessary risk would seem prudent.

2.9 The system for remuneration that Sanford had in place at the time was that in order to get paid the crew had to catch fish and the amount of salary was directly proportional to the fish caught. This system places commercial pressure on skippers and crew to push the limits, commercial pressure from which Sanford stands to gain as well.

2.10 While the company should have been able to place some reliance on the qualifications and expertise of the skipper and crews to exercise good judgement, the system of remuneration it had adopted elevated the risk of compromising the safety of a vessel and its crew if the skipper exercised poor judgement for financial reward. That is not to say the system of remuneration was not appropriate, but it needed to be tempered with guidance from the company on acceptable operational limits. Such guidance would need to be more than simply issuing yet another instruction in a manual, but instilling a risk adverse culture within its crews.

2.11 The skipper could have taken paid medical leave through ACC for his back injury. However, had he done so his crew would have earned no wages when they were not fishing. The skipper was also concerned that the company was considering decommissioning the *San Cuvier*, and that leaving the vessel alongside while he recovered might influence that decision. Whether it was safe for the skipper to be at sea in his condition could not really be determined because it would rely on how well he had recovered since his last treatment. Equally difficult to establish was whether his medical condition and reduced mobility affected his chances of survival when he abandoned ship.

2.12 Another consideration was whether the medication that the skipper was taking could have affected his performance. In a major systematic review of the effectiveness of tramadol (Accident Compensation Corporation, Evidence Based Health Care Unit, 2005), 62 studies of the symptom relief and adverse effects of tramadol reported that the most common symptom was nausea. Drowsiness and central nervous system side effects were less common, sleepiness only being recorded in one case in the 62 studies. Idiosyncratic or unusual individual reactions to tramadol do occur, albeit rarely. As the skipper had been taking tramadol for about 2 months, the development of adverse effects on alertness or decision-making on the accident voyage was considered unlikely.

Anchoring performance

2.13 Awaawakino did give shelter from the east through southeast to southwest winds that were forecast, but the shelving sea bottom and the enclosed nature of the bay would have caused the north to northeast combined waves to steepen as they approached the coast and to start breaking further out to sea, probably outside the 10 m sounding line where the *San Cuvier* was anchored. The rapid increase in height of the waves as recorded on the wave buoy would have caused the vessel to yaw and surge, putting a lot of pressure on the anchor and its rode.

2.14 There was little instruction and guidance for the skipper to post anchor watches, and evidence shows it to be customary within this sector of the industry for crews to relax when vessels are at anchor.

2.15 In this case there were enough crew on board to have taken turn at keeping an anchor watch and not been suffering from fatigue the next day.

2.16 Marine notices had been issued covering the prudence of keeping an anchor watch, particularly in adverse weather. No evidence could be found that these marine notices had been placed on board Sanford vessels, but they had not been incorporated into procedures. The weather forecast was not good, and even the wind forecast alone should have highlighted the need to keep a watch. The speed with which sea conditions changed in this case is a stark reminder of that.

2.17 It is common for modern electronic navigation equipment to have proximity alarms; the chart plotter and radar on the *San Cuvier* were typical examples. However, the alarms had not been set on this occasion. It is not known whether the audible alarm on those units would have been sufficiently loud to wake the crew sleeping in the cabin below, but setting the alarms would have at least demonstrated that some degree of caution had been exercised, even though proper watches were not kept.

2.18 The vessel appears to have dragged its anchor in a slightly west of southerly direction for about one kilometre [0.53 nm] almost directly in line with the prevailing swell. Only the shank of the plough anchor was recovered, the head having become detached. The lugs through which the pivot for the head was secured were slightly splayed, suggesting that they had opened under severe strain. It is unlikely that the holding power of the anchor in a sand and mud bottom was sufficient to impart enough force on the anchor to detach its head. A more likely scenario was that the rapid increase in the height of the swell waves caused the vessel to surge, resulting in the anchor breaking out of the sea bottom. Once the anchor had broken out, the vessel would have gathered speed, probably too fast and erratic for the anchor to reset and hold, until it reached the outer part of the reef where it would have jammed and held. However, the momentum gained by the moving vessel would have imparted too much weight on the anchor, which would have broken at its weakest point, the pivot. The vessel would then have been further pushed onto the reef until it grounded 40 or 50 m from the cliff face.

2.19 The main anchor on the *San Cuvier* was estimated to weigh less than the weight prescribed in the Maritime Rules, and it was estimated to be less than the high-holding-power equivalent of the stockless anchor that it replaced. The length of chain and wire was sufficient to meet the provisions of the Maritime Rules for length of anchor cable. It is not known for sure whether an anchor of the correct size would have held under the conditions in the bay that night, but probably not, again emphasising the need for an appropriate anchor watch to be kept.

2.20 There was no record of when the anchor had been changed on the *San Cuvier*, neither on board nor in maintenance records ashore. That a critical piece of equipment that was estimated not to comply with Maritime Rules was placed on the vessel with no knowledge of the owner or surveying company, shows that in this case the safety management system had failed. How deep that failure went depended on how long the anchor had been fitted to the vessel. If the anchor had been fitted recently with only the knowledge of the skipper, that would amount to a one-person failure within the system; however, with the company being responsible for equipping and maintaining the vessel, it is difficult to imagine that its replacement did not in some way involve the company system of repair and maintenance.

Survivability

2.21 The intact condition of the vessel after the accident indicated that it would almost certainly have been preferable for the crew to remain on the vessel rather than take the risk of swimming to, and climbing up, the steep and jagged rocks. Had they remained onboard they might have sustained injuries and hypothermia, but they might have survived. However, it would have required a stoic skipper and crew to remain calm and steadfast while the vessel was being pounded against the rocks by huge waves, particularly at night. With the main exit from the wheelhouse being on the starboard side, the side to which the vessel was rolling, there would have been the fear of becoming trapped if it rolled over. A similar type of accident that involved a fishing vessel being driven ashore under rocky cliffs was reported on in the Marine Accident Investigation Branch safety digest 3/2008 (Marine Accident Investigation Branch, 2008). In that case the skipper and crew did remain on the vessel and even though some of the crew did suffer hypothermia, they were all successfully rescued.

2.22 Once the crew had abandoned the vessel they were at the mercy of the sea and the severe confused waves that were pounding the rocks. All the crew had donned lifejackets, but the survivors reported that the seas were such that they almost had the lifejackets torn off them during the time they were in the water.

2.23 As mentioned in paragraph 2.11, it is unclear to what extent the existing back injury of the skipper might have restricted his movement about the vessel and his mobility once he had entered the water. The eye-witness account was that the skipper was caught by a wave that drew him forward along the side of the ship before sucking him under the bow. If he had been fully able, it is unknown if he would have been able to withstand those forces.

3 Findings

Findings and safety recommendations are listed in order of development, not in order of priority

3.1 The *San Cuvier* grounded close to Tarakeha Point after dragging its anchor during severe weather during the early hours of 27 July 2009.

3.2 The high-holding-power anchor fitted to the *San Cuvier* was estimated to be smaller than that required by Maritime Rules, but it is doubtful whether a heavier anchor would have held in the weather conditions at the chosen anchorage.

3.3 The chosen anchorage was not suitable for the forecast weather conditions. The anchorage may have afforded protection from the wind that was forecast from the easterly quadrant, but it was exposed to the combined wind and swell waves from the northern quadrant.

3.4 The severe weather had been adequately predicted and was available to the skipper through several different means. It was not established what forecasts the skipper had sought, or what credence he had placed on them.

3.5 The skipper was an experienced fisherman and the *San Cuvier* was crewed in excess of its minimum designated crew.

3.6 Had an adequate anchor watch been maintained, and the dragging anchor been detected early, it is likely the grounding of the *San Cuvier* could have been avoided. The absence of an anchor watch in this case is symptomatic of what has become normal for the inshore and coastal fishing fleet.

3.7 The weather conditions forecast for Saturday 26 and Sunday 27 July made operating in the eastern Bay of Plenty marginal for a vessel the size of the *San Cuvier* in the absence of suitable shelter.

3.8 Commercial pressures may have influenced the skipper's decision to sail from Tauranga and fish in the Bay of Plenty in forecast marginal weather conditions.

3.9 The company system for remunerating the skipper and crew, on a percentage of catch only, has the potential for commercial pressure to influence poor judgement of when to start and cease fishing operations in adverse weather.

3.10 The activation of the EPIRB and an effective response by search and rescue resulted in the survival of the 2 deckhands. In this case, the crew might have increased the possibility of survival had they remained on board the vessel instead of trying to swim ashore.

4 Safety Actions

4.1 Since the accident, Sanford has added the following section to the watchkeeping document for crew members of its vessels:

> ***<u>Ship at anchor</u>***
>
> The master should ensure, with a view to the safety of the vessel and personnel, that proper navigational watch shall be maintained at anchor. While at anchor, the watchkeeper shall:
>
> 1. determine and plot the ship's position on the appropriate chart as soon as practicable;
> 2. when circumstances permit, check at sufficiently frequent intervals whether the ship is remaining securely at anchor by taking bearings of fixed navigation marks or readily identifiable shore objects;
> 3. ensure that proper look-out is maintained;
> 4. ensure that inspection rounds of the ship are made periodically;
> 5. observe meteorological and tidal conditions and the state of the sea;
> 6. notify the master and undertake all necessary measures if the ship drags anchor;
> 7. ensure that the state of readiness of the main engines and other machinery is in accordance with the master's instructions;
> 8. if visibility deteriorates, notify the master;
> 9. ensure that the ship exhibits the appropriate lights and shapes and that appropriate sound signals are made in accordance with all applicable regulations; and
> 10. take measures to protect the environment from pollution by the ship and comply with applicable pollution regulations.

5 Safety Recommendations

5.1 On 31 August 2010, the following recommendations were made to the Director of Maritime New Zealand, because the recommendations deal with issues that potentially affect the entire fishing industry rather than just the individual operator cited in this case:

5.1.1 Several deaths of crew in the inshore and coastal fishing fleet, including the 2 seafarers lost in this accident, have been attributed, at least in part, to the absence of an effective anchor watch, in spite of the various marine notices and other literature on the topic of keeping anchor watches. A review of the Maritime New Zealand database together with data available from other nations and the International Maritime Organization would be useful in measuring the magnitude of the issue, and would serve as a useful tool to work with the fishing industry to resolve what has become a routine poor practice. (029/10)

5.1.2 Operators' safety management systems should indentify risks to their operations and put in place processes to mitigate any identified risk. The share fishing system of remuneration has the potential to place significant commercial pressure on skippers, which could compromise good judgment when making decisions affecting the safety of their vessels and crew. This potentially serious safety issue should be addressed through operators' safety management systems with guidance from Maritime New Zealand in consultation with fishing industry organizations. (030/10)

A reply was not available at the time of publication.

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Approved on 18 August 2010 for Publication

Mr John Marshall QC
Chief Commissioner

Appendix 1

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A world of valuable information

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Weather Conditions in the Plenty Coastal Forecast Area 26 to 27 July 2008

Introduction

This report has been prepared at the request of Doug Monks of Transport Accident Investigation Corporation in relation to an investigation into the grounding of FV "San Cuvier" near Haurere Point, Bay of Plenty at about 3 a.m. on 27 July 2008.

This report contains:

1. A description of the meteorological situation on 26 and 27 July,
2. Coastal Marine Forecasts for Plenty issued from midnight 25/26 July to midday 27 July 2008,
3. Hourly observations from Whakatane Airport, Hicks Bay and White Island between midnight 25/26 July and midday 27 July 2008,
4. An assessment of the wind, sea and swell conditions in the vicinity of Whakatane, White Island and Te Kaha.

28 August 2008

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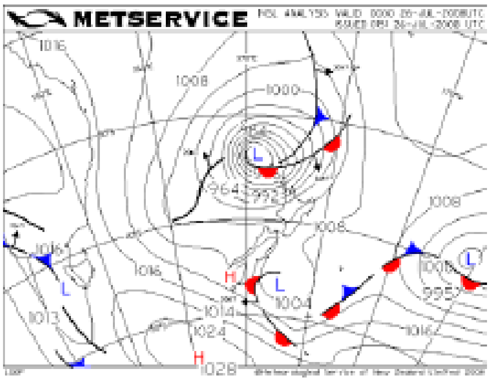
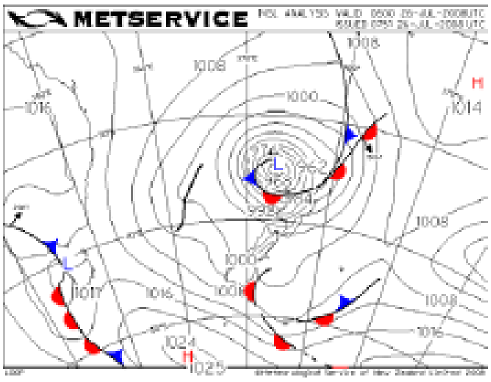
Meteorological Situation



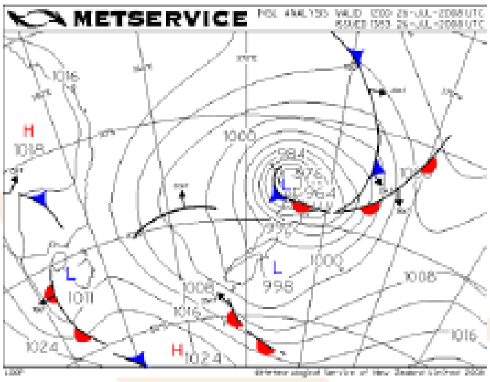
Analysis chart midday 26 July 2008



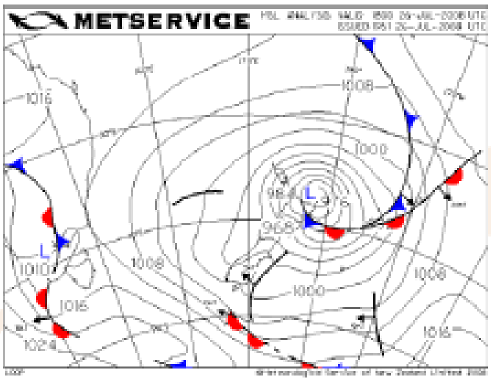
Analysis chart 6pm 26 July 2008

At midday on 26 July a very deep depression was centred about 60 nautical miles northwest of Cape Reinga moving quickly southeast. Gale to storm force winds were affecting land and sea areas within about 200 nautical miles from the centre, and gale northeasterlies had reached Coromandel Peninsula at that time.

At 6pm the centre of the depression was over the far north of the North Island, and continuing to move quickly southeast.



Analysis at midnight 26/27 July 2008



Analysis at 6 am 27 July 2008

During 27 July the centre of the depression continued moving towards the southeast across Bay of Plenty and eastern North Island.

Coastal Marine Forecasts for PLENTY

The Coastal Marine Forecasts for the Plenty area issued from midnight 25/26 July to 6 a.m. 27 July 2008 are listed below.

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MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 0005HRS 25-JUL-2008
VALID UNTIL MIDNIGHT TONIGHT 25-JUL-2008
NORTH ISLAND:

PLENTY
Southwest 25 knots, easing to southeast 15 knots Friday afternoon.
Rough sea easing.
OUTLOOK FOLLOWING 3 DAYS: Southeast rising early Saturday 30 knots
and later 40 knots with rough sea, turning Sunday westerly 35 knots,
easing Monday 25 knots. Heavy northeast swell developing late
Saturday, easing Sunday.
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MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 0406HRS 25-JUL-2008
VALID UNTIL MIDNIGHT TONIGHT 25-JUL-2008
NORTH ISLAND:

PLENTY
Southwest 25 knots, easing to southeast 15 knots Friday afternoon.
Rough sea easing.
OUTLOOK FOLLOWING 3 DAYS: Southeast rising early Saturday 30 knots
and later 40 knots with rough sea, turning Sunday westerly 35 knots,
easing Monday 25 knots. Heavy northeast swell developing late
Saturday, easing Sunday.
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MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 1233HRS 25-JUL-2008
VALID UNTIL MIDNIGHT 26-JUL-2008
NORTH ISLAND:

PLENTY
*STORM WARNING IN FORCE*
Southeast 15 knots, rising to 25 knots early morning and to easterly
35 knots in the afternoon. Easterly rising to 50 knots north of Mayor
Island for a time in the evening. Sea becoming high for a time in the
north. Northeast swell 4 metres developing. Poor visibility
developing in rain early morning,with some heavy falls.
OUTLOOK FOLLOWING 3 DAYS: Change Sunday southwest 45 knots, easing
Monday 25 knots, tend Tuesday northeast 15 knots, rising late Tuesday
southeast 35 knots. Sea very rough at times. Heavy northeast swell
developing late Saturday, easing Sunday.
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MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 1642HRS 25-JUL-2008
VALID UNTIL MIDNIGHT 26-JUL-2008
NORTH ISLAND:

PLENTY
*STORM WARNING IN FORCE*
Southeast 15 knots, rising to 25 knots early morning and to easterly
35 knots in the afternoon. Easterly rising to 50 knots north of Mayor
Island for a time in the evening. Sea becoming high for a time in the
north. Northeast swell 4 metres developing. Poor visibility
developing in rain early morning, with some heavy falls.
OUTLOOK FOLLOWING 3 DAYS: Change Sunday southwest 45 knots, easing
Monday 25 knots, tend Tuesday northeast 15 knots, rising late Tuesday
southeast 35 knots. Sea very rough at times. Heavy northeast swell
developing late Saturday, easing Sunday.
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MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 0004HRS 26-JUL-2008
VALID UNTIL MIDNIGHT TONIGHT 26-JUL-2008
NORTH ISLAND:

PLENTY
*STORM WARNING IN FORCE*
Southeast 15 knots, rising to 30 knots this morning, to easterly 40
knots this afternoon and to 50 knots this evening. Sea becoming high.
Northerly swell 4 metres developing. Poor visibility developing in
rain early morning, possibly thundery at night.
OUTLOOK FOLLOWING 3 DAYS: Change Sunday southwest 45 knots, easing
Monday 25 knots, tend Tuesday northeast 15 knots, rising late Tuesday
southeast 35 knots. Sea very rough at times. Heavy northeast swell
developing late Saturday, easing Sunday.
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AMEND/CORRECT MARINE WEATHER BULLETIN FOR NZ COASTAL WATERS
ISSUED APPROX 0324 NZST, FORECAST VALID UNTIL MIDNIGHT TONIGHT
26-JUL-2008
ZLM (all WARNINGS to be broadcast on receipt)

PLENTY
*STORM WARNING IN FORCE*
Southeast 15 knots, rising to 30 knots this morning, to easterly 40
knots this afternoon and to 50 knots this evening. Sea becoming high.
Northerly swell 4 metres developing. Poor visibility developing in
rain early morning, possibly thundery at night.
OUTLOOK FOLLOWING 3 DAYS: Change Sunday southwest 45 knots, easing
Monday 25 knots, tend Tuesday northeast 15 knots, rising late Tuesday
southeast 35 knots. Sea very rough at times. Heavy northeast swell
developing easing Sunday.
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MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 0410HRS 26-JUL-2008
VALID UNTIL MIDNIGHT TONIGHT 26-JUL-2008
NORTH ISLAND:

PLENTY
STORM WARNING IN FORCE
Southeast rising to 30 knots this morning, to easterly 40 knots this afternoon and to 50 knots this evening. Sea becoming high.Northerly swell 4 metres developing. Poor visibility in rain, possibly thundery at night.
OUTLOOK FOLLOWING 3 DAYS: Change Sunday southwest 45 knots, easing Monday 25 knots, tend Tuesday northeast 15 knots, rising late Tuesday southeast 35 knots. Sea very rough at times. Heavy northeast swell developing easing Sunday.

MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 1234HRS 26-JUL-2008
VALID UNTIL MIDNIGHT 27-JUL-2008
NORTH ISLAND:

PLENTY
STORM WARNING IN FORCE
Easterly 40 knots, rising to 50 knots for a time this afternoon and evening. Change southwest in the morning, easing 40 knots Sunday night. Sea becoming high for a time. Northerly swell rising to 6 metres for a time. Poor visibility in rain, some thundery, easing Sunday evening.
OUTLOOK FOLLOWING 3 DAYS: Easing Monday morning westerly 25 knots, then 15 knots evening. Tend Tuesday morning easterly 15 knots, rising Tuesday evening 25 knots, then 35 knots overnight. Becoming Wednesday morning northerly 40 knots, change westerly 35 knots later. Sea very rough at times. Moderate northeast swell easing Monday. Heavy northeast swell developing Wednesday.

MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 1607HRS 26-JUL-2008
VALID UNTIL MIDNIGHT 27-JUL-2008
NORTH ISLAND:

PLENTY
STORM WARNING IN FORCE
Easterly 40 knots, rising to 50 knots for a time this evening. Becoming southwest during the morning. Sea becoming high for a time. Northerly swell rising to 6 metres for a time. Poor visibility in rain, some thundery, easing Sunday evening.
OUTLOOK FOLLOWING 3 DAYS: Easing Monday morning westerly 25 knots, then 15 knots evening. Tend Tuesday morning easterly 15 knots, rising Tuesday evening 25 knots, then 35 knots overnight. Becoming Wednesday morning northerly 40 knots, change westerly 35 knots later. Sea very rough at times. Moderate northeast swell easing Monday. Heavy northeast swell developing Wednesday.

MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 0009HRS 27-JUL-2008
VALID UNTIL MIDNIGHT TONIGHT 27-JUL-2008
NORTH ISLAND:

PLENTY
GALE WARNING IN FORCE
Easterly 40 knots, becoming southwest this morning. Sea very rough. Northerly swell rising to 6 metres for a time. Poor visibility in rain, easing this evening.
OUTLOOK FOLLOWING 3 DAYS: Easing Monday morning westerly 25 knots, then 15 knots evening. Tend Tuesday morning easterly 15 knots, rising Tuesday evening 25 knots, then 35 knots overnight. Becoming Wednesday morning northerly 40 knots, change westerly 35 knots later. Sea very rough at times. Moderate northeast swell easing Monday. Heavy northeast swell developing Wednesday.

MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS
FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND
AT 0412HRS 27-JUL-2008
VALID UNTIL MIDNIGHT TONIGHT 27-JUL-2008
NORTH ISLAND:

PLENTY
GALE WARNING IN FORCE
Southwest 40 knots. Sea very rough. Northerly swell rising to 6 metres for a time. Poor visibility in rain, easing this evening.
OUTLOOK FOLLOWING 3 DAYS: Easing Monday morning westerly 25 knots, then 15 knots evening. Tend Tuesday morning easterly 15 knots, rising Tuesday evening 25 knots, then 35 knots overnight. Becoming Wednesday morning northerly 40 knots, change westerly 35 knots later. Sea very rough at times. Moderate northeast swell easing Monday. Heavy northeast swell developing Wednesday.

Wind Observations

The following table lists wind observations recorded at White Island, Whakatane Airport and Hicks Bay between midnight 25/25 July and midday 27 July 2008.

	White Island			Whakatane Airport			Hicks Bay		
NZ Standard Time	Dir'n DegT	Speed Knots	MxGst Knots	Dir'n DegT	Speed Knots	MxGst Knots	Dir'n DegT	Speed Knots	MxGst Knots
26 Jul 2008 00:00	340	4	18	180	3	5	200	5	14
26 Jul 2008 01:00	170	6	21	180	4	6	190	8	18
26 Jul 2008 02:00	330	5	17	180	4	6	170	18	25
26 Jul 2008 03:00	330	5	21	200	4	7	170	21	31
26 Jul 2008 04:00	360	8	22	210	5	7	160	20	31
26 Jul 2008 05:00	040	11	27	210	4	6	160	19	33
26 Jul 2008 06:00	060	12	25	190	4	7	170	23	32
26 Jul 2008 07:00	060	21	33	140	3	7	160	20	31
26 Jul 2008 08:00	060	20	36	150	5	7	160	21	29
26 Jul 2008 09:00	060	26	44	160	8	10	150	23	29
26 Jul 2008 10:00	060	31	52	150	6	10	160	18	27
26 Jul 2008 11:00	060	29	54	160	11	16	160	20	27
26 Jul 2008 12:00	060	38	63	150	8	14	100	25	34
26 Jul 2008 13:00	060	36	65	110	12	20	110	28	33
26 Jul 2008 14:00	060	40	68	120	11	23	110	29	37
26 Jul 2008 15:00	070	50	78	120	12	23	120	28	38
26 Jul 2008 16:00	070	46	76	120	13	23	130	30	40
26 Jul 2008 17:00	070	48	84	130	14	27	110	28	38
26 Jul 2008 18:00	060	46	77	130	15	24	120	24	39
26 Jul 2008 19:00	070	50	85	130	15	27	120	26	37
26 Jul 2008 20:00	060	34	75	120	12	23	090	20	38
26 Jul 2008 21:00	070	43	67	130	11	25	050	19	43
26 Jul 2008 22:00	050	13	59	130	15	24	350	21	26
26 Jul 2008 23:00	020	15	30	130	11	26	010	8	22
27 Jul 2008 00:00	050	15	26	140	12	23	010	20	25
27 Jul 2008 01:00	070	26	41	150	12	20	010	26	37
27 Jul 2008 02:00	020	13	42	160	15	23	020	24	37
27 Jul 2008 03:00	070	25	33	170	16	23	020	22	32
27 Jul 2008 04:00	190	13	34	180	15	23	030	18	33
27 Jul 2008 05:00	140	12	42	190	10	22	010	8	22
27 Jul 2008 06:00	160	25	41	210	10	17	180	15	20
27 Jul 2008 07:00	*260*	*29*	*41*	230	15	20	170	23	35
27 Jul 2008 08:00	*310*	*26*	*40*	210	13	19	180	24	40
27 Jul 2008 09:00	*360*	*28*	*40*	210	14	23	240	11	32
27 Jul 2008 10:00	*350*	*25*	*41*	220	13	21	200	2	21
27 Jul 2008 11:00	*360*	*29*	*38*	240	12	19	280	4	9
27 Jul 2008 12:00	*360*	*29*	*41*	230	14	21	250	17	23

Note that the directions and possibly the wind speeds recorded at White Island after 7am 27 July are probably incorrect.

Dir'n is the direction, measured in angular degrees clockwise from Geographic North, that the wind is blowing from, and is the mean over the 10 minutes immediately before each hour.

Speed is the mean wind speed measured over the 10 minutes immediately before each hour.

MxGst is the highest gust during the whole hour before the observation time.

Wind, Sea and Swell Conditions - midday 26 July to 6 a.m. 27 July 2008

To reconstruct the wind sea and swell conditions in the vicinity of Whakatane, White Island and Te Kaha, the following information was used:

1. Significant wave direction and height information recorded by the Environment Bay of Plenty wave buoy[1]
2. Computed wave analyses from the ECMWF[2] ocean wave forecasting system
3. MetService analysis charts, and wind observations at While Island.

Wave Buoy data

The wave buoy is located about 13 kilometres off Pukehina Beach about half way between Tauranga and Whakatane. Data transmission problems have resulted in some missing data but sufficient data was captured to allow a commentary to be made of the wave behaviour at the wave buoy. The wave buoy data is plotted in Figure 1, and listed in a table in the Appendix (Table 1).

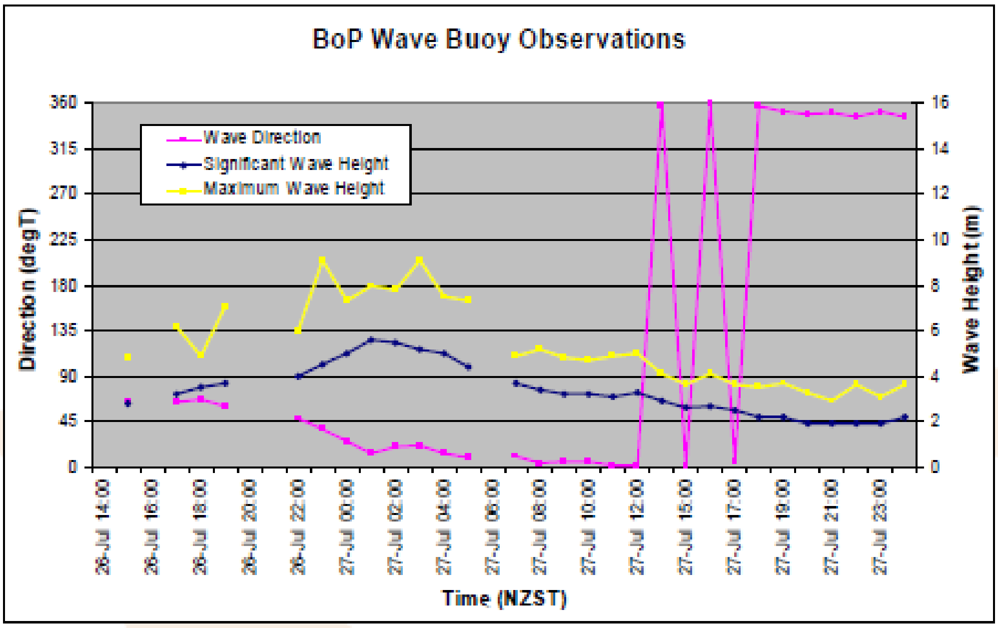


Figure 1: Graph of significant wave direction (the direction that waves are moving from), significant wave height and maximum wave height as measured by the Environment Bay of Plenty wave buoy between 2 p.m. 26 July and midnight 27/28 July 2008.

[1] This data was provided by Gen Ellery, Data Services Manager, Environment Bay of Plenty, and is produced here by permission.

[2] The European Centre for Meduim-range Weather Forecasting runs global numerical weather prediction systems and distributes analysis and forecast data by arrangement. Data received at MetService from the ocean wave forecasting system are rendered on maps for weather monitoring and forecasting.

"Significant wave height" referred to in Figure 1 is defined as the average height of the highest 1/3 of waves. This is supposed to represent the wave height that an experienced marine observer would estimate in the same conditions. The wave data processing obtains the highest wave height in a 20-minute sampling interval before each hour and recorded against that time. This data represents the combined waves – that is the combination of both the locally generated sea waves and the swell waves that have travelled to the buoy after being generated somewhere else.

ECMWF computed wave analyses

This data is distributed in a gridded format in arrays with a point spacing of a quarter of a degree in both latitude and longitude. The fields available include the significant wave height of wind waves, the significant wave height of swell waves and the significant wave height of combined wind and swell waves. "Wind waves" are those waves that are being generated by the local wind, and "swell" waves are those that have travelled after being generated at another location. "Significant wave height" in this data gas the same meaning as described above.

There are two analysis and prognosis runs each day (at 0000 UTC and 1200 UTC), initialised on the results of the previous run for the advection of existing waves, and a current wind analysis for the generation of wind waves. The results of the run consist of the analysis at the initialisation time and prognoses at 6-hour intervals out to several days.

For state of sea and waves, marine forecasts contain a mention of wind waves, referred to as the state of sea, and a mention of swell. In New Zealand coastal marine forecasts the state of sea is given in qualitative terms such as "moderate", "rough", and "high", etc., and the swell is given in terms of a height in metres and the direction the waves are travelling from. A swell is not mentioned if its height is less than 1 metre, and more than one swell may be mentioned. There is no explicit mention of the combined waves that are contributed to by the wind waves and the one or more swells that may be present.

Because the computed wave analyses and prognoses have the ability to present the wind wave field and swell wave field separately, they provide good guidance to the marine forecaster for the content of the forecasts, particularly for swell.

Only the analysis fields from the ECMWF computed wave data are presented here. The three fields of wind wave height and direction, swell height and direction and combined wind and swell wave height and direction for the analysis times of midday 26 July, midnight 26/27 July and midday 27 July 2008 are reproduced in the Appendix.

It is particularly useful in this case to note the origin of heavy swell areas depicted in the swell field can be identified as an area of high wind waves (sea) in the analysis chart of an earlier initialisation time.

Between midday 26 July and 6 p.m.:

The (combined) significant wave height measured by the wave buoy was slowly increasing through about 3 metres, and the highest waves were generally increasing from about 5 to 6 or 7 metres. The direction of the combined significant waves was from the east-northeast, and more or less steady.

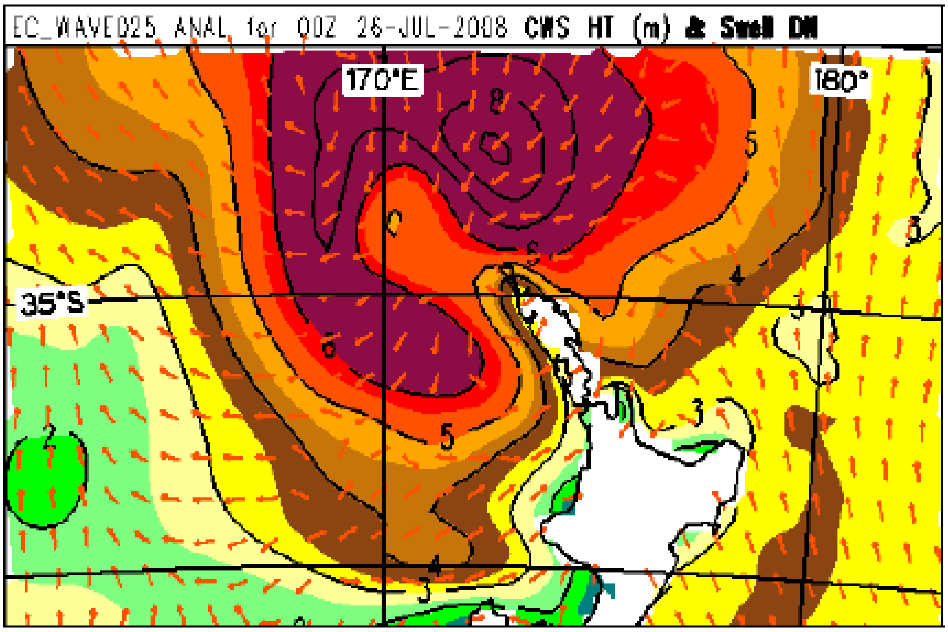


Figure 2: Combined wind wave and swell (CWS) computed analysis for midday 26 July 2008 (0000 UTC 26 July). Significant wave height is contoured in metres and the direction is indicated by the orange arrows.

The computed wave analysis at midday (Figure 2) is consistent with an extrapolation back to midday from the available wave buoy observations.

During this period, the wind at White Island was measured between 38 and 50 knots from the east-northeast. The wind speed had rapidly increased from 20 to 25 knots about mid morning.

Based on this, the combined significant waves in the area between White Island and the coast from Whakatane to Te Kaha during this period would have been about 2 metres increasing to about 3 metres, travelling from the east-northeast. The wind would have been from the east, 30 to 40 knots, but less close to the coast and more further out. Visibility would have been deteriorating as increasingly heavy rain spread from the northeast with the frontal system (see the analysis charts for midday and 6 p.m. on 26 July).

Between 6 p.m. 26 July and midnight 26/27 July:

The wave buoy shows the significant wave height continuing to increase through 4 metres, and a maximum wave height of 9.1 metres recorded at 11 p.m. From 6 p.m. the direction that the waves were travelling from changed from east-northeast at 6 p.m. to north-northeast at midnight.

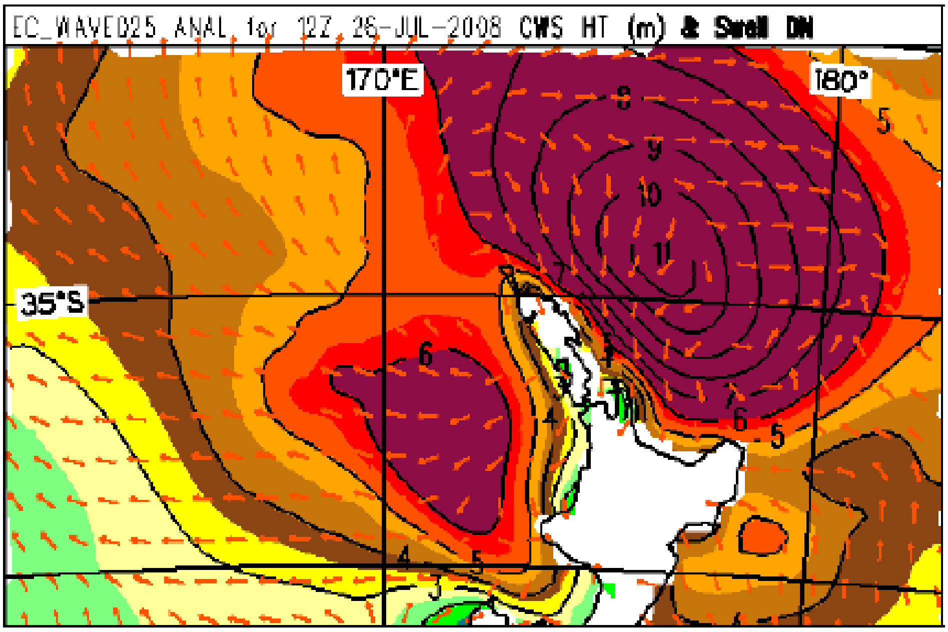


Figure 3: Combined wind wave and swell (CWS) computed analysis for midnight 26/27 July 2008 (1200 UTC 26 July).

The computed wave analysis at the end of this period indicates the significant change in wave characteristics resulting from the movement of the depression along the east Northland coast, and the consequent change in wind distribution and wave generation areas.

The wind at White Island during this period was measured at between 34 and 50 knots from the east-northeast until a significant easing to about 15 knots from the northeast consistent with the timing of the passing of the frontal system over the station late in the evening.

Based on this, the combined significant waves in the area between White Island and the coast from Whakatane to Te Kaha during this period would have been 3 to 4 metres and occasional waves 5 to 6 metres and isolated waves higher still, all in an increasing trend. During this period the significant wave direction gradually changed from east-northeast at 6 p.m. to north-northeast at midnight. The wind would have been from the east, 35 to 45 knots. Between 9 and 10 p.m. the wind changed direction to north or northeast and the speed decreased to about 15 knots. At about the same time the rain would have eased but visibility would still be poor.

The significant change in the direction that the significant waves were travelling from towards the end of this period was the result of the predominant wave component (in the combined waves) changing from wind waves travelling from the east to swell waves travelling from the north.

Figure 4 shows a large area of high wind generated waves north of Northland at midday on 26 July when the depression was centred to the northwest of Cape Reinga. During the following 12 hours those waves propagated southeastwards into the Bay of Plenty (ocean area). A large portion of these waves were absorbed by the coasts of Northland, Hauraki Gulf, Coromandel and Bay of Planty (region). The extent of the remainder is illustrated in Figure 5 as a northerly swell were it affects the coast between Whakatane and Te Kaha.

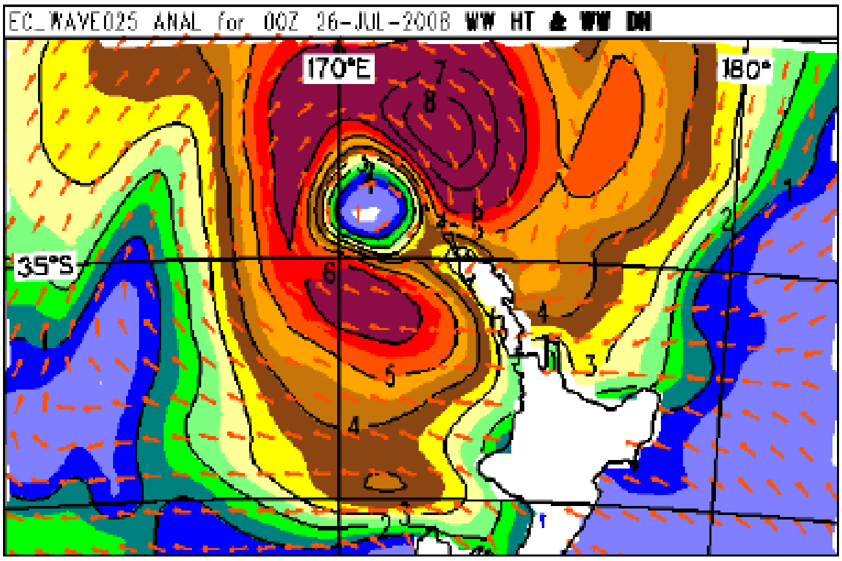


Figure 4: Wind wave (WW) computed analysis for midday 26 July 2008 (0000 UTC 26 July).

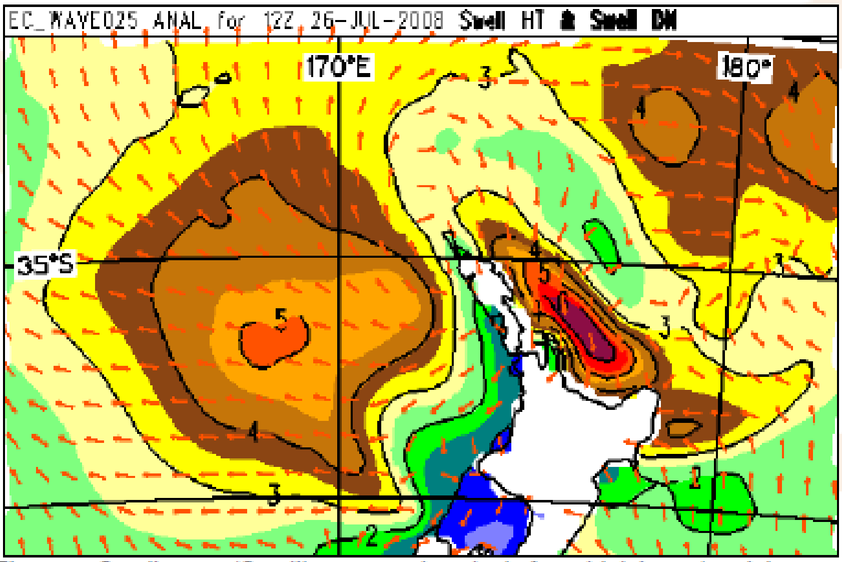


Figure 5: Swell wave (Swell) computed analysis for midnight 26/27 July 2008 (1200 UTC 26 July).

Between midnight 26/27 July and 6 .am. 27 July:

The wave buoy recorded the highest waves during this period. The significant wave height rose to a peak of 5.5 metres around 1 and 2 a.m. and then slowly decreased to 4 metres at 6 a.m. A maximum wave height of 9.1 metres recorded at 3 a.m. The significant wave direction was from north-northeast and continuing to change towards a wave direction of from north.

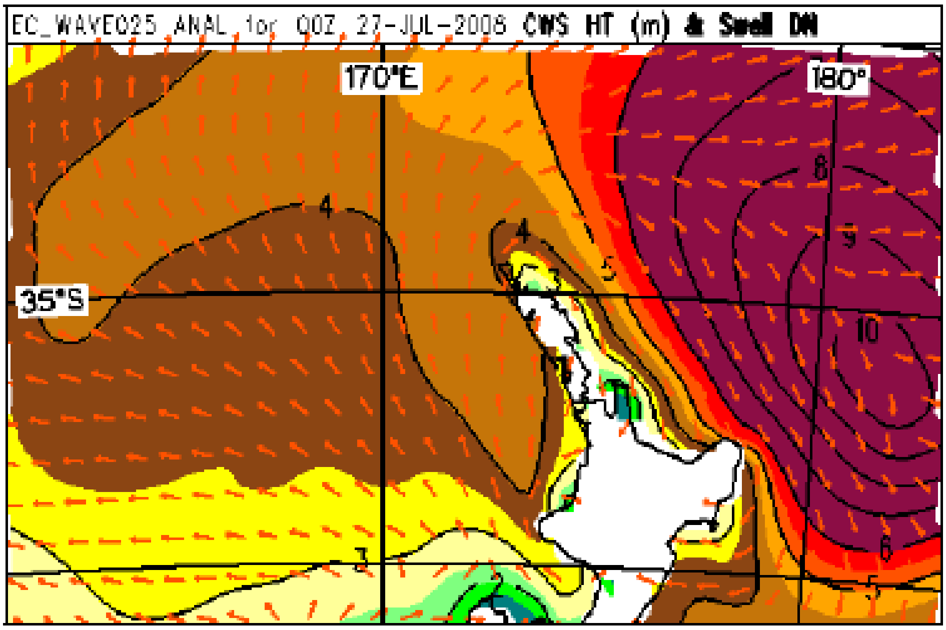


Figure 6: Combined wind wave and swell (CWS) computed analysis for midday 27 July 2008 (0000 UTC 27 July).

The computed wave analysis at midday, 6 hours after the end of this period indicates lowering combined significant wave heights in the near-coast Bay of Plenty except in the outer and eastern parts. The wave direction is indicated as north to northwest.

The wind recorded at White Island was between 15 and 15 knots and from northeast, and then from south or southeast after about 3 a.m. This means that the depression centre moved past fairly close to the northeastern side of the island.

Based on this the combined significant waves in the area between White Island and the coast from Whakatane to Te Kaha at the start of this period would have been 5 to 6 metres and occasional waves 7 to 8 metres and isolated waves higher still. Gradually the significant wave height decreased to about 4 metres with occasional waves about 6 metres. The waves were travelling from north-northeast. The wind was 15 to 20 knots turning easterly again and gradually further around to the southeast at 6 a.m. Because the wind had eased considerably, most of the contribution to the wave height was from the heavy northerly swell which had been generated north of Northland the previous day. Visibility was still poor in rain or drizzle, but was improving about 6 a.m. as the rain continued to ease.

Conclusion

The above meteorological information has been retrieved from our records. To the best of my knowledge the information is correct.

For and on behalf of Meteorological Service of New Zealand Ltd

Ross Marsden
Consultant Meteorologist
MetService

28 August 2008

Appendix

Wave Buoy data

Table 1: Wave data recorded by the Environment Bay of Plenty Wave Buoy located about 13 kilometres off Pukehina Beach about half way between Tauranga and Whakatane.

Date Time (NZST)	Significant Wave Height (metres)	Maximum Wave Height (metres)	Significant Wave Period (seconds)	Wave Direction (degrees M)	Wave Direction (degrees T)
26-Jul-2008 12:00					
26-Jul-2008 13:00					
26-Jul-2008 14:00					
26-Jul-2008 15:00	2.8	4.8	6	044	064
26-Jul-2008 16:00					
26-Jul-2008 17:00	3.2	6.2	7	044	064
26-Jul-2008 18:00	3.5	4.9	8	047	067
26-Jul-2008 19:00	3.7	7.1	8	040	060
26-Jul-2008 20:00					
26-Jul-2008 21:00					
26-Jul-2008 22:00	4.0	6.0	9	028	048
26-Jul-2008 23:00	4.5	9.1	10	018	038
27-Jul-2008 00:00	5.0	7.3	10	006	026
27-Jul-2008 01:00	5.6	.08	11	354	014
27-Jul-2008 02:00	5.5	7.8	12	360	020
27-Jul-2008 03:00	5.2	9.1	12	001	021
27-Jul-2008 04:00	5.0	7.5	12	354	014
27-Jul-2008 05:00	4.4	7.3	12	350	010
27-Jul-2008 06:00					
27-Jul-2008 07:00	3.7	4.9	13	351	011
27-Jul-2008 08:00	3.4	5.2	12	344	004
27-Jul-2008 09:00	3.2	4.8	12	345	005
27-Jul-2008 10:00	3.2	4.7	12	345	005
27-Jul-2008 11:00	3.1	4.9	12	342	002
27-Jul-2008 12:00	3.3	5.0	12	341	001
27-Jul-2008 14:00	2.9	4.1	11	338	358
27-Jul-2008 15:00	2.6	3.6	10	341	001
27-Jul-2008 16:00	2.7	4.1	11	340	360
27-Jul-2008 17:00	2.5	3.6	11	345	005
27-Jul-2008 18:00	2.2	3.5	10	337	357
27-Jul-2008 19:00	2.2	3.7	10	332	352
27-Jul-2008 20:00	1.9	3.3	9	329	349
27-Jul-2008 21:00	1.9	2.9	9	331	351
27-Jul-2008 22:00	1.9	3.6	9	327	347
27-Jul-2008 23:00	1.9	3.1	9	332	352
28-Jul-2008 00:00	2.2	3.6	10	327	347

This data was provided by Gen Ellery, Data Services Manager, Environment Bay of Plenty, and is produced here by permission.

ECMWF computed wave analyses

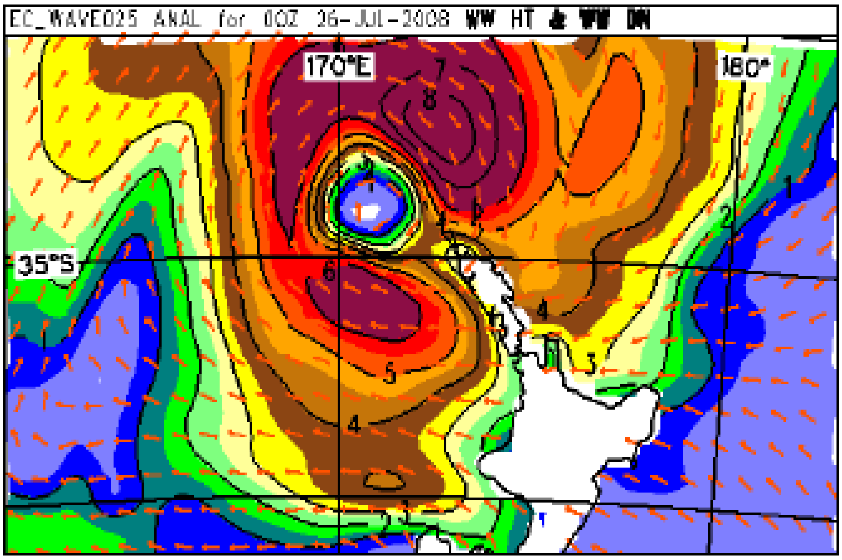
The three fields of

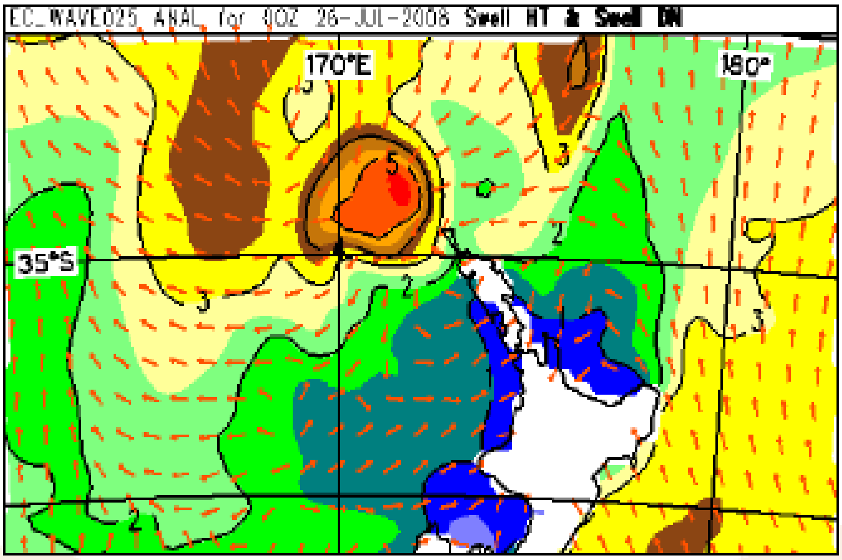
wind wave height and direction,

swell height and direction and

combined wind and swell wave height and direction

for the analysis times of midday 26 July, midnight 26/27 July and midday 27 July 2008 are reproduced on the following three pages.


EC_WAVE025 ANAL for 00Z 26-JUL-2008 WW HT & WW DN
170°E
180°
35°S


EC_WAVE025 ANAL for 00Z 26-JUL-2008 Swell HT & Swell DN
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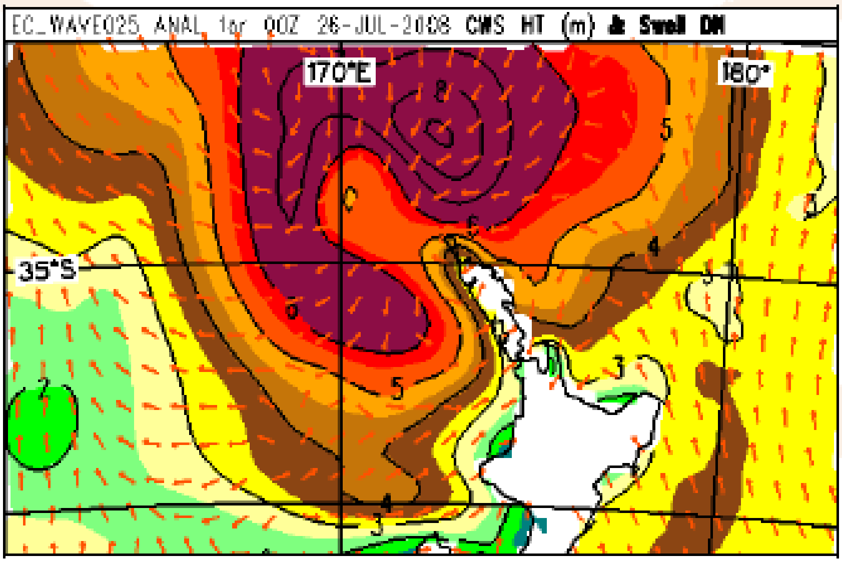
180°
35°S


EC_WAVE025 ANAL for 00Z 26-JUL-2008 CWS HT (m) & Swell DN
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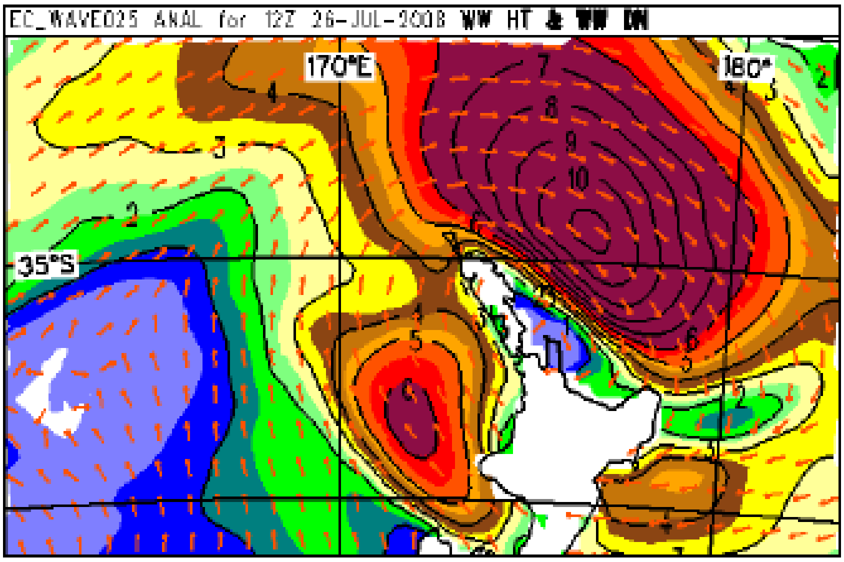
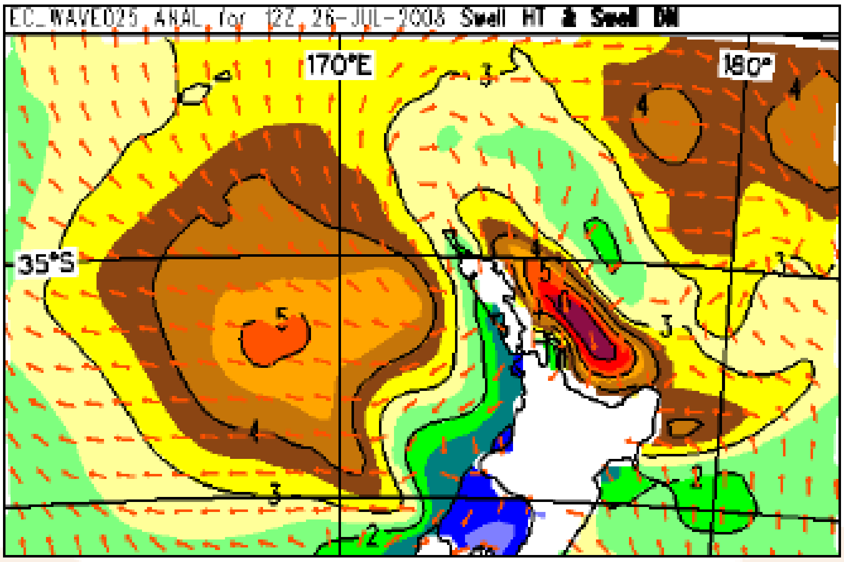
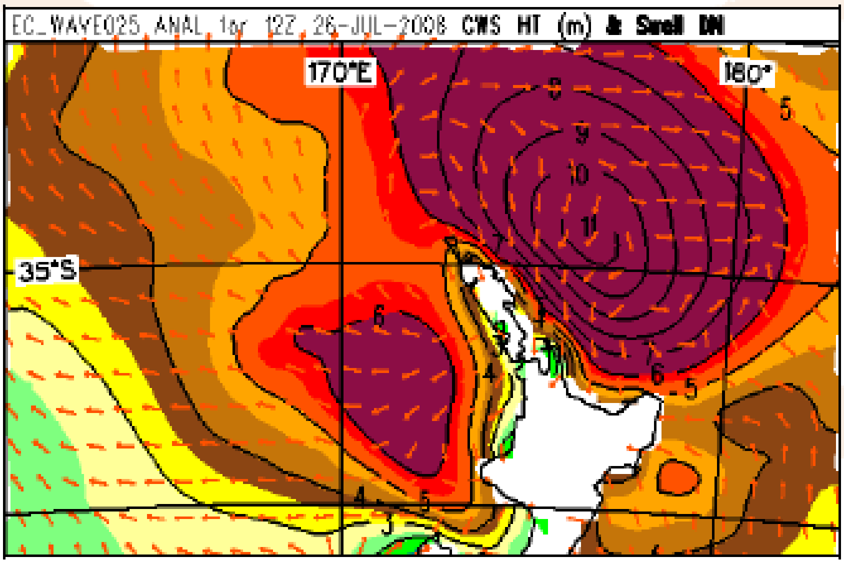
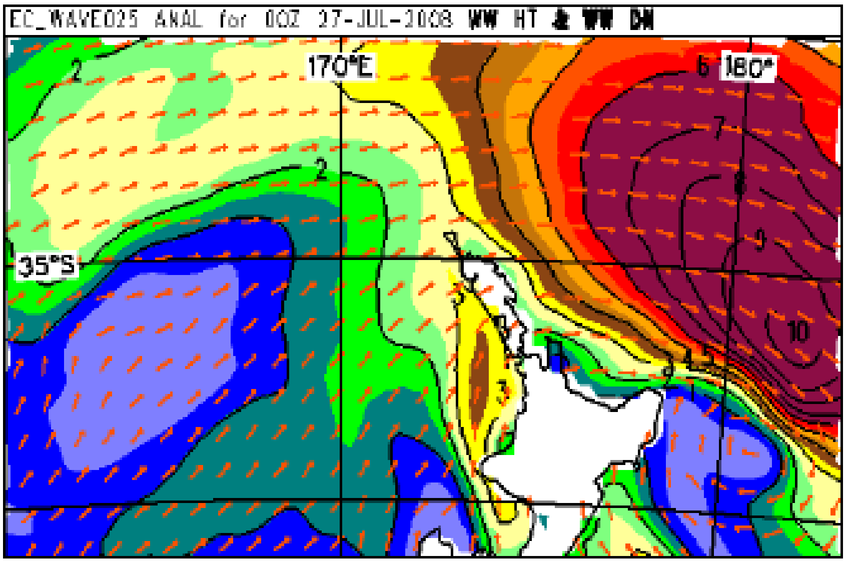
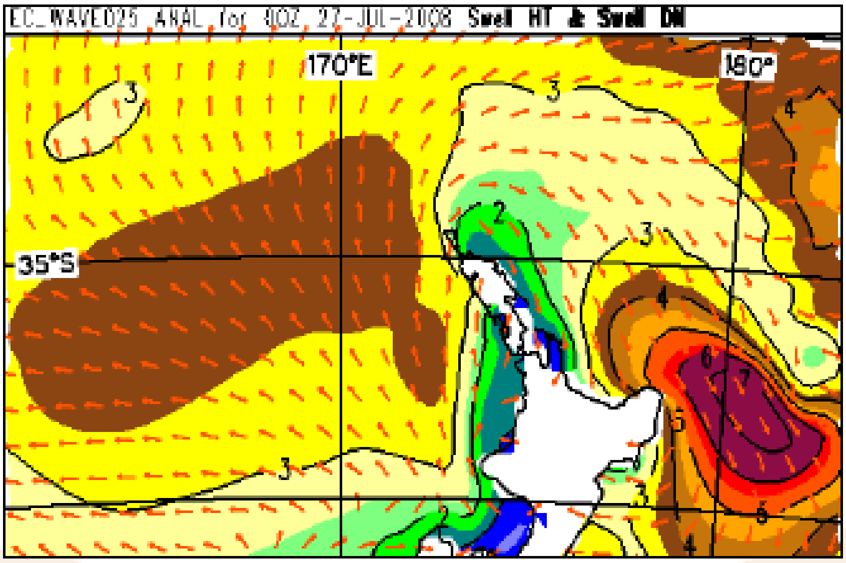
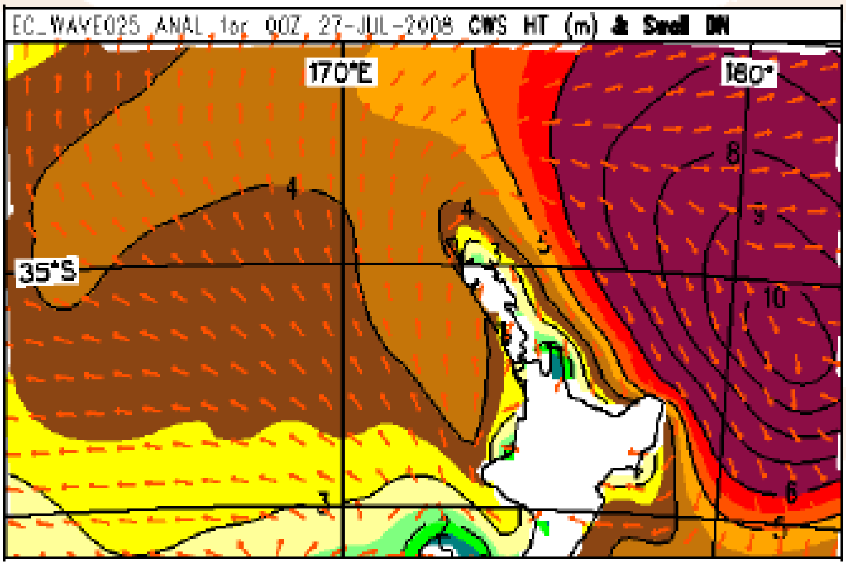

EC_WAVE025 ANAL for 12Z 26-JUL-2008 WW HT & WW DN
170°E
180°
35°S


EC_WAVE025 ANAL for 12Z 26-JUL-2008 Swell HT & Swell DN
170°E
180°
35°S


EC_WAVE025 ANAL for 12Z 26-JUL-2008 CWS HT (m) & Swell DN
170°E
180°
35°S


EC_WAVE025 ANAL for 00Z 27-JUL-2008 WW HT & WW DN
170°E
180°
35°S


EC_WAVE025 ANAL for 00Z 27-JUL-2008 Swell HT & Swell DN
170°E
180°
35°S


EC_WAVE025 ANAL for 00Z 27-JUL-2008 CWS HT (m) & Swell DN
170°E
180°
35°S

Appendix 2

Marine

Notice

Boats - 12 /1996
August

Anchor watches

Recently, in only moderate sea conditions, an anchored vessel grounded off the coast of New Zealand. Prior to the grounding, it was found that only an occasional watch had been kept of the vessel's position.

Mariners are reminded of the importance of keeping, when necessary, a continuous navigational watch when at anchor.

In all circumstances, while at anchor, it is recommended that the Mariner who is keeping a watch should:

(i) Determine and plot the vessel's position on the appropriate chart as soon as possible after anchoring.

(ii) When circumstances permit, check at frequent intervals whether the vessel is remaining securely at anchor by taking radar/visual bearings and distances of fixed navigation marks or readily identifiable charted shore objects.

(iii) Ensure that an efficient lookout is maintained at all times.

(iv) Ensure that inspection rounds of the vessel, including the anchor cable, are made periodically.

(v) Keep a careful check on weather and tidal conditions and the state of the sea and swell.

(vi) Immediately notify the Master/Skipper if the vessel starts to drag anchor.

(vii) Where possible, ensure the main engine is kept on stand by, ready for immediate use, in the event of an emergency.

(viii) Ensure that the vessel exhibits the appropriate lights and shapes and that appropriate sound signals are made as required by the Collision Regulations.

MARITIME SAFETY AUTHORITY
OF NEW ZEALAND
Te Mana Ārai Hauata Moana o Aotearoa
PO BOX 27006, WELLINGTON
PH (04) 473 0111 FAX (04) 473 6699

Appendix 3

Marine Notice

Boats - 01/1999
April

Anchor Watches on Fishing Vessels

Two recent accidents, one of which led to the death of three persons, highlight the need for skippers of fishing vessels to ensure that they choose a safe anchorage and maintain proper anchor watches.

When selecting a place to anchor the skipper should take the following factors into account:

- The nature of the sea bed.
- The shelter that it gives from the prevailing wind.
- The forecast weather for the period the vessel will lie at anchor, which may leave the vessel on a lee shore.
- The proximity to dangers. E.g. other vessels, submerged rocks, wrecks, etc.

The Maritime Safety Authority reminds owners and skippers of the need to maintain a continuous anchor watch. To accomplish this it is suggested that all crew members are trained in the operation of navigational equipment so that they can check the position of the vessel at regular intervals while at anchor. Use should be made of the proximity alarms on radar, GPS, track plotter and echo sounder units, to assist crew members to ensure the vessel is maintaining position.

In addition skippers should ensure that crew members are aware of the action they should take if it appears the vessel is not maintaining the anchorage position.

MARITIME SAFETY AUTHORITY
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Recent Marine Occurrence Reports published by the Transport Accident Investigation Commission (most recent at top of list)

08-206	passenger ferry Monte Stello, collisions with wharfs, Picton and Wellington, 8 and 9 August 2008
09-205	stern trawler Pantas No.1, fatality while working cargo, No.5 berth, Island Harbour, Bluff, 22 April 2009
09-203	jet boat, DRJS-11 grounding and subsequent rollover Dart River, near Glenorchy, 20 February 2009
08-203	Report 08-203 Passenger Ferry Monte Stello, Loss of Power, Tory Channel, 2 May 2008
08-207	Report 08-207, Commercial Jet Boat Kawarau Jet No. 6, Roll-Over, confulence of the Kawarau and Shotover Rivers, 25 September 2008
08-204	Report 08-204, 6-metre workboat Shikari, collision with moored vessel, Waikawa Bay, Queen Charlotte Sound, 20 June 2008
08-202	Report 08-202, coastal bulk carrier Anatoki and bulk carrier Lodestar Forest, collision, Tauranga Harbour roads, 28 April 2008
07-202	Report 07-202, fishing vessel Walara-K, flooding and sinking, 195 nautical miles off Cape Egmont, 7 March 2007
07-207	Report 07-207, Bulk carrier, Taharoa Express, Cargo shift and severe list 42 nautical miles southwest of Cape Egmont, 22 June 2007
08-201	Fishing charter vessel, *Pursuit*, grounding, Murimotu Island, North Cape (Otou), 13 April 2008
07-206	Report 07-206, tug Nautilus III and barge Kimihia, barge capsize while under tow, Wellington Harbour entrance, 14 April 2007
06-207	restricted limit passenger vessel, *Milford Sovereign*, engine failure and impact with rock wall, Milford Sound, 31 October 2006
06-204	fishing vessel "Kotuku", capsized, Foveaux Strait, 13 May 2006
07-201	charter catamaran, *Cruise Cat*, collision with navigational mark, Waikato River entrance, Lake Taupo, 22 February 2007

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