This report for inquiry 12-201 is suppressed

until 5.00am, Friday, 3 May 2013

Pursuant to its powers, including in sections 11, 14B(2) and 14K of the Transport Accident Investigation Commission Act 1990, the Transport Accident Investigation Commission directs that this report is provided to you in confidence and that its contents are supressed and must remain confidential until its public release at 5.00am, Friday, 3 May 2013.

Any illegitimate disclosure of this report and/or its contents before this publication time in contravention of the suppression order is an offence.

Inquiry 12-201:
Fishing vessel Easy Rider, capsize and foundering,
Foveaux Strait, 15 March 2012

Final Report

Marine inquiry 12-201

Fishing vessel *Easy Rider*, capsize and foundering, Foveaux Strait, 15 March 2012

Approved for publication: March 2013

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission and this report

The Transport Accident Investigation Commission (Commission) is an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. The principal purpose of its inquiries is to determine the circumstances and causes of the occurrence with a view to avoiding similar occurrences in the future. Its purpose is not to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. The Commission carries out its purpose by informing members of the transport sector, both domestically and internationally, of the lessons that can be learnt from transport accidents and incidents.

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Important notes

Nature of the final report

This final report has not been prepared for the purpose of supporting any criminal, civil or regulatory action against any person or agency. The Transport Accident Investigation Commission Act 1990 makes this final report inadmissible as evidence in any proceedings with the exception of a Coroner's inquest.

Ownership of report

Citations and referencing

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this final report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1980 have been referenced as footnotes only. Other documents referred to during the Commission's inquiry that are publicly available are cited.

Photographs, diagrams, pictures

Unless otherwise specified, photographs, diagrams and pictures included in this final report are provided by, and owned by, the Commission.

Photograph courtesy of Professional Skipper magazine

The *Easy Rider* in 2012

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Abbreviations

%	Percentage
am	ante meridiem
Commission	Transport Accident Investigation Commission
ECMWF	European Centre for Medium-range Forecasting
FV	fishing vessel
hPa	hecto Pascal
ILM	inshore launch master
kW	kilowatt(s)
LLO	local launch operator
m	metre(s)
MetService	Meteorological Service of New Zealand Limited
mm	millimetre(s)
NZDT	New Zealand Daylight Time
NZOW	New Zealand offshore watchkeeper
pm	post meridiem
UTC	co-ordinated universal time

Glossary

bulwark	plating or wooden erections around the outboard edge of the upper deck to protect the deck and its occupants from the entry of the sea
heel	the condition of a vessel when it is inclined about its longitudinal axis
interested person	the person referred to in paragraph 2.15 of the report
metacentre	the point at which a vertical line passing through the heeled centre of bouancy intersects with the vertical line passing through the original upright centre of bouancy. The metacentre can be considered as being similar to a pivot point when a vessel is inclined at small angles of heel.
metacentric height	the distance between the centre of gravity of a vessel (G) and the metacentre (M) is known as the metacentric height (GM). A stable vessel when upright is said to have a positive GM, i.e. when the M is found to be above the G. This is usually referred to as having a positive GM or a positive initial stability
owner/operator	AZ1 Enterprises Ltd.
well found	properly furnished and equipped

Data summary

Vessel particulars

Name:	*Easy Rider*
Type:	fishing
Limits:	Inshore Limits comprising: Foveaux Strait, Fiordland and restricted inshore area commencing at Wakatapu Point, thence 245 degrees for 12 miles to the New Zealand Territorial Limit, thence following the New Zealand Territorial Limit around Stewart Island to a point 035 degrees, 12 miles from Waipapa Point, thence Waipapa Point; and all Enclosed Limits within these Inshore Limits
Safe ship management company:	Maritime Management Services
Length:	11.00 metres
Breadth:	3.76 metres
Gross tonnage:	9.3 tons
Built:	1970 by Dillingham, Auckland
Propulsion:	one Caterpillar D330, 4-cylinder diesel engine driving a single fixed-pitch propeller through a reduction gearbox
Service speed:	8 knots
Owner/Operator:	AZ1 Enterprises Limited
Port of registry:	Bluff
Minimum crew:	one

Date and time	about 0003 on Thursday 15 March 2012[1]
Location	Foveaux Strait approximately in position 46 degrees 38.749 minutes south, 167 degrees 50.768 minutes east
Persons involved	9
Injuries	8 fatal one minor
Damage	vessel lost, sunk

[1] Times in this report are in New Zealand Daylight Time (Universal Co-ordinated Time + 13 hours) and are expressed in the 24-hour mode.

1. Executive summary

1.1. At about 2000 on 14 March 2012, the fishing vessel *Easy Rider* departed Bluff for Big South Cape Island off the west coast of Stewart Island. The skipper, 2 crew members and 6 passengers were on board. The passengers were to be offloaded at Big South Cape Island, where they were to prepare for the upcoming muttonbird harvest. The skipper intended then to travel to his fishing grounds to engage in commercial fishing.

1.2. The weather at the time that the vessel sailed was described by local fishermen as poor. It was forecast to deteriorate further as a frontal weather system passed across the Foveaux Strait area. The wind was forecast to increase to about 40-50 knots from the northwest before easing to 15 knots from the southwest after the weather front had passed.

1.3. During 14 March the skipper loaded the *Easy Rider* with ice and bait in the fish hold and loaded cod and crayfish pots and other associated fishing gear on the deck. The skipper then loaded stores, equipment and personal effects for the "muttonbirders". The stores and equipment covered most of the aft fishing deck and in places were stacked as high as the roof of the wheelhouse.

1.4. At about 0003 on 15 March the *Easy Rider* was somewhere in the area of the Bishop and Clerks Islands at the western end of Foveaux Strait in an area known for strong, variable currents and turbulent water. The *Easy Rider* was engulfed by a large wave in this area and capsized, remaining afloat for about 2 hours before sinking. The only survivor was one crew member, who had been sitting out on deck at the time. He described the wave swamping the deck and the vessel heeling violently to port and capsizing. Four bodies were recovered and 4 are still missing, declared drowned.

1.5. The Transport Accident Investigation Commission (Commission) made findings that the *Easy Rider* was loaded with too much weight, too high in the vessel, resulting in it having insufficient reserve stability for the intended voyage. The skipper did not have the required maritime qualification to be in charge of the *Easy Rider* when it was operating as a commercial fishing vessel, and he did not have a sound knowledge of his vessel's stability.

1.6. The skipper intended to go fishing after dropping off his passengers and their equipment. Therefore, the *Easy Rider* was operating as a commercial fishing vessel and should not have been carrying the 6 passengers and their equipment on the accident trip to the Titi Islands.

1.7. There was not sufficient life-saving equipment for the number of people on board, including as few as 4 approved lifejackets to share between 9 persons.

1.8. In the early years, when the "Owenga" class vessels were built, surveyors realised that the vessels had limited reserves of stability. This information appears to have been lost over time with successive changes in ownership and with changes in maritime administration. The Commission made recommendations to the Director of Maritime New Zealand to alert owners of existing vessels built to the "Owenga" design of these stability issues, and that he address issues around the retention and disposal of important maritime records.

1.9. Key lessons learnt from this accident include:

- skippers and persons in charge of vessels must have at least a basic understanding of ship stability and how the loading of people and equipment can affect this stability
- navigating small craft in rough sea conditions at night is an inherently dangerous activity and should be avoided if and when possible
- the life-saving equipment on a vessel of any description being used for any purpose must be suitable for the intended trip and for the number and size of persons on board
- Maritime Rules specify the bare minimum requirements for life-saving equipment. Operators should consider purchasing a higher standard of equipment that can improve the chances of detection and rescue in the event of a mishap

- individuals and entities, including companies and directors, that own and operate commercial vessels must ensure that they fully understand and comply with all legal requirements arising from this ownership and operation.

2. Conduct of the inquiry

2.1. On 15 March 2012 at about 1800, the Commission learned through the media that an accident involving a fishing vessel, the *Easy Rider,* had occurred earlier that day.

2.2. The Commission immediately opened an inquiry into the occurrence under section 13(1) of the Transport Accident Investigation Commission Act 1990 and appointed an investigator in charge.

2.3. Two investigators and the Commission's communications manager travelled to Invercargill on 16 March 2012, and in the following 5 days the Commission's investigators met with senior officers from the New Zealand Police, the Coroner's office and Maritime New Zealand. The investigators also received briefings on the search and rescue effort. Once the wreck had been located the investigators worked with the Royal New Zealand Navy dive team and the New Zealand Police dive team to obtain underwater footage of the wreck.

2.4. The investigators also interviewed the sole survivor, and other persons who had seen the *Easy Rider* depart from Bluff.

2.5. Information was sourced from Maritime New Zealand, the vessel's owner, the vessel's safe ship management provider, naval architects and other maritime industry persons.

2.6. The investigators returned to Invercargill on 2 April 2012 to meet with the families of the victims and to carry out further interviews and investigations.

2.7. The Commission estimated a virtual stability model of the *Easy Rider* by using data supplied from various sources, in particular using data provided by another naval architect who had measured the hull of a sister vessel and made a stability assessment of that vessel.

2.8. An independent expert naval architect was used to verify the stability report that the Commission produced.

2.9. On 7 May 2012 the Commission published an urgent safety recommendation that it had made to the Director of Maritime New Zealand concerning limitations to the stability of "Owenga" class fishing vessels, of which the *Easy Rider* was one.

2.10. The Coroner-authorised autopsy reports for the 4 bodies that were recovered were obtained and used to comment on survival aspects, including the toxicology results.

2.11. On 18 September 2012 Commissioners approved a draft final report regarding the accident and agreed that it could be circulated to 18 people, for comment. Many of these people were families of the victims. Before releasing this draft final report, the Commission telephoned these families to inform them of the impending release and to explain how they could participate in the Commission's consultation process. The Commission also informed them that the closing date for receiving submissions was 19 October 2012.

2.12. On 16 October 2012 the Commission extended this closing date until 15 November 2012 in response to a request from the interested person defined in paragraph 2.15. In the next few days the Commission contacted the families of the victims, or left messages, informing them of this new date and asking them to contact the Commission if they had questions about its draft final report or the process for preparing a submission.

2.13. In November 2012 the Commission invited the families to meet with Commission staff in Invercargill so that the Commission could explain the technical aspects of its draft final report and the Commission's consultation process. This meeting occurred on the evening of 28 November 2012.

2.14. Following that meeting the Commission extended the date for receiving submissions 3 more times (i.e. 23 January 2013, 30 January 2013 and 31 January 2013) in response to requests from the interested person.

2.15. By the closing date the Commission had received submissions from 3 people – one from the sole survivor (dated 29 January 2013), 2 from Maritime New Zealand (dated 11 October 2012 and 31 January 2013) and several submissions from an interested person (i.e. a preliminary submission received on 8 February 2013, 2 appendices received on 11 February 2013, a further submission and exhibits received on 4 March 2013, an addendum received on 6 March 2013, a further document received on 7 March 2013 and a final addendum with supporting documents received on 18 March 2013). Although this person appeared to be acting in a personal capacity when making these submissions, she was also the sole director of AZ1 Enterprises Limited (the company that owned and operated the *Easy Rider*), a shareholder of that company and the partner of the skipper (for ease of reference, this person is referred to as the "interested person" throughout the report).

2.16. On 5 March 2013 the interested person made a verbal submission to Commissioners in Wellington.

2.17. The Commission has considered all submissions and any changes as a result of those submissions have been included in this final report.

2.18. The report was approved for publication by the Commission on 20 March 2013.

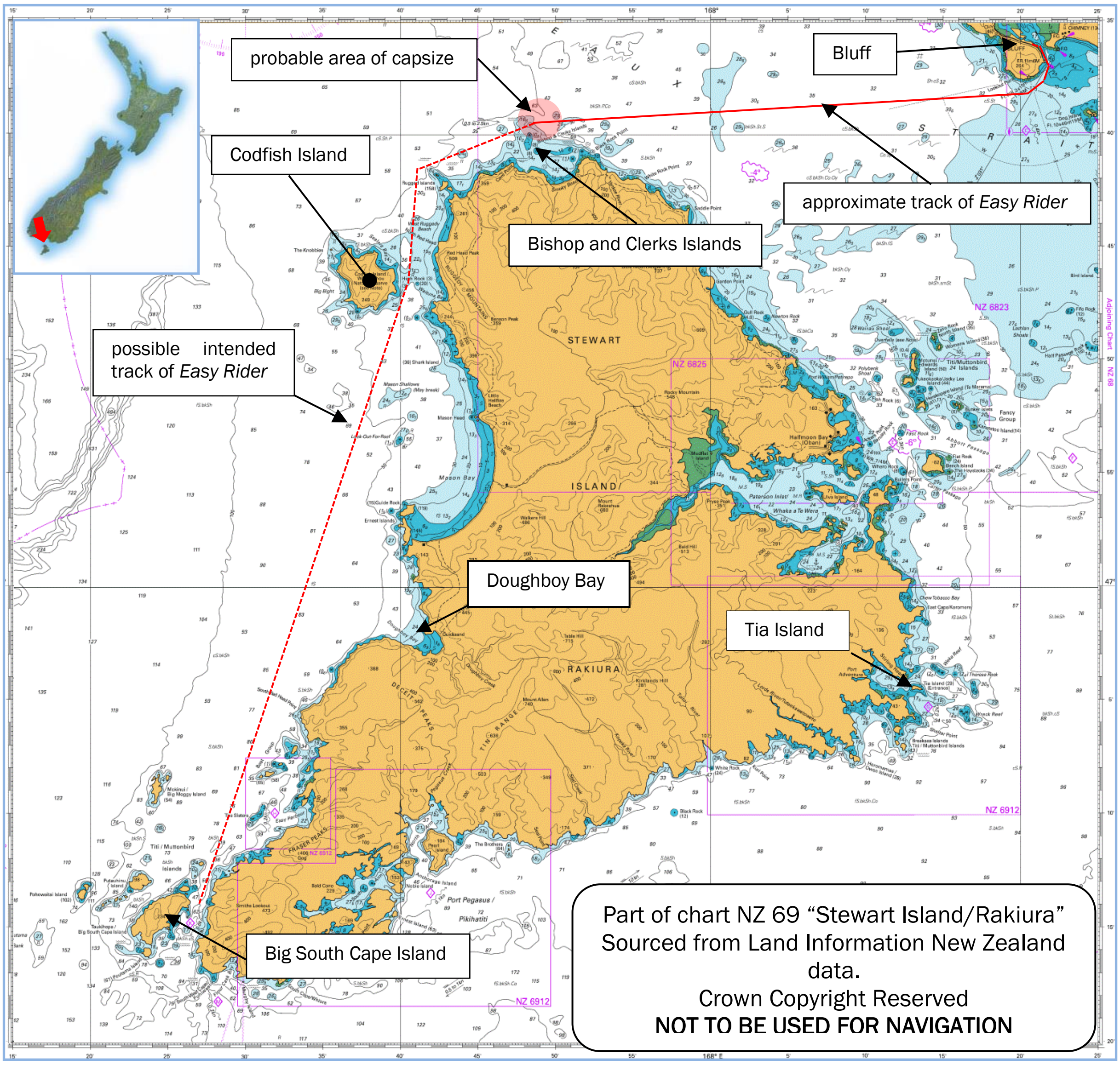

Figure 1
Chart of the general area

3. Factual information

3.1. Narrative

3.1.1. The skipper of the *Easy Rider* had agreed to transport 2 members of his extended family along with their cargo to Big South Cape Island, one of the Titi (Muttonbird Islands), (see Figure 1) for 15 March so that they could prepare for the start of the muttonbirding season.

3.1.2. The skipper of the *Easy Rider* had arranged for the vessel to be lifted out of the water at Bluff on Monday 12 March 2012. He intended to clean the underwater portion of the hull, apply some anti-fouling paint and have some minor repairs done to the vessel's propulsion and steering systems.

3.1.3. On Tuesday 13 March the skipper was still working on the vessel. A maritime safety inspector from Maritime New Zealand stopped on his way to audit another vessel nearby, to arrange an appointment for him to carry out a safe ship management compliance inspection of the *Easy Rider*. The maritime safety inspector said that they agreed for him to return after lunch the next day (Wednesday 14 March), when the vessel would be back in the water. The work on the *Easy Rider* was completed that same afternoon and the vessel was re-floated at about 1500.

3.1.4. During the morning of Wednesday 14 March the skipper was busy on board his vessel, collecting equipment that he had taken off the vessel when it was lifted out of the water. At about 1100 he moved the *Easy Rider* to the end of the fish wharf, where he loaded approximately 2.1 tonnes of ice and about 360 kilograms of bait. Both these commodities were stowed in the vessel's fish hold.

3.1.5. At about 1300 the maritime safety inspector arrived at the *Easy Rider,* which by then was tied up to the Fisherman's Company Wharf to the east of the ferry terminal. The skipper told him that he was not ready and asked him to come back in an hour. The maritime safety inspector left the vessel and returned at about 1400.

3.1.6. The inspector started the survey but it soon became apparent that the *Easy Rider* had not been adequately prepared. He had another vessel to inspect, so he agreed with the skipper to return to the *Easy Rider* on Friday, 2 days later.

3.1.7. While the inspector was still on the vessel a truck arrived with stores and materials belonging to the extended family members. After the inspector left the vessel the skipper ran an errand then returned to the vessel. The skipper, the truck driver and one other then took the *Easy Rider* out into the harbour and retrieved the skipper's cod pots from where they had been stored on the sea bed. On their return they loaded the stores and materials on board the *Easy Rider* from the truck.

3.1.8. An observer on the opposite quay noted that as the equipment and stores were loaded the vessel sat lower in the water towards the stern. Towards the end of the loading a quantity of wood was lifted from the truck and lowered, by crane, to one side of the vessel. However, the vessel listed heavily to that side, so the wood was lifted clear then lowered to sit transversely across the vessel at the stern (see Figure 2).

3.1.9. As the afternoon progressed, more members of the skipper's extended family arrived at the vessel and more equipment and personal effects were loaded on board. At about 1930 two crew members arrived on board. The skipper and crew filled the fuel tanks from the pump on the wharf and filled the fresh water barrel, which was on deck.

3.1.10. The 2 crew members then checked all the lashings on the equipment, materials and cargo on the after-deck (see Figure 2), which was so tightly packed that the crew members could only access the sides of the stow by standing on the bulwark rail. The passengers then boarded the vessel. Some of the extended family members who had not been scheduled to go to the

Titi Islands decided there and then to journey to the Islands on the *Easy Rider*, and the skipper allowed them to board.

3.1.11. At about 2000 the *Easy Rider* departed. On board were the skipper, 2 crew members and 6 passengers. As the vessel manoeuvred away from the wharf, an observer on the opposite quay noted that the sea water was sloshing onto the after-deck and draining out of the aft-most freeing ports[2].

Photograph courtesy of one of the next of kin

Figure 2
The *Easy Rider* loading alongside in Bluff before departure

3.1.12. As the *Easy Rider* was transiting the entrance channel the skipper contacted Bluff Fisherman's Radio and gave a trip report. He continued to steer the vessel through the Bluff entrance channel and out into Foveaux Strait, where he then turned the vessel in a generally westerly direction (see Figure 3).

3.1.13. One crew member, the survivor, was sitting outside the wheelhouse with his back against some blue barrels (see Figure 2). Two of the passengers sat in the space between the wheelhouse and the cargo as both were suffering from the effects of motion sickness. The crew member had given these 2 passengers his and the other crew member's lifejackets. The skipper was standing in the wheelhouse behind the steering wheel. One passenger was sitting in the entranceway to the forecastle cabin and one passenger was sitting on the couch on the port side of the wheelhouse, with his son sitting on his lap. One passenger and the other crew member were asleep in the forecastle cabin.

3.1.14. The crew member on deck saw that the youngest passenger was looking cold, so he found a child's lifejacket that had come on board with the cargo and put it on him.

3.1.15. The surviving crew member said that he had just been listening to the radio news at 2400 (midnight). Shortly after he heard the sound of a larger wave. The wave came over the starboard side of the vessel, the deck filled with water and he was washed to the port side of the vessel. The vessel then heeled sharply to port and the crew member was tipped into the sea. He managed to grab a rope and was swept to the stern of the vessel.

[2] Openings in the bulwarks to allow water to clear from the deck overboard.

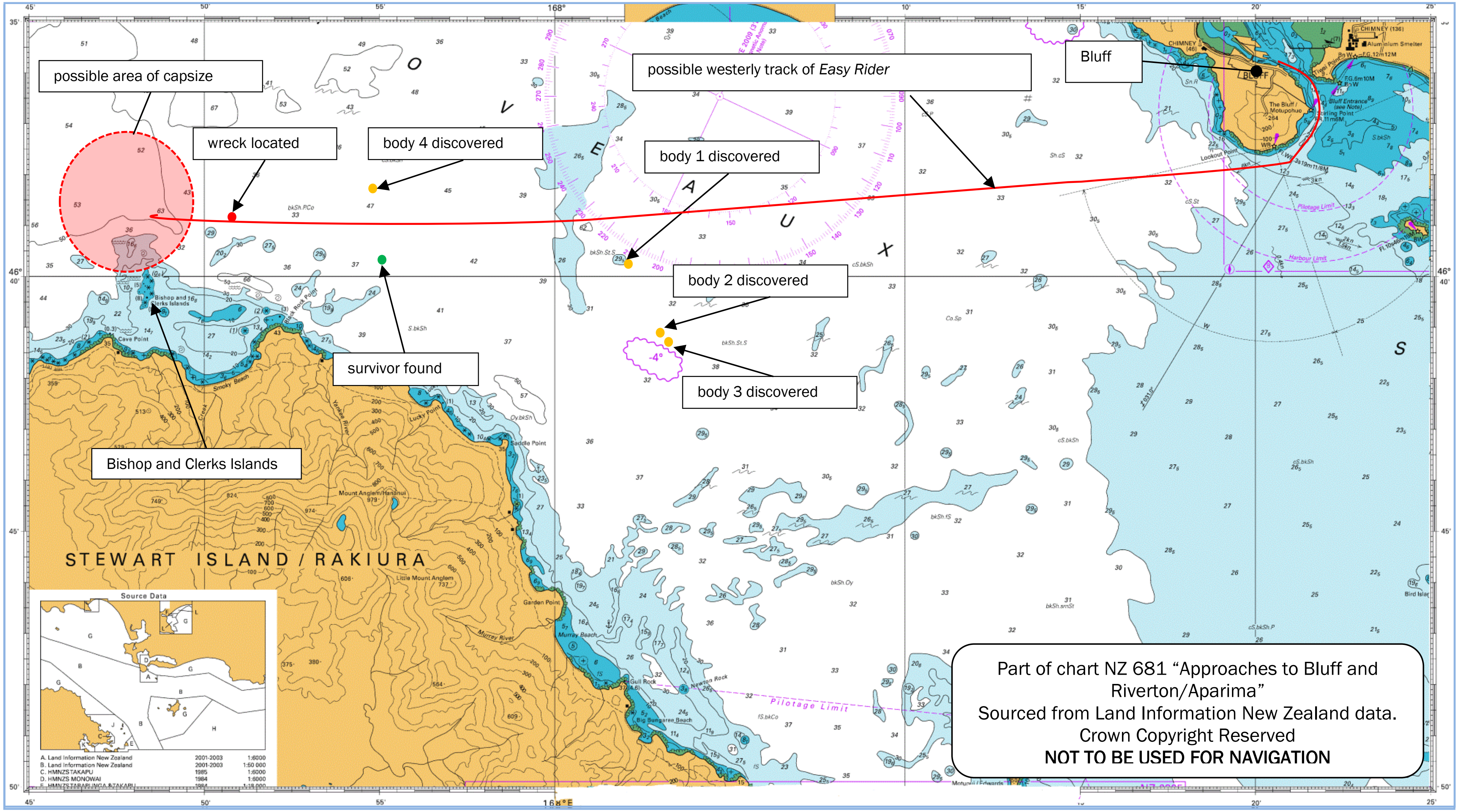

Figure 3
Chart showing positions of wreck, survivor and bodies as found

3.1.16. As the crew member was swept to the stern of the vessel he felt the vessel capsize. He managed to pull himself up onto the inverted hull and wedged himself into a space at the stern by the rudder. He then started hammering on the hull, but got no answer. After what he estimated to be 2 hours he heard what he described as a "whoosh" from the forward end of the vessel; the *Easy Rider* then heeled to starboard and started to sink by the stern.

3.1.17. The crew member crawled up the hull to the bow before having to step off into the water. As he kicked away from the vessel a fuel canister popped up beside him, which he then used to help support himself in the water. He was not wearing a lifejacket.

3.2. Search and rescue

3.2.1. The helicopter that was to offload the cargo for the *Easy Rider*'s passengers had arranged to be at Big South Cape Island at about midday on Thursday 15 March. The helicopter had also arranged to offload cargo from 3 other vessels at Big South Cape Island and one vessel at Tia Island on the east coast of Stewart Island.

3.2.2. The helicopter pilot lifted the cargo off 3 vessels at Big South Cape Island. The *Easy Rider* had not arrived and the helicopter pilot could not contact or find the *Easy Rider,* so he flew to Tia Island and offloaded cargo from a vessel there. On his way back to Big South Cape Island from Tia Island he was still unable to contact the *Easy Rider*, so he radioed his base to contact the skipper's partner to find out if the *Easy Rider* had departed as expected. The pilot also contacted Stewart Island Fisherman's Radio, but the operator had not heard from the *Easy Rider*.

3.2.3. The skipper of one of the other vessels at Big South Cape Island informed the helicopter pilot that the *Easy Rider* had been having alternator problems and the vessel may be in one of the coves with a flat battery. He told the helicopter pilot that he was checking the inlets on Big South Cape Island for the *Easy Rider*. At about 1500 the helicopter pilot was informed that the vessel had left at about 2000 the previous night.

3.2.4. At about 1525 Bluff Fisherman's Radio informed the Police of the overdue vessel and a search was organised. The helicopter pilot was requested to search the coast of Big South Cape Island, after which he landed on the Island to refuel before commencing a coastline search along the west coast of Stewart Island northwards from Doughboy Bay (see Figure 1).

3.2.5. At about 1704, as the helicopter pilot entered Foveaux Strait, he noticed a patch of smooth water, which as he flew over he saw was caused by an oil slick. The pilot fixed the position by global positioning system and radioed this find to the Police search and rescue team. He did not notice any flotsam in the vicinity of the oil slick.

3.2.6. The Police search and rescue co-ordinator arranged for land, air and sea units to take part in a search. At about 1810 one of the sea units, the Royal New Zealand Coastguard vessel stationed in Bluff, was proceeding to the area of the accident when a lookout saw the fuel canister being thrown into the air by the survivor. The Coastguard vessel manoeuvred alongside and the survivor was rescued (see Figure 3). The first body was found at about 2030.

3.2.7. On Friday 16 March the wreck of the *Easy Rider* was identified on the sea bed at about 0930. The wreck at the time was lying on its side in approximately 40 metres of water. Bodies 2 and 3 were found at about 1245 that same afternoon and body 4 was found at about 1530.

3.2.8. The Royal New Zealand Navy ship *Resolution* had been assisting in the search. On Friday evening members of the Royal New Zealand Navy dive team and members of the New Zealand Police dive team boarded the vessel to go to the wreck site. On Saturday 17 March the dive teams were able to dive on the wreck, which by this time had assumed an upright position. They carried out a search but did not find any of the 4 missing persons.

3.2.9. The dive teams took a video recording of their inspection of the vessel. The video showed that the life-raft had moved from its stowage position on top of the wheelhouse and was wedged between the port-side rail and the wheelhouse bulkhead. The emergency position indicating radio beacon was still in its stowage position, inside the wheelhouse, and was operating.

3.2.10. When the search was called off by the incident commander, one crew member had been recovered alive and the bodies of one crew member and 3 passengers had been recovered. The bodies of the skipper and 3 other passengers, including the child, were still missing.

3.3. Climatic and environmental conditions

For a full description of the weather conditions off the north coast of Stewart Island in Foveaux Strait, see Appendix 1.

3.3.1. The weather when the vessel departed was overcast and it was raining. The wind was blowing from the northwest at about 15-20 knots. The tide was just starting to ebb, with high tide occurring at 2002.

3.3.2. The accident happened in the "Foveaux" coastal waters forecast area. The next forecast area to the west was "Puysegur" and the *Easy Rider* was heading into this area. The Meteorological Service of New Zealand Limited (MetService) issued coastal waters forecasts at regular times. The coastal waters forecasts were valid within 60 nautical miles of the New Zealand coastline and described in a general sense the weather conditions expected. However, MetService stated a caveat that over small parts of the forecast area, for example off a particular headland or in a sheltered bay, weather conditions could be significantly different from those forecast.

3.3.3. The coastal waters forecast issued at 1606 New Zealand Daylight Time on 14 March 2012 for the "Foveaux" and "Puysegur" coastal areas was:

> MARINE WEATHER BULLETIN FOR NEW ZEALAND COASTAL WATERS FORECAST ISSUED BY METEOROLOGICAL SERVICE OF NEW ZEALAND AT 16:09 14-MARCH 2012 VALID UNTIL 23:59 15-MARCH-2012
>
> PUYSEGUR
>
> *STORM WARNING IN FORCE*
>
> Northwest 50 knots, easing to 40 knots north of Puysegur Point this evening. Changing southwest 15 knots everywhere overnight, rising to 25 knots in the morning, then easing to 15 knots again Thursday afternoon. High sea easing. Southwest swell rising to 4 metres. Northwest swell 2 metres easing. Poor visibility in rain clearing Thursday afternoon.
>
> OUTLOOK FOLLOWING 3 DAYS: Tending early Friday, northerly 20 knots, rising late Friday, 40 knots with very rough sea, changing Sunday, southwest 20 knots. Heavy southwest swell, easing.
>
> FOVEAUX
>
> *GALE WARNING IN FORCE*
>
> Northwest 35 knots changing southwest 15 knots overnight, rising to 25 knots in the morning, then easing to 15 knots again Thursday night. Sea becoming very rough for a time. Southwest swell rising to 4 metres. Poor visibility in rain developing this evening, clearing Thursday afternoon.
>
> OUTLOOK FOLLOWING 3 DAYS: Southwest 15 knots, tending Friday, northerly 15 knots, rising Saturday, northwest 25 knots with rough sea, changing Sunday, southwest 20 knots. Heavy southwest swell, easing Friday.

3.3.4. MetService provided an after-cast of the weather in Foveaux Strait at the time of the accident. The after-cast is contained in Appendix 1.

3.3.5. The sea temperature in Foveaux Strait was stated by MetService as being 13 degrees Celsius during the night of 14/15 March 2012.

3.3.6. The table below shows the times of high and low water at Bluff on 14 March 2012, as obtained from the New Zealand Nautical Almanac (Government of New Zealand, 2011). South Port New Zealand Limited, the port operator, also produced tide tables for the port of Bluff. These were the tables generally used by Bluff fishermen for determining the state of the tide. The times of high and low water as determined by South Port New Zealand Limited are shown below. The table also shows the calculated times of high and low water for the approximate accident site as computed by Tide Forecaster (National Institute of Water and Atmospheric Research).

Place	Date	Low water	High water	Low water	High water
Bluff (Nautical Almanac)	14 Mar 2012	0112	0723	1341	2002
Bluff (South Port)	14 Mar 2012	0145	0800	1415	2030
Accident site (NIWA)	14 Mar 2012			1203	1826
	15 Mar 2012	0041	0651	1312	1939

Table 1
Times of high and low water for Bluff and accident site

3.3.7. The moon was showing about one-quarter and would have risen at about 2337 on 14 March and set at about 1434 on 15 March.

3.4. Vessel information

3.4.1. The *Easy Rider* was classed as a restricted limit fishing vessel. As far as can be determined it was probably built in Auckland in 1970 by Dillingham of Dillingham Transportation (N.Z.) Limited, Auckland, which took over the Scholten and Brijs shipbuilding yard in 1969.

3.4.2. The *Easy Rider* was built to the same Breekveldt design as the “Owenga” class of fishing vessels constructed from the late 1960s onward for the Chatham Islands’ cray-fishing boom. The vessel’s hull was constructed from steel and had an overall length of 11 metres, a breadth of 3.76 metres and a moulded depth of 1.82 metres. The gross tonnage was 9.3 tons.

3.4.3. The *Easy Rider* was powered by a 4-cylinder in-line Caterpillar D330 diesel engine that produced 120 horsepower (89.48 kilowatts [kW]) driving a single fixed-pitch propeller through a twin-disc MG 560 reduction gearbox that gave a service speed of about 8 knots.

3.4.4. The *Easy Rider* was fitted with the following navigational and communication equipment at the time of its survey for entry into the safe ship management system:

- a Solara digital selective calling very-high-frequency radio transmitter receiver
- a Furuno GD 1000 global positioning system receiver and video plotter
- a Coursemaster CM 450 automatic pilot
- a JRC 2000 radar
- a Sestrel magnetic compass
- a Furuno depth sounder
- a GME Accusat emergency positioning indicating radio beacon

The interested person said that the skipper had probably also had a handheld very high frequency radio transmitter receiver with him.

3.4.5. Since being built the *Easy Rider* had been used both commercially and privately. When built it was given a fishing number, AK98, applicable to the Auckland region. It had then been used on the west coast of the South Island. By 2007 it was operating out of Dunedin as a private vessel and as such was not within the safe ship management system.

3.4.6. In June 2008 the then owner presented the vessel for survey to re-enter safe ship management. The surveyor informed the then owner that due to the extensive nature of the repairs required to bring the vessel into survey, the vessel was in effect a constructive total loss. The surveyor also noted to Maritime New Zealand that if an attempt were made to bring the vessel into survey a full investigation would need to be made as to the vessel's condition.

3.4.7. In March 2011 AZ1 Enterprises Limited acquired the vessel and moved it to Bluff.

3.4.8. The owner then carried out substantial repair work on the vessel in Bluff. This repair work was overseen by a surveyor on behalf of Maritime Management Services, a safe ship management company. The surveyor issued a fit-for-purpose certificate for the *Easy Rider* with certain defined inshore and enclosed limits (see "Data summary").

3.4.9. Maritime Rules Part 21, Safe Ship Management Systems came into force in 1997. The safe ship management system was based on the established International Safety Management System, but was modified for domestic commercial ships. Part 21 was supported by, and included, New Zealand Safe Ship Management Code, which outlined how an SSM system should be implemented.

3.4.10. The inspection regime under safe ship management was a combination of surveys and audits. These were intended to assess the condition of ships and the adherence to safety management systems by owners, operators and crews.

3.4.11. On 6 September 2011 Maritime New Zealand issued a safe ship management certificate for the *Easy Rider* to AZ1 Enterprises Limited. The certificate named AZ1 Enterprises Limitedas the owner of the *Easy Rider*. The certificate had a compliance date of 6 March 2012 and was valid until 14 August 2012, when the vessel was due for an inspection of the propeller shaft. A safety inspection was to be carried out by Maritime New Zealand prior to the compliance date; and it was this inspection that the Maritime New Zealand safety inspector was trying to complete on 14 March 2012.

3.4.12. The safe ship management certificate stated that the vessel was not to proceed beyond its operating limits, which were the same as those contained in the fit-for-purpose certificate. Within the designated limits it was fit to ply as a fishing vessel. Life-saving appliances were provided for 3 persons and the vessel was not to carry passengers.

3.4.13. Page 2 of the *Easy Rider* safety management policy and operations manual stated that the minimum manning requirements for the vessel in both the enclosed and inshore limits was to be one master holding a New Zealand Inshore Launch Master's certificate of competency.

3.4.14. Section 7.1, Operating Parameters of the safety management policy and operations manual stated:

> The business has put in place the following operating parameters for this vessel.
>
> - Vessel may be used for recreational purposes by the owner or the owner's representatives, with no fare paying passengers on board. MMS [Maritime Management Services] must be advised
> - Vessel operation is at the discretion of the Master subject to safe sea and weather conditions.

3.5. Stability and loading

3.5.1. For a description of the basic principles of statical stability, see Appendix 3. For a more detailed discussion of the hydrostatic model used to determine the stability of the *Easy Rider* from the data available to the Commission, see Appendix 4.

3.5.2. The lightship weight of the *Easy Rider* was the weight of the vessel when complete and ready for service but empty. To the lightship weight was added the deadweight, which was the weight in tonnes that the vessel could carry when loaded to the maximum permissible draught. The deadweight included fuel, fresh water, gear, supplies, catch and crew. The displacement mass was the total weight of the vessel; the lightship weight plus the deadweight.

3.5.3. When the *Easy Rider* left Bluff it was loaded with a deadweight for the forthcoming voyage estimated to be at least 9.884 tonnes (see Appendix 4 for details of how these weights were derived). The following table shows what contributed to the estimated deadweight:

Description	Weight (tonnes)
Fuel	2.800
Fresh water	0.200
Cargo and equipment	3.294
Vessel's stores including victualing	0.200
Ice	2.100
Bait	0.360
Crew and passengers	0.930
Deadweight	9.884
Lightship weight	17.531
Displacement	27.415

Table 2
Easy Rider's estimated deadweight on departure 14 March 2012

When embarking on a "normal" fishing voyage the *Easy Rider* would typically have had 7 tonnes of deadweight on departure. The following table shows how that deadweight could have been made up:

Description	Weight (tonnes)
Fuel	2.800
Fresh water	0.200
Cod and cray pots	1.000
Vessel's stores including victualing	0.200
Ice	2.100
Bait	0.360
Crew	0.341
Deadweight	7.001
Lightship weight	17.531
Displacement	24.532

Table 3
Easy Rider's estimated deadweight on a typical fishing voyage

3.6. Survivability

3.6.1. The *Easy Rider* was fitted with an RFD Pacific-4 life-raft (4 persons), which had been purchased from RFD in Christchurch in August 2011. The Pacific-4 life-raft had been manufactured for RFD by Plastimo, a French company. The Pacific-4 life-raft had been type approved in New Zealand by the Ministry of Transport in 1991. The maritime safety inspector checked the life-raft before discontinuing his survey on the day the *Easy Rider* departed Bluff. He noted that it was in survey and that its next annual service was due in August 2012. He also noted that it was correctly installed and secured.

3.6.2. The life-raft was secured in its cradle by a hydrostatic release unit. These units were designed to operate at a pre-set depth to release a life-raft so that it could float to the surface. The type of hydrostatic release unit fitted to the life-raft on board the *Easy Rider* was a Hammar H20 HRU, which was designed and certified to operate at a depth of between 1.5 metres and 4 metres. It was a non-serviceable item that was required to be replaced every 2 years. This type of HRU had been in production since 1986 and was certified and approved by many classification societies and maritime administrations around the world. The Maritime Safety Authority had issued a certificate of acceptance for the HRU on 5 March 2002.

3.6.3. The hydrostatic release unit used a water-pressure mechanism to activate a spring-operated blade. The blade severed a loop of line through which the life-raft securing lanyards were fastened. The installation instructions that accompanied each HRU explained that a slip-hook or similar should be used to allow easy manual deployment of the life-raft. It is unknown if such a quick-release device was fitted to the *Easy Rider*'s life-raft securing system.

3.6.4. The *Easy Rider* was equipped with 3 type-approved lifejackets. The interested person submitted that, in addition to the 3 type-approved lifejackets, there were possibly 2 or 3 other lifejackets of indeterminate age and condition on board. The child's lifejacket that was brought on board was put on the child by a crew member. The crew member did this because the child was cold, but he could not recall if he had fastened it correctly. No lifejackets were recovered during the search and rescue operation.

3.6.5. The *Easy Rider* was fitted with a GME Accusat MT 406G emergency positioning indicating radio beacon. This beacon operated on the 406 megahertz frequency and included a global positioning receiver and a 121.5 megahertz homing transmitter. That model of beacon did not automatically operate or float free. It had to be removed from its bracket and switched on manually. Once removed from its stowage position the beacon was buoyant and could be attached to a person or life-raft with the supplied buoyant line. The beacon had an internal global positioning receiver and once activated the beacon transmitted a message that included a global positioning system derived position to about 100 metres accuracy. If the beacon were above water, satellites would pick up this message and relay it to Rescue Coordination Centre New Zealand.

3.6.6. Providing the beacon had been registered, which the *Easy Rider*'s had, the Rescue Coordination Centre would then know from its database the vessel to which the beacon belonged and the contact numbers for the owners.

3.6.7. When the Maritime New Zealand safety inspector started his audit on the day that the vessel sailed from Bluff, he noted on his check sheet that the vessel was equipped with 4 hand distress flares and 2 distress smoke canisters; all were in date.

3.7. Personnel

3.7.1. The skipper had spent most of his adult life, and a part of his childhood, on fishing vessels. The interested person said that the skipper had spent about 30 years fishing as a deckhand, but that the *Easy Rider* was his first vessel as skipper.

3.7.2. The skipper held a New Zealand certificate of competency as a qualified fishing deckhand. He also held a certificate as a radio operator. He did not have the certificate of competency that Maritime Rules required to operate the *Easy Rider* commercially.

3.7.3. Under Maritime Rules Part 31C, Crewing and Watchkeeping Fishing Vessels (see Appendix 2), the manning of the *Easy Rider* had to be sufficient for the safe operation of the vessel. The minimum crew was derived from the applicable tables and flow charts after carrying out a minimum safe crewing assessment. Maritime Rules 31C also contained a list of acceptable equivalents for the required certificates of competency.

3.7.4. The manning for operation in the inshore area was set at one inshore launch master certificate of competency. Suitable equivalent certificates of competency were listed, with conditions, as a New Zealand offshore watch-keeper, inshore fishing skipper, master restricted limit launch or commercial launch master.

3.7.5. Both of the deckhands had spent several years in the fishing industry, but neither held any maritime qualification.

3.7.6. The 6 passengers were all members of the same extended family, ranging in age between 7 years and 58 years. None of the passengers held any maritime qualification.

3.8. Toxicology

3.8.1. A post-mortem examination was carried out on the 4 bodies recovered, including routine toxicology reports. The toxicology reports revealed that:

- the crew member had a level of tetrahydrocannabinol $C_{21}H_{30}O_2$ (THC)[3] of 7 micrograms per litre in the blood. No alcohol was detected
- one passenger had no traces of performance-impairing substances
- one passenger had a level of THC of 1.6 micrograms per litre in the blood. No alcohol was detected
- one passenger had a blood alcohol level of 125 milligrams per 100 millilitres[4] and a trace of THC in the blood.

3.9. Regulation

3.9.1. The following information is provided to support a later discussion about the nature of the voyage the *Easy Rider* was on at the time of the accident.

Maritime Transport Act 1994

3.9.2. The Maritime Transport Act 1994 defines commercial and pleasure craft as follows (in part):

> A ***commercial ship*** means a ship that is not a pleasure craft.
>
> A **pleasure craft** means a ship that is used exclusively for the owner's pleasure or as the owner's residence, and is not offered or used for hire or reward; but does not include:
>
> (a) a ship that is provided for transport or sport or recreation by or on behalf of any institution, hotel, motel, place of entertainment, or other establishment or business:
>
> (b) a ship that is used on any voyage for pleasure if it is normally used or intended to be normally used as a fishing ship or for the carriage of passengers or cargo for hire or reward.
>
> (c) a ship that is operated or provided by any club, incorporated society, trust, or business

3.9.3. The Maritime Transport Act 1994 defines the owner as follows (in part):

> **owner**
>
> (a) in relation to a ship registered in New Zealand under the Ship Registration Act 1992, means the registered owner of the ship:
>
> (b) in relation to a ship registered in any place outside New Zealand, means the registered owner of the ship:
>
> (c) in relation to a fishing ship, other than one to which paragraph (a) or paragraph (b) applies, means the person registered as the owner under section 57 of the Fisheries Act 1983:
>
> (d) in relation to a ship to which paragraph (a) or paragraph (b) or paragraph (c) applies, where, by virtue of any charter or demise or for any other reason, the registered owner is not responsible for the management of the ship, includes the charterer or other person who is for the time being so responsible:
>
> (e) in relation to an unregistered ship or a registered ship that does not have a registered owner, means the person who is for the time being responsible for the management of the ship

[3] The active ingredient in cannabis.

[4] For comparative purposes the legal blood alcohol limit for driving on the road was 80 milligrams per 100 millilitres of blood.

Fisheries Act 1996

3.9.4. Section 103 of the Fisheries Act states that:

> (1) No person shall use a fishing vessel, or any tender of that fishing vessel, to take fish, aquatic life, or seaweed for sale, in New Zealand fisheries waters, unless:
>
> (a) the vessel is registered in the Fishing Vessel Register as a fishing vessel; and
>
> (b) that person is named in that register as an operator of, or a notified user in relation to, that vessel; and
>
> (c) that person complies with all conditions of registration (if any) and any conditions of any consent of the chief executive given under subsection (4).

3.9.5. Section 111 of the Fisheries Act states that:

> (1) For the purposes of this Act, all fish, aquatic life, or seaweed that is on board, or landed from, or transhipped from, any fishing vessel or fish carrier registered under this Act is deemed to have been taken or possessed for the purpose of sale, unless:
>
> (a) the taking or possession of the fish, aquatic life, or seaweed was in accordance with a general or particular approval of the chief executive and with any conditions imposed on that approval; and
>
> (b) the taking or possession occurred after that approval was given.
>
> (2) Subsection (1) does not apply if the fish, aquatic life, or seaweed were lawfully taken under regulations made under section 186.

Stability and construction

3.9.6. Maritime Rules Part 40D, Design, Construction and Equipment – Fishing Ships came into force on 1 February 2000. Part 40D applied to almost every New Zealand ship that was required to be registered under section 57 of the Fisheries Act 1983, or section 103 of the Fisheries Act 1996, or recognised by the Director as being engaged in fisheries research. Part 40D prescribed the standards of design and construction of fishing ships, and the equipment they were required to carry.

3.9.7. Sections 40D.34 and 40D.35 required fishing vessels of less than 24 m in length and engaged in trawling, dredging or similar forms of fishing where heavy gear was towed, or engaged in purse seining, to undergo stability tests and freeboard assignation that had not been required for such ships previously.

3.9.8. Intact stability for a vessel was required for 5 typical loading conditions:

(i) departure for the fishing grounds with full fuel, stores, ice and fishing gear

(ii) departure from the fishing grounds with full catch

(iii) arrival at home port with full catch and 10% fuel and stores

(iv) arrival at home port with 10% fuel, stores and a minimum catch, that is normally to be 20% of a full catch but may be up to 40%, provided the surveyor is satisfied that operating patterns justify such a value

(v) any other actual operating conditions the surveyor considers would produce the lowest values of the parameters contained in the criteria required by sub-rule (4)(c).

The intact stability for a vessel was considered satisfactory if certain conditions were met in each of the loading conditions.

3.9.9. In recognition of the difficulties involved in undertaking stability tests on existing vessels, the Rule allowed that such ships did not have to comply with the stability requirements until 1 February 2002, 2 years after Part 40D came into force.

3.9.10. The advisory circular that accompanied Part 40D allowed that an alternative method on trawlers of less than 12 m in length could be used to determine the initial metacentric height (GM, see Appendix 3) of a vessel by carrying out an inclining test on the vessel in the departure for the fishing grounds condition and using the displacement of the vessel in the calculation. This alternative method circumvented the need for lines plans, so cost less than a full stability analysis. Safe ship management companies applied to Maritime New Zealand to be allowed to conduct other methods of alternative stability tests on inshore trawlers of less than 16 m in length and a main engine of less than 200 kW (270 horsepower). On 26 September 2001 Maritime New Zealand accepted the alternative stability method proposed by SGS M&I, a safe ship management company. The *Easy Rider* had an engine rating of 89.84 kW, was less than 16 m in length and had been, in 2003, trawling in the inshore area, so met the conditions for the alternative stability test.

3.9.11. The *Easy Rider* had an alternative stability test done in October 2003 for a new owner when the vessel was sold. However, details were unavailable as to any recommendations from the SSM company's naval architect with respect to loading. The records have been lost over time.

3.9.12. The assumption is that the *Easy Rider* must have passed this stability test because the Commission has obtained evidence that it was at some point fitted with a trawl gantry and was used at some time for trawling. However, the trawl gantry had at some time been removed and was not fitted at the time the vessel capsized on the accident voyage. This information is provided for later discussion on the issue, the retention of ship records and the possible loss of safety-critical information

Safe ship management responsibilities

3.9.13. On 6 September 2011 Maritime New Zealand issued a safe ship management certificate to AZ1 Enterprises Limited for the *Easy Rider*. This meant that AZ1 Enterprises Limited, as the owner of the *Easy Rider*, was responsible for meeting the safe ship management obligations for this vessel.

3.9.14. The New Zealand Safe Ship Management Code as contained in Appendix 6 of Maritime Rule Part 21, Safe Ship Management Systems stated that the safe ship management system should ensure:

- compliance with mandatory rules and regulations
- that applicable codes and standards prescribed or recommended by the Maritime Safety Authority were taken into account.

3.9.15. The Code placed certain responsibilities on the owner of a vessel, which included:

- providing for safe practices in ship operation and a safe working environment
- establishing safeguards against all identified risks.

3.9.16. Paragraph 3.1 of the Code stated that the owner should define and document the responsibilities, authorities and interrelations of all personnel who managed, performed and verified work relating to and affecting safety and pollution prevention.

3.9.17. Paragraph 6.1 of the Code stated that the owner should ensure that the master was:

- properly qualified to command
- fully conversant with the owner's Safe Ship Management System.

3.9.18. Paragraph 6.4 of the Code stated that the owner should ensure that all personnel involved in the owner's Safe Ship Management System had an adequate understanding of relevant mandatory rules and regulations.

4. Analysis

4.1. Introduction

4.1.1. The *Easy Rider* was transporting extended family to an island where they were to prepare for the upcoming muttonbird harvest. The accident happened 6 years after the *Kotuku* tragedy, in which 6 members of an extended family had also lost their lives in Foveaux Strait while returning, by fishing vessel, from islands after completing the muttonbird harvest. The circumstances of the 2 tragedies were different. Nevertheless, in each case a fishing vessel not normally used for transporting passengers and their equipment was involved, and in each case standards of the day and the Maritime Rules were not met. During the course of this investigation the Commission talked to the owners, and inspected the operation, of 4 vessels that were being prepared to transport passengers and their effects to Titi Islands. Those inspections showed that many of the lessons from the *Kotuku* tragedy had been heeded, at least by those operators, and that, as a rule, other boats involved in transporting people to the Islands for the muttonbird harvest appeared to be fit for purpose and were being operated in compliance with Maritime Rules.

4.1.2. For the 2013 muttonbird season approximately 5 commercial operators said that they would be operating vessels to the Titi Islands. These 5 vessels were correctly certified and had been surveyed as suitable for that purpose by Maritime New Zealand. Maritime New Zealand estimated that prior to the start of the muttonbird season up to 12 vessels of other classes might also intend operating at times to the Titi Islands. This was an estimate only because the situation changed from one year to the next. Other means for accessing the Titi Islands were available, such as using helicopters. Maritime New Zealand thought that some of these vessels might be commercial fishing vessels being used to transport family members, similar to the *Easy Rider* situation. Maritime New Zealand had consulted the muttonbird associations and made it known that skippers and anybody intending to travel on these other vessels could request a free "safety check" from Maritime New Zealand before departure from Bluff.

4.1.3. Every vessel has limits to what it can withstand. If the crew does not know these limits then the risk of exceeding them could be high. If they were to push the margins or knowingly exceed them, the risk of there being an accident would increase. It follows then that no vessel is immune from capsize regardless of how structurally sound it is, how well it has been maintained, and how inherently stable it is. An overloaded vessel with poor stability might survive a trip in good weather and a properly loaded vessel might survive a trip in severe weather, but a poorly loaded vessel with poor stability in severe weather will be at serious risk of capsize.

4.1.4. The *Easy Rider* had been operated by several owners during its 42-year history, sometimes as a pleasure boat, but primarily as a commercial fishing boat. It had no doubt operated in worse sea conditions than those it experienced on the night it sank, but the weather conditions were not good. The boat was heavily loaded on the accident trip, and it had marginal stability when it departed from Bluff.

4.1.5. This following section analyses what happened to the *Easy Rider* to cause it to capsize. It also discusses how it came to be in that location in those weather conditions under the command of a skipper who did not hold the necessary qualification to be in command.

4.1.6. The analysis also examines the regulatory system of which the *Easy Rider* was part of over the years and the opportunities the system had for reducing the risk of the accident.

4.1.7. When an accident like this occurs, the consequences of it are largely dependent on: someone being alerted to the accident; the emergency response to the accident; the preparedness of the vessel and crew to deal with the emergency; and the equipment that is available to preserve life while help is on its way. These issues are discussed also.

4.1.8. Of the 4 bodies recovered, one passenger was found to have a level of alcohol in his blood and one crew member was found to have a high level of THC, the active ingredient of cannabis. The report discusses the effects of alcohol and cannabis on the ability of people to survive in cold water.

4.2. What happened

4.2.1. Although the *Easy Rider* was 42 years old, it had undergone extensive restoration under the guidance of a surveyor, then successfully entered into the safe ship management system. There were a number of deficiencies that the inspector noted in his preliminary inspection of the *Easy Rider* earlier on the day that it departed Bluff, but no evidence was found that any of these deficiencies directly contributed to the accident. The description of events given by the sole surviving crew member was useful in discounting a number of other factors that could contribute to a boat capsizing.

4.2.2. There did not appear to be any malfunction with the boat or its equipment, although this could not be entirely ruled out because the sole survivor was not in the wheelhouse at the time, but was instead out on deck. The description he gave was of the boat being overwhelmed by a wave, or waves. This possibility is now explored further.

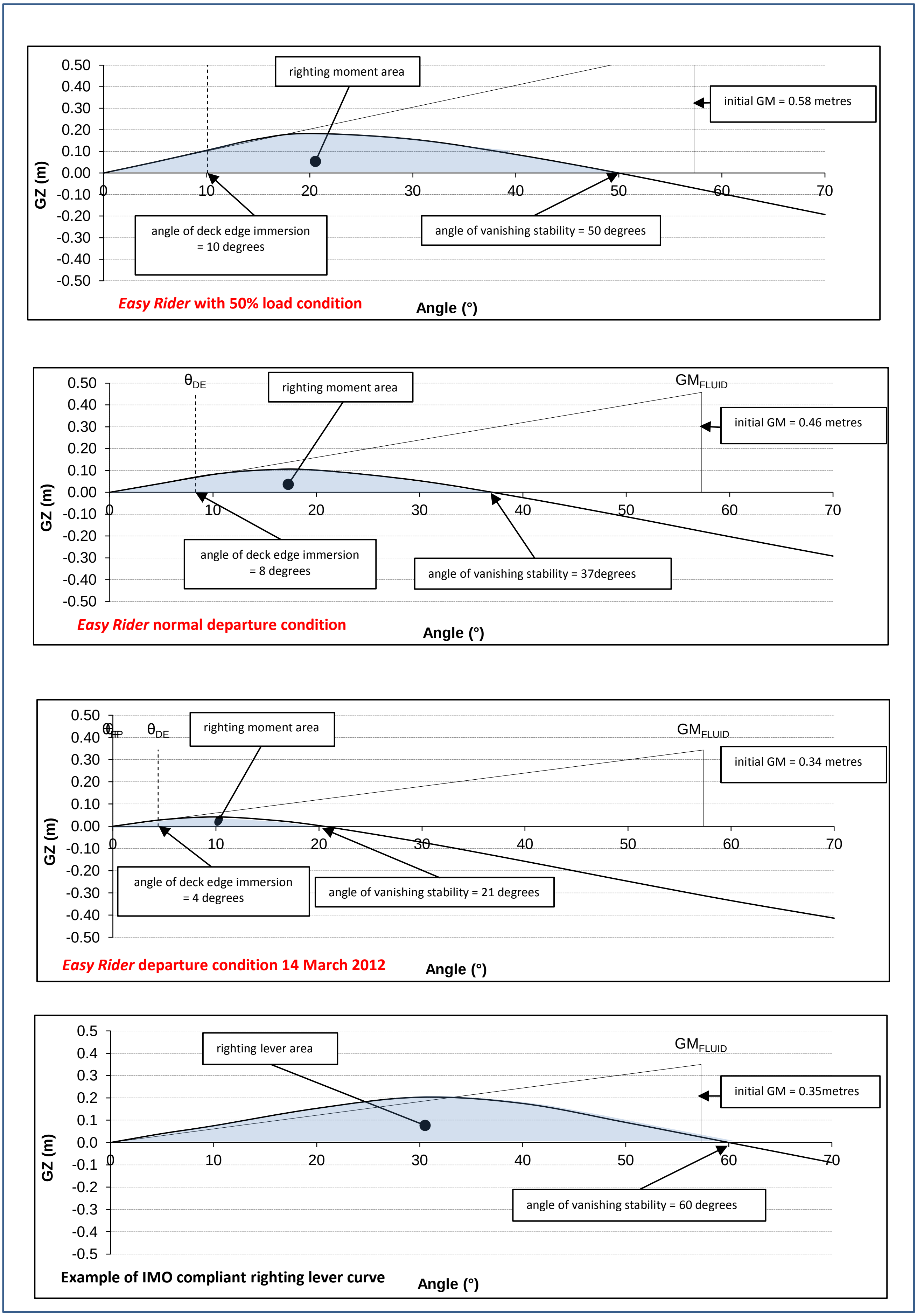

Figure 4
Charts showing *Easy Rider*'s stability under differing load conditions and an example of an International Maritime Organization-compliant vessel

4.3. Stability (weight and balance)

4.3.1. The stability of the *Easy Rider* was calculated from the data available. The Commission did not have the "as-built" lines plan of the vessel, but it obtained sufficient data to build a stability model of the vessel that was accurate enough to determine that the *Easy Rider* had low stability reserve when it departed Bluff. Appendix 4 shows the detail of this stability assessment and any limitations with its accuracy.

4.3.2. Figure 4 shows 3 stability curves (GZ curves) using the model created for the *Easy Rider*: one shows a typical departure condition; one shows a typical mid-voyage (50% load) condition; and the other shows the departure condition from Bluff for the accident voyage. A sample stability curve is shown for comparative purposes.

4.3.3. This fourth curve shows the minimum current-day standards set by the International Maritime Organization for fishing vessels. At the time the *Easy Rider* was designed and built, these requirements had not been written, and due to its size the *Easy Rider* was not and would still not be required to comply with these requirements.

4.3.4. The dynamic stability is the stability characteristic of a vessel when moving (particularly rolling) and is the energy necessary to incline the vessel to a certain angle of heel. The dynamic stability may be determined by measuring the area under the righting lever curve (GZ curve) up to a certain angle of heel. The larger the area, the better the dynamic stability. The area under the curve is shown in blue in Figure 4. Put another way, the larger the blue area under the curve, the harder it is to capsize the vessel. Appendix 3 gives a more detailed explanation of stability.

4.3.5. The *Easy Rider* with a 50% load is a typical condition while fishing: partially loaded with fuel, water, ice, bait, cod pots and fish. The blue area under this curve is greater than it is when the vessel departs on a fishing trip. The deck edge immerses at 10 degrees of heel but the vessel maintains positive stability until the angle of heel reaches 50 degrees.

4.3.6. The second load case shows the *Easy Rider* typically loaded ready for departure on a fishing voyage. The vessel is full of fuel, bait, ice and stores and equipment on deck. The blue area under the curve is flatter and smaller. The vessel is less stable and more at risk of capsize. The deck edge immerses at 8 degrees of heel but the vessel only maintains positive stability until the angle of heel reaches 37 degrees.

4.3.7. The third load condition shows the *Easy Rider* as it was loaded ready for departure on the accident voyage. The extra load of cargo on deck and the passengers themselves raised the centre of gravity of the vessel and consequently the blue area under the curve is very flat and very small. In this condition the deck edge immersed at 4 degrees and the vessel only maintained positive stability until the angle of heel reached 21 degrees.

4.3.8. The vessel in this condition is said to be "tender", meaning that it would take only a small force or a small shift in weight to cause the vessel to take on an angle. Evidence of this was observed by onlookers when loading the cargo at the wharf. Placing one "lift" of wood on the side of the deck caused the vessel to list noticeably. The wood was repositioned across the vessel to balance the load. Such a list caused by a relatively small part of the load was an indication to someone who understood the concept of vessel stability that there was a problem with the stability of the vessel.

4.3.9. It is important for vessel operators to know that the stability of a vessel is determined by not just how much weight is placed on board, but how it is distributed around the vessel. Generally speaking, weights loaded higher up (above the centre of gravity) will adversely affect stability, while the more weight that can be loaded down low (below the centre of gravity) will improve the stability. On smaller vessels, people can represent a large percentage of the load, and when they are standing in a wheelhouse or on deck this can be above the vessel's centre of gravity.

4.3.10. The fishing deck was tightly packed with fishing equipment and cargo. If water had landed on the deck in significant quantities, it would not have had clear passage to the freeing ports. In the initial moment after landing on the deck the water would have been the equivalent of loading more weight on the vessel, and unlike the lashed cargo that weight would have been relatively free to move around. The Commission calculated that it would have taken about 2.5 tonnes of sea water to fill the fishing deck to the height of the bulwarks. It would have taken as little as 0.5 tonnes of sea water on the deck to reduce the *Easy Rider*'s GM to zero. Water on the fishing deck would have:

- caused the vessel to sink lower in the water (reduced its freeboard)
- caused a direct rise in the centre of gravity of the vessel and consequently eroded the already small stability in reserve (the blue area under the curve)
- caused an additional "virtual rise" in the vessel's centre of gravity due to the free surface effect, because the entrapped water was free (albeit restricted by the deck cargo) to move across the vessel and exacerbate any roll angle caused by wave action.

4.3.11. There is a margin of error with the stability calculations for the *Easy Rider* (refer to Appendix 4). Even so, the calculations show that the *Easy Rider* was in a precarious condition from the time it left the shelter of Bluff Harbour. The question then arises, how did it survive the first 4 hours of the voyage without capsizing?. The answer probably lies in the complexity of forces that act on a small vessel as it rolls and pitches in relatively large waves.

4.3.12. The *Easy Rider*'s direction of travel once reaching open waters was into the wind, waves and swell, so it would not have been rolling as much as if the waves had been coming from the side. Another consideration is the amount of water on the deck. As mentioned above, shipping water on a deck will erode a vessel's stability reserves, but it might not be enough to cause it to capsize unless it coincided with the vessel taking a sizable roll.

4.3.13. It could not be established with any certainty how far off the Bishop and Clerks Islands the skipper intended to pass. The general area where the *Easy Rider* was thought to have capsized was one of known turbulent waters, more so the closer a boat got to the Islands. The area was also close to where the skipper would start to adjust the course to head down the west coast of Stewart Island. Guiding a vessel through a confused sea at night and when the visibility is reduced by rain is difficult. Waves approaching from different directions will possibly not be visible to the skipper until it is too late to react, particularly with a slow-speed displacement vessel that will take some time to turn.

4.3.14. The surviving deckhand said that the *Easy Rider* was engulfed by a wave from the side, causing it to heel over. The waves had generally been taken on the bow while the *Easy Rider* headed westwards toward the Bishop and Clerks Islands. A wave coming from the side could have been due to the confused sea in the area or it could have resulted from the *Easy Rider* changing course (whether planned or not). No-one really knows for sure. The surviving deckhand's account of what happened is understandable given what we now know about the stability. He first heard a large wave, which for him to single it out from the ambient noise would indicate possibly a breaking wave larger than the average waves.

4.3.15. He noted that when the wave hit, "the deck filled with water and I was washed to the port side of the vessel – the vessel then heeled sharply to port".

4.3.16. The deck becoming immersed in water would have eroded the vessel's already-small reserves of stability. The wave heeled it over past the angle of vanishing stability – and it capsized.

Findings

The *Easy Rider* capsized when it was engulfed by what was probably a large breaking wave, which reduced the vessel's stability by landing sea water onto the fishing deck, at the same time as rolling the vessel past the angle where it lost any chance of recovery.

> The *Easy Rider* was loaded with too much weight, too high up on deck, which left the boat with insufficient reserve stability for its intended voyage when it departed from Bluff.

4.4. Voyage planning and climatic conditions

4.4.1. The actual weather conditions in Foveaux Strait during the night of 14/15 March were similar to those that had been forecast (see Appendix 1). MetService had forecast the wind to be about 25 knots at the western end of Foveaux Strait, with the sea becoming high for a time with a southwest swell of 3 metres and easing. The computer model for the combined wind and swell waves provided by MetService after the accident gave a significant wave height in the area of the accident of about 3 metres, with a note to indicate there would be occasional waves as much as 25% higher and isolated waves up to 50% higher.

4.4.2. These weather conditions were not ideal, but should have been manageable for a well founded fishing vessel the size of the *Easy Rider*, provided it was operated with care. Navigation at night in small vessels carries an increased risk because the skippers cannot see far ahead to "read" the waves and react accordingly. The situation is made worse if visibility is restricted by rain. It was not prudent to embark on the voyage that night given that the *Easy Rider* was also heavily loaded and was carrying passengers. Other experienced fishermen had read the forecast and stayed in Bluff that night – others had delayed their departures until the cold front had passed. The pre-arranged rendezvous with the helicopter the following morning was one likely reason for the skipper deciding to depart that night. The helicopter had been arranged to offload supplies and equipment from 4 other vessels at the same time.

4.4.3. The *Easy Rider* departed from Bluff Harbour at about 2000, which was just about at high tide. As the tide ebbed, the general direction of the tidal flow was to the west, so the skipper would have gained the advantage of the current for the duration of the transit of Foveaux Strait. As the *Easy Rider* headed to the area of the Bishop and Clerks Islands it still had the tidal current running with it. In this case the tidal current would have been running against the wind and the prevailing waves. When waves encounter a current flowing in the opposite direction they get steeper, taller and closer together.

4.4.4. Another phenomenon that can alter wave characteristics is when surface waves move towards shallow water. They slow down, their wave height increases and the distance between waves decreases. This behaviour is called "shoaling", and the waves are said to shoal. The waves may or may not build to the point where they break, depending on how large they were to begin with and how steep the slope of the sea bed is. In particular, waves shoal as they pass over submerged banks or reefs. This can be treacherous for vessels and ships (World Meteorological Organization, 1998).

4.4.5. The area around the Bishop and Clerks Islands is generally shallow, at around 50 metres depth. Close in to the Islands is an area renowned for shoaling, tidal eddies and rips. The general area given for the capsize is approximate only. No-one knows for sure how close to the Bishop and Clerks Islands the *Easy Rider* was when it capsized, but it was entirely predictable for it to encounter larger-than-the-average (significant wave height) waves in the area. It was also predictable that waves could come from different directions in such an area. A small vessel such as the *Easy Rider* entering this area at night in heavy weather would be particularly vulnerable.

4.4.6. The interested person submitted that a "rogue wave" from a direction other than the normal swell had capsized the *Easy Rider*. The Commission considered this possibility and determined that it was possible; however, it would not necessarily have taken a "rogue wave" to cause the *Easy Rider* to capsize in its current condition of stability.

4.4.7. The height of the *Easy Rider* above the waterline was 2.8 metres. With the significant wave height at 3 meters, an isolated wave 4.5 metres high can be expected (50% more than the significant wave height). Such a wave could have easily engulfed the *Easy Rider*, especially if it came from the side and was standing up and breaking (steeper) due to the complexities of the tides and wind/wave direction in the area. Using the same stability model that was used to produce the 3 conditions of stability referred to earlier in the report, the Commission calculated that it would have taken only about half of one tonne of sea water to deposit on the *Easy Rider's* deck to reduce its GM to zero, ignoring any free surface effect. It need not have been a particularly large wave to achieve that. With this amount of water captured on the fishing deck and with the stability reserves at near zero, the *Easy Rider* would have had little or no resistance to being capsized as it rolled in response to any wave, large or small.

4.4.8. The tidal current was heading to the west, the wind waves were coming from the northwest and the swell waves were coming from the southwest. The resultant wave spectrum anywhere at the western end of Foveaux Strait would have been complex, with the possibility of waves coming from more than one direction.

4.4.9. In such an area mariners can expect nodes (areas) of lower-than-average-height waves and nodes of higher-than-average-height waves. Some of the nodes of higher-than-average wave height can include what is popularly known as "rogue waves". T Janssen, an oceanographer at San Francisco State University, has stated that a widely accepted definition of a "rogue wave" is one roughly 3 times the average height of its neighbours. Janssen qualified this by noting that "this is a somewhat arbitrary cut-off – really, they are just unexpectedly large waves" (Peeples, 2009). Another expert has defined "rogue waves" as ones greater than twice the significant wave height (NOAA/National Weather Service, 2012).

4.4.10. In summary, the Commission concludes that the forecast and actual sea conditions on that night were not appropriate for a vessel the size of the *Easy Rider* to take to sea, having marginal reserve stability. How large the wave was that capsized the *Easy Rider* is a debatable point, but the debate does not resolve the underlying safety issue of poor vessel loading resulting in poor stability when heading out into deteriorating weather at night.

4.4.11. Had the skipper of the *Easy Rider* decided to take the route to the east of Stewart Island he might have had a more sheltered trip in the lee of the island. However, the vessel would have first had to cross Foveaux Strait with the wind and waves on the beam. With the *Easy Rider*'s reduced state of stability, it is feasible that it would have overturned before reaching that lee.

Findings

The weather conditions were not suitable for the *Easy Rider* to venture across Foveaux Strait at night, with marginal stability and with passengers on board.

The pre-arranged rendezvous with the helicopter to coincide with unloading other vessels at Big South Cape Island possibly influenced the skipper's decision to continue with his planned departure.

4.5. Survival aspects

4.5.1. It is a matter of speculation to suggest what might have happened to the passengers and crew who died when the *Easy Rider* capsized. No bodies were found in the sunken wreck when divers made their search. Some may have been trapped in the upturned hull for a while and others may have ended up in the water almost immediately or soon afterwards. When someone ends up in the water there are several factors that will determine whether they survive. The 2 main factors are: the time it takes for rescuers to arrive; and the life-saving equipment on hand to assist survival while waiting for that rescue.

4.5.2. Once the passengers and crew entered the water there would have been several other factors that determined their survival times. These included the sea state, sea-water temperature, air temperature, wind chill, age, gender, anaerobic fitness, swimming ability and any physical injury sustained during the capsize.

4.5.3. Of the 4 bodies found following the capsize, 3 had experienced minor but not disabling injuries, and the cause of death was recorded as drowning for all 4. This is clearly supported by the presence of water in the lungs. There were no other medical or pathological findings relevant to the accident or survival in the water.

4.5.4. Another factor that is detrimental to cold-water survival is alcohol consumption. Alcohol accelerates hypothermia through increased rates of heat loss due to increased blood flow through the skin. Therefore alcohol in the blood system reduces the chances of survival in cold water (Water Safety New Zealand, 2012). Of the 4 bodies recovered, one of the passengers had a blood-alcohol level of 125 milligrams per 100 millilitres of blood (1.5 times the legal limit for driving a car), which is consistent with impairment of decision-making and psychomotor co-ordination. It is possible that this level of alcohol reduced his survival time through swim failure and/or hypothermia.

4.5.5. One passenger and one of the crew members reported to be asleep down below in the cabin at the time of the accident had levels of THC in their blood that were consistent with a recent consumption of cannabis. Recent consumption may have been associated with mental impairment to the extent that it might have affected their ability to escape from the capsized vessel. A crew member has safety responsibilities to all on board.

4.5.6. On 8 March 2011, in its report on a collision between a jet boat and a jetski (Transport Accident Investigation Commission, 2011), the Commission made a recommendation to the Secretary for Transport regarding substance impairment in the maritime sector. The recommendation referenced persons in charge of any craft, but the same would apply to any crew member who had responsibilities or duties to do with the safety of passengers and other crew. The recommendation and the reply on behalf of the Secretary for Transport are shown below:

> Until legislation is made setting limits for and testing of alcohol and other performance impairing substances for recreational and commercial boat drivers, the risk of alcohol-related accidents will be elevated.
>
> It is recommended that the Secretary for Transport address this safety issue by promoting appropriate legislation to set maximum allowable levels of alcohol and other performance impairing substances for persons in charge of recreational and commercial craft, and supporting legislation to allow testing for such levels in these cases. (005/11)

On 16 March 2011 the Manager Maritime and Freight of the Ministry of Transport replied to the final recommendation:

> The recommendation is that the Secretary for Transport promote legislation to set limits and establish a testing regime to address the risk of recreational and commercial boating accidents due to the use of alcohol or other performance-impairing substances.
>
> Recreational and commercial boating is one of three areas of transport activity where no alcohol and drug limits or testing regime yet exists. The introduction of such a regime in any of these areas would be a major policy decision for government that would need to be informed by a thorough understanding of the problem and the policy options. The Ministry therefore intends to develop a report to government on the feasibility of a compulsory post-accident and incident drug and alcohol testing regime for the aviation, maritime and rail transport sectors.
>
> Accordingly, implementation of recommendation 005/11 would only be practicable once the relevant policy work had been undertaken by the Ministry, and then only if the results indicated that a drug and alcohol testing regime is a feasible option.

The recommendation still had an “open” status at the time this report was published.

Lifejackets

4.5.7. None of the persons whose bodies were recovered was wearing a lifejacket when located. Prolonged immersion in cold water normally causes drowning by swim failure before death from hypothermia occurs.

4.5.8. A self-righting lifejacket will help keep the wearer's head clear of the water and its buoyancy will slow the onset of fatigue. With a sea-water temperature of 13ºC and moderate seas, an adult male wearing an appropriate lifejacket could be expected to have a fair chance of survival for up to 5 hours (Maritime New Zealand, 2012). Without flotation assistance, swim failure caused by a combination of muscle fatigue, cramps and hypothermia can be expected after about 20-30 minutes. The deckhand surviving some 18 hours before being rescued is highly unusual. His survival can be partially attributed to his time spent on the upturned hull before it sank, the flotation provided by the fuel container that fortuitously rose to the surface beside him, and a substantial amount of willpower.

4.5.9. A lifejacket's effectiveness and usefulness will depend on a number of factors, including:

- the size of the lifejacket relative to the size of the wearer
- the correct fitment of the lifejacket
- the type of the lifejacket
- the accessibility of the lifejacket
- the nature of the emergency.

4.5.10. In this case the *Easy Rider* did not have sufficient lifejackets for the 9 people on board. Instead, it appears that there were only 3 adult lifejackets and one child lifejacket. The interested person submitted that there may have been 2 or 3 other lifejackets on board; however, she was unable to confirm the types, sizes and condition of those lifejackets. She subsequently revised this figure upwards to 9 lifejackets in total on board. The Commission, however, did not find evidence to support this later claim. The average weight of all 9 persons on board was about 103 kilograms, and the largest person weighed 184 kilograms. The adult lifejackets that were on board would not have fitted securely on some of the adults on board, even if they had been able to access them. The Maritime Rules provide for the carriage of children's lifejackets on commercial vessels where children are likely to be carried, but is silent on the carriage of lifejackets for large people. Rule Part 91 requires skippers of recreational craft to have a lifejacket of an appropriate size for every person on board. Most people would understand this in the context of carrying small children, but might not necessarily relate this to having over-sized lifejackets for large people.

4.5.11. Although not relevant to this accident, the Commission has noted that Maritime Rules require that an **approved** lifejacket be carried for every person on board every recreational and commercial vessel. While an approved lifejacket is marked as complying with the appropriate standard, other lifejackets are freely available for purchase that are not approved to the appropriate standard, yet they are often labelled as being approved to some standard that is not accepted in New Zealand. An unwary purchaser, particularly a recreational boating person, could be misled into thinking they were purchasing a lifejacket approved to New Zealand standards.

4.5.12. There is at least one manufacturer in New Zealand that manufactures approved lifejackets in varying sizes up to XXXL, and will custom-make a lifejacket to suit a person with a non-standard physique for a nominal fee.

4.5.13. The key to the best chance of survival is to have a number of lifejackets at least equal to, or preferably more than, the number of people on board, and stowed in the most readily accessible place. This would typically be near to, or if possible outside, the means of escape from the cabin. For a boat the size of the *Easy Rider* in those sea conditions, the skipper should have required everyone on deck to be wearing a lifejacket. Apparently the 2 passengers sitting out on deck behind the wheelhouse were wearing lifejackets, but there is some question about whether they were properly fitted and secured. An improperly secured lifejacket can quickly dislodge when the wearer enters the water, particularly if the wearer becomes fatigued or unconscious. The bodies of these 2 passengers were among the 4 recovered and they were not wearing lifejackets at the time of recovery.

4.5.14. The child was wearing the one child's lifejacket, but this was placed on him more for warmth and there is some question about whether it was properly secured on him. That child's lifejacket was later found by divers on the wreck, snagged in the deck rigging.

4.5.15. For any who managed to escape from the inverted hull, the availability of suitable lifejackets would have improved their chances of survival, whether that was simply to stay and wait for rescue or to swim for shore or to a life-raft.

Life-raft

4.5.16. A life-raft is perhaps the most effective aid to survival in the event of having to abandon a vessel, provided it can be activated. It keeps survivors out of the water and provides cover from the elements. It also has basic survival equipment inside it. However, the *Easy Rider*'s life-raft was only designed for 4 people. As noted above there were 9 people on board with an average weight of about 103 kilogram per person. It would not therefore have been sufficient to accommodate all of the people, had they all survived the initial capsize.

4.5.17. There are 2 ways a life-raft can be activated: it can be manually released from its cradle and manually inflated; or it can automatically release from its cradle and float to the surface, where it can either automatically inflate or be manually inflated.

4.5.18. Manual release and inflation takes time, and in this case where the *Easy Rider* capsized suddenly, there was no time. The hydrostatic release mechanism is a well proven device that seems to have worked on this occasion. The life-raft was found by divers wedged between the bulwarks and the wheelhouse, so it must have released from its cradle at some point. There is an element of chance whether a life-raft floating free from a sinking vessel will reach the surface. A lot depends on the position of the life-raft cradle and the attitude of the vessel as it sinks. From the description of the survivor, the *Easy Rider* sank stern first and upside down. The life-raft would therefore have been prevented from floating free until the vessel rolled as it sank to the sea bed (it was initially found lying on its side). It seems to have become wedged within the bulwarks before it could float free as the vessel began to right itself under water.

Trip reports

4.5.19. There was a time delay of about 14 hours between when the accident happened and when the *Easy Rider* was reported overdue. That was when the vessel failed to arrive at Big South Cape Island for the rendezvous with the helicopter. Even then some time was taken to consider reasons for its not arriving.

4.5.20. The *Easy Rider*'s skipper radioed Bluff Fishermen's Radio on departure from Bluff and submitted a trip report, which said where he was and where he was going and gave an estimated time of arrival. The skipper did not say which route he was intending to take to get there. This type of trip report has its merits but also has its limitations, because there are no intermediate check-in points and no close-out report on arrival at the destination. To be truly effective, lodging a trip report should result in an automatic response by the receiver if some predetermined check or close-out is not met. Even a pre-arranged phone call with another family member can be beneficial, but a broadcast over a common frequency has the benefit of other vessels in the vicinity knowing the vessel's whereabouts.

4.5.21. The very high frequency radio coverage on the west coast of Stewart Island is limited, which could have precluded the skipper closing out a trip report with Bluff Fishermen's Radio. Under these circumstances an intermediate checkpoint, such as at the Bishop and Clerk Islands, would have provided a useful check on progress before leaving the area of good VHF radio coverage.

Emergency position indicating radio beacon

4.5.22. The *Easy Rider* was required by Maritime Rules to carry a 406 megahertz emergency position indicating radio beacon. The one it carried complied with the minimum requirements. It was required to be removed from its bracket, manually activated and taken with the survivor(s). When above water it is a quick and accurate method of alerting search and rescue that something has gone wrong. The emergency position indicating radio beacon transmits its actual position via satellite to the search and rescue co-ordination centre. The transmitted message also includes other information that will assist the authorities in the search and rescue.

4.5.23. Divers later found the beacon still in its bracket, with the aerial in its stowage position folded into the bracket. The beacon was operating with the light-emitting diode flashing weakly. This light-emitting diode also functions as the strobe. However, it cannot be inferred that it had been manually activated by someone on board. The beacon complied with international standards that required waterproof testing at a depth of 10 metres for 5 minutes. The depth at which the beacon was found was far in excess of this, so the casing could have leaked and a short circuit formed, causing the operation of the beacon. The unit is activated by pushing down a short-travel-length plunger that depresses a rubber diaphragm activating a switch. With an external pressure of 400 kilopascals and a pressure differential of 300 kilopascals there may have been enough external pressure to depress the diaphragm to switch the unit on. In either of the above conditions the beacon would have been transmitting into short circuit, and after the amount of time it was submerged in the water the batteries would have been close to exhaustion. Whatever the reason for the beacon activating, unless it was above the sea surface its transmission would not have been picked up by the satellites.

4.5.24. Float-free beacons are available in New Zealand for between $800 and $1300. These beacons are usually mounted outside the wheelhouse and automatically release from their brackets and float to the surface, in much the same way that a float-free life-raft does. Like the life-raft, however, there is a possibility that the beacon will become entangled on its way to the surface in the event of a capsize. Having it mounted outside the wheelhouse means that it is more accessible for survivors to retrieve from a vessel that does not sink immediately, such as in the case of the *Easy Rider*. Despite its limitations, a float-free type emergency position indicating radio beacon will have a better chance of success than a manually activated one inside the wheelhouse.

4.5.25. There is another type of emergency position indicating radio beacon that can increase the chances of survival: the personal locator beacon. It is not required to be carried by Maritime Rules but can significantly improve the chances of survival in some circumstances. It is small (about the size of a cigarette packet) and fits easily into a jacket pocket. The personal locator beacon retails at about $600 and can be hired for $20 per day. When activated, it performs the same function as a larger emergency position indicating radio beacon, transmitting an accurate position and supporting information via a satellite to the search and rescue coordination centre.

4.5.26. One advantage of these smaller beacons is that they can be worn by crew all of the time when working on deck. They do have the same limitation as larger beacons in that they will not be effective under water. In the *Easy Rider*'s case, had the surviving deckhand been wearing one and activated it immediately, the authorities would have been alerted to the vessel's plight, possibly within minutes, and directed the search to the exact spot where the capsize occurred. If any of the other occupants had survived the initial capsize they might have survived. Because of its small size and weight, the personal locator beacon can be used for other land-based activities as well.

4.5.27. A personal locator beacon cannot be substituted for an emergency position indicating radio beacon unless it meets the stringent standards laid down for the watertightness, flotation, transmission life when activated, and transmission aerial requirements of an emergency position indicating radio beacon, but it is a useful safety enhancement that private and commercial operators might like to consider.

Other available options for position monitoring and tracking

4.5.28. Another method of determining the position of a vessel at sea from ashore is the automatic identification system, which is a vessel tracking system utilising very high frequency radio transmitters and receivers combined with a positioning system. The signals transmitted by the vessel can be tracked by shore-based stations using receiving aerials around the coast, and in some areas of the world, by satellites fitted with automatic identification system receivers.

4.5.29. The system was initially designed as an anti-collision aid for larger ships, but has since been found useful for shore-based monitoring of shipping movements near and in ports and harbours. Very high frequency radio works essentially on line of sight, so the range of any system that uses it is limited, unless repeater stations or the satellite options are used. Such a system would have its limitations in the context of the *Easy Rider*'s operation. A dedicated shore station would have to have been monitoring the track and have a reason for raising an alarm.

4.5.30. When the *Easy Rider* sank it was probably still within very high frequency radio coverage; however, it would soon have moved out of very high frequency radio range as it headed down the west coast of Stewart Island. Had an observer been monitoring the vessel it would have given early warning that something was amiss when its automatic identification system signal ceased. This assumes that someone, somewhere was actually watching the vessel at a certain time, which is unlikely considering the number of vessels fitted with automatic identification system compared with the number of observers. However, automatic identification system data can be and is recorded, so once a vessel has been reported as overdue, that information could be useful for determining the last recorded position of the vessel in the absence of an emergency position indicating radio beacon being activated.

4.5.31. At the time of writing there was no requirement in New Zealand for fishing vessels, especially those the size of the *Easy Rider*, to be fitted with an automatic identification system. The International Maritime Organization's International Convention for the Safety of Life at Sea requires automatic identification systems to be fitted aboard international voyaging ships with gross tonnages of 300 or more, and all passenger ships regardless of size. An automatic identification system "class B" transponder (transmitter and receiver) suitable for fitting to an inshore fishing vessel can be purchased in New Zealand for about $2000.

4.5.32. There are also several commercially available satellite-based tracking systems available from New Zealand providers. Some of these systems are used extensively by emergency and rescue services, others are used by aircraft operators for determining the locations of their assets. The system provided to the Royal New Zealand Coastguard was used extensively by the Police search and rescue co-ordinators during the search for the *Easy Rider*.

4.5.33. A satellite-based tracking system uses a tracking unit that is installed in the asset. Using the global positioning system the unit calculates its position and transmits that information in real time by satellite and by cellular network to the provider's secure server. The server can then be accessed via the Internet by the subscriber to monitor the status of the asset and in some cases communicate with the asset.

4.5.34. There is a cost to install the tracking unit in the asset, and ongoing monthly costs. There is also an additional cost for every position fix, as this incurs satellite transmission fees and use of the provider's server. At the time of writing the cost of the transponder from one of the New Zealand providers was about $1250, with ongoing monthly costs of about $25 for the service and position fixes, calculated at about $6 per day assuming half-hourly transmissions.

4.5.35. Similar to the automatic identification system, there are limitations to the usefulness of these satellite-based systems for alerting someone to a situation such as the *Easy Rider* capsizing. Again, someone would need to be monitoring the track of the vessel 24 hours each day for it to be truly effective as an emergency-alerting system.

4.5.36. These various other means of tracking a vessel are only mentioned here to highlight their availability and potential use. The limitations described for each would preclude mandating their use on board fishing vessels. Nevertheless, they are options that vessel operators should consider.

Findings

The *Easy Rider* did not have sufficient life-saving equipment for the 9 persons on board.

The *Easy Rider*'s manually operated emergency position indicating radio beacon had probably not been intentionally activated and was still stowed in its bracket within the wheelhouse when the vessel sank.

Float-free emergency position indicating radio beacons and the enhancement of people carrying personal locator beacons will improve the chances of being noticed and rescued, particularly in the event of a sudden or catastrophic event such as a capsize.

It has not been possible to determine how many, if any, of the 8 persons who died survived the initial capsize, and if so for how long they survived.

There were as few as 4 approved lifejackets on board the *Easy Rider* to be shared among 9 people, which not only contravened Maritime Rules but significantly reduced the chances of persons not wearing lifejackets surviving in the water after the vessel capsized.

The *Easy Rider*'s life-raft was in current survey and was properly installed, but was not able to float free to the surface because it became lodged between the wheelhouse and the bulwarks as the vessel was sinking. Rated for 4 persons only, the life-raft did not have sufficient capacity to cater for the 9 persons on board.

4.6. Regulatory

Record-keeping

4.6.1. Prior to the introduction of Maritime Rule Part 21 (Safe Ship Management) in 1997, the *Easy Rider* was not required to be in survey and had never been required to undergo a stability assessment. Even then it was not engaged in trawling or lifting what was considered to be heavy weights, so there was still no requirement for a stability assessment.

4.6.2. It was not until the *Easy Rider* was modified for inshore trawling in 2003 that a stability assessment was required. This assessment was carried out in September/October 2003 and a fit-for-purpose certificate for inshore trawling was issued. The *Easy Rider* went through a succession of owners between 2003 and 2005, and at some time during this period the stability assessment booklet was lost or not handed on to another owner.

4.6.3. The stability information in that booklet would have been superseded by the various modifications made to the vessel over the years. For example, the removal of the trawl gantry would have improved the stability by removing weight from higher up on the vessel. However, there were a number of vessels built to the same design, what became known as the "Owenga" design, and it was recognised early on that the design had limited reserve stability. In some cases ballast was added to the vessels to improve their stability. In one case the surveyor recommended that a plaque be placed in the wheelhouse warning skippers not to load too much on deck. These earlier observations are supported by the calculations made by the Commission.

4.6.4. Following the accident, the Commission had some difficulty accessing sufficient information about the *Easy Rider*, despite the fact that it was a vessel that was still actively in the maritime regulatory system. Maritime New Zealand was not able to find the older part of the ship file. Consequently the Commission had to rely on records from other vessels in order to make a reasonable assessment of the *Easy Rider*'s stability.

4.6.5. When the *Easy Rider* was converted for inshore trawling it was required to undergo a simplified stability assessment, which it did. Unfortunately, when the records were sourced from the safe ship management company only partial details of the inclining test and stability calculation were available. These details did not include a copy of the stability advice letter said to have been sent to the owner. Such a letter would normally include recommendations on the loading of the vessel.

4.6.6. When the Commission made an urgent safety recommendation to the Director of Maritime New Zealand in April 2012, to notify owners of other "Owenga" design vessels and alert them to the stability characteristics of their vessels, the lack of current records made this task difficult, and even today some doubt remains over how many fishing vessels built to this design still exist.

4.6.7. With the introduction of the Maritime Transport Act the maritime ship records were transferred from the Marine Department of the Ministry of Transport to the newly formed Maritime Safety Authority (now Maritime New Zealand). Later, with the introduction of Safe Ship Management, these records were transferred to Marine and Industrial. Marine and Industrial was the entity that had formerly been the survey division of the Marine Department, then became one of the bigger safe ship management companies. Confronted with storage issues, Marine and Industrial either returned the ship files to the vessel owners that wanted them or had the files destroyed.

4.6.8. Transfers between safe ship management companies of ship files and information from ship files have been a problem in the past. Safe Ship Management companies are commercial operators competing for the same clients. Unless there is a central repository for information on ships that remain in the maritime system, these commercial interests could result in important records being lost in future. The safe ship management system is about to undergo a change to the Maritime Operator Safety System (MOSS). The Commission recommends that the Director of Maritime New Zealand adopt a strategy under the Public Records Act 2005 that ensures that important ship records are maintained until vessels make permanent exits from the New Zealand maritime system and for a specified number of years following that.

Status of the *Easy Rider* and the accident voyage

4.6.9. The Commission received a substantive submission from the interested person regarding the status of the *Easy Rider* and the nature and purpose of its voyage at the time of the accident. The key components of this submission can be summarised, as follows:

- the voyage of the *Easy Rider* on the day of the accident comprised 2 legs. The first leg involved transporting family members to Big South Cape Island to gather muttonbirds. The second leg (commencing from the moment the passengers left the vessel) was less clear. It may or may not have involved commercial fishing (the interested person could not confirm the intentions of the skipper)
- at the time of the accident (i.e. on the first leg) the *Easy Rider* was not a commercial fishing vessel but rather a pleasure vessel
- at the time of the accident (i.e. on the first leg) the *Easy Rider* was not engaged in commercial fishing. Rather it was engaged on a private and "customary" voyage for the purpose of transporting family members to Big South Cape Island to gather muttonbirds in accordance with their customary rights, as affirmed by the Titi (Muttonbird) Islands Regulations 1978
- the *Easy Rider*'s customary voyage and the crew's and passengers' muttonbird activities were recognised and governed by Article 2 of the Treaty of Waitangi and the Titi (Muttonbird) Islands Regulations 1978
- the Maritime Transport Act, the Fisheries Act and the Maritime Rules did not apply to the *Easy Rider* (as a fishing vessel) or to its skipper and its owner at the time of the accident, as the vessel was a recreational vessel engaged on a "customary voyage" for the purpose of gathering muttonbirds.

Customary voyage under the Treaty of Waitangi and Titi (Muttonbird) Islands Regulations

4.6.10. The Commission's statutory purpose is to determine the circumstances and causes of accidents with a view to avoiding similar occurrences in the future. Accordingly, it was not appropriate for the Commission to make findings about the interested person's submission regarding Maori customary rights and the Treaty of Waitangi unless those rights in some way contributed to the circumstances and causes of the Easy Rider capsizing and sinking. However it is clear from the Titi (Muttonbird) Islands Regulations 1978 that Rakiura Maori have customary rights to take mutton birds from the Titi Islands. The Commission acknowledges that Rakiura Maori have these rights and observes that the Waitangi Tribunal acknowledged the appropriateness of these regulations in its 1991 Ngai Tahu Report (Wai 27).

The Commission also notes the interested person submitted a memorandum from Sir Tipene O'Reagan regarding the purpose of the Easy Rider voyage and the heritage surrounding such voyages. In that memorandum he said that:

> The rights of access to the [Titi] islands stem from a set of statutory and regulatory arrangements specifically developed over generations to protect the rights of Hopu Titi; those rights are rooted in a customary activity protected by Article II of the Treaty of Waitangi. The exercise of those rights necessarily involves voyaging and its thus arguable that such voyaging is subject to the same protections.
>
> I am not arguing that voyaging should be undertaken carelessly and without due and proper care to a high standard of seamanship and neither – as I understand it – is [the interested person].

4.6.11. The Commission agrees that, even if the voyage had been specifically for the purpose of carrying Rakiura Maori to the Titi Islands for the muttonbird season, the voyage would still have needed to be carried out with due proper care.

Commercial vessel vs pleasure craft

4.6.12. The distinction between a pleasure craft (or a recreational vessel) and a commercial vessel is important. If the *Easy Rider* had been operating as a commercial fishing vessel at the time of the accident, it would have been subject to the Maritime Transport Act, the Fisheries Act and the Maritime Rules. These rules were more stringent when applied to commercial fishing vessels than when applied to pleasure craft. For example: a commercial fishing ship could not carry passengers; a minimum number of crew were required on board the vessel; the skipper was required to hold an appropriate certificate; and the vessel needed to carry a life-raft or EPIRB (Maritime New Zealand).

4.6.13. By comparison, a skipper of a pleasure craft (although still subject to the Maritime Transport Act and the Maritime Rules) did not need to have a maritime qualification, could carry other people on their vessel, and there was no requirement for the vessel to have a life-raft or emergency position indicating radio beacon. However, there was a key requirement to have one approved lifejacket for each person on board.

4.6.14. From time to time owners of commercial fishing vessels would want to use their vessels as recreational craft or for private voyages. Evidence reviewed by the Commission showed that safe ship management companies would allow this to happen provided that the owners satisfied certain criteria. For example, an owner would need to inform the Ministry for Primary Industries that they did not intend to catch fish commercially. The owner then needed to inform the safe ship management company of the date(s) that their vessel would be used as a pleasure craft. Once completed, the owner could not use their vessel for hire or reward. Evidence showed that Maritime New Zealand was aware of this practice.

4.6.15. Turning to the *Easy Rider*, a submission from the interested person claimed that the vessel was operating as a pleasure craft at the time of its accident and that the purpose of the accident voyage was to transport passengers to Big South Cape Island to prepare for hunting muttonbirds, as was their customary right. The interested person, in other words, was claiming that the skipper did not need to have an appropriate certificate and that he was allowed to carry people other than crew.

4.6.16. The evidence collected by the Commission, however, did not support this claim. For example, the evidence showed that the *Easy Rider* was registered as a commercial fishing vessel at the time of the accident and that it was still owned by AZ1 Enterprises Limited. Section 2 of the Maritime Transport Act stated that a pleasure boat did not include a ship that was operated by a business. Further, the Maritime Transport Act stated that a pleasure boat did not include "a ship that [was] used on any voyage for pleasure if it [was] normally used or intended to be normally used as a fishing ship or for the carriage of passengers or cargo for hire or reward". Evidence shows that the *Easy Rider* had been used to fish commercially, as recently as 6 days before the accident.

4.6.17. In terms of the accident voyage, the Commission did not find records proving that the owner of the *Easy Rider* had satisfied the criteria for converting the *Easy Rider* from a fishing vessel to a pleasure craft. There was no evidence that the vessel had been deregistered and that the owner had informed the Ministry for Primary Industries and the safe ship management company that the *Easy Rider* would be used as a pleasure craft on the day of the accident. Nor was any of the fishing gear removed from the vessel. On the contrary, the *Easy Rider* was loaded with salt, ice, cod pots and a significant quantity of fish bait on the accident voyage (not consistent with a pleasure voyage only). In addition, the surviving deckhand confirmed that he had been on board the vessel as part of the crew and that he had been expecting to go fishing and to be paid accordingly. Contrary to the interested person's submission, the surviving crew member did not understand the accident voyage to be a private voyage for the sole purpose of carrying people and their equipment to prepare for muttonbird hunting.

4.6.18. All these factors support the Commission's view that the skipper was intending to operate the *Easy Rider* as a fishing vessel on the accident voyage, albeit after offloading his passengers and their cargo. This meant that the skipper should not have carried passengers on the accident voyage (which he did) and he should have had an inshore launch master's certificate (which he did not).

Safe ship management

4.6.19. Every New Zealand flagged commercial vessel has to comply with the safe ship management requirements provided under Maritime Rule Part 21. Safe ship management requires vessel owners to be responsible for safety and pollution prevention in the day-to-day operation of their vessels.

4.6.20. The safe ship management system aims to ensure that all aspects of the operation remain fit for purpose and includes systems for hazard management, crew training and maintaining the condition of the vessel. These are to be detailed in a safe ship management manual, which has to be developed by individual vessel owners to be specific to their vessels. The checks and maintenance work specified in the manual and maintenance plans had to be done as scheduled, and recorded in a logbook (or similar) to show that vessel safety was being managed throughout the year, not just on survey day[5].

4.6.21. Serious responsibilities come with the ownership and operation of a vessel. These are clearly stated in the Maritime Transport Act 1994, the Fisheries Act 1996, the Maritime Rules and the Health and Safety in Employment Act 1992. These responsibilities were put in place to ensure the safe operation of a vessel and compliance with the requirements of New Zealand law. Non-compliance could lead to serious or tragic consequences, as it did in this case.

4.6.22. The owner of the *Easy Rider* did not appear to understand the concept of safe ship management although it appears that it was making an attempt to comply. The fundamental problem was that the owner seemed to be under the impression that safe ship management

5 Safe Ship Management: Your Guide to Entry. Maritime New Zealand publication, pg 3.

was an exercise that the company had to go through to enable the vessel to catch fish and to sell it commercially.

4.6.23. The *Easy Rider* had entered the safe ship management system on 6 September 2011, when Maritime New Zealand issued AZ1 Enterprises Limited with a safe ship management certificate (paragraphs 3.4.6 to 3.4.12). This safe ship management membership meant that the owner had to (among other things):

- ensure that the skipper and crew complied with the procedures in the safe ship management manual
- ensure that the skipper and crew held appropriate qualifications
- have a valid SSM certificate displayed prominently on the vessel at all times
- maintain the vessel in a fit-for-purpose condition at all times.

4.6.24. It also meant that the skipper had similar responsibilities, including an obligation to ensure that:

- the vessel was operated safely, and that the safety and wellbeing of all passengers and crew, and the safety of cargo were properly managed
- all personnel employed on board were properly trained to carry out their duties safely
- all personnel employed on board had appropriate seafarer qualifications.

4.6.25. The evidence reviewed by the Commission, however, showed that the owner and the skipper did not meet all of their safe ship management obligations on the day of the accident. In particular, the evidence showed that the owner:

- knew that the skipper was intending to fish commercially on the day of the accident after offloading his passengers and their equipment on Big South Cape Island
- knew that the skipper did not have the required maritime qualification
- did not arrange for a Maritime New Zealand safety inspector to conduct a compliance safety inspection of the *Easy Rider* by the due date (being 6 March 2012).

4.6.26. The evidence also showed that the skipper:

- operated the *Easy Rider* without the appropriate maritime qualification
- allowed passengers and muttonbird cargo on board the *Easy Rider* even though the *Easy Rider* would operate as a commercial fishing vessel once the people had been landed ashore
- allowed the *Easy Rider* to sail poorly loaded and without adequate reserves of stability to complete the accident voyage
- deliberately thwarted the Maritime New Zealand safety inspector from completing his safety compliance inspection of the *Easy Rider* before the vessel sailed on the accident voyage.

4.6.27. From the way the skipper loaded the *Easy Rider* for the accident voyage, it appears that he did not understand the concept of vessel stability. The fundamentals of stability were not covered in the qualified fishing deckhand certificate (which he had); however, they were covered in both the inshore launch master's certificate and the local launch operator's certificate (which he did not have but which he needed to have to skipper the *Easy Rider*). The syllabus for these certificates included the requirement to "understand what is meant by good stability and poor stability and recognise the warning signs of poor stability". It also required the skipper to "describe the effect on stability of:

- raising and lowering weights
- freely suspended weights
- free fluid surface

- low freeboard
- obstructed freeing ports".

4.6.28. Apart from obtaining the requisite qualification, the skipper could have accessed any one of many online documents aimed at teaching stability. Two such examples were "A guide to fishing vessel stability" (Maritime New Zealand, 2011) and the document appended to this report entitled "Safety practices related to small fishing vessel stability" (Food and Agriculture Organization of the United Nations, 2009).

4.6.29. Understanding the basics of ship stability is a fundamental requirement for any commercial operator. It is a fundamental requirement for anyone operating a craft of any sort, including people in charge of recreational craft.

4.6.30. The fact that the skipper did not have these qualifications and, therefore, did not receive formal training on the fundamentals of vessel stability explains, in part, why he allowed the *Easy Rider* to sail overloaded and without adequate reserves of stability to complete the accident voyage.

4.6.31. The submission received from the interested person claimed that AZ1 Enterprises Limited did not "own" the vessel as it had been gifted to the skipper by a family member. Accordingly, AZ1 Enterprises Limited was not responsible for performing the safe ship management obligations in respect of the *Easy Rider*.

4.6.32. The Commission sought advice from Maritime New Zealand on this point. Maritime New Zealand confirmed that:

> The 1983 Fisheries Act has been replaced by the Fisheries Act 1996 and section 103 of the new Act now provides for vessel registration for fisheries purposes placing the obligation on registration on the operator of the vessel. Under this new Act, "operator" includes any person who has lawful possession of the ship. The FishServe register states the operator of Easy Rider as AZ1 Enterprises Ltd…
>
> Under maritime law, a valid Safe Ship Management (SSM) certificate must be held to operate a commercial fishing ship. Part 21 of the maritime rules requires the owner of the ship to apply for this certificate. According to Maritime New Zealand records, AZ1 Enterprises Limited applied to the Director of Maritime New Zealand as the owner of the Easy Rider for a SSM certificate on 7 July 2011. The SSM certificate was issued to AZ1 Enterprises Limited on 6 September 2011.
>
> In light of the above, Maritime New Zealand considers AZ1 Enterprises Limited to be the owner of Easy Rider.

4.6.33. The interested person then submitted that the vessel's safe ship management certificate had automatically lapsed before the accident voyage, thereby turning the *Easy Rider* into a pleasure craft and releasing the owner and skipper from all safe ship management obligations. The interested person based this argument on the fact that the Maritime New Zealand inspector had failed to complete the *Easy Rider* safety compliance inspection by 6 March 2012 (a requirement of the *Easy Rider*'s safe ship management certificate, which Maritime New Zealand issued for the vessel on 6 September 2011). Accordingly, when the *Easy Rider* sailed on the accident voyage (15 March 2012) a condition of its safe ship management certificate had not been met.

4.6.34. The Commission sought further advice from Maritime New Zealand on this point. Maritime New Zealand confirmed that:

- when a ship is normally used, or is intended to be normally used, as a fishing vessel it is a commercial ship
- in these circumstances, the commercial ship must have a valid SSM certificate, as per Part 21 of the Maritime Rules

- where a ship fails to have such a certificate, the owner/operator of the ship is in breach of the Maritime Rules and the Maritime Transport Act; however, this failure does not cause the ship in question to become a pleasure craft.

4.6.35. The Commission examined other matters when considering the interested person's submission that the *Easy Rider* had been outside the safe ship management system at the time of the accident. For example, the skipper's actions before and on the day of the accident voyage strongly indicated 2 things: first, that the *Easy Rider* was being operated as a commercial fishing vessel; and, second, that he and the owner had every intention of continuing to operate the *Easy Rider* within the safe ship management system. This first contention is supported by the discussion in the section above (pleasure versus commercial vessel) and by the fact that the skipper had fished and declared a commercial catch after 6 March 2012 (i.e. after the date for completing the safety compliance audit). Therefore if (as the interested person claimed) the *Easy Rider* safe ship management certificate had expired on 6 March 2012, the skipper continued to fish commercially after this date contrary to the Fisheries Act.

4.6.36. The first contention is also supported by the fact that section 2 of the Maritime Transport Act states that a pleasure craft cannot be a ship that is operated or provided by a business. In other words, the fact that AZ1 Enterprises Limited owned the *Easy Rider* and operated a fishing business in relation to that vessel meant that the *Easy Rider* could not be a pleasure craft under section 2 of the Maritime Transport Act.

4.6.37. The second contention is supported by the fact that the skipper made arrangements with the Maritime New Zealand safety inspector for him to complete the compliance inspection before the *Easy Rider* was to leave on the accident voyage. For example, on 13 March (2 days before the accident voyage), the skipper spoke with the inspector and arranged for him to return the next day to complete the inspection. When the inspector returned the next day, the skipper asked him to return one hour later. The inspector did this but upon beginning the inspection he realised that the skipper was not fully prepared for it. He and the skipper then agreed that the inspector would return on 16 March 2012 to complete the compliance inspection (paragraphs 3.1.3 to 3.1.7).

4.6.38. Although it turned out that the skipper had no intention of keeping this appointment with the inspector, the skipper's actions caused the inspector to believe that the *Easy Rider* would continue to remain within the safe ship management system. At no time did the skipper confirm (or even intimate) to the inspector that this was to change.

Findings

The skipper's intention was for the *Easy Rider* to operate as a commercial fishing vessel on the accident voyage, as he fully intended to go fishing commercially once his passengers and their equipment had been offloaded.

Neither the owner nor the skipper sought or was given a dispensation by the safe ship management company or the Director of Maritime New Zealand to operate as a pleasure vessel for the accident voyage, which meant that the *Easy Rider* was a commercial fishing vessel and should not have been carrying any person other than its crew.

Although the *Easy Rider* had been entered into the safe ship management system, it was never going to help the owner and skipper to run a safe fishing operation, because the owner did not understand the principles of safe ship management and the skipper did not appear to show a willingness to comply with the rules.

The owner of the *Easy Rider* was not meeting its responsibilities for ensuring the safe operation of the vessel, as required by the Maritime Transport Act and Maritime Rules.

The skipper did not hold the qualification required for him to be in charge of the *Easy Rider* on the accident voyage.

The skipper did not have the requisite knowledge of ship stability, or if he did, he did not apply it wisely when loading the *Easy Rider* for the trip. The *Easy Rider* being overloaded, with the average distribution of weight being too high, was the prime factor leading to its capsize.

A historical lack of common and good-standard practice for keeping ship operation and safety records has resulted in the loss of important information about commercial vessels that are still operating today.

Because commercial vessels can frequently change ownership and their owners can switch between safe ship management providers, there is a need for Maritime New Zealand to maintain a central database of all important safety and operation records for the entire life of each vessel in the system.

5. Findings

5.1. The *Easy Rider* capsized when it was engulfed by what was probably a large breaking wave, which reduced the vessel's stability by landing sea water onto the fishing deck, at the same time as rolling the vessel past the angle where it lost any chance of recovery.

5.2. The *Easy Rider* was loaded with too much weight, too high up on deck, which left the boat with insufficient reserve stability for its intended voyage when it departed from Bluff.

5.3. The weather conditions were not suitable for the *Easy Rider* to venture across Foveaux Strait at night, with marginal stability and with passengers on board.

5.4. The prearranged rendezvous with the helicopter to coincide with unloading other vessels at Big South Cape Island possibly influenced the skipper's decision to continue with his planned departure.

5.5. The *Easy Rider* did not have sufficient life-saving equipment for the 9 persons on board.

5.6. The *Easy Rider*'s manually operated emergency position indicating radio beacon had probably not been intentionally activated and was still stowed in its bracket within the wheelhouse when the vessel sank.

5.7. Float-free emergency position indicating radio beacon and the enhancement of people carrying personal locator beacons will improve the chances of being noticed and rescued, particularly in the event of a sudden or catastrophic event such as a capsize.

5.8. It has not been possible to determine how many, if any, of the 8 persons who died survived the initial capsize, and if so for how long they survived.

5.9. There were as few as 4 approved lifejackets on board the *Easy Rider* to be shared among 9 people, which not only contravened Maritime Rules but significantly reduced the chances of persons not wearing lifejackets surviving in the water after the vessel capsized.

5.10. The *Easy Rider*'s life-raft was in current survey and was properly installed, but was not able to float free to the surface because it became lodged between the wheelhouse and the bulwarks as the vessel was sinking. Rated for 4 persons only, the life-raft did not have sufficient capacity to cater for the 9 persons on board.

5.11. The skipper's intention was for the *Easy Rider* to operate as a commercial fishing vessel on the accident voyage, as he fully intended to go fishing commercially once his passengers and their equipment had been offloaded.

5.12. Neither the owner nor the skipper sought or was given a dispensation by the safe ship management company or the Director of Maritime New Zealand to operate as a pleasure vessel for the accident voyage, which meant that the *Easy Rider* was a commercial fishing vessel and should not have been carrying any person other than its crew.

5.13. Although the *Easy Rider* had been entered into the safe ship management system, it was never going to help the owner and skipper to run a safe fishing operation, because the owner did not understand the principles of safe ship management and the skipper did not appear to show a willingness to comply with the rules.

5.14. The owner of the *Easy Rider* was not meeting its responsibilities for ensuring the safe operation of the vessel, as required by the Maritime Transport Act and Maritime Rules.

5.15. The skipper did not hold the qualification required for him to be in charge of the *Easy Rider* on the accident voyage.

5.16. The skipper did not have the requisite knowledge of ship stability, or if he did, he did not apply it wisely when loading the *Easy Rider* for the trip. The *Easy Rider* being overloaded, with the average distribution of weight being too high. was the prime factor leading to its capsize.

5.17. A historical lack of common and good-standard practice for keeping ship operation and safety records has resulted in the loss of important information about commercial vessels that are still operating today.

5.18. Because commercial vessels can frequently change ownership and their owners can switch between safe ship management providers, there is a need for Maritime New Zealand to maintain a central database of all important safety and operation records for the entire life of each vessel in the system.

6. Safety actions

General

6.1. The Commission classifies safety actions by 2 types:

a) safety actions taken to address safety issues identified by the Commission that would otherwise have resulted in the Commission issuing a recommendation

b) safety actions taken to address other safety issues that would not normally have resulted in the Commission issuing a safety recommendation.

6.2. On 31 July 2012 Maritime New Zealand advised that:

I. Maritime New Zealand advises that it has been in contact with the 2 administrative committees for the Titi Islands (Rakiura Mutton Bird Committee, and Titi Island Committee) with proposals to introduce safety initiatives during the permit application process (all vessels calling at the islands must hold permits to do so, the permits being issued by the respective committees) including:

(i) vessel safety standards included in the Titi Island Management Plan

(ii) development and introduction of a safety checklist for all vessels as a pre-requisite to the permit process

(iii) safety measures during tender transfers to and from the Islands

(iv) education of all groups regarding the responsibilities and penalties whilst undertaking either commercial or non-commercial voyages (for example: provisions in Section 65 of the Maritime Transport Act)

II. Maritime New Zealand advises that calls were made to all vessel owners who were thought to be involved in trips to the Titi Islands emphasising safety messages of:

(i) Loading and stowage of “cargo”, and issues which may arise from using soft sided bulk bags and when transferring cargo to the deck of the fishing vessel for lift off by helicopter

(ii) Stability risk due to stowing cargo on deck so that the helicopter could lift it off easily

(iii) Communications

(iv) Weather and routing considerations

(v) Loads for return trips.

III. Maritime New Zealand advises that the owners and operators of known “Owenga Class” vessels in the district were contacted to discuss stability issues.

IV. Maritime New Zealand is in the process of developing (at the time of the report being written) an education programme on stability which it hopes to implement in about 6 months.

6.3. On 12 March 2013 Maritime New Zealand further advised that:

- Good progress has been made to date with both Rakiura Maori and the transport operators; however, there is much work still to be done on the “community education” aspect of the compliance tool. Maritime New Zealand is committed to achieving a positive outcome.

- Other stakeholders, including the Department of Conservation, Environment Southland and the Regional Harbourmaster, have offered their support and interest to be involved where possible

- The Maritime New Zealand National Advisor Industry Support (NAIS) will be talking to the Rakiura Titi Island Administration Body about possible funding through Ngai Tahu for educational material to be printed. Using this approach Maritime New Zealand is working towards creating a partnership approach and developing a sense of ownership for safety outcomes by the community.

- The NAIS has been working alongside Rakiura Maori spokesmen to bring together the 2 muttonbird committees, transport operators and associated stakeholders to create a set of best practice guidelines that can be used as a self-regulating compliance tool, administered by the muttonbirding communities.
- The NAIS and Maritime Officers have spoken with committee members at 2 pre-season hui. Each hui showed good interest, and positive suggestions were received on the way forward.
- The anticipated outcome is that all stakeholders participate in discussions and have constructive input into suggested ideas put forward by Maritime New Zealand, and stakeholder groups to ensure a commonly agreed and consistent approach is taken regarding pre-trip planning, in regard to safety considerations for both muttonbirders and transport operators alike.

7. Recommendations

General

7.1. The Commission may issue, or give notice of recommendations to any person or organisation that it considers the most appropriate to address the identified safety issues, depending on whether these safety issues are applicable to a single operator only or to the wider transport sector. In this case, a recommendation has been issued to the Director of Maritime New Zealand.

7.2. In the interests of transport safety it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

Urgent recommendations

7.3. On 18 April 2012 the Commission made the following urgent recommendation to the Director of Maritime New Zealand:

The Commission has evidence that since the Owenga class fishing vessels were built, authorities have recognised that they had limited reserve stability and could become unstable if too much weight was loaded on deck. In one case the surveyor recommended that a plaque be placed in the wheelhouse warning skippers not to load too much on deck. The Commission has made preliminary calculations that support this view.

Thirty seven years after the Owenga class of fishing vessels were built and with successive changes in ownership, it is possible that the current owners of the remaining vessels may not be aware of the special stability characteristics of their vessels.

The Commission recommended that the Director of Maritime New Zealand trace the whereabouts of the remaining Owenga class fishing vessels and ensure that the appropriate stability calculations have been made for each vessel and alert the owners to any special stability characteristics they should be considering in the daily operation of their vessels. (020/12)

7.4. On 1 May 2012 the Director of Maritime New Zealand replied to the safety recommendation as follows:

> The Director has commenced a process to identify all Owenga class fishing vessels to assess stability characteristics and discuss associated operational requirements with the owners of the vessels. It is expected that this process will be concluded by the end of May 2012.
>
> The Director is also assessing whether there are other vessels that may have similar stability characteristics requiring attention. It is intended that this assessment process be completed by the end of June 2012, with decisions as to further action being made at that time.

On 11 October 2012 the Director of Maritime New Zealand further replied:

> We have completed the process to identify all Owenga class fishing vessels and contacted all owners to update them on carrying cargo and/or fish bins on deck. Owners have been advised that there is a one tonne maximum which must not be exceeded when placing cargo or fish bins on deck. All owners were also given information on the circumstance which led to the capsize of Easy Rider. These visits were completed by May 2012.
>
> A stability assessment was completed of all other Owenga class vessels. None of the other vessels appear to be in the same category of high risk as the Easy Rider.
>
> MNZ completed an assessment to identify vessels with similar characteristics as the Owenga class fishing vessels and started an education process using a simplified traffic light method called WOLSEN. The method is based on the UK MCA papers on simplified stability and requires the length and breadth to calculate the minimum freeboard of the vessel required for safe operation. This assessment was completed by June 2012.

> This education programme is ongoing and Maritime Safety Inspectors are assessing all vessels on a ship by ship basis using the WOLSEN method.

Further recommendations

7.5. On 13 February 2013 the Commission made the following recommendations to the Director of Maritime New Zealand:

7.5.1. Following the accident, the Commission had some difficulty accessing sufficient information about the *Easy Rider*, a vessel that was still actively in the system. Maritime New Zealand was not able to find the older part of the ship file. Consequently the Commission had to rely on records from other vessels in order to make a reasonable assessment of the *Easy Rider*'s stability.

When the *Easy Rider* was converted for inshore trawling it was required to undergo a simplified stability assessment, which it did, but the records sourced from the safe ship management company included only partial details of the inclining test and stability calculation that had been carried out. There was no record of the stability advice letter said to have been sent to the owner. Such a letter would normally include recommendations on the loading of the vessel.

Because commercial vessels can frequently change ownership and their owners can switch between safe ship management providers, there is a need for Maritime New Zealand to maintain a central database of all important safety and operation records for the entire life of each vessel in the system.

The Commission recommends the Director of Maritime New Zealand develops and maintains a system for centralising important operating and safety records for every commercial vessel in the New Zealand maritime system, including a policy on the retention and disposal of records that would best ensure records are kept for an appropriate period after a vessel leaves the system. (001/13)

On 11 October 2012 the Director of Maritime New Zealand replied to the draft safety recommendation:

> We have a centralised electronic database for various types of records relating to vessels which tracks changes in a vessel's name, ownership and SSM Company.
>
> MNZ has policies on record retention and disposal which are in accordance with the Public Records Act and are approved by the Chief Archivist.

On 31 January 2013 the Director of Maritime New Zealand further replied to the draft safety recommendation:

> MNZ accepts the recommendation. Under the new Maritime Operator Safety System (MOSS) it will be a requirement for all new vessels to provide all design approval and survey information to the Director of MNZ.

On 23 April 2013 the Director of Maritime New Zealand replied to the final safety recommendation:

> MNZ currently has a centralised database for records relating to vessels. Since September 2008 this has included records relating to vessel name and type, inspections, audits, deficiencies, and corrective actions for vessels in the SSM system. Ownership is recorded at the time of issue and reissue of SSM certificates. In addition, information about each vessel is held by the Safe Ship Management Company responsible for carrying out functions for that vessel.
>
> It is proposed that the current SSM framework will be replaced with the new Maritime Operator Safety System (MOSS). Going forward, this will mean that all key vessel information is held and managed by MNZ. The implementation work for MOSS includes consideration and assessment of how best to provide for the transition and management of information currently held by SSM companies.

7.5.2. Before the *Easy Rider* could be used as a pleasure craft there were certain requirements that the owner had to meet under the Maritime Rules and the Fisheries Act. The complete requirements were not contained in the safe ship management documentation.

7.5.3. The Commission recommends that the Director of Maritime New Zealand clarifies with industry the legal requirements around dual purpose use of vessels and the use of commercial vessels as pleasure craft, and ensures that safe ship management documents refer to the full requirements an owner must comply with before the vessel is used for another purpose. (002/13)

On 11 October 2012 the Director of Maritime New Zealand replied to the draft safety recommendation:

> We have clarified and confirmed our policy on the use of commercial vessel for pleasure trips in the new Maritime Operator Safety System (MOSS) and will be clarifying the requirements and operator's responsibilities with industry during the implementation of this system.

On 23 April 2013 the Director of Maritime New Zealand replied to the final safety recommendation:

> The current legal position under the Maritime Transport Act is that a ship is operated commercially is a commercial ship at all times and therefore required to comply with the applicable provisions of the Maritime Transport Act and the Maritime Rules for commercial ships.
>
> In the case of Easy Rider, the vessel was normally used or intended to be normally used as a fishing ship and was in fact embarking on a commercial fishing voyage when the accident occurred. It was therefore a commercial ship at the time of the accident.
>
> MNZ is currently developing a new Maritime Operator Safety System (MOSS) which will include clarity over the application of the rule to the non-commerical use of a commercial ship.

7.5.4. A number of the passengers and crew on the *Easy Rider* had a large physique. There were only 3 adult and one child lifejackets on board to share among 9 passengers and crew. The 3 adult lifejackets were not large enough to be securely fitted to those passengers and crew whom had a large physique. The Maritime Rules make provision for the carriage of children's lifejackets but are silent on the need for larger lifejackets to cater for people whom have a large physique. This is a safety issue.

Larger oversize approved life jackets are available in New Zealand, and at least one manufacturer will custom make a life jacket to suit.

Maritime Rules require that an **approved** life jacket be carried for every person on board every recreational and commercial vessel. While an **approved** life jacket is marked as complying with the appropriate standard, other life jackets are freely available for purchase that are **not approved** to the appropriate standard, yet they are often labelled as being approved to some other standard that is not accepted in New Zealand. An unwary purchaser, particularly a recreational boating person, could be misled into thinking they were purchasing a life jacket approved to New Zealand standards. This is another safety issue.

The Commission recommends that the Director of Maritime New Zealand addresses these 2 safety issues in any educational campaigns by making it clear that not all life jackets that can be purchased in New Zealand are approved and meet the requirements of New Zealand Maritime Rules, and that persons who have a large physique should purchase or be provided with a life jacket that is appropriate for their physique. (003/13)

On 11 October 2012 the Director of Maritime New Zealand replied to the draft safety recommendation:

> We have noted above that MNZ's information is not consistent with the factual basis stated in this recommendation. MNZ actively promotes and supports the correct use, size and fitting of lifejackets at education seminars, boat shows, and

> through the boating education programmes. This combined with on-going campaigns in all forms of media (including the MNZ website) to emphasise the variety of valuable information on choosing the correct lifejacket for all boating activities; and will continue to promote these messages.

On 23 April 2013 the Director of Maritime New Zealand replied to the final safety recommendation:

> The Commission has identified two safety issues, namely a potential lack of awareness by the public of the importance of ensuring that life jackets are an appropriate size for the intended person (including those of larger physique); and the risk that a person wishing to purchase a lifejacket may be misled into believing that the lifejacket is approved when this is not the case.
>
> Maritime Rules (Part 91 definition of PFD) provide that a personal flotation device (PFD), which includes a lifejacket, carried and used on board a recreational craft must be certified by a recognised authority as meeting NZ standard NZS 5823 series or a national or international standard that the Director is satisfied substantially complies with these standards.
>
> The Director has made such determinations in respect of a number of such national and international standards. This includes Australian, US, ISO and EN standards. The Directors's determination in respect of these standards is available on the MNZ website, including advice on choosing the appropriate PFD.
>
> MNZ also actively promotes and supports the correct use, size and fitting of life jackets at education seminars, boat shows, and through boating education programmes. MNZ also conducts ongoing campaigns in all forms of media (including the MNZ website) to emphasise the variety of valuable information on choosing the correct life jacket for all boating activities. These messages will continue to be promoted.

8. Key lessons

- Skippers and persons in charge of vessels must have at least a basic understanding of ship stability and how the loading of people and equipment can affect this stability.

- Navigating small craft in rough sea conditions at night is an inherently dangerous activity and should be avoided if and when possible.

- The life-saving equipment on a vessel of any description being used for any purpose must be suitable for the intended trip and for the number and size of persons on board.

- Maritime Rules specify the bare minimum requirements for life-saving equipment. Operators should consider purchasing a higher standard of equipment that can improve the chances of detection and rescue in the event of a mishap.

- Individuals and entities, including companies and directors, that own and operate commercial vessels must ensure that they fully understand and comply with all legal requirements arising from this ownership and operation.

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Northern Coast of Stewart Island
11pm 14 March to 1am 15 March 2012
FV "*Easy Rider*"

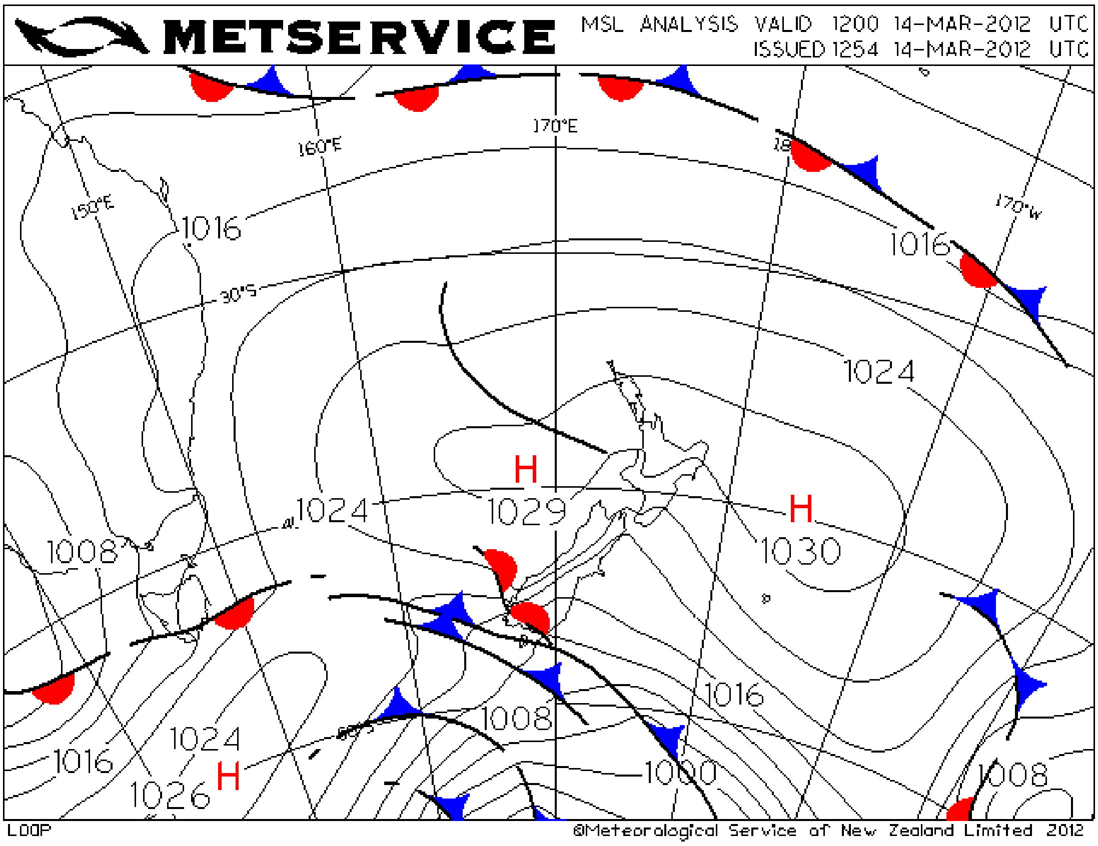
Introduction

This report has been prepared at the request of , Marine Accident Investigator for Transport Accident Investigation Commission, who is investigating the sinking of FV "*Easy Rider*" near the north coast of Stewart Island about midnight between 14 and 15 March 2012.

Scope

This report will provide a description of the weather and sea conditions near the north coast of Stewart Island about midnight between 14 and 15 March 2012. Information will be obtained from the larger scale meteorological analysis, recorded meteorological observations at automated weather stations in the vicinity, and computer modelled sea and swell analyses. The report will also include the coastal weather forecasts for the Puysegur and Foveaux areas.

Meteorological Situation



At midnight between 14 and 15 March (see analysis chart above for that time 1200 UTC 14 Mar 2012), a frontal system was moving north-eastwards over Stewart Island preceded by a strong west-northwest air stream. Further north, a ridge of high pressure lay west to east across the North Island and a westerly air stream covered central New Zealand and the South Island.

Coastal Marine forecasts for Puysegur and Foveaux

A map showing the boundaries of these areas is in the Appendix.

The following coastal marine forecasts for Puysegur and Foveaux were issued between 0000 hours on 14 March and 0030 hours on 15 March 2012.

Issued: 14-MAR-2012 00:06
Valid to: 14-MAR-2012 23:59
PUYSEGUR
STORM WARNING IN FORCE
Northwest 30 knots rising to 40 knots early morning and to 50 knots late morning, then easing to westerly 35 knots, but 25 knots south of Puysegur Point this evening. Sea becoming high for a time. Southwest swell 3 metres easing. Northwest swell 2 metres developing. Poor visibility in rain developing this morning.
OUTLOOK FOLLOWING 3 DAYS: Southwest 15 knots, dying out Thursday night. Developing Friday, northerly 20 knots, gradually rising Friday, 40 knots with very rough sea, then easing Saturday, northwest 25 knots. Southwest swell becoming heavy for a time Thursday.
FOVEAUX
GALE WARNING IN FORCE
Northwest 15 knots rising to 25 knots this morning and to 35 knots this afternoon, Changing westerly 20 knots this evening. Sea coming very rough for a time. Southwest swell 3 metres easing. Poor visibility in rain developing this morning.
OUTLOOK FOLLOWING 3 DAYS: Southwest 25 knots, dying out early Friday. Developing later Friday, northerly 15 knots, rising Saturday,
northwest 25 knots. Sea rough at times. Southwest swell becoming heavy offshore for a time Thursday.

Issued: 14-MAR-2012 04:03
Valid to: 14-MAR-2012 23:59
PUYSEGUR
STORM WARNING IN FORCE
Northwest 30 knots rising to 40 knots early morning and to 50 knots late morning, then easing to westerly 35 knots, but 25 knots south of Puysegur Point this evening. Sea becoming high for a time. Southwest swell 3 metres easing. Northwest swell 2 metres developing. Poor visibility in rain developing this morning.
OUTLOOK FOLLOWING 3 DAYS: Southwest 15 knots, dying out Thursday night. Developing Friday, northerly 20 knots, gradually rising Friday, 40 knots with very rough sea, then easing Saturday, northwest 25 knots. Southwest swell becoming heavy for a time Thursday.
FOVEAUX
GALE WARNING IN FORCE
Northwest 15 knots rising to 25 knots this morning and to 35 knots this afternoon. Changing westerly 20 knots this evening. Sea becoming very rough for a time. Southwest swell 3 metres easing. Poor visibility in rain developing this morning.
OUTLOOK FOLLOWING 3 DAYS: Southwest 25 knots, dying out early Friday. Developing later Friday, northerly 15 knots, rising Saturday,
northwest 25 knots. Sea rough at times. Southwest swell becoming heavy offshore for a time Thursday.

Issued: 14-MAR-2012 12:44
Valid to: 15-MAR-2012 23:59
PUYSEGUR
STORM WARNING IN FORCE
Northwest 50 knots, easing to 40 knots north of Puysegur Point this evening. Changing southwest 15 knots everywhere overnight, rising to 25 knots in the morning, then easing to 15 knots again Thursday afternoon. High sea easing. Southwest swell rising to 4 metres. Northwest swell 2 metres easing. Poor visibility in rain developing this afternoon, clearing Thursday afternoon.
OUTLOOK FOLLOWING 3 DAYS: Tending early Friday, northerly 20 knots, rising late Friday, 40 knots with very rough sea, changing Sunday, southwest 20 knots. Heavy southwest swell, easing.
FOVEAUX
*GALE WARNING IN FORCE
Northwest 25 knots, rising to 35 knots this afternoon. Changing southwest 15 knots overnight, rising to 25 knots in the morning, then easing to 15 knots again Thursday night. Sea becoming very rough for a time. Southwest swell rising to 4 metres. Poor visibility in rain developing this evening, clearing Thursday afternoon.
OUTLOOK FOLLOWING 3 DAYS: Southwest 15 knots, tending Friday, northerly 15 knots, rising Saturday, northwest 25 knots with rough sea, changing Sunday, southwest 20 knots. Heavy southwest swell, easing Friday.

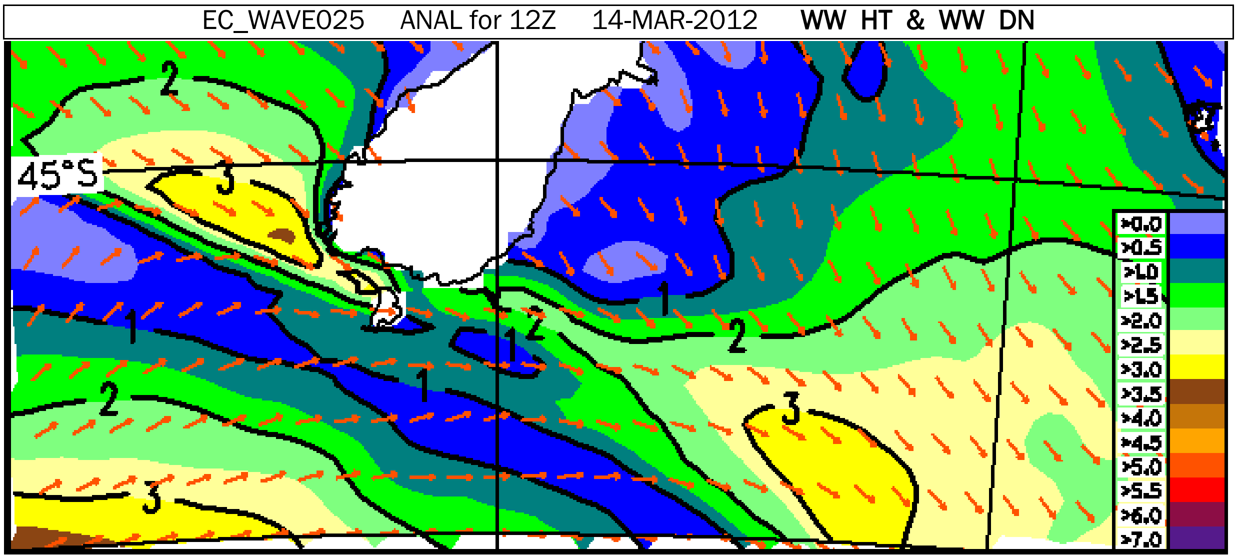
Issued: 14-MAR-2012 16:09
Valid to: 15-MAR2012 23:59
PUYSEGUR
STORM WARNING IN FORCE
Northwest 50 knots, easing to 40 knots north of Puysegur Point this evening. Changing southwest 15 knots everywhere overnight, rising to 25 knots in the morning, then easing to 15 knots again Thursday afternoon. High sea easing. Southwest swell rising to 4 metres. Northwest swell 2 metres easing. Poor visibility in rain clearing Thursday afternoon.
OUTLOOK FOLLOWING 3 DAYS: Tending early Friday, northerly 20 knots, rising late Friday, 40 knots with very rough sea, changing Sunday, southwest 20 knots. Heavy southwest swell, easing.
FOVEAUX
GALE WARNING IN FORCE
Northwest 35 knots changing southwest 15 knots overnight, rising to 25 knots in the morning, then easing to 15 knots again Thursday night. Sea becoming very rough for a time. Southwest swell rising to 4 metres. Poor visibility in rain developing this evening, clearing Thursday afternoon.
OUTLOOK FOLLOWING 3 DAYS: Southwest 15 knots, tending Friday, northerly 15 knots, rising Saturday, northwest 25 knots with rough sea, changing Sunday, southwest 20 knots. Heavy southwest swell, easing Friday.

Issued: 15-MAR-2012 00:26
Valid to: 15-MAR-2012 23:59
PUYSEGUR
Southwest 25 knots, easing to 15 knots this afternoon. Sea becoming rough for a time. Southwest swell rising to 4 metres. Poor visibility in rain, clearing this afternoon.
OUTLOOK FOLLOWING 3 DAYS: Tending early Friday, northerly 20 knots, rising late Friday, 40 knots with very rough sea, changing Sunday, southwest 20 knots. Heavy southwest swell, easing.
FOVEAUX
Northwest 25 knots. Changing southwest 25 knots early morning, then easing to 15 knots tonight. Rough sea easing. Southwest swell rising to 4 metres. Poor visibility in rain, clearing this afternoon. OUTLOOK FOLLOWING 3 DAYS: Southwest 15 knots, tending Friday,
northerly 15 knots, rising Saturday, northwest 25 knots with rough sea, changing Sunday, southwest 20 knots. Heavy southwest swell, easing Friday.

Computer modelled wind and swell waves

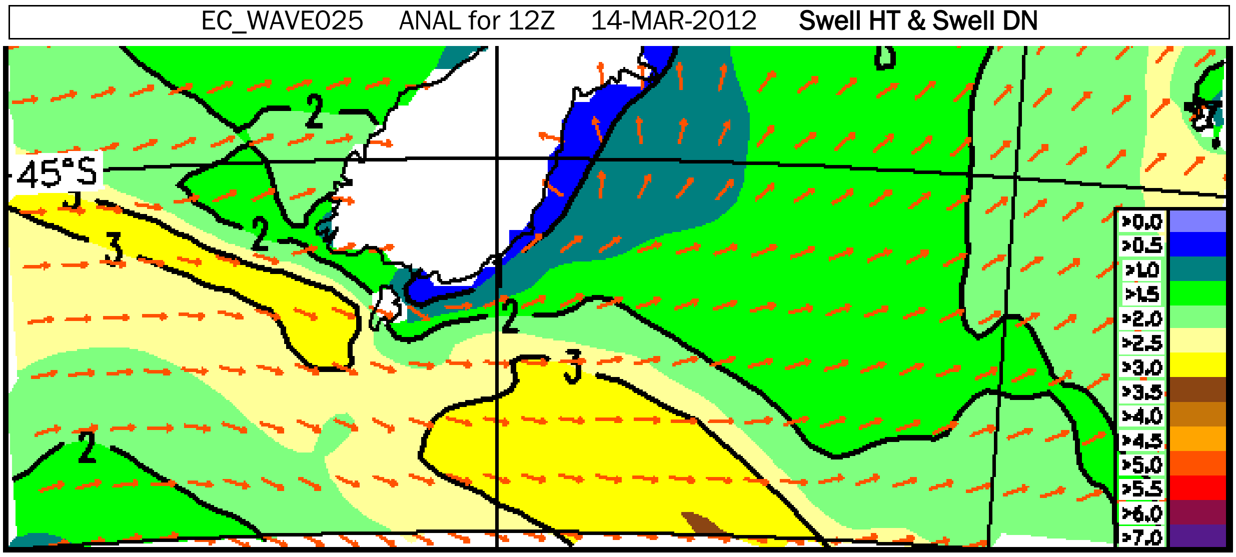
The ECMWF[6] provides global analyses and forecasts of ocean waves based on 0000 UTC and 1200 UTC analysis times. The following are parts of selected charts displaying the analysed wave field at 1200 UTC 14 March 2012 (1am 15 March 2012 NZDT) for wind waves, swell waves and combined wind and swell waves. The full versions of these charts together wind some explanation is in the Appendix. These charts depict significant wave height of deep water waves – more than 100 metres depth where bottom effects and shoaling do not affect wave height and direction.

Wind waves



Deep water wind wave (driven by the local wind) significant height in the vicinity of the north coast of Stewart Island was analysed at 1am 15 March 2012 to be about 3 metres near Codfish Island, and lower (about 2 metres) further east into Foveaux Strait.

Swell waves



Swell waves here were travelling from a generation area further to the west

Deep water swell wave significant height in the vicinity of the north coast of Stewart Island was analysed at 1am 15 March 2012 to be in a gradient from about 1.5 metres in Foveaux Strait to 2 metres further west about Codfish Island. The wave direction was from the west northwest.

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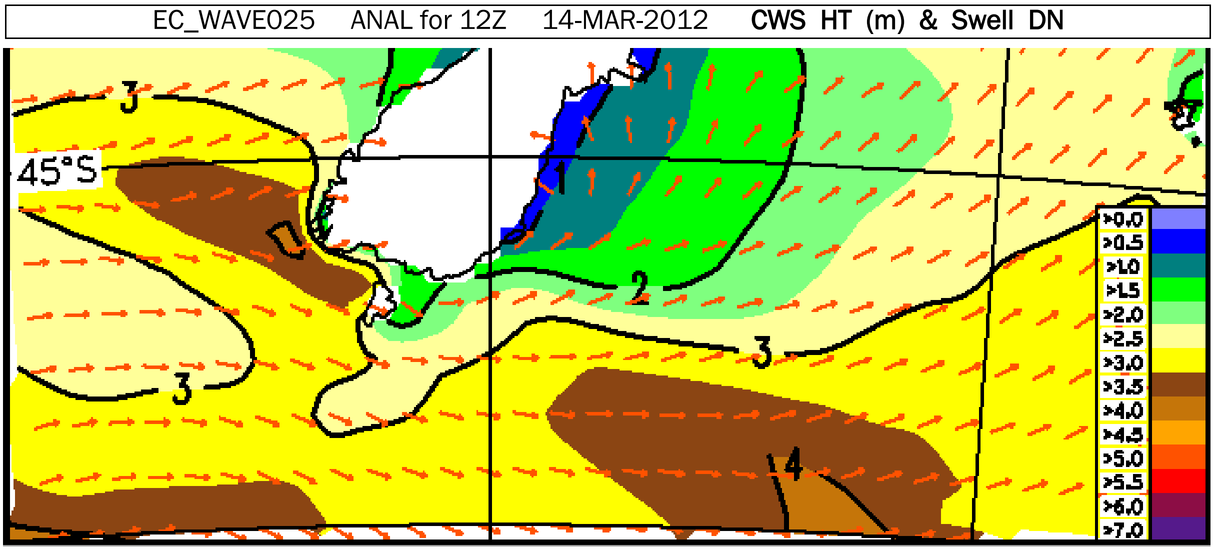
[6] European Centre for Medium-range Forecasting

Combined wind and swell waves.



The significant wave height of the combination of wind and swell waves in the vicinity of the north coast of Stewart Island was analysed at this time to be in a gradient from about 3 metres in Foveaux Strait to about 3.5 metres further west about Codfish Island. The wave direction was from the northwest.

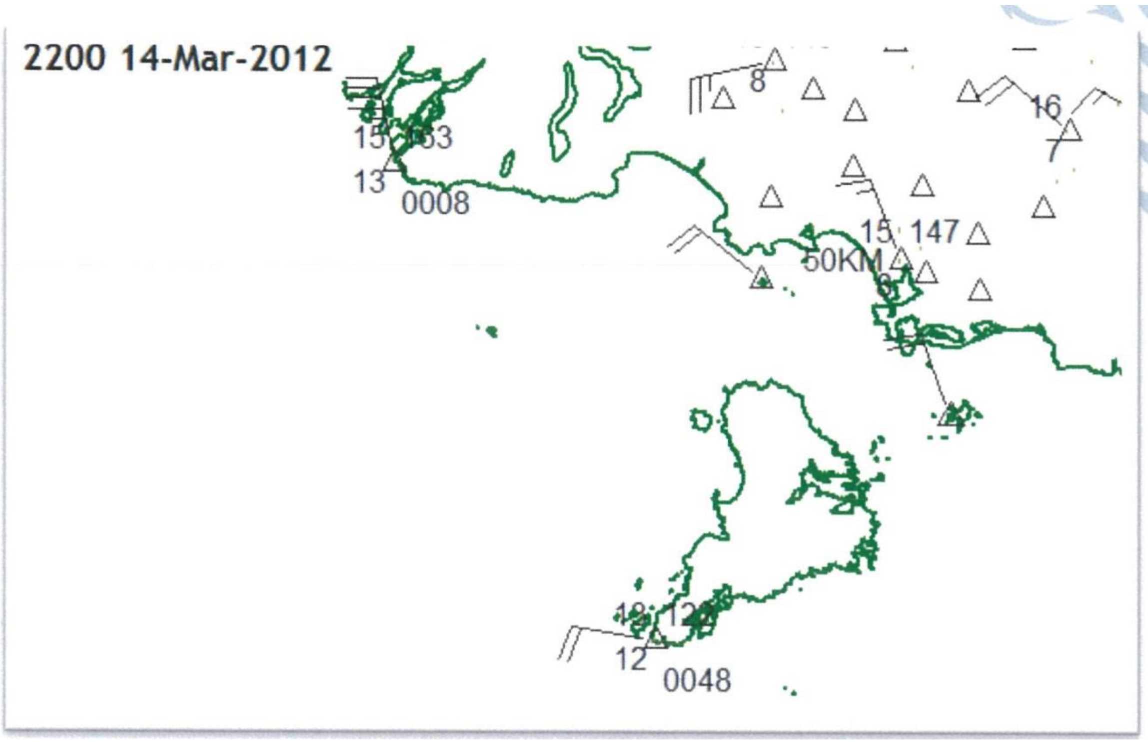
Note that the significant wave height is a characteristic wave height and there would be occasional waves as much as 25% higher, and isolated waves up to 50% higher.

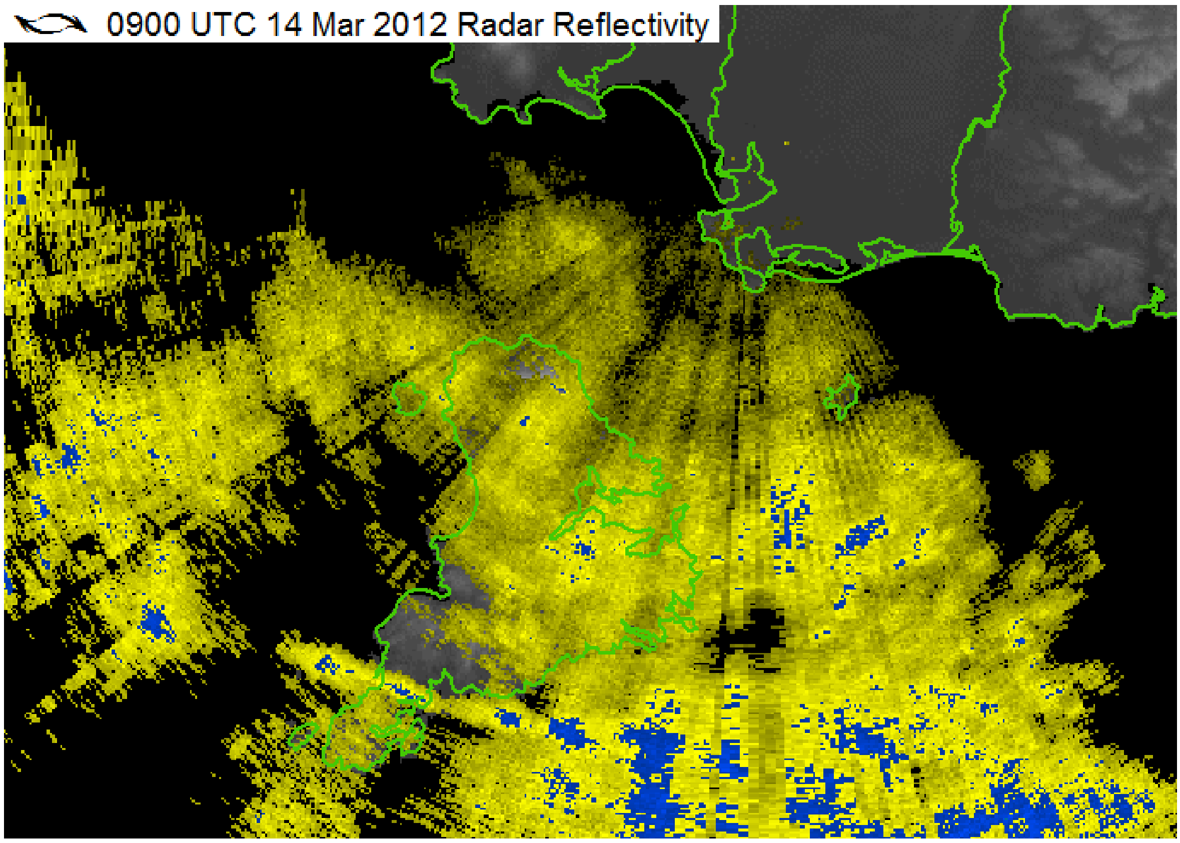
Meteorological Observations

MetService and the Coast Guard operate some automated weather stations in the vicinity of Foveaux Strait. The following stations are of interest regarding wind and sea conditions near the north coast of Steward Island: Puysegur Point (southern Fiordland), Centre Island (west of Invercargill and Bluff), Ruapuke Island (southeast of Bluff), and Southwest Cape (southern tip of Stewart Island.

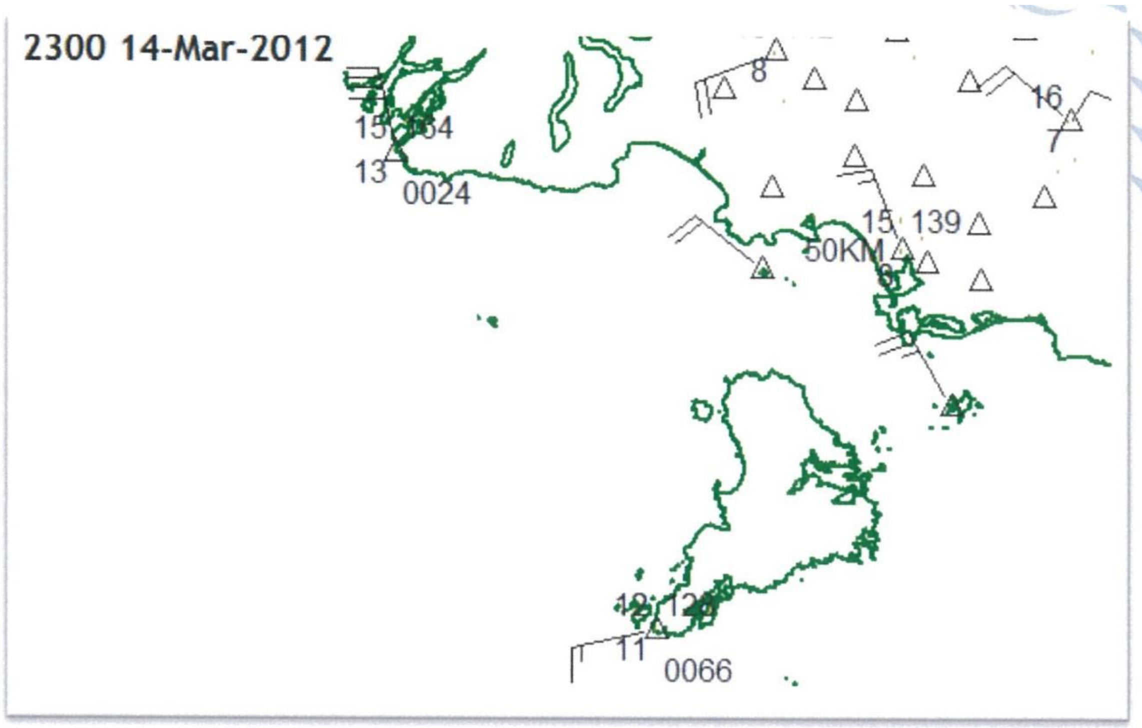
A series of maps are presented below. They are timed between 10pm on 14 March to 2am on 15 March 2012 at hourly intervals. The station plotting model is described in the Appendix. The times displayed in the top left of the maps are NZDT. Where available, the Invercargill radar scan for the same time is included. The time stamp embedded in the image is in UTC, 13 hours behind NZDT.

In the descriptions with each map, the wind speed and direction in the vicinity of the north coast of Stewart Island is based on consideration of the wind observations from the 4 surrounding weather stations, and the sea state is obtained from that depicted in the charts of the previous section, “Computer modeled wind and swell waves”, on pages 4 and 5.



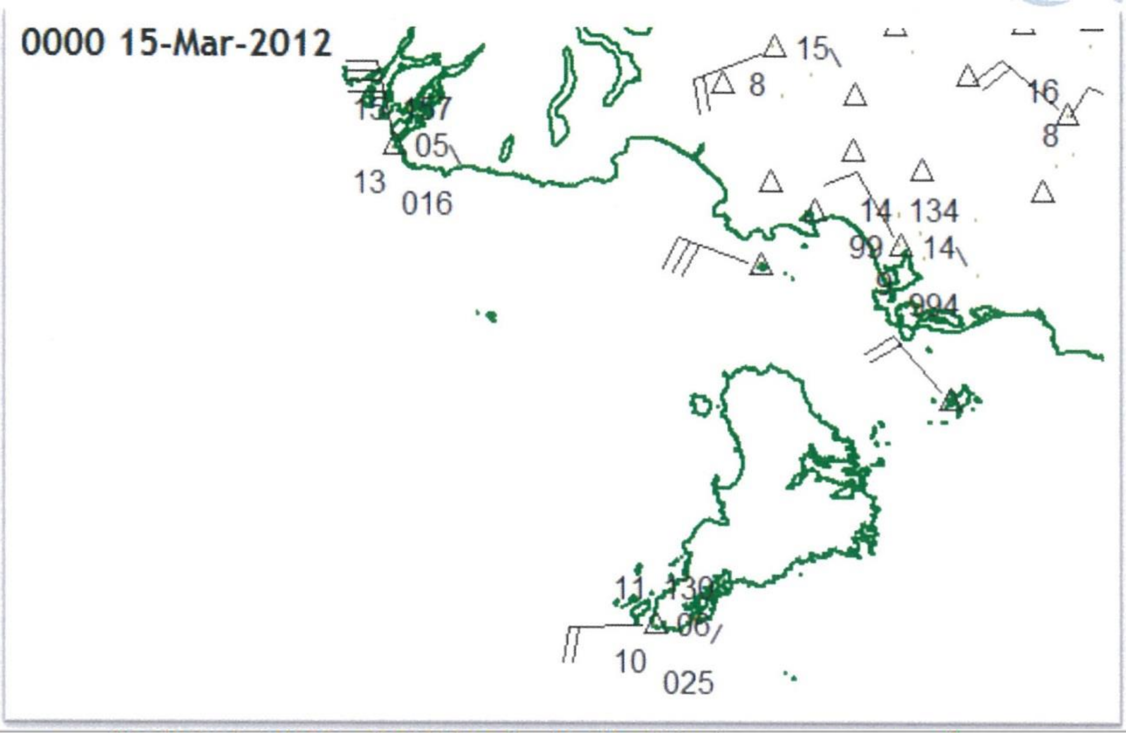


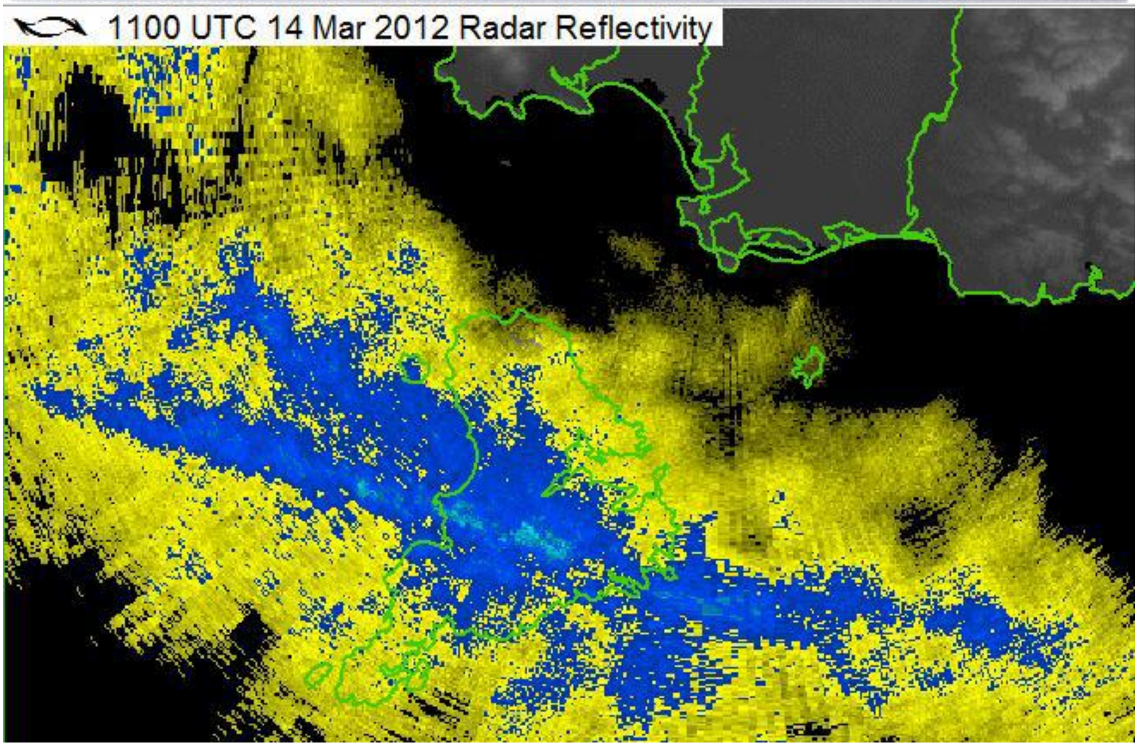
At 10pm 14 March, in the vicinity of the north coast of Stewart Island, the wind was blowing from the west to northwest at about 20 to 25 knots. There is more or less continuous rain which was reducing the visibility.



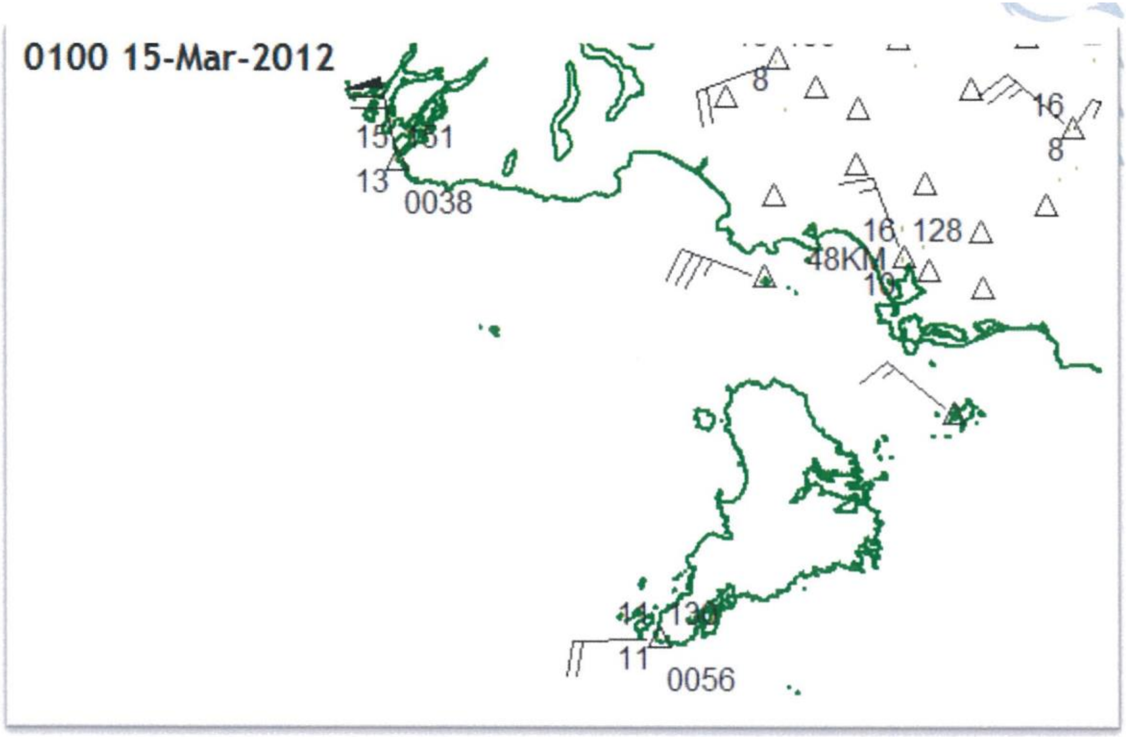
(Radar data was not available between 10:07pm and 11:45pm on 14 March 2012.)

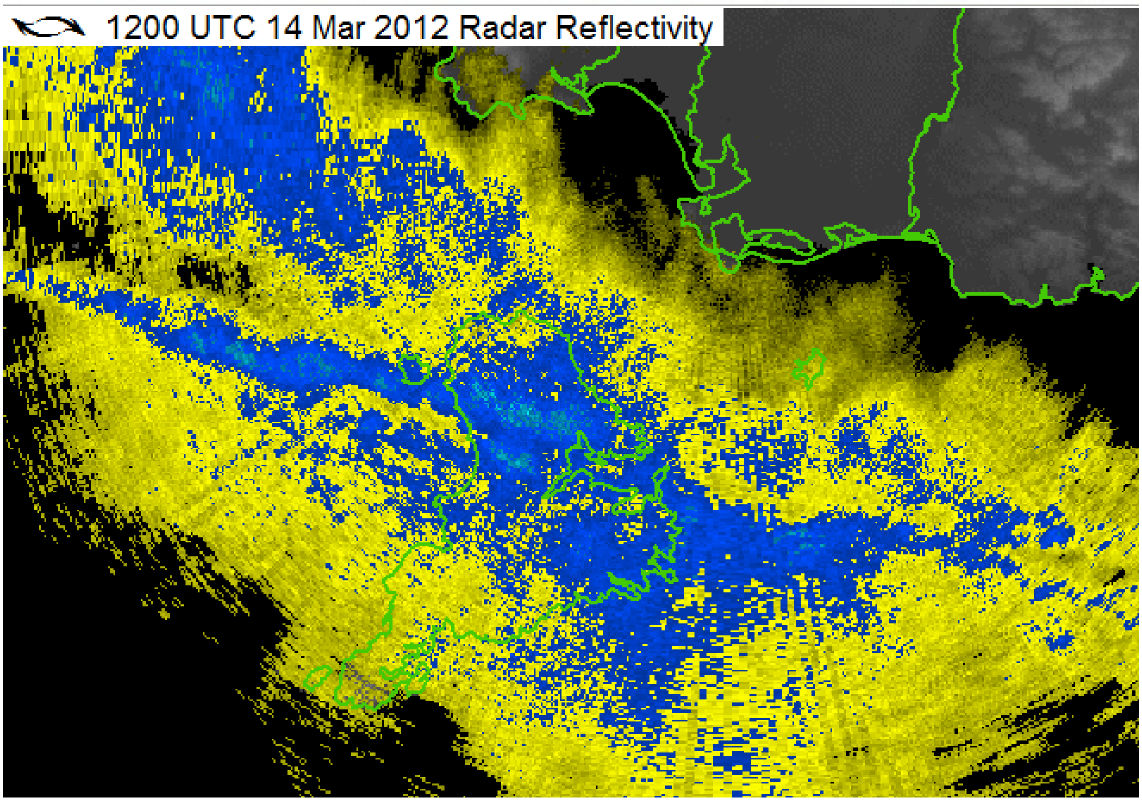
At 11pm 14 March, the cold front had passed to the north of Southwest Cape; the barometric pressure was rising, the wind direction had changed to south of westerly, and the temperature was lowering. The wind in the vicinity of the north coast of Stewart Island was blowing from the west- northwest at about 25 to 30 knots.





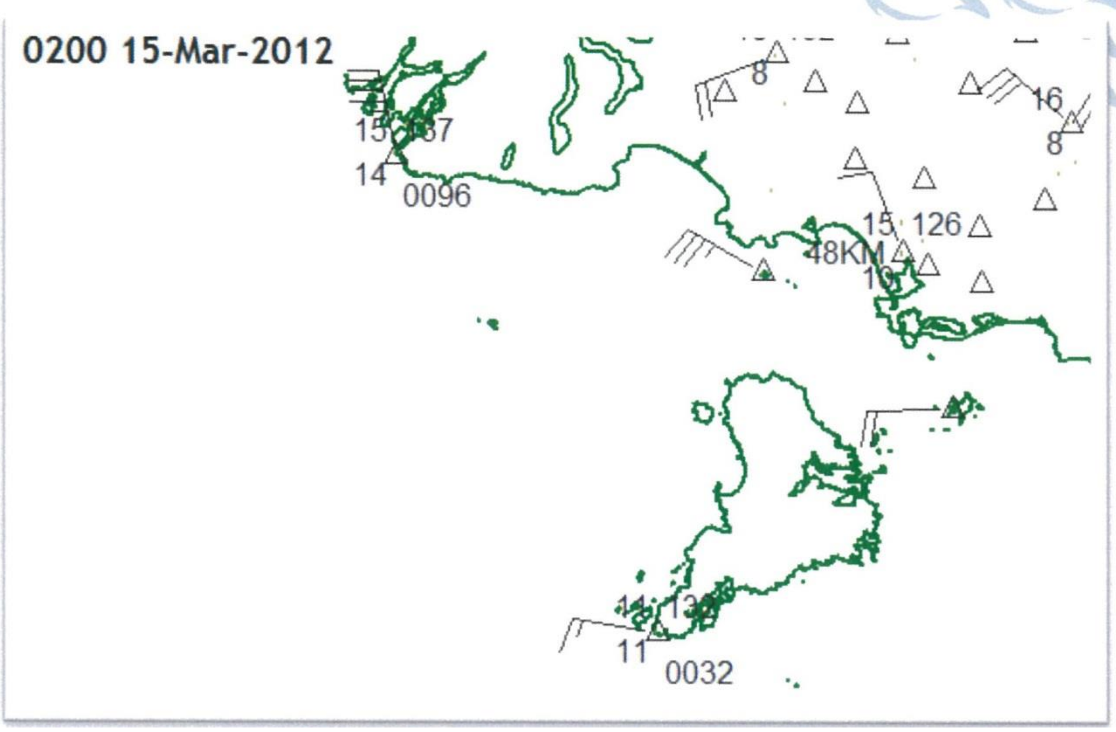
At midnight between 14 and 15 March, the cold front was moving northeast over Stewart Island. The wind in the vicinity of the north coast of Stewart Island was blowing from the west-northwest at about 25 to 30 knots. The significant wave height of the combination of wind and swell waves was in a gradient from about 3 metres in Foveaux Strait to about 3.5 metres further west near Codfish Island. There may have been isolated waves of 5 metres. The waves were travelling from the west-northwest.

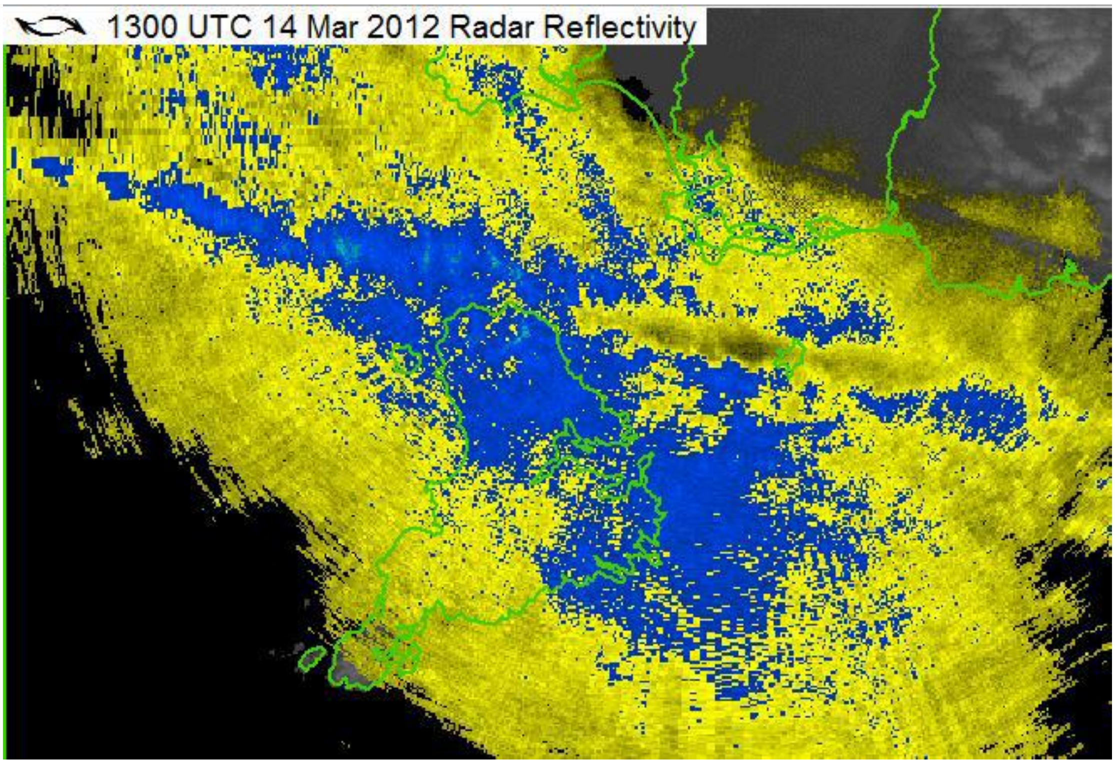




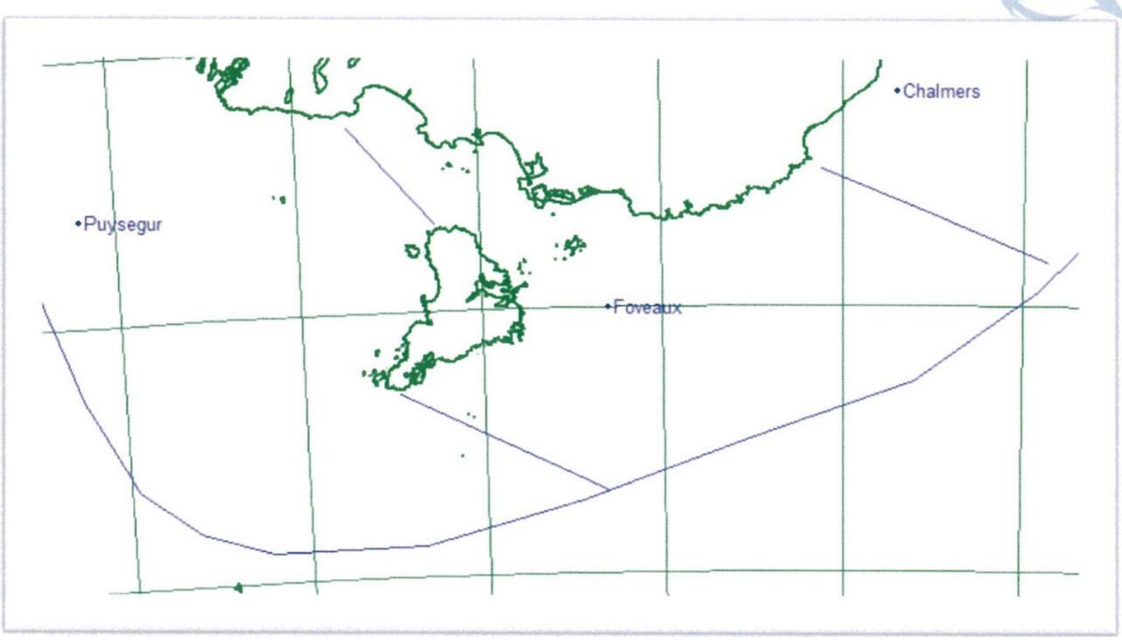
At 1am 15 March the cold front was near the north of Stewart Island. The wind in the vicinity of the north coast of Stewart Island was blowing from the west-northwest at about 25 to 30 knots. The significant wave height of waves was between 3 and 3.5 metres with higher waves near the west coast of Stewart Island, and isolated waves of 5 metres. Visibility would have been restricted by the moderate to heavy rain that was falling.

At 2am 15 March the cold front was close to Puysegur Point, over Ruapuke Island but not yet reached Centre Island which was recording 35 knots from the northwest. The wind had probably eased to 20 knots from west or southwest in the vicinity of the north coast of Stewart Island. Wave heights were probably still in the range 3 to 3.5 metres with isolated waves 5 metres high. Visibility was being reduced by the moderate rain that was still falling.

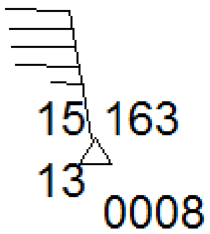




Map of Coastal Forecast areas



Station plotting model

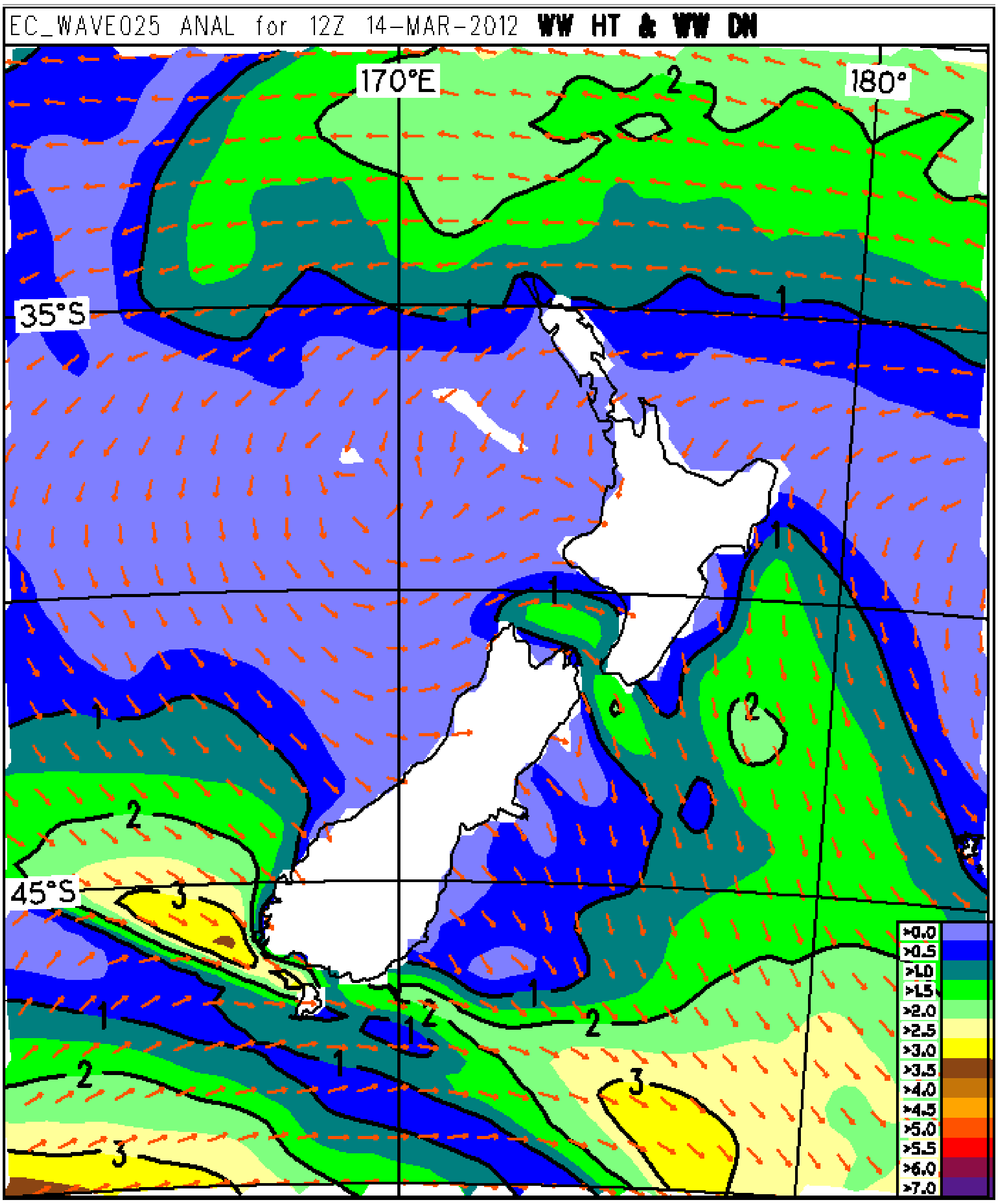


The triangle is plotted at the station location.
Wind is represented by a stylised arrow that flies with the wind. In this case the arrow is pointing from the north-northwest (towards the south-southeast). The flights of the arrow tail indicate the wind speed. Full lines represent 10's of knots and a half-line, 5 knots. In this example the wind speed is 45 knots (to the neatest 5 knots).
The figures to the left of the station symbol (upper and lower) are the air temperature and dew point, respectively, in degrees Celsius.
The figure to the upper right is the barometric pressure in tenths of a hectopascals with the hundreds and thousands digits omitted. Here, "163" means 1016.3 hPa.
The figure to the lower right is the hourly rainfall in tenths of a millimetre. Here, "0008" means 0.8 mm.

Computer analysed wind and swell wave charts

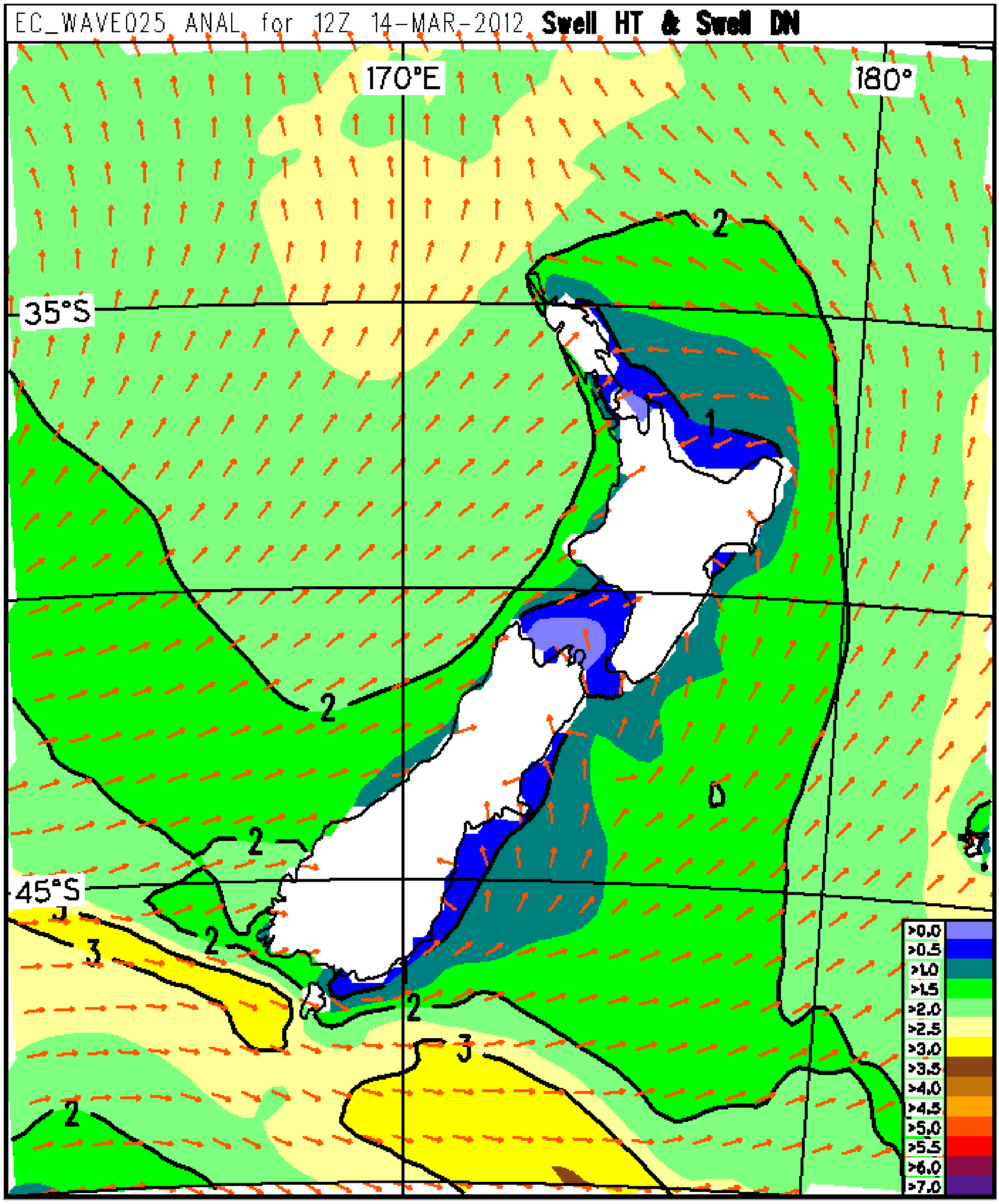
These are the full, un-cropped versions of wind wave, swell wave and combined wave charts obtained from the ECMWF global ocean wave modelling system. In these charts, the wave heights represent the "significant wave height" which is the average of the highest 1/3 of the wave heights in the total wave height distribution.

Wind wave height and direction analysis for midnight 14/15 March 2012 NZST



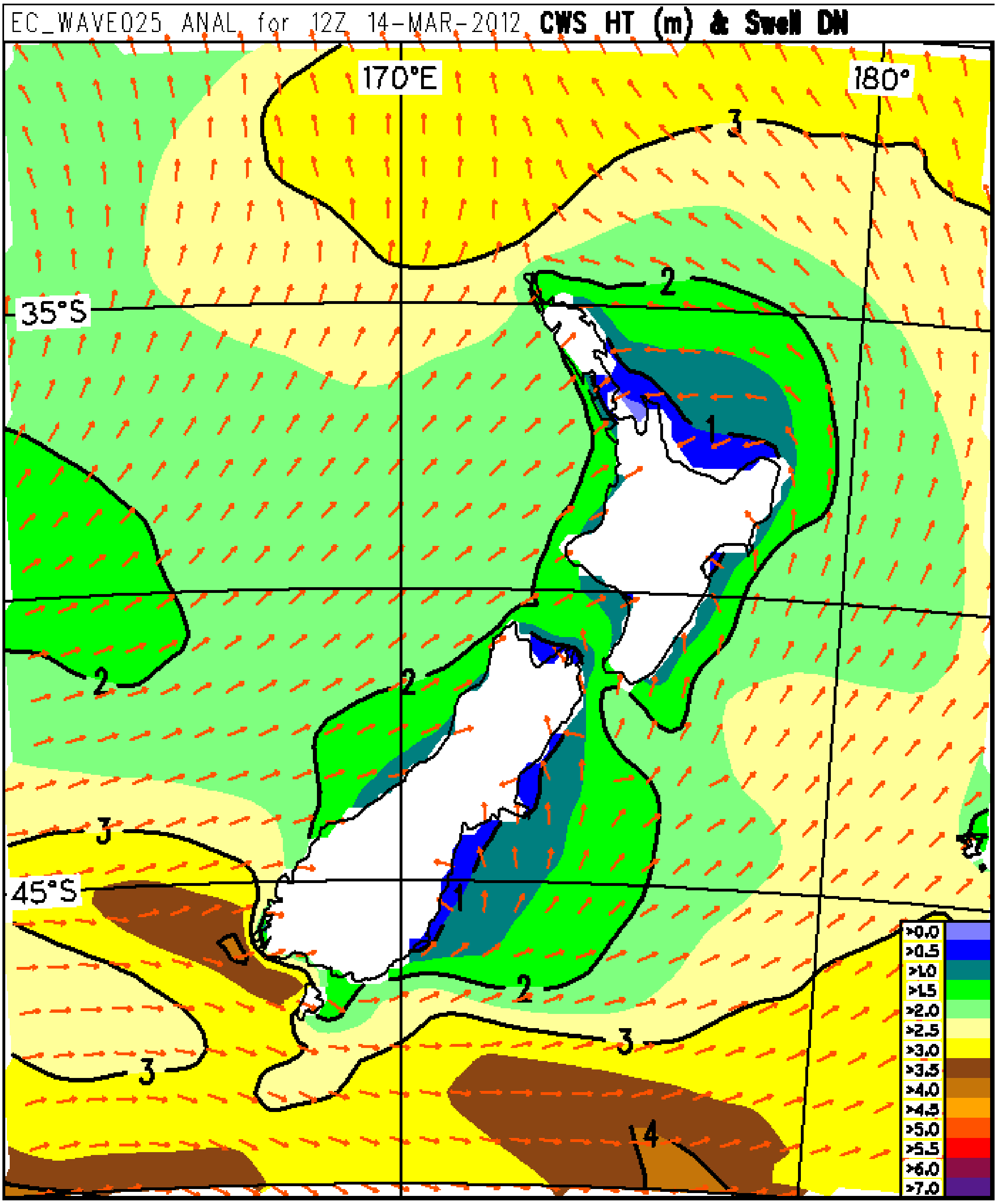
Wind waves are those generated in situ by the local wind.

Swell height and swell direction analysis for midnight 14/15 March 2012 NZST.



Swell waves are those that have travelled from a generation area somewhere else.

Combined wave height and direction analysis for midnight 14/15 March 2012 NZST



The combined wave height is the height of the combination together of wind waves and swell waves. Heights of wave sets combine in proportion to the energy of the waves which is in proportion to the square of the wave height. Like the hypotenuse rule, the square of the height of the combined waves is equal to the sum of the squares of the heights of the individual wave sets.

Appendix 2 Extract from relevant Maritime Rules

Maritime Rule Part 31C.12 Inshore Area

(1) Fishing vessel's operating in the inshore area must carry at least –

a. Seafarers holding the minimum required qualifications specified in table 5 and the accompanying flow-chart: and

b. The applicable minimum crew specified in Table 5

(2) If the master of a fishing vessel operating within the inshore limits set out in Appendix 1 of Part 20 holds an LLO, the master must ensure that the vessel remains within the nominated parts of the inshore area endorsed on the master's certificate.

(3) If the master of a fishing vessel operating within any defined section of the coastal area that –

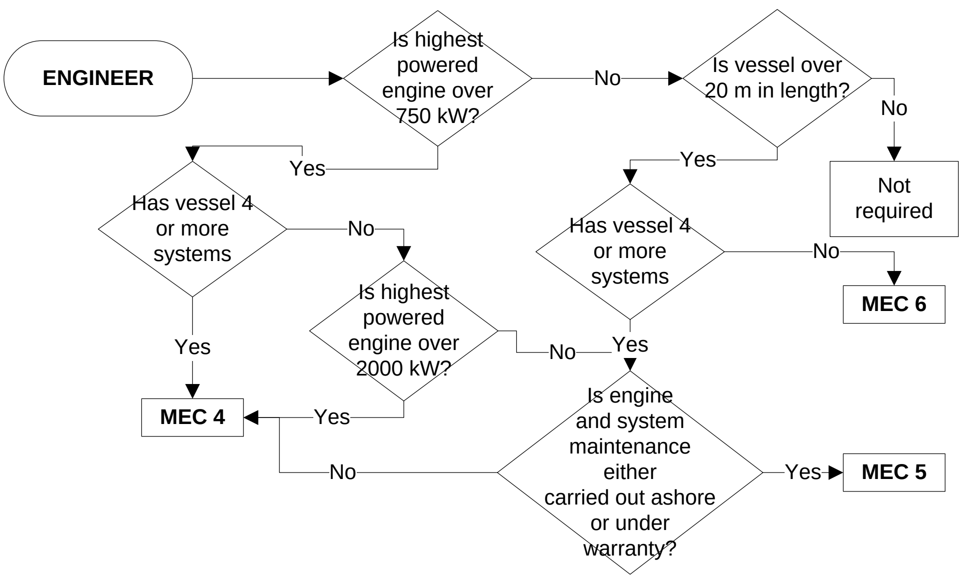
a. Is not beyond the 12 mile territorial sea of New Zealand; and

b. Has been assigned to the vessel as an inshore limit by a surveyor in accordance with Part 20,

holds an LLO, the master must ensure that the vessel remains within the area of operation endorsed on the master's certificate, provided that the area is within 15 miles of a nominated safe haven and within 4 miles of the coast.

Table 5

Vessel Length	Minimum Required Qualifications	Minimum Crew
30 m or more	Master – NZOW endorsed ILM Engineer – Qualification determined in accordance with the flow-chart and may be Master or other seafarer	3
20 m or more but less than 30 m		2
6m or more but less than 20 m	Master – ILM Engineer – Qualification determined in accordance with the flow-chart and may be Master or other seafarer	1
Less than 6 m	Master – LLO	



Stability and Associated Seaworthiness

40D.33 Ships of 24 metres or more in length

(1) The owner of any ship of 24 metres or more in length must ensure that the ship is subjected to an inclining test, conducted or witnessed by a surveyor recognised for that purpose by the Director under rule 46.29, in the following circumstances –

(a) where it is a new ship, upon its completion; or

(b) where alterations made to an existing ship, which has previously been subject to an inclining test, result in a deviation of the lightship weight exceeding 2 per cent; or

(c) where it is an existing ship, which has not previously been subject to an inclining test, in which case it must be inclined before the date which is two years after the date on which this Part comes into force.

(2) On completion of the inclining test the surveyor referred to in rule 40D.33(1) must –

(a) determine the actual displacement and position of the centre of gravity for the lightship condition; and

(b) produce righting lever curves (GZ curves) for the following conditions:

(i) departure for the fishing grounds with full fuel, stores, ice, and fishing gear; and

(ii) departure from the fishing grounds with full catch; and

(iii) arrival at home port with full catch and 10 per cent fuel and stores; and

(iv) arrival at home port with 10 per cent fuel, stores, and a minimum catch, that is normally to be 20 per cent of a full catch but may be up to 40 per cent, provided the surveyor is satisfied that operating patterns justify such a value; and

(v) any other actual operating conditions the surveyor considers would produce the lowest values of the parameters contained in the criteria required by rule 40D.33(2)(d); and

(c) in determining the righting lever curves (GZ curves), take into account the following:

(i) allowance for the weight of wet fishing nets and other fishing gear on the deck; and

(ii) homogeneous distribution of the catch, unless this is inconsistent with practice; and

(iii) catch on deck, if anticipated, in operating conditions referred to in rules 40D.33(2)(b)(ii),(iii), and (v); and

(iv) water ballast if carried; and

(v) allowance for the free surface effect of liquids and, if applicable, catch carried; and

(vi) where a ship operates in areas where ice accretion is likely to occur, make the following icing allowance:

(aa) 30 kg/m^2 on exposed weather decks and gangways; and

(bb) 7.5 kg/rn^2 for projected lateral area of each side of the ship above the water plane; and

(cc) the projected lateral area of discontinuous surfaces of rail, spars (except masts) and rigging of ships having no sails and the projected lateral area of other small objects must be computed by increasing the total projected area of continuous surfaces by 50 per cent and the static moments of this area by 10 per cent; and

(d) confirm that the righting lever curves (GZ curves) for the loaded conditions required by rule 40D.33(2)(b) comply with the following criteria:

(i) the area under the righting lever curve (GZ curve) must not be less than 0.055 metre-radians up to 30° angle of heel and not less than 0.090 metre- radians up to 40°. Additionally, the area under the righting lever curve (GZ curve) between the angles of heel of 30° and 40° or between 30° and Θ_f if this angle is less than 40° must not be less than 0.03 metre-radians. Θ_f is the angle of heel at which openings in the hull, superstructure or deckhouses that cannot rapidly be closed weathertight begin to immerse[7]; and

(ii) the righting lever (GZ) must be at least 200 millimetres at an angle of heel equal to or greater than 30°; and

(iii) the maximum righting lever (GZ_{max}) must occur at an angle of heel preferably exceeding 30° but not less than 25°; and

(iv) the initial metacentric height (GM) must not be less than 350 millimetres for single deck ships. For ships of 70 metres in length and over with complete superstructure, the metacentric height may be reduced to the satisfaction of the surveyor referred to in rule 40D.33(1), but is in no case to be less than 150 millimetres; and

(v) the range of positive stability must not be less than 60°. The effects of enclosed deck erections with openings closed by approved weathertight fittings may be taken into account in determining the range of positive stability; and

In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

(e) confirm that the angle of heel at which progressive flooding of fish holds could occur through hatches that remain open during fishing operations and that cannot rapidly be closed, is at least 20°, unless the stability criteria of rule 40D.33(2)(d) can be satisfied with the respective fish holds partially or completely flooded.

(3) Where arrangements other than bilge keels are provided to limit the angles of roll, the surveyor referred to in rule 40D.33(1) must be satisfied that the stability criteria given in rule 40D.33(2)(d) are maintained in all operating conditions.

(4) The surveyor referred to in rule 40D.33(1), taking account of the seasonal weather conditions, the sea states in which the ship will operate, the type of ship, and its mode of operation, must be satisfied that a ship is able to withstand –

(a) the effect of severe wind and rolling in associated sea conditions; and

(b) the effect of water on deck.

(5) The surveyor referred to in rule 40D.33(1) must prepare stability information in a form acceptable to the Director. The stability information must –

(a) be supplied to the owner by the surveyor; and

(b) must enable the master to assess with ease and certainty the stability of the ship under various operating conditions; and

(c) include specific instructions to the master regarding those operating conditions that could adversely affect either the stability or trim of the ship.

(6) The owner and master of a ship must ensure that the stability information prepared in accordance with rule 40D.33(5) is –

(a) kept on board the ship, and readily accessible at all times; and

(b) if alterations are made to the ship, to the extent defined in rule 40D.33(1)(b), revised to the satisfaction of a surveyor recognised for that purpose by the Director under rule 46.29.

40D.34 Ships of less than 24 metres in length

(1) The owner of any new ship of 12 metres or more in length, but less than 24 metres in length that is engaged in trawling, dredging, or similar forms of fishing where heavy gear is towed, or is engaged in purse seining, must ensure that the ship is subject, upon its completion, to an inclining test conducted or witnessed by a surveyor recognised for that purpose by the Director under rule 46.29.

[7] In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

(2) On completion of the inclining test, the surveyor referred to in rule 40D.34(1) must –

(a) determine the actual displacement and position of the centre of gravity for the lightship condition; and

(b) produce righting lever curves (GZ curves) for the conditions listed in rule 40D.33(2)(b), taking into account the factors listed in rule 40D.33(2)(c)(i) to (vi) inclusive; and

(c) confirm that the righting lever curves for the conditions required by rule 40D.33(2)(b) meet the criteria given in rule 40D.33(2)(d); and

(d) prepare stability information in a form prescribed by the Director, which must be kept by the owner and made available on request to a surveyor or the Director.

(3) The owner of any new ship of 12 metres or more in length, but less than 24 metres in length that is not engaged in purse seining or forms of fishing using heavy towed gear must ensure that the ship is subject, upon its completion, to an inclining test conducted or witnessed by a surveyor recognised for that purpose by the Director under rule 46.29.

(4) On completion of the inclining test required by rule 40D.34(3), the surveyor referred to in rule 40D.34(1) must –

(a) determine the actual displacement and position of the centre of gravity for the lightship condition; and

(b) produce righting lever curves for the ship in the following conditions:

(i) departure for the fishing grounds with full fuel, stores, ice, and fishing gear; and

(ii) arrival at home port with full catch and 10 per cent fuel and stores; and

(c) confirm that the righting lever curves for the load conditions of rule 40D.34(4)(b) meet the criteria of rule 40D.33(2)(d); and

(d) prepare stability information in a form prescribed by the Director, which must be kept by the owner and made available on request to a surveyor or the Director.

(5) The owner of any new ship of less than 12 metres in length that is engaged in fishing operations using towed gear must ensure that the ship, either –

(a) complies with the requirements of rules 40D.34(3) and 40D.34(4); or

(b) is subject, on completion, to an inclining test conducted or witnessed by a surveyor recognised for that purpose by the Director under rule 46.29. On completion of that inclining test, that surveyor must confirm that the metacentric height of the ship for the departure for the fishing grounds condition with full fuel, stores, ice, and fishing gear is not less than 0.75 metres.

(6) Any new non-decked ship or new partially decked ship must be fitted with buoyancy compartments distributed so that the ship will stay afloat and in good trim, without listing if flooded. This buoyancy must be demonstrated by –

(a) calculation, using the following formula:

Buoyancy (litres) = Hull (kgs) + Equipment (kgs) + Motor (kgs) + 250M where M = 0.1 x L x B L = length overall B = maximum beam

For a wooden ship, the calculations may take into account half the volume of buoyancy of wood; or

(b) completing the following practical test:

The ship must be loaded with a simulation of the equipment and motor weights plus 250M kgs and then be flooded to the point of submergence. The ship must then bear a weight of 15 kgs on the gunwhale amidships on one side of the ship without capsizing.

(7) The cockpit of any new ship to which this rule applies must be watertight and self- draining. The ship must have a reserve of buoyancy and its static stability must remain intact when the cockpit is full of water. With the boat upright and at its deepest load draught, the cockpit must be capable of self-draining in 3 minutes.

(8) The owner of any existing ship of 12 metres or more in length, but less than 24 metres in length, that is engaged in trawling, dredging, or other forms of fishing where the heavy gear is towed, or engaged in purse seining, must ensure that the ship complies with the requirements of rules

40D.34(1) and 40D.34(2) from the day which is two years after the day on which this Part comes into force.

(9) The owner of any existing ship of less than 12 metres in length that is engaged in fishing operations using towed gear, must ensure that the ship complies with the requirements of rule 40D.34(5) from the day which is two years after the day on which this Part comes into force.

40D.35 Freeboard

(1) The surveyor must be satisfied that the bow height of any ship to which rules 40D.33, 40D.34(1), 40D34(3) and 40D.34(5) apply is sufficient to prevent the excessive shipping of water. In determining the sufficiency of bow height the surveyor must take into account –

- (a) the seasonal weather conditions; and
- (b) the sea states in which the ship will operate; and
- (c) the type of ship; and
- (d) its mode of operation.

(2) For any ship to which rules 40D.33, 40D.34(1), and 40D.34(5) apply, a maximum permissible operating draught, and if appropriate a maximum permissible trim, must be approved by the surveyor referred to in rules 40D.33, 40D.34(1) and 40D.34(5) in accordance with rules 40D.35(3) and (4).

(3) A maximum permissible operating draught, and if applicable maximum permissible trim, must be —

- (a) such that in the associated operating condition, the stability criteria of rule 40D.33(2)(d) are satisfied in the case of any ship to which rules 40D.33 and 40D.34(1) apply, and the scantling draught is not exceeded; and
- (b) clearly noted in the stability information required by rules 40D.33(5) and 40D.34(2)(d); and
- (c) posted up in the wheelhouse, in a prominent position, clearly visible to the master and crew of the ship.

(4) Each ship for which a maximum permissible operating draught is approved by a surveyor must be marked with a load line amidships, port and starboard. Where a maximum permissible trim by the stern is also approved by the surveyor, a load line must be marked on the transom or stern of the ship to indicate the maximum permissible submergence of the transom or stern at that position. Load lines must be 300 mm long by 30 mm deep permanently marked and painted light on dark background or dark on light background. The upper edge of the load line must coincide with the maximum permissible operating draught.

(5) Rules 40D.35(2), (3) and (4) shall not apply to an existing ship until the date two years after the date Part 40D comes into force.

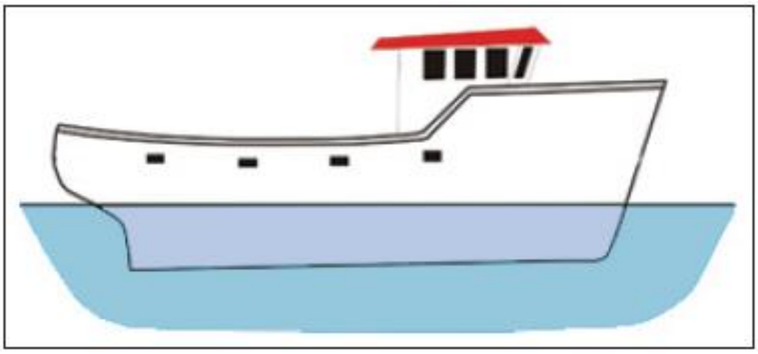
(6) For any non-decked ship or partially-decked ship to which rule 40D.34(6) applies, the freeboard when loaded with 250M kgs (as defined in rule 40D.34(6)) must not be less than 0.5 metres for a ship permitted to operate in the inshore limit and 0.35 metres for a ship permitted to operate in enclosed waters.

(7) For any ship fitted with a cockpit and to which rule 40D.34(7) applies the freeboard measured from the designed waterline for the maximum load to the lowest point of the cockpit sole must not be less than 0.2 metres.

Appendix 3 Basic principles of statical stability as contained in "Safety practices related to small fishing vessel stability", published by the Food and Agriculture Organization of the United Nations (FAO)

DISPLACEMENT

Archimedes principle: Every floating body displaces its own weight of the liquid in which it floats.

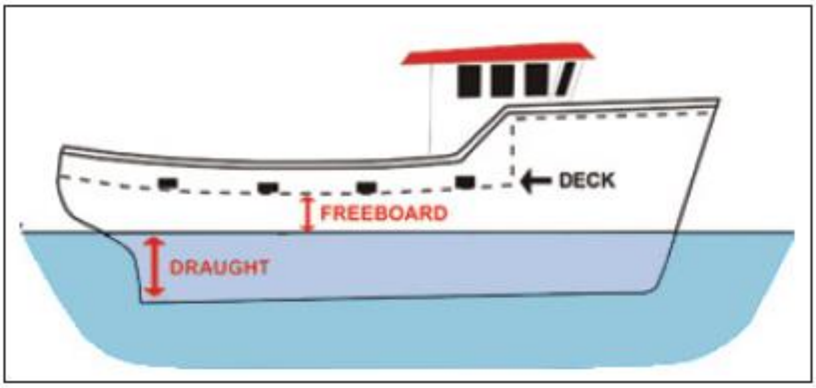


For a vessel to float freely in water, the weight of the vessel must be equal to the weight of the volume of water it displaces.

Displacement is the volume of water the vessel displaces.

DRAUGHT

Draught relates to the depth of water required for a vessel to float freely and is measured vertically from the underneath side of the keel to the waterline.

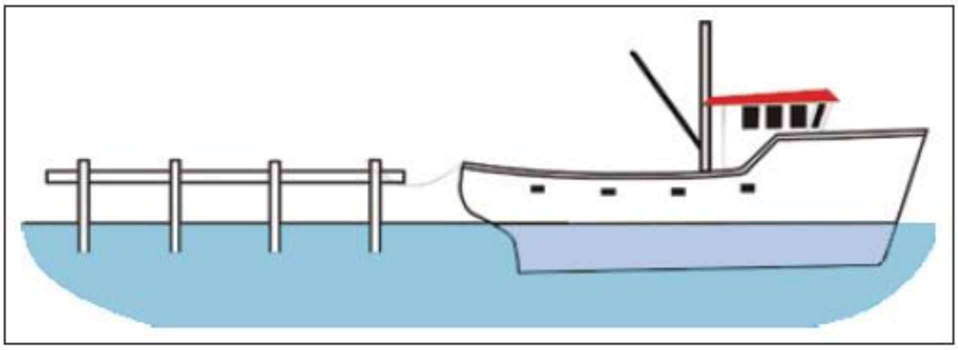


FREEBOARD

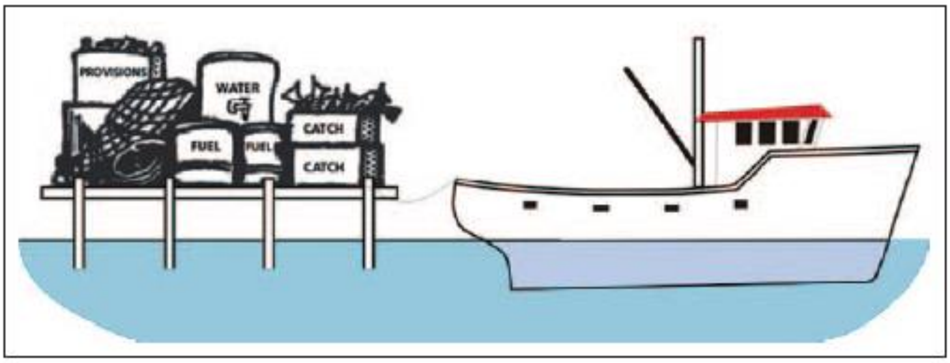
Freeboard is the vertical distance from the top of the lowest point of the working deck at the side of the vessel to the waterline.

LIGHT SHIP WEIGHT

The light ship weight is the actual weight of a vessel when complete and ready for service but empty.

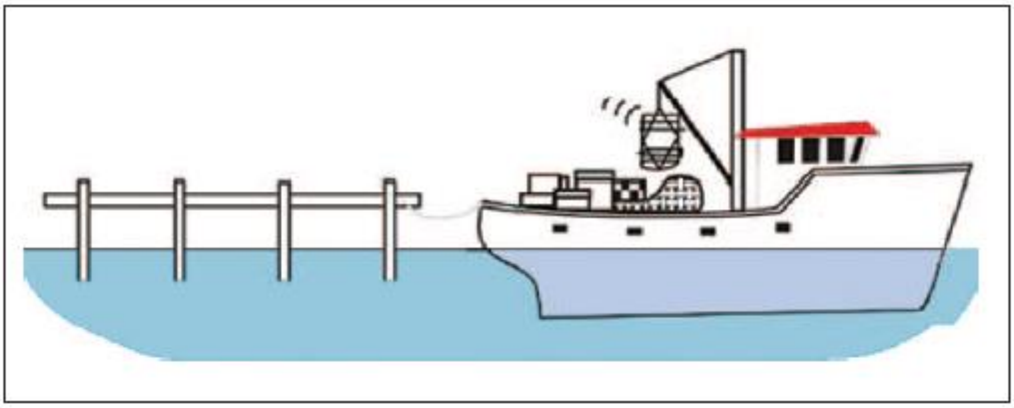


DEADWEIGHT



Deadweight is the actual amount of weight in tonnes that a vessel can carry when loaded to the maximum permissible draught (includes fuel, fresh water, gear supplies, catch and crew).

DISPLACEMENT MASS



Displacement mass is the total weight of the vessel, i.e.:

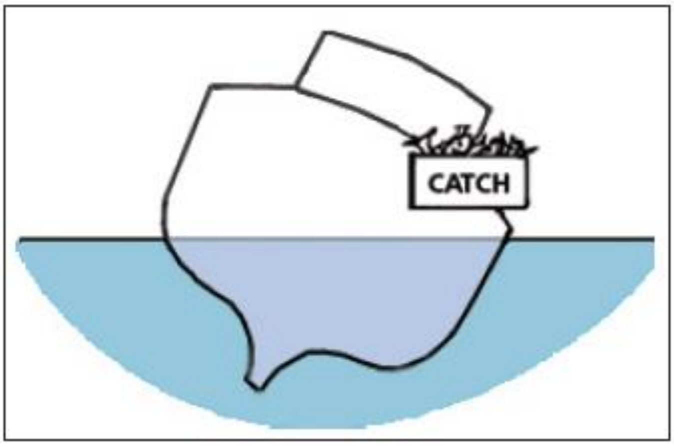
Lightship weight + deadweight = displacement mass

LIST

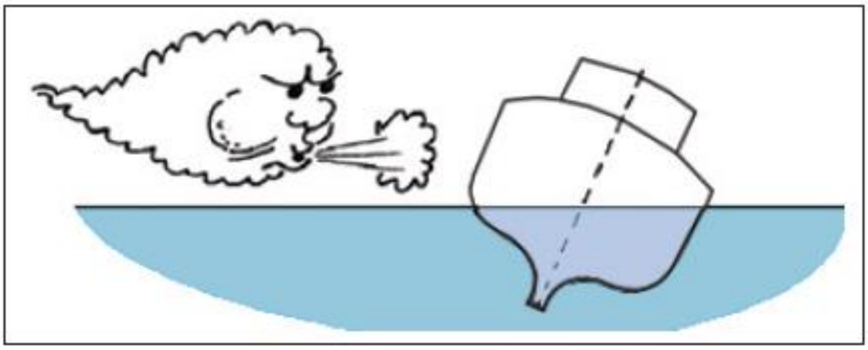
A vessel is said to be listed when it is inclined by forces within the vessel, e.g. movement of weight within the vessel.

A list reduces the stability of the vessel.

When a list is corrected by increasing the displacement mass, the additional weight should be placed as low as possible in the vessel.



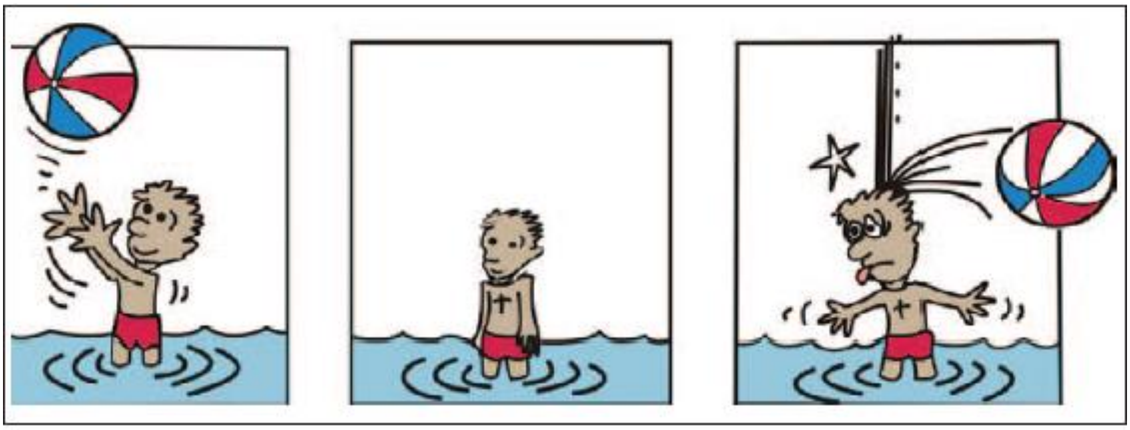
HEEL



A vessel is said to be heeled when it is inclined by an external force, e.g. from waves or the wind.

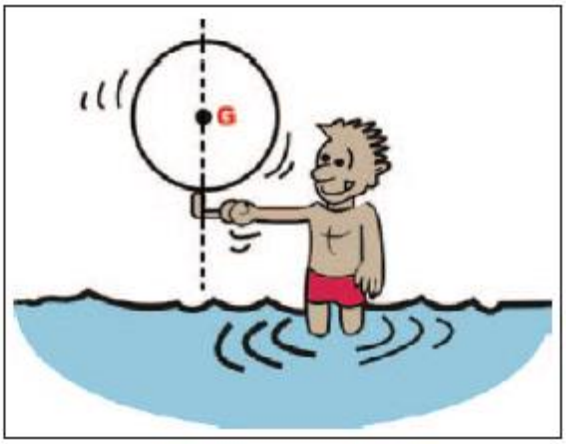
GRAVITY

"What goes up must come down". Throw a ball in the air. It soon comes back down in response to the earth's gravitational pull.

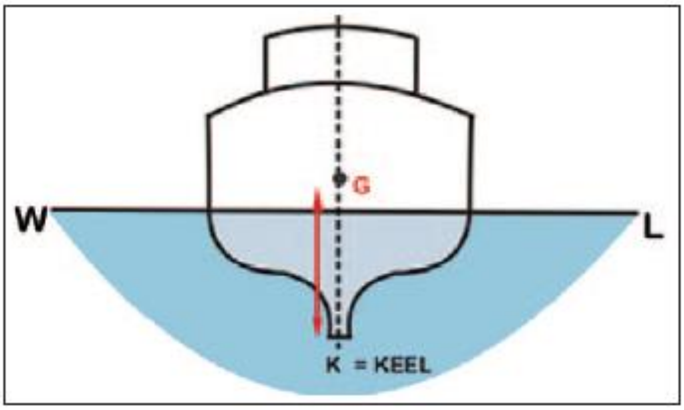


CENTRE OF GRAVITY

Centre of gravity is the point (G) at which the whole weight of a body can be said to act vertically downwards.



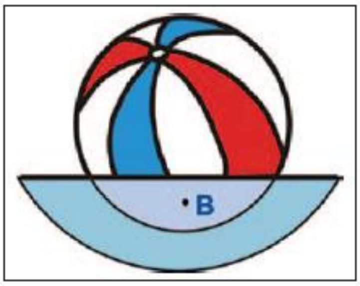
The centre of gravity depends upon weight distribution within the vessel and its position may be found by carrying out an inclining test or by calculation. The position of the centre of gravity (G) is measured vertically from a reference point, usually the keel of the vessel (K). This distance is called KG.

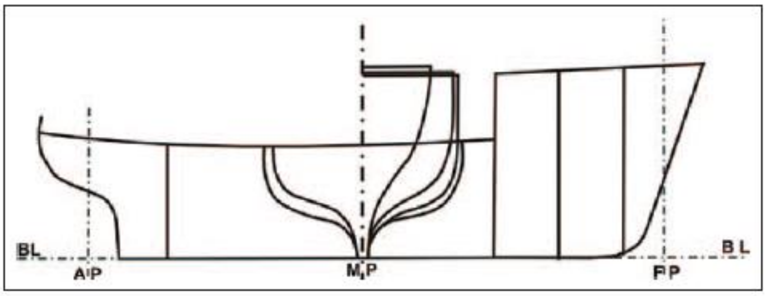


BUOYANCY

If a ball is pushed underwater it will soon bob up again. This force is called buoyancy. When a vessel floats freely, its buoyancy is equal to its displacement mass (refer to Archimedes principle on page 54).

CENTRE OF BUOYANCY



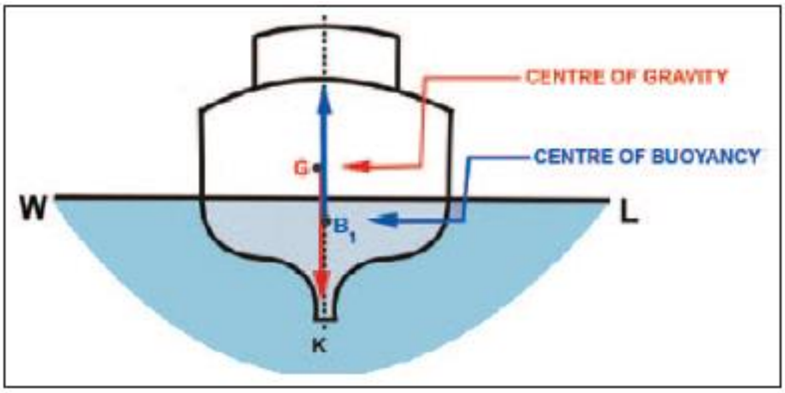


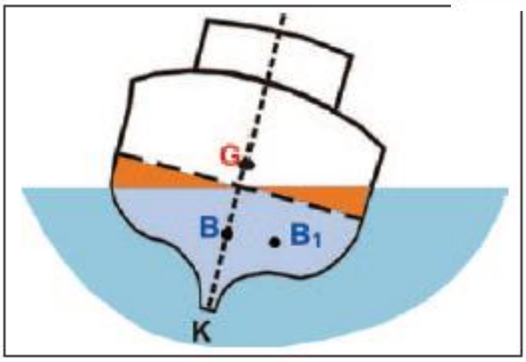
The centre of buoyancy (**B**) is the point through which the force of buoyancy is considered to act vertically upwards. It is located at the geometric centre of the underwater section of the vessel.

When the shape of the hull of a vessel is known, the designer, often a naval architect, can calculate the centre of buoyancy (**B**) for the various combinations of displacement, trim and heel.

TRANSVERSE STABILITY

When a vessel is floating upright (at equilibrium) in still water, the centre of buoyancy (upthrust) and the centre of gravity (downthrust) will be on the same line, vertically above the keel (K).

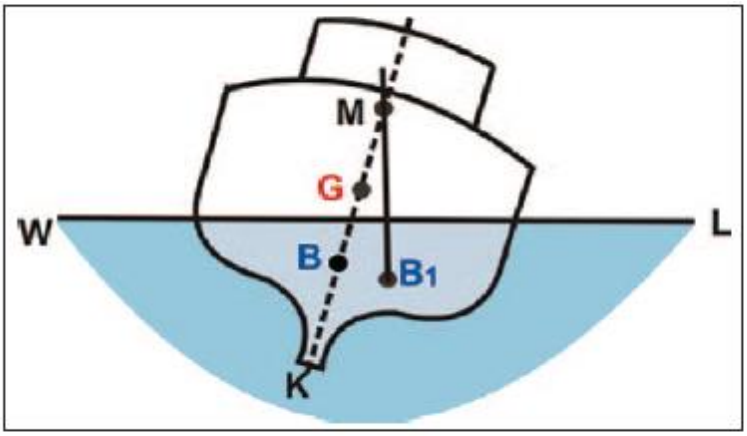




If the vessel is inclined by an external force (i.e. without moving internal weight) a wedge of buoyancy is brought out of the water on one side and a similar wedge of buoyancy is immersed on the other side. The centre of buoyancy being the centre of the underwater section of the vessel has now moved from point **B** to **B1**.

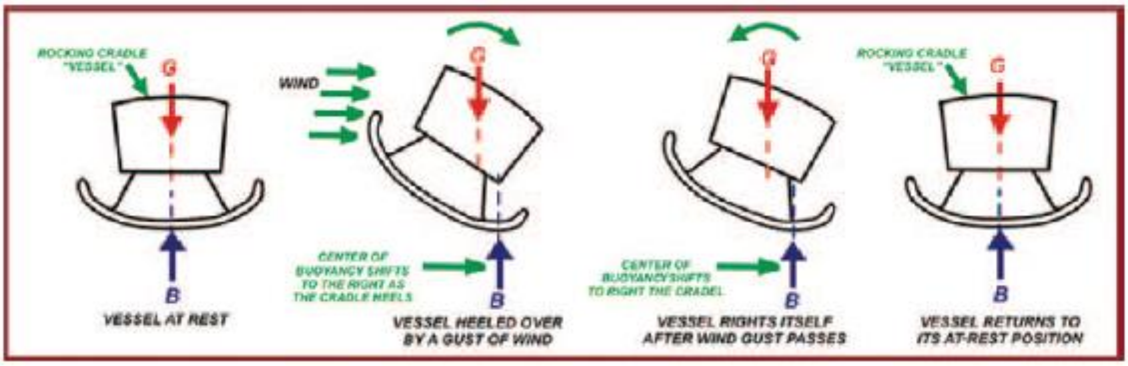
METACENTRE

Vertical lines drawn from the centre of buoyancy at consecutive small angles of heel will intersect at a point called the metacentre (**M**). The metacentre can be considered as being similar to a pivot point when a vessel is inclined at small angles of heel. The height of the metacentre is measured from the reference point (**K**) and is, therefore, called **KM**.

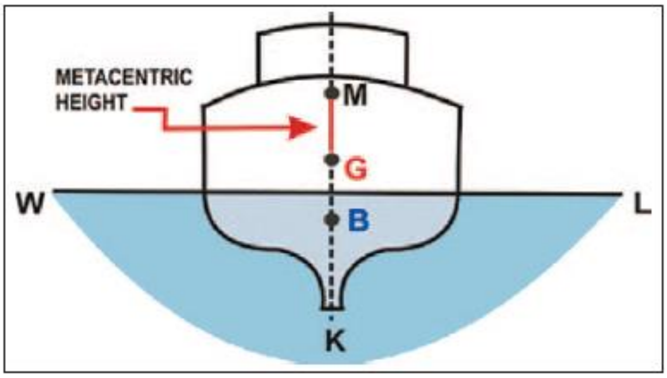


WHY A FISHING VESSEL REMAINS UPRIGHT

Another way of understanding how a fishing vessel stays upright is to imagine the rocking of a baby cradle, as shown in the figure. The fishing vessel (weight) is represented by the cradle and its centre of gravity (**G**) is the near the centre of the cradle. The “buoyant force” supporting the cradle is represented by the rocker resting on the floor and the centre of buoyancy (**B**) is the point where rocker contacts the floor. As with a fishing vessel, the cradle’s (vessel’s) centre of gravity (**G**) is above its rocker, the centre of buoyancy (**B**). The slightest disturbance (wind or waves) causes the cradle (vessel) to roll (heel) to one side. As the cradle (vessel) rolls to one side, the point where the rocker touches the floor (the centre of buoyancy (**B**)) shifts outboard. To keep the cradle (vessel) upright, the point where the rocker touches the floor (the centre of buoyancy (**B**)) must shift outboard. It is this shifting of the centre of buoyancy (**B**) that allows a fishing vessel to return to upright after being heeled by an external force.



EQUILIBRIUM



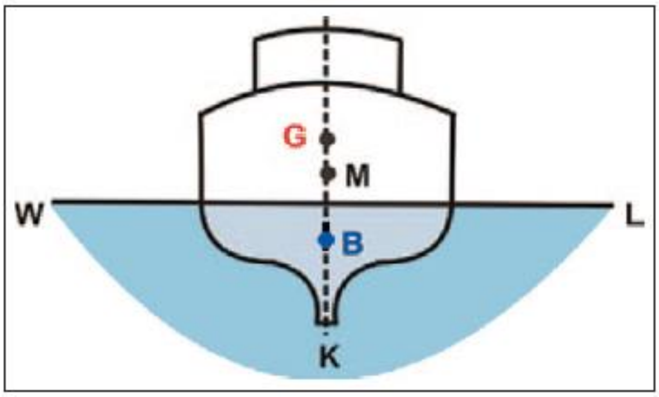
A vessel is said to be in stable equilibrium if, when inclined, it tends to return to the upright. For this to occur the centre of gravity (**G**) must be below the metacentre (**M**).

METACENTRIC HEIGHT

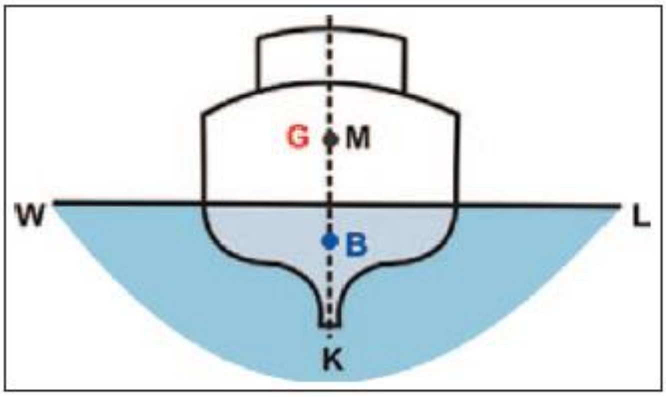
The distance between **G** and **M** is known as the metacentric height (**GM**). A stable vessel when upright is said to have a positive metacentric height (**GM**), i.e. when the metacentre (**M**) is found to be above the centre of gravity (**G**). This is usually referred to as having a positive **GM** or a positive initial stability.

UNSTABLE EQUILIBRIUM

If the centre of gravity (**G**) of a vessel is above the metacentre (**M**) the vessel is said to have a negative **GM** or a negative initial stability. A vessel in this state has a loll, i.e. it floats at an angle from the upright to one side or the other and there is a danger that it may capsize.

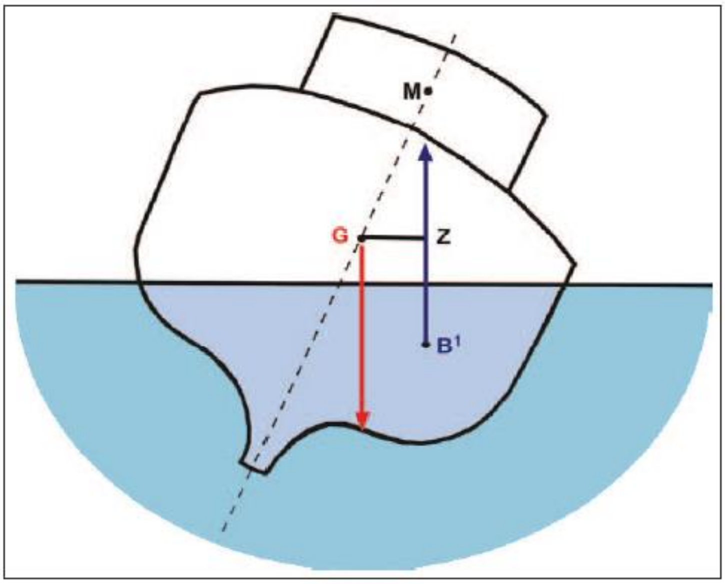


NEUTRAL EQUILIBRIUM



When the position of a vessel's centre of gravity (**G**) and the metacentre (**M**) coincide the vessel is said to be in neutral equilibrium (**Zero GM**) and if inclined to a small angle of heel it will tend to remain at that angle.

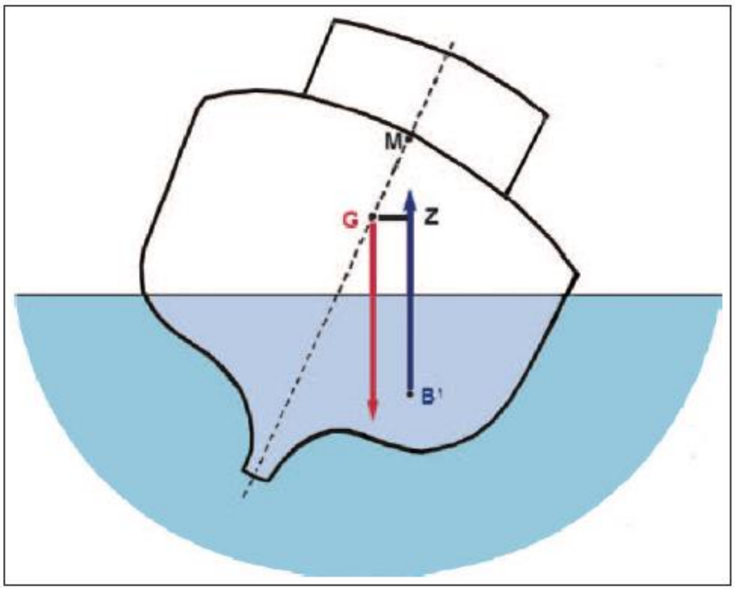
RIGHTING LEVER



When heeled by an external force, the vessel's centre of gravity (**G**), which is unaffected by the heel and the weight (of the vessel), is considered to act vertically downward through **G.** The centre of buoyancy (**B**) (being the geometric centre of the underwater section) has moved to a new position **B1** and the force of buoyancy (equal to the weight of water being displaced) is considered to act vertically up through the new centre of buoyancy **B1.**

The horizontal distance from the centre of gravity (**G**) to the vertical line from **B1** is called the **righting lever.** This distance can be measured and is usually referred to as **GZ.**

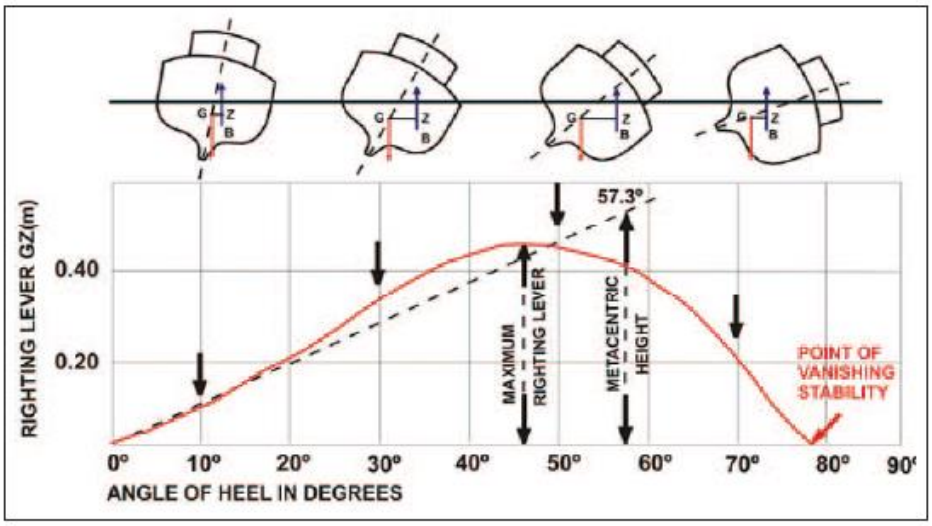
Therefore, the force involved in returning the vessel to the upright position is the weight of the vessel acting down through the centre of gravity (**G**) multiplied by the righting lever (**GZ**). This is referred to as the **moment of statical stability.**



The vessel's centre of gravity (**G**) has a distinct effect on the righting lever (**GZ**) and consequently the ability of a vessel to return to the upright position. The lower the centre of gravity (**G**), the bigger is the righting lever (**GZ**).

Should the vessel's centre of gravity (**G**) be near the metacentre (**M**) the vessel will have only a small metacentric height (**GM**) and the righting lever (**GZ**) will also be a small value. Therefore, the moment of statical stability to return the vessel to the upright position will be considerably less than that of the previous illustration.

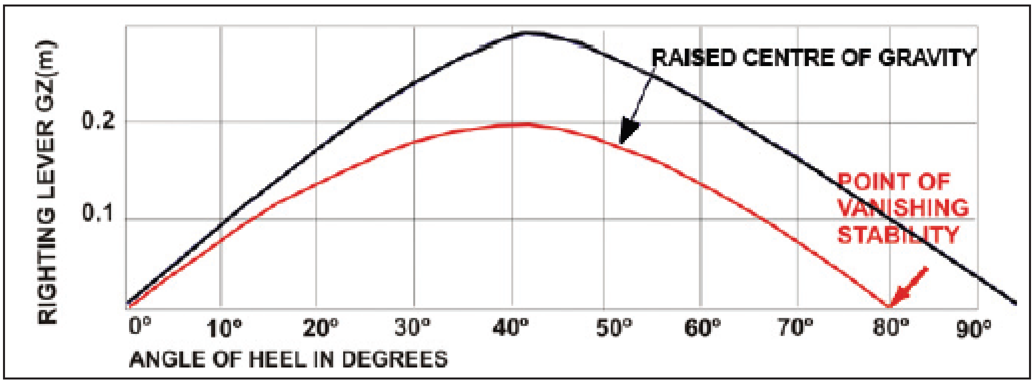
STABILITY CURVES (GZ CURVES)



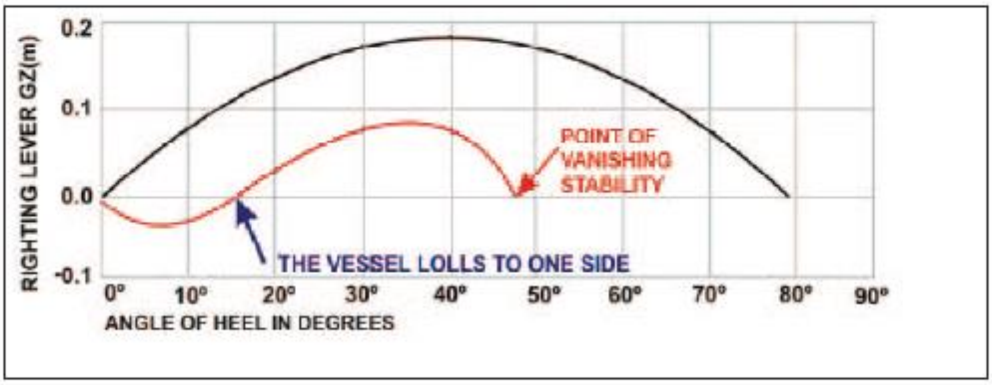
Stability curves (GZ curves) are used to show graphically the stability levers (GZ) exerted by a vessel to return itself to a position of equilibrium from the various conditions of heel. The curves have several general characteristics and the following factors should be observed:

a) the metacentric height (**GM**);
b) (b) the maximum value of the righting lever (**GZ**); and
c) (c) the point of vanishing stability.

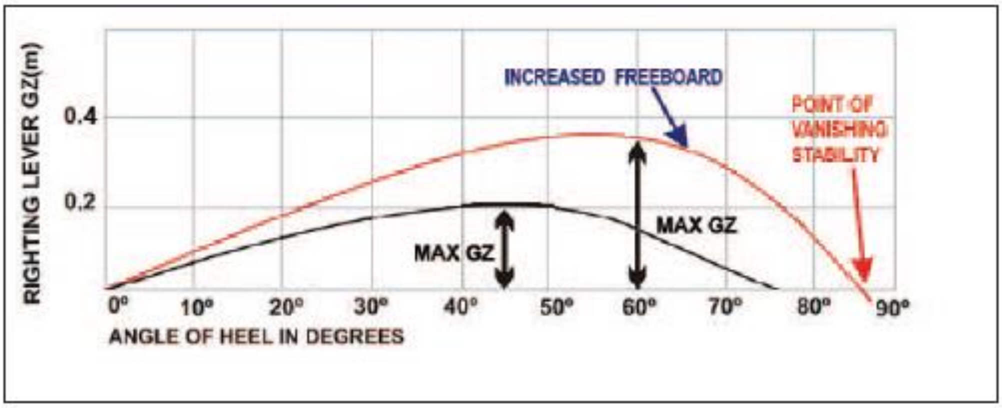
The shape of the righting lever curves is dependent on the form of the vessel's hull and its loading. The shape of the curve at small angles of heel generally follows the slope of the line plotted to the initial metacentric height (GM). In this regard, the freeboard and the ratio between the vessel's breadth and depth are also very important.



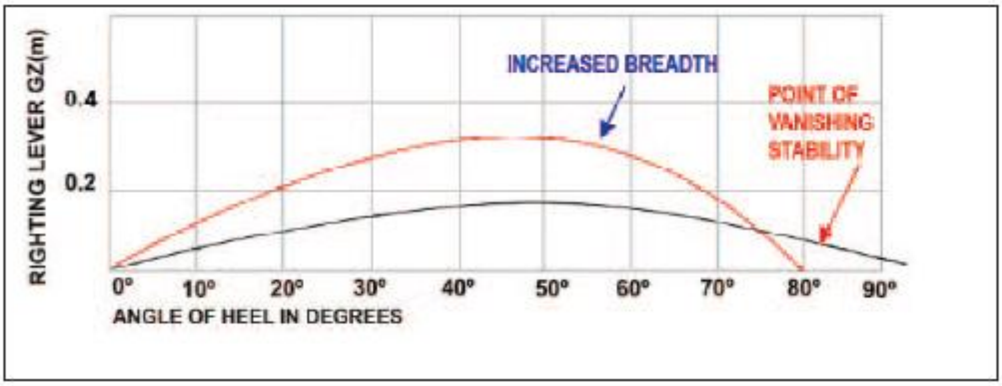
Raising the vessel's centre of gravity (**G**) causes a decrease in the metacentric height (**GM**) and thereby smaller values of the righting levers (**GZ**).



If the vessel's centre of gravity (**G**) is above the metacentre (**M**), the vessel is in an unstable equilibrium. The vessel has a negative **GM** and is not able to float upright. Either the vessel will capsize of or float at an angle from the upright to one side. (See also the section on loll on page 73).



By loading less the vessel will have more freeboard and the values of the righting lever (**GZ**) will, in general, be higher. The point of vanishing stability will also be higher, i.e. the vessel's ability to return to upright after having been heeled to large angles of heel is better.



The hull form of a vessel is an important factor in determining the characteristics of its stability. Increased breadth (beam) will result in higher values for metacentric heights (**GM**) and righting levers (**GZ**). However, the point of vanishing stability will be less, i.e. the vessel will capsize at a smaller angle of heel.

DYNAMIC STABILITY

This is the stability characteristic of the vessel when moving (particularly rolling) and is the energy necessary to incline a vessel to a certain angle of heel and thereby counteract the **moment of statical stability.**

The dynamic stability may be determined by measuring the area under the righting lever curve (**GZ** curve) up to a certain angle of heel. The larger the area, the better is the dynamic stability. Waves are the most common external force that causes a vessel to heel. Steep waves with short wavelengths, particularly breaking waves, are the most dangerous to small vessels. The relationship between a vessel's dynamic stability and wave energy is complex and is, for example, dependent on the speed and course of the vessel in relation to the speed and direction of the wave. However, in general, the smaller the vessels, the smaller the waves they are able to cope with.

The skipper should keep himself informed on weather forecasts in order to have sufficient time to avoid any weather conditions that could threaten the safety of his vessel.

Appendix 4 *Easy Rider* hydrostatic model and stability calculation

Origin of the model

A4.1 The Transport Accident Investigation Commission (the Commission) was unable to locate the as-built plans and other hydrostatic data for the *Easy Rider* itself, to use as a basis for calculating the *Easy Rider*'s stability. The stability profile presented below is the result of calculations made using an estimated hydrostatic model. The model was estimated using hydrostatic data available from other vessels built to the same design.

Hull-form

A4.2 The Commission had access to a copy of the original lines plan for a sister vessel. This lines plan was used to develop a hull-form. A naval architect took a set of hull-form measurements from another sister vessel and also performed a test to determine its vertical centre of gravity. The naval architect made the data available to the Commission and it was used to verify the hydrostatic model. Another naval architect had performed similar tests on another sister vessel; that data was also used to verify the model.

Uncertainty

A4.3 The various “Owenga” class vessels were built in different geographical locations at different times over several years. The first was launched in the late 1960s. Owing to the nature of shipbuilding, the characteristics of individual vessels would vary from the design. No two vessels would be identical, and some could deviate significantly from the design. The variations in hydrostatic characteristics between vessels built to the same design mean that the hydrostatic data used in this report may differ from that of the *Easy Rider*.

Vessel weights' estimate

The weights accounted for in this report are outlined as follows.

Weight name	Description	Origin of data
Lightship weight	The weight of the vessel in ready-for-service but empty condition. For example, no fuel or fresh water, no cargo, no fishing bait/ice/catch on board.	The lightship weight and vertical centre of gravity used in the model were taken from a naval architect's report on a sister vessel.
Fuel tanks	As per fuel tanks given in the design of a sister vessel.	Volume and location derived from interviews and a naval architect's report on a sister vessel.
Vessel stores	Stores related to the fishing vessel, not the muttonbirders.	Weight and location estimated from naval architect's report.
Fresh water drum	A drum used to carry fresh water for the vessel crew, not the passengers.	Volume and location estimated from photographs and interview records.
Vessel crew	The crew of the vessel not including the passengers.	Weights estimated from autopsy report. Location estimated from interview with survivor.
Fishing load	The load on board the vessel related to fishing operations, for example cod and cray pots.	Weight estimated from records. Location estimated from photographs and interview records.
Ice/Bait	Fishing bait and ice.	Weight and location estimated

		from naval architect's reports on a sister vessel.
Cargo	Includes the total weight due to the carriage of the passengers and their cargo. Includes the weight of passengers and their personal effects and food, and also the equipment, raw materials and consumables they were taking to Big South Cape Island.	The weights and locations of the passengers were estimated from interview and autopsy reports. The weights and locations of their equipment etc. were estimated from photographs, pre-departure and interview records.

Load cases

Three load cases were considered:

1. the stability for the vessel in a 50 percent loaded condition. Considered to be the load case in which the vessel probably spent most of its working life, with 50 percent fuel, water ice, bait and catch and a crew of 3

2. estimated typical departure from Bluff on a fishing voyage, with full fuel tanks, water, ice and bait, vessel stores and provisions and a crew of 3

3. estimation of the *Easy Rider*'s loading as the vessel left port on 15 March. Similar to load case 2 but with the addition of the 6 passengers and their equipment and stores.

Stability

Results given include primary hydrostatic data and GZ curve up to 70 degrees.

Load case 1 – 50% load

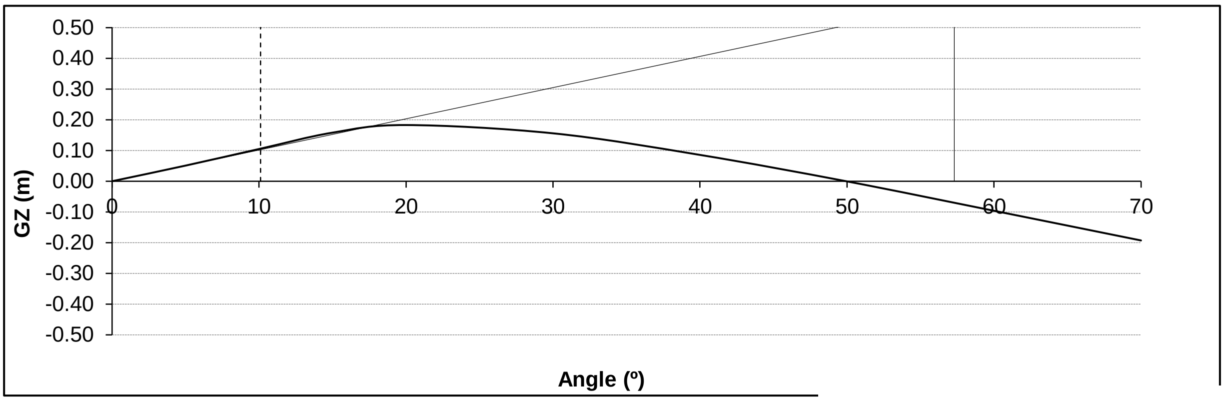
This load case is assumed to be representative of a fishing condition with 50 percent loading.

CONDITION No. 1	**50% load condition**								
ITEM	**LOADING** PERCENT	**WEIGHT** TONNES	**LCG** METRES	**L. MOM** TONNE METRES	**VCG** METRES	**V. MOM** TONNE-METRES	**TCG** METRES	**T. MOM** TONNE-METRES	**FSM** TONNE-METRES
FUEL									
Fuel Stb	50%	1.40	5.53	7.75	1.00	1.39	1.38	1.93	0.08
Fuel Pt	50%	1.40	5.53	7.75	1.00	1.39	-1.38	-1.93	0.08
(SUB TOTAL)		**2.80**		**15.50**		**2.79**		**0.00**	**0.16**
Vessel Load									
FW Drum	50%	0.10	6.27	0.63	2.30	0.23	-1.50	-0.15	0.00
Vessel Stores		0.10	6.15	0.61	2.80	0.28	0.00	0.00	-
Vessel Crew		0.34	6.94	2.39	2.22	0.76	-0.12	-0.04	-
Fishing Load		0.57	3.48	1.97	2.47	1.39	0.00	0.00	-
Ice/Bait		2.46	2.60	6.39	1.67	4.11	0.00	0.00	-
(SUB TOTAL)		**3.57**		**11.99**		**6.78**		**-0.19**	**0.00**
Cargo Load									
		0.00	3.57	0.00	2.66	0.00	0.14	0.00	
(SUB TOTAL)		**0.00**		**0.00**		**0.00**		**0.00**	**0.00**
TOTAL DEADWEIGHT		6.37	4.32	27.49	1.50	9.57	-0.03	-0.19	
LIGHTSHIP WEIGHT		17.53	5.03	88.11	1.84	32.17	0.00	0.00	
TOTAL DISPLACEMENT		**23.90**	**4.84**	115.61	**1.75**	41.73	**-0.01**	-0.19	0.0

Stability:

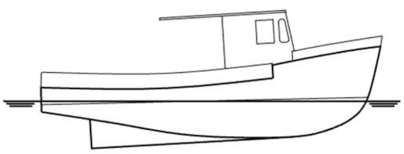
DRAFTS (HYDROSTATICS)				**DRAFT AT MARKS**		
DRAFT (USK) @ LCF	1.39	m		FWD DRAFT (USK)	-	m
DRAFT (USK) @ FP	1.02	m		AFT DRAFT (USK)	-	m
DRAFT (USK) @ AP	1.67	m				
PRIMARY HYDROSTATIC DATA						
L_{WL}	10.52	m		KG_{SOLID}	1.75	m
LCB FROM AP	4.87	m		FREE SURFACE CORRECTION	0.00	m
LCF FROM AP	4.58	m		KG_{FLUID} (ABOVE BASELINE)	1.75	m
MCTC	0.19	t-m		KM_O (ABOVE BASELINE)	2.33	m
TRIM OVER L_{BP}	0.66	m	BY STERN	GM_{FLUID}	0.58	m

Angle Degrees	**0**	**5**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**
SIN θ	0.000	0.087	0.174	0.342	0.500	0.643	0.766	0.866	0.940	
KN	0.01	0.20	0.41	0.78	1.03	1.21	1.34	1.42	1.45	
KG_{FLUID}SIN θ	0.00	0.15	0.30	0.60	0.87	1.12	1.34	1.51	1.64	
GZ_{FLUID}	0.00	0.05	0.10	0.18	0.16	0.09	0.00	-0.10	-0.19	



θ_{DE}= DECK EDGE IMMERSION ANGLE = 10 degrees

STABILITY CRITERIA	**ACTUAL**		
AREA 0º-30º	0.056	m-rads	
AREA 0º- 40 º or 0º - θ_F	0.067	m-rads	
AREA 30º- 40 º or 30º - θ_F	0.012	m-rads	
GZ_{FLUID} @ 30º OR GREATER	0.09	m	
ANGLE FOR MAX. GZ_{FLUID}	20.9	•	degrees
GM_{FLUID}	0.58	m	



Load case 2 – Departure from home port, normal fishing voyage

With full fuel tanks, water, ice, bait, vessel stores and provisions and a crew of 3.

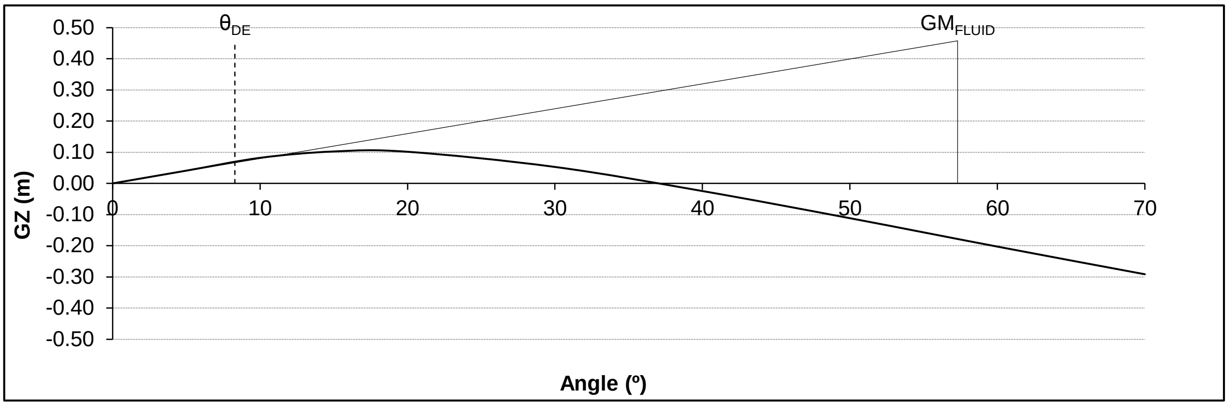
CONDITION No. 2 **Departure from home port normal fishing voyage**

ITEM	LOADING PERCENT	WEIGHT TONNES	LCG METRES	L. MOM TONNE METRES	VCG METRES	V. MOM TONNE-METRES	TCG METRES	T. MOM TONNE-METRES	FSM TONNE-METRES
FUEL									
Fuel Stb	100%	1.40	5.54	7.76	1.29	1.80	1.42	1.99	0.00
Fuel Pt	100%	1.40	5.54	7.76	1.29	1.80	-1.42	-1.99	0.00
(SUB TOTAL)		**2.80**		**15.51**		**3.61**		**0.00**	**0.00**
Vessel Load									
FW Drum	100%	0.20	6.27	1.25	2.30	0.46	-1.50	-0.30	0.00
Vessel Stores		0.20	6.15	1.23	2.80	0.56	0.00	0.00	-
Vessel Crew		0.34	6.94	2.39	2.22	0.76	1.11	0.38	-
Fishing Load		1.13	3.48	3.94	2.47	2.79	0.00	0.00	-
Ice/Bait		2.46	2.60	6.39	1.67	4.11	0.00	0.00	-
(SUB TOTAL)		**4.33**		**15.20**		**8.68**		**0.08**	**0.00**
Cargo Load									
Passengers' Cargo Load		0.00	3.57	0.00	2.66	0.00	-0.01	0.00	
(SUB TOTAL)		**0.00**		**0.00**		**0.00**		**0.00**	**0.00**
TOTAL DEADWEIGHT		7.14	4.30	30.71	1.72	12.29	0.01	0.08	
LIGHTSHIP WEIGHT		17.53	5.03	88.11	1.84	32.17	0.00	0.00	
TOTAL DISPLACEMENT		**24.67**	**4.82**	118.82	**1.80**	44.46	**0.00**	0.08	0.0

Stability:

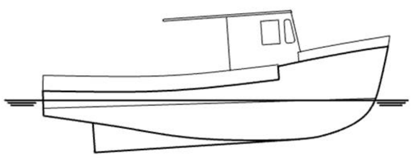
DRAFTS (HYDROSTATICS)				**DRAFT AT MARKS**		
DRAFT (USK) @ LCF	1.50	m		FWD DRAFT (USK)	-	m
DRAFT (USK) @ FP	1.08	m		AFT DRAFT (USK)	-	m
DRAFT (USK) @ AP	1.81	m				
PRIMARY HYDROSTATIC DATA						
L_{WL}	10.55	m		KG_{SOLID}	1.80	m
LCB FROM AP	4.77	m		FREE SURFACE CORRECTION	0.00	m
LCF FROM AP	4.60	m		KG_{FLUID} (ABOVE BASELINE)	1.80	m
MCTC	0.19	t-m		KM_O (ABOVE BASELINE)	2.26	m
TRIM OVER L_{BP}	0.73	m	BY STERN	GM_{FLUID}	0.46	m

Angle Degrees	0	5	10	20	30	40	50	60	70	80
SIN θ	0.000	0.087	0.174	0.342	0.500	0.643	0.766	0.866	0.940	
KN	0.01	0.20	0.40	0.72	0.95	1.13	1.27	1.36	1.40	
KG_{FLUID}SIN θ	0.00	0.16	0.31	0.62	0.90	1.16	1.38	1.56	1.69	
GZ_{FLUID}	0.00	0.04	0.08	0.10	0.05	-0.02	-0.11	-0.20	-0.29	



θ_{DE}= DECK EDGE IMMERSION ANGLE = 8 degrees

STABILITY CRITERIA	ACTUAL	
AREA 0º-30º	0.037	m-rads
AREA 0º- 40 º or 0º - θ_F	0.040	m-rads
AREA 30º- 40 º or 30º - θ_F	0.003	m-rads
GZ_{FLUID} @ 30º OR GREATER	-0.02	m
ANGLE FOR MAX. GZ_{FLUID}	17.3	• degrees
GM_{FLUID}	0.46	m



Load case 3 – Departure from home port, 14 March 2012

As for load case 2 with passengers and their cargo added.

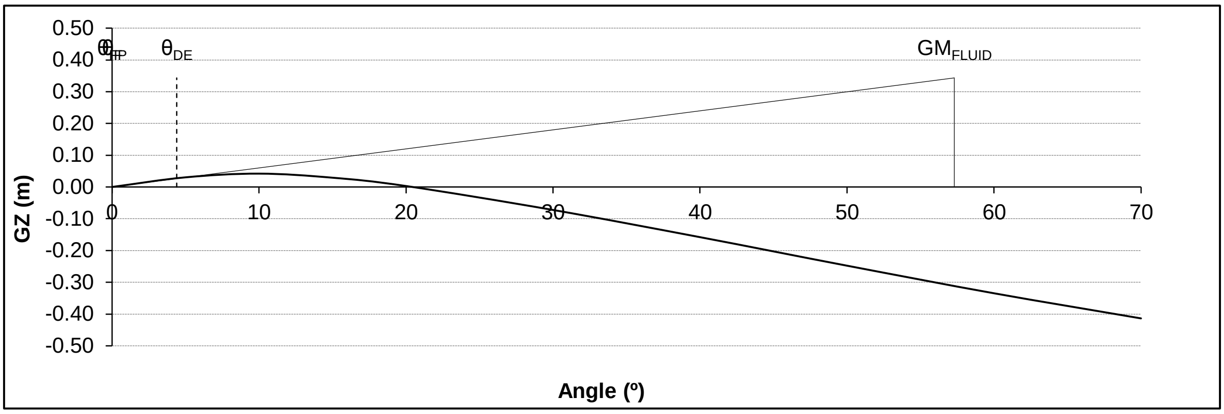
CONDITION No. 3 Departure from home port, 14 March 2012

ITEM	LOADING PERCENT	WEIGHT TONNES	LCG METRES	L. MOM TONNE METRES	VCG METRES	V. MOM TONNE-METRES	TCG METRES	T. MOM TONNE-METRES	FSM TONNE-METRES
FUEL									
Fuel Stb	100%	1.40	5.54	7.76	1.29	1.80	1.42	1.99	0.00
Fuel Pt	100%	1.40	5.54	7.76	1.29	1.80	-1.42	-1.99	0.00
(SUB TOTAL)		2.80		15.51		3.61		0.00	0.00
Vessel Load									
FW Drum	100%	0.20	6.27	1.25	2.30	0.46	-1.50	-0.30	0.00
Vessel Stores		0.20	6.15	1.23	2.80	0.56	0.00	0.00	-
Vessel Crew		0.34	6.94	2.39	2.22	0.76	1.11	0.38	-
Fishing Load		1.13	3.48	3.94	2.47	2.79	0.00	0.00	-
Ice/Bait		2.46	2.60	6.39	1.67	4.11	0.00	0.00	-
(SUB TOTAL)		4.33		15.20		8.68		0.08	0.00
Cargo Load									
Passengers' Cargo		2.75	3.57	9.82	2.66	7.32	-0.01	-0.04	
(SUB TOTAL)		2.75		9.82		7.32		-0.04	0.00
TOTAL DEADWEIGHT		9.89	4.10	40.54	1.98	19.61	0.00	0.04	
LIGHTSHIP WEIGHT		17.53	5.03	88.11	1.84	32.17	0.00	0.00	
TOTAL DISPLACEMENT		27.42	4.69	128.65	1.89	51.78	0.00	0.04	0.0

Stability:

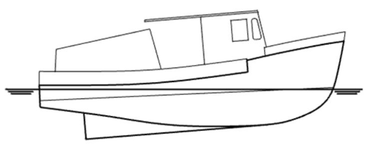
DRAFTS (HYDROSTATICS)				DRAFT AT MARKS		
DRAFT (USK) @ LCF	1.58	m		FWD DRAFT (USK)	-	m
DRAFT (USK) @ FP	1.08	m		AFT DRAFT (USK)	-	m
DRAFT (USK) @ AP	1.97	m				
PRIMARY HYDROSTATIC DATA						
L_{WL}	10.56	m		KG_{SOLID}	1.89	m
LCB FROM AP	4.63	m		FREE SURFACE CORRECTION	0.00	m
LCF FROM AP	4.60	m		KG_{FLUID} (ABOVE BASE LINE)	1.89	m
MCTC	0.19	t-m		KM_O (ABOVE BASELINE)	2.23	m
TRIM OVER L_{BP}	0.89	m	BY STERN	GM_{FLUID}	0.34	m

Angle Degrees	0	5	10	20	30	40	50	60	70	80
SIN θ	0.000	0.087	0.174	0.342	0.500	0.643	0.766	0.866	0.940	
KN	0.01	0.20	0.37	0.65	0.87	1.06	1.20	1.30	1.36	
KG_{FLUID}SIN θ	0.00	0.16	0.33	0.65	0.94	1.21	1.45	1.64	1.77	
GZ_{FLUID}	0.00	0.03	0.04	0.00	-0.07	-0.16	-0.25	-0.33	-0.41	



θ_{DE}= DECK EDGE IMMERSION ANGLE = 4 degrees

STABILITY CRITERIA	ACTUAL		
AREA 0º-30º	0.009	m-rads	
AREA 0º- 40 º or 0º - θ_F	0.009	m-rads	
AREA 30º- 40 º or 30º - θ_F	0.000	m-rads	
GZ_{FLUID} @ 30º OR GREATER	-0.16	m	
ANGLE FOR MAX. GZ_{FLUID}	10	•	degrees
GM_{FLUID}	0.34	m	



Weight of crew/passengers on board the *Easy Rider*

Crew/Passenger	Note	Individual weight (kg)
Skipper	Approximate weight	80
Crew member 1	Actual weight	130
Crew member 2	Weight from pathologist	131
Passenger 1	Weight from pathologist	96
Passenger 2	Weight from pathologist	126
Passenger 3	Weight from Pathologist	184
Passenger 4	Approximate weight	25
Passenger 5	Approximate weight	75
Passenger 6	Approximate weight	83
Total weight of crew/passengers		930

Total weight of cargo (recovered & known unrecovered) + fuel + fresh water + persons on board	
Known unrecovered items	4416
Total weight of crew/passengers	930
Recovered items	1487
Total weight	6833

The total weight used in this calculation does not constitute the total weight of all cargo, stores, equipment and personal effects on board; only the weight of known and recovered items. Where weights have been estimated they have been sourced from the average weights of these items readily available on the open market.

Easy Rider recovered items with weights				
Item	**Location on vessel**	**Unit weight (kilogram)**	**Units**	**Total weight (kilogram)**
Vessel items				
Blue dinghy	Above wheelhouse	43	1	43
Fish box, grey (contains wax slabs)	Forecastle	27	1	27
Fish bin (7 in number) set1	Upper deck aft	3.85	7	27
Fish bin (7 in number) set2	Upper deck aft	3.42	7	24
Fish bin with assorted items	Upper deck aft	15	1	15
Fish bin with green bucket	Upper deck aft	7	1	7
Fish bin grey (with wax slabs)	Upper deck aft	47	1	47
Fish bin with wax slabs 1	Upper deck aft	19	1	19
Fish bin with wax slabs 2	Upper deck aft	23	1	23
Fish bin with ropes	Upper deck aft	19	1	19
Blue drum with ropes	Upper deck aft	45	1	45
Cargo items				
Compressed gas cylinder	Upper deck aft	38	1	38
Compressed gas cylinder	Upper deck aft	41	1	41
Compressed gas cylinder	Upper deck aft	37	1	37
Compressed gas cylinder	Upper deck aft	38	1	38
Compressed gas cylinder	Upper deck aft	38	1	38
Compressed gas cylinder	Upper deck aft	38	1	38
Compressed gas cylinder (small)	Upper deck aft	7	1	7
Fuel container, red, 1	Upper deck aft	18	1	18
Fuel container, red, 2	Upper deck aft	15	1	15
Fuel container, red, 3	Upper deck aft	16	1	16
Fuel container, red, 4	Upper deck aft	19	1	19
Crate red (contains wax)	Upper deck aft	15	1	15
Crate (big plastic)	Upper deck aft	47	1	47
White paint container	Upper deck aft	11.5	1	11.5
Wood (2.70 x 0.075 x 0.05 metres)	Upper deck aft	4.42	7	31
Wood (1.52 x 0.075 x 0.05 metres)	Upper deck aft	3.1	10	31
Wood (short rounds)	Upper deck aft	4.8	6	29
Blue drum (big) empty (0.57 x 0.95 metres)	Upper deck aft	9	1	9
Blue drum empty 1	Upper deck aft	7	1	7
Blue drum empty 2	Upper deck aft	6.5	1	6.5
Blue drum with assorted items 1	Upper deck aft	18	1	18
Blue drum with assorted items 2	Upper deck aft	38	1	38
Blue drum with assorted items 3	Upper deck aft	22	1	22
Blue drum with assorted items 4	Upper deck aft	34	1	34
Insulated container (chilly bin)	Upper deck aft	2	1	2
Cage	Upper deck aft	42.5	1	42.5
Inflatable dinghy	Upper deck aft	46	1	46
Oil drum containing diesel/petrol	Upper deck aft	225	1	225
Engine oil black drum	Upper deck aft	18	1	18
Door (silver)	Upper deck aft	31	1	31

Easy Rider recovered items with weights				
Item	**Location on vessel**	**Unit weight (kilogram)**	**Units**	**Total weight (kilogram)**
Black lid 1 (same length as door)	Upper deck aft	15	1	15
Black lid 2	Upper deck aft	14	1	14
Grey bin cover	Upper deck aft	7	1	7
Assorted items 1	Upper deck aft	50	1	50
Assorted items 2	Upper deck aft	14	1	14
First aid kit	Wheelhouse?	2.5	1	2.5
Assorted food products	**Upper deck aft**	120	1	120
Total weight of recovered cargo and vessel's equipment				**1487**

Weights of unrecovered items known to be on board *Easy Rider*					
Description	**Location on vessel**	**Unit weight** (kilogram	**Units**	**Weight** (kilogram)	**Note**
Known unrecovered Items					
Life-raft	Above wheelhouse	40	1	40	Obtained from manufacturer
Boxes of wax	Upper deck aft	30	5	150	Weight obtained from supplier
Barrel of salt (density 1.154 grams per cubic centimetre)	Upper deck aft	279	1	279	Calculated from bulk density of salt and barrel dimensions
Water pump (assuming an Onga Hi Flo-150 centrifugal pump)	Upper deck aft	42	1	42	Appearance in photo, similar to "Onga Hi Flo centrifugal pump"
Chainsaw	Upper deck aft	4	1	4	Estimated weight from retail outlet
Large empty diesel tank	Upper deck aft				Dimensions unknown
Brushcutter	Upper deck aft	6	1	6	Estimated weight from retail outlet
Plywood sheets	Upper deck aft	19	6	114	Estimated weight from manufacturer
Door	Upper deck aft	31	1	31	Appearance in photo, similar to recovered door
Corrugated iron roofing sheets	Upper deck aft	10	4	40	Estimated weight from roofing supplier
Cod pots	Upper deck aft	100	8	800	Weight obtained from manufacturer
Cray pots	Upper deck aft	85	2	170	Weight obtained from manufacturer
Cage	Upper deck aft	40	2	80	Similar cage weighed
Fresh water drum	Upper deck aft	200	1	200	Weight calculated from dimensions of similar drum
Bait	Fish hold	24	15	360	Weight obtained from supplier
Ice	Fish hold	2100	1	2100	Weight obtained from supplier
Total weight of known unrecovered items				**4416**	

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09-205	Stern trawler Pantas No.1, fatality while working cargo, No.5 berth, Island Harbour, Bluff, 22 April 2009
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