# Accident Report

## Foundering resulting in 2 fatalities

## *Viper 1*

16 March 2009

Maritime New Zealand

Maritime New Zealand (MNZ) is a Crown Entity appointed under section 429 of the Maritime Transport Act 1994, with the responsibility to promote maritime safety, security and the protection of the marine environment.

Section 431 of the Maritime Transport Act sets out MNZ's functions. One of those functions is to investigate and review maritime transport accidents and incidents.

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# TABLE OF CONTENTS

# 1. SUMMARY

1.1 At about 9.30 am on Monday 16 March 2009, the recreational vessel *Viper 1* was launched from Waitarere Beach. Two men – the skipper and his passenger – were on board the vessel with the intention of fishing recreationally. At around 9.30 pm Police were alerted to the vessel being overdue and a search and rescue operation commenced. The two men were both found deceased around 2.00 am the following morning.

1.2 *Viper 1* was recovered from the seabed on 17 March 2009. An examination of the vessel revealed that *Viper 1* was unseaworthy due to a number of severe leaks in the hull.

1.3 As a result of the investigation into this matter Maritime New Zealand (MNZ) has made several recommendations concerning information that should be highlighted within the recreational boating community.


Photograph 1
*Viper 1* post recovery.

# 2. FACTUAL INFORMATION

2.1 The information contained in this report comes from a variety of sources including witness statements, government and voluntary organisations and the New Zealand Police.

2.2 At about 9.30 am on Monday 16 March 2009, two men – the skipper and his passenger – set out with the intention of fishing recreationally on *Viper 1*. At approximately 9.33 pm that day Police communications received a call from a local resident who had discovered an unattended boat trailer parked on Waitarere Beach. The resident recognised the trailer as belonging to the skipper of *Viper 1*.

2.3 A search and rescue operation involving two helicopters, a fixed wing aircraft and seven vessels was launched shortly thereafter.

2.4 At approximately 1.32 am on Tuesday 17 March 2009, the Foxton Coastguard vessel involved in the search located *Viper 1* approximately 3–4 km offshore, partially submerged with only the bow protruding from the water.

2.5 The Coastguard vessel tied onto *Viper 1* but cut free at 2.14 am to assist in recovering the body of the passenger, who had been found some distance away. On being cut free from the Coastguard vessel, *Viper 1* sank in about 30 m of water.

2.6 The body of the skipper was recovered nearby at 2.40 am. Both the skipper and passenger were wearing sheltered waters lifejackets and were found floating face-up.

2.7 Police and MNZ raised *Viper 1* from the seabed later that day and an examination of the vessel followed.

2.8 On 5 April 2009, an anchor and 300 m of rope was recovered by a local fisherman. These was later identified as belonging to *Viper 1*.

2.9 A post mortem examination concluded that both men drowned with the onset of hypothermia.

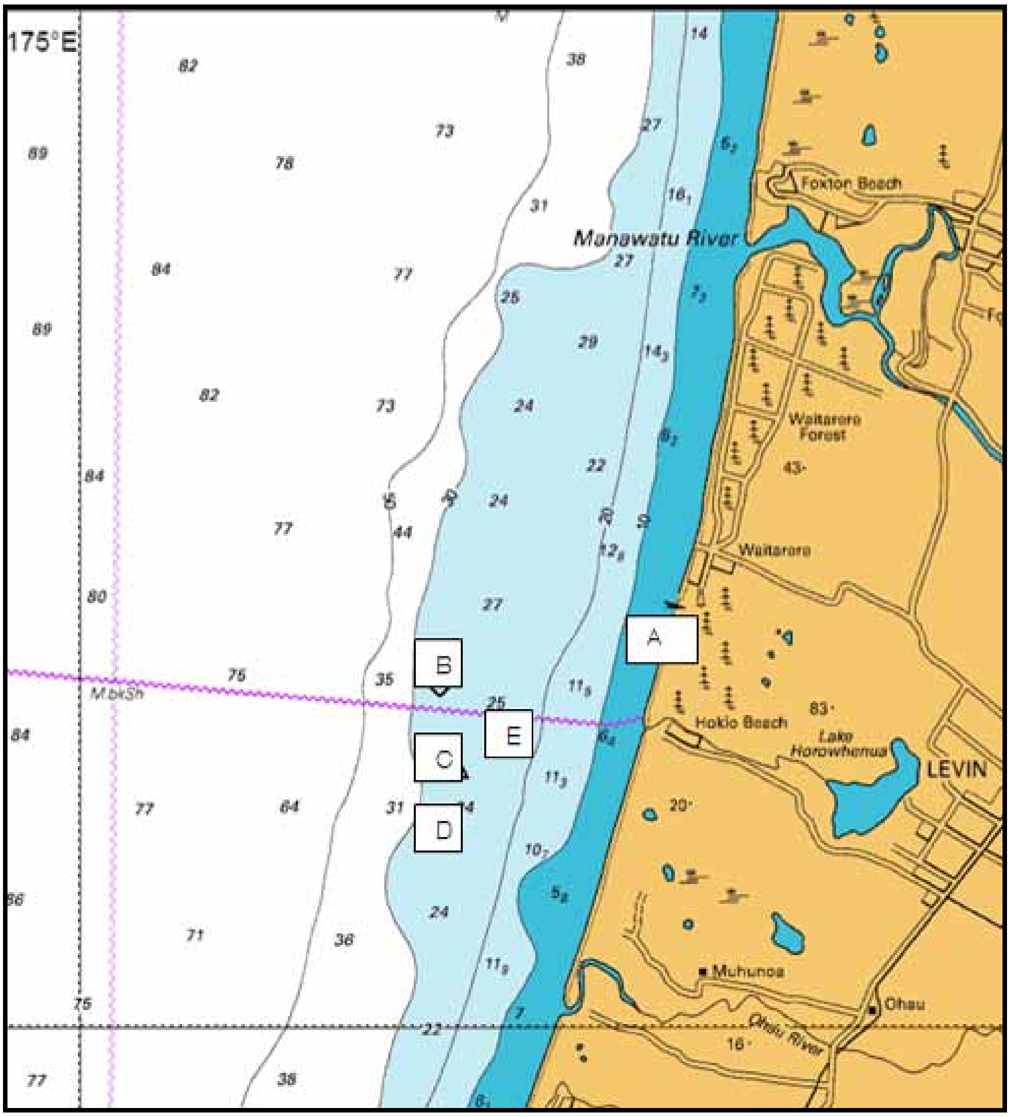



Figure 1
Image taken from Chart NZ46.

The above chart shows the following locations:

A location of trailer and general area of launching
B *Viper 1* found by Coastguard
C passenger located
D skipper located
E anchor located.

# 3. COMMENT AND ANALYSIS

## The vessel

3.1 Enquires with the manufacturer of *Viper 1* and an examination of the vessel revealed the following.

*Viper 1* is a 14 foot 6 inches aluminium dinghy manufactured by Fyran Boats sometime between 1980–1985. A copy of the sales brochure is attached in Appendix 1.

The specifications of *Viper 1* are as follows.

| | |
|---|---|
| Length (m) | 4.42 |
| Length (feet) | 14' 6" |
| Beam (m) | 1.78S–1.80DV |
| Weight (kg, approx) | 132 |
| Horsepower (recommended max) | 40 |
| Seating (no. people) | 4/5 |
| Metal thickness sides (mm) | 2 |
| Metal thickness bottom (mm) | 2 |
| Flotation built in | Deep V 15 |

The flotation referred to consisted of foam blocks situated beneath the bench seats. The term "Deep V" usually relates to a hull's form and does not relate to the foam buoyancy built into this vessel.

3.2 Several modifications had been made to *Viper 1*, although the investigation was unable to determine exactly when these had been made and by whom. The modifications did not appear to be recent and it is most likely they were made prior to the skipper purchasing the vessel 8 or 9 years before this accident.

3.3 These modifications included the addition of:

- an aluminium windscreen
- a galvanised rod holder at the stern
- an extendable canopy
- two pedestal seats.
- marine plywood attached to the transom.

The addition of the galvanised rod holder and marine plywood strengthening added extra weight to the stern of vessel, while the pedestal seats raised the centre of gravity.

3.4 Other additional weight in the vessel at the time of this accident included:

- a 20 L tote tank, situated at the stern, weighing approximately 22 kg when full
- a heavy duty marine battery, situated at the stern, weighing 21 kg
- any fishing gear or long line weights that the skipper was known to carry
- an auxiliary engine, weighing 34 kg.

Photograph 2
The rod holder, pedestal seats, canopy, and plywood stern strengthening added to the vessel.

3.5 *Viper 1* was fitted with a 50 horsepower Tohatsu outboard engine, model M50D, which was controlled remotely. This exceeds Fyran Boats' recommendation of a maximum 40 horsepower engine for this boat. The serial number of the engine shows that it was manufactured in 1992. The Tohatsu engine specifications show this model has a weight range of 70.5–77.5 kg.

3.6 Overall the outboard engine, although suffering from general wear and tear, was found to be in reasonable order. Despite having spent in excess of 15 hours submerged in salt water, the Tohatsu engine turned over and nearly started when later examined.

3.7 The skeg, anti-cavitations plate and bottom leg of the Tohatsu were in relatively good condition and there was no damage which would have indicated that the engine had struck an object, contributing to it foundering.

3.8 The remote functions of the Tohatsu operated correctly. The key was found turned on, the engine was in the forward gear and the throttle was set at three-quarters. The Tohatsu manual describes that set in this position the engine would produce 3,750–4,275 rpm, indicating the vessel was well underway, or attempting to get underway, at the time it foundered.

Photograph 3
The throttle at the three-quarter position.

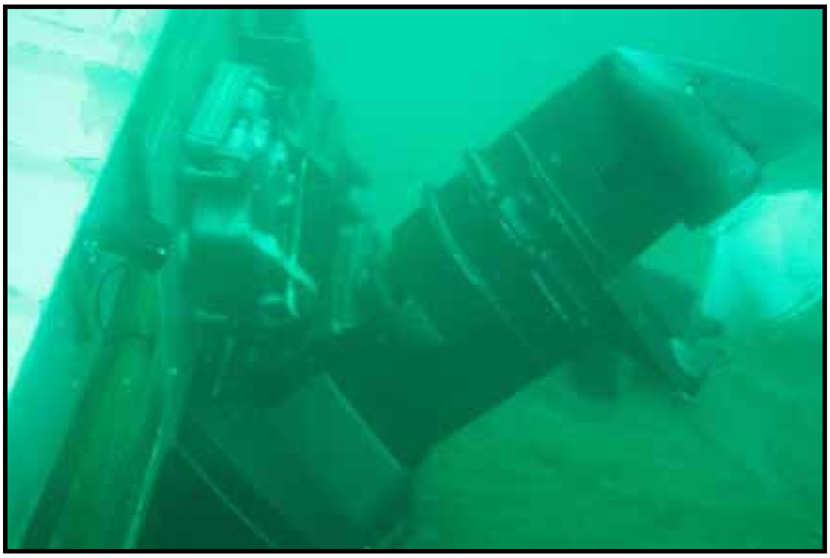
3.9 The engine was equipped with a power tilt and trim function, which allowed the skipper to raise or lower the engine while underway. This function was performed by operating the "trim-tilt" button situated on the throttle.

3.10 "Trim" is the term used to define an outboard engine's angle in relation to the hull. The ideal trim angle is one in which the vessel rides level, with most of the hull on the surface, instead of ploughing through the water. If the engine is trimmed out too far the bow will ride high out of the water and the stern will be driven lower into the water. With too little trim the bow rides too low.

3.11 When later examined, the trim-tilt function of the engine was found to operate correctly with the full range of movement. A trim-tilt button should usually return to the neutral position when operated, although when tested the button was found to stick in the position in which it was set. For example, when pushed to trim the engine higher, the button did not return to the neutral position when released and the engine continued to rise until it reached the full trim position.

3.12 When recovered, the engine was found to be in the full trim position. It is common for recreational boaters to trim an engine in this manner when negotiating an area where the propeller may touch the bottom, such as launching from the beach. When doing this it would be highly unusual for the vessel to be driven quickly with the throttle at three-quarters as was the case with *Viper 1*.

3.13 The high trim position of *Viper 1's* engine could have resulted from two scenarios. One – the skipper may have intentionally raised the engine to this position. However, the only logical explanation for the skipper doing this is that the vessel was sinking at the stern and he was attempting to keep the engine's air intake above the water. The second scenario is that the skipper may have been trying to trim the engine a little but the trim button stuck, causing him to temporarily lose control of the trim function, and the engine lifted completely.



Photograph 4
Taken on the seabed, showing the trim of the engine.

3.14 A 9.8 horsepower Mercury, model 110, auxiliary outboard engine was also fitted to the vessel. This model was produced in the late 1970s, and when removed from *Viper 1* weighed 34 kg. The auxiliary engine was mounted on a standard auxiliary bracket, which hung slightly off the port quarter, exaggerating its weight.

3.15 At a conservative estimate, the total weight on the stern, which includes the engines, fuel and battery, was somewhere between 147–154 kg. This does not include the galvanised rod holder or any additional fishing equipment or weights that may have been in the vessel at the time it foundered.

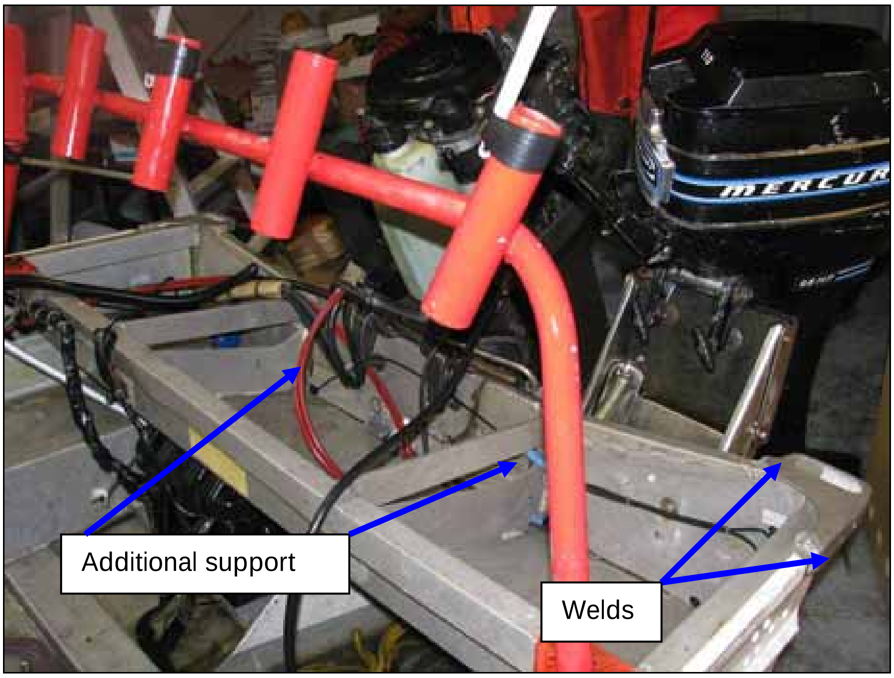
3.16 This added weight had an overall affect of significantly reducing the stern freeboard of *Viper 1*.

Photograph 5
*Viper 1* sitting low in the stern.


Photograph 6

3.17 Photograph 6 shows the extent that the freeboard of ***Viper 1*** could be reduced with two people near the stern. Note how the extra weight of the auxiliary causes the vessel to list port side. The port transom-well drainage hole is submerged as a result, while the starboard transom-well drainage hole is sitting on the water-line. The general purpose of these drainage holes is to allow any water that may slop into the transom to drain out. They are not intended to allow water ingress into the transom-well.

3.18 Extra structural support had been added, and several repairs made, to the transom of ***Viper 1***. The repairs included welds in the corners of the transom. The welds were free from defect and appeared to be in good order, however, they indicate that at some stage the transom had come away or been damaged and needed repair.

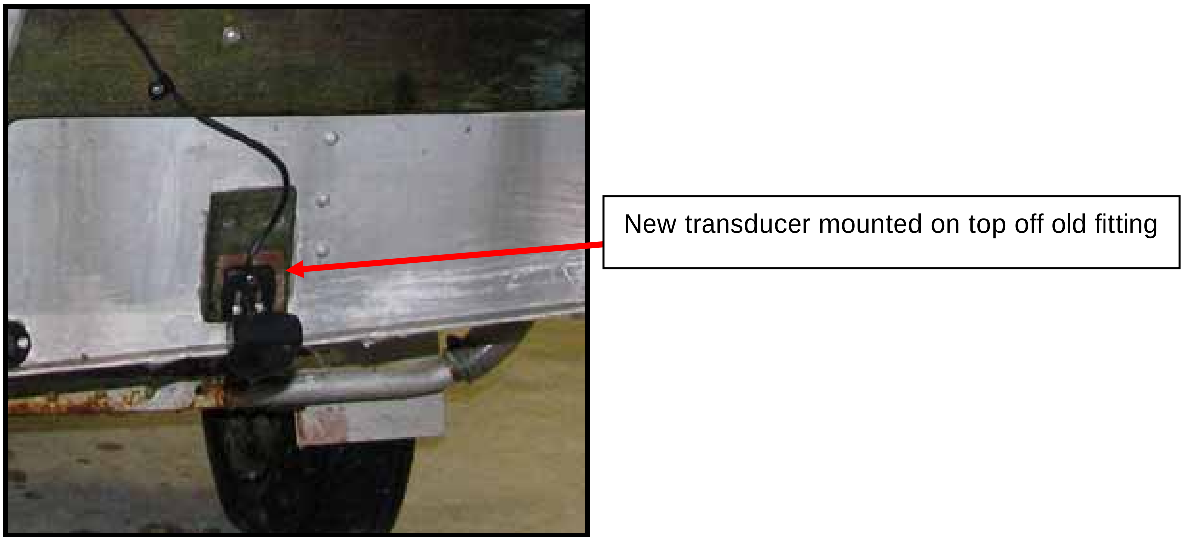



Photograph 7
The welded repairs and additional transom support.

3.19 A piece of marine plywood had been attached to the transom to offer further support. The investigation could not determine when this was attached or by whom. The plywood showed signs of weathering and had begun to deteriorate, with rot showing in some areas giving the appearance of having been on the vessel for several years. The plywood had also come away from the stern by as much as 15 mm around the transom-well drainage holes. This allowed water to freely ingress behind the plywood, placing additional weight and pressure on the stern.

Photograph 8
The marine plywood attached to the stern.

3.20 A Humminbird Matrix 12 depth sounder had been added to the vessel. The transducer for this was attached to a block of marine plywood on the transom and appeared to have replaced an older transducer. Two screw holes from the old transducers were not filled, allowing the ingress of water into the hull. The investigation was unable to determine exactly when this was replaced, however, the skipper's family believed the skipper had fitted the depth sounder sometime within the last 2 years.

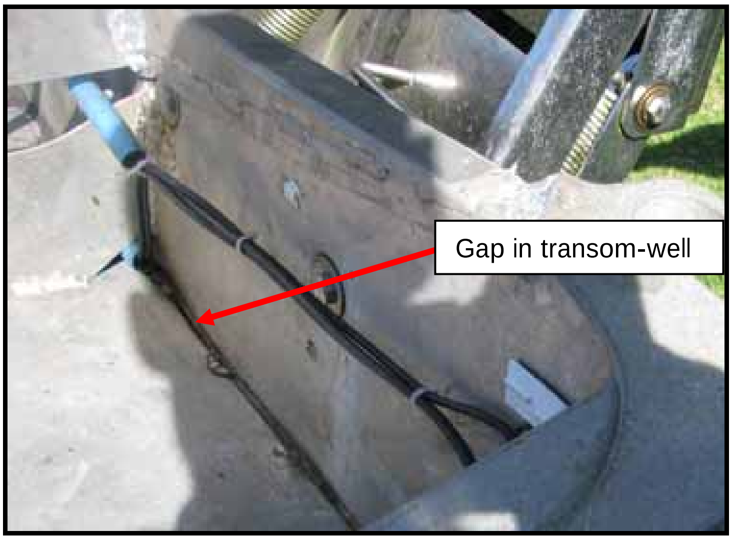



Photograph 9
New transducer.


Photograph 10

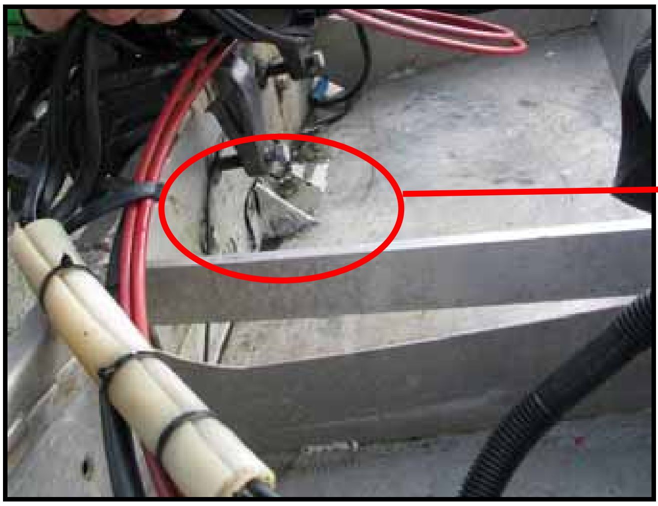
3.21 Photograph 10 shows water flowing freely through the two old transducer screw holes. These holes are situated behind the battery box on the starboard side of the vessel. Two other old holes had been repaired with silicone sealant, and it is unknown if all of the holes were repaired in this way and the silicone failed, or if these holes were never filled.

3.22 At some stage silicone sealant had been added to the transom-well. This was most likely done to fill gaps that caused water to run from the transom-well into the floor space. The sealant had deteriorated with age and come away from the gaps it was intended to fill. With the freeboard reduced, water that drained into the transom-well soon found its way through these gaps and into the floor space.



Photograph 11

3.23 The transom-well support bracket was found to be cracked and missing rivets. This damage did not appear to be new, and allowed for water in the transom-well to drain down into the floor space beneath the floorboards that were usually fitted. This type of damage suggests that at some stage the transom had been placed under significant stress. This could result from such things as the skeg touching the bottom, or operating an engine that exceeds the manufacturer's recommendations.


Photograph 12
Transom-well.


Photograph 13
A closer view of the transom-well support bracket.

3.24 Water flowed freely through a missing rivet hole beneath the transom-well. Again, this water ran into the floor space. The hole was surrounded by smudges of old silicone, indicating that it had been repaired at some stage, but the silicone had since come away.

Photograph 14

3.25 Photograph 14 shows water flowing freely through the missing rivet hole beneath the transom-well. Water can also been seen leaking through either side of the old rivet hole, in the seam between the transom and the transom-well.

3.26 Good practice would have seen the holes and cracks in the transom welded, not sealed with silicone.

3.27 Both of the bungs were secure when recovered from the seabed. The bungs were well fitted and did not leak.


Photograph 15
The bungs were secure.


Photograph16

3.28 *Viper 1* was fitted with a non-automatic bilge pump, and was known to leak to the extent that the fuel tank would sometimes begin floating. To rectify this, the skipper was known to usually turn the bilge pump on when returning to shore, however, the bilge pump was known to be unreliable.

3.29 Attempts to get the bilge pump working once the vessel was recovered were unsuccessful. The bilge pump was switched off when *Viper 1* was recovered, indicating that it was switched off at the time it sank.

3.30 "Free surface effect" in this context is a term used to describe a mechanism where water that is unconfined – as flooding water that enters a damaged or leaking hull is likely to be – runs to the lowest reachable point, exacerbating the heel that caused the low point.

3.31 In relation to *Viper 1*, any water in the underfloor compartment would move in response to any movement caused by the skipper or passenger or the sea.

3.32 For example, if *Viper 1* rolled slightly to port, the water would shift in that direction, so the weight of it would be on the port side. This would subsequently move the vessel's centre of mass and centre of movement towards port and slow the vessel's return to vertical. This effect would become worse if the vessel was then shifted back through the vertical to starboard, as it would take time for the water to respond and shift. This would result in the water shifting quickly and further exaggerate the heel to starboard. The overall effect being that each roll would become more and more extreme.

3.33 To determine the effect the leaks would have, the MNZ investigators tested the stability of *Viper 1*. The skipper and passenger were both reasonably well-built men, and in order to replicate this two test subjects were used.

3.34 After 20 minutes of being in the water, the vessel had taken on approximately 95 L of sea water, with the resulting free surface effect significantly reducing the stability.[1] At this point, the vessel was so unstable that any movement was grossly exaggerated by the free surface effect, and *Viper 1* could have easily rolled. As such, it was considered unsafe for the two test subjects to remain in the vessel and the lighter of the two was removed.

3.35 In all respects the test erred on the conservative side. The 20 L fuel tank that would have been in the vessel on the day of the accident was replaced with a spare 20 L fuel container found stowed in the bow. The wooden floor of the vessel, that would have usually sat on the transverse framing, had not been recovered and was not included in the test.

3.36 The test was also conducted in the calm waters of an estuary, and the vessel was not subject to any additional water ingress which would be likely in a choppy sea condition, as it was on the day of the accident

3.37 From time to time the test subject moved about the vessel, as a recreational fisherman would usually do when getting organised for a day's fishing.

Photograph 17
*Viper 1* in the stability test at 26 minutes.

[1] Seawater weighs approximately 1027 kg/m3. 95 L equates to approximately 97.5 kg.

Photograph 18
*Viper 1* in the stability test at 26 minutes, 30 seconds.

Photograph 19
*Viper 1* in the stability test at 29 minutes.

Photograph 20
*Viper 1* in the stability test at 32 minutes.

Photograph 21
*Viper 1* in the stability test at 33 minutes.

Photograph 22
*Viper 1* in the stability test at 34 minutes.

3.38 To allow for the safe removal of the vessel it was sunk onto its trailer, which did not alter the results of the test in any way. Water only leaked through the stern, with no indication of leaks elsewhere in the hull.

3.39 After 34 minutes in the test environment *Viper 1* had completely sunk. Note that in Photograph 22 the bow has come to rest on the trailer.

3.40 With the leaks situated in the transom area it is considered unlikely that the vessel would take on water while underway.

3.41 Once anchored, it would take approximately 20–30 minutes before any water entering *Viper 1* reached a level where it would be visible above the plywood floor. By this stage as much as 95 kg of water may have entered the vessel, significantly compromising the vessel's stability and buoyancy.

3.42 If *Viper 1* was quickly shifted forward with this quantity of water beneath the floor, the free surface effect of water shifting rapidly to the stern would significantly reduce the aft freeboard. This would be exacerbated with the engine being in the full trim position, driving the bow out of the water, and the additional weight *Viper 1* was already carrying at her stern.

3.43 Any small waves or chop would cause the bow to lift even higher, and subsequently drive the stern lower into the water. As shown in the photographs taken at 32 and 33 minutes in the test, once the corner of the vessel is submerged water pours in rapidly and *Viper 1* sinks.

3.44 If this were to occur while *Viper 1* was at three-quarter throttle, as she is believed to have been when she foundered, one of two things would most likely occur – the sudden shift of weight would basically drive the stern completely beneath the water, or alternatively render *Viper 1* so unstable that it would founder at the slightest list or roll.

## The fishing trip

3.45 *Viper 1* was launched from Waitarere Beach at around 9.30 am. This involved the vessel being launched off the beach as there are no breakwaters or boat ramps in this area. The skipper was familiar with this launching procedure and had fished this area regularly since owing the vessel.

3.46 It was common for the skipper to fish for snapper in an area known locally as "the 30 metre mark". It is believed this is where he was intending to fish that day. However, without the evidence of the skipper and passenger, where they went and exactly what they did will never be determined. The 30 metre mark is a colloquial term used to describe an area where the flat sandy seabed gradually drops away to a depth of 30 m. This area is not specific and runs the full length of the coast in this region.

3.47 This general area is prone to moderate currents that run parallel to the shore as the tides shift. As a result, most people fishing this area anchor while fishing, and the skipper was known to usually fish in this way.

3.48 It is most likely *Viper 1* would have reached the 30 metre mark by around 10.00 am, and the skipper and passenger would most likely have set about fishing at around this time.

3.49 From the results of the stability test previously discussed, it is highly unlikely that *Viper 1* would have been able to remain afloat past 11.00 am.

## Trip reporting

3.50 The skipper did not log a trip report with Coastguard, and the two radios recovered from the boat were switched off.

3.51 The skipper was known to usually be home around 5.00 or 6.00 pm so that he could clean *Viper 1* before it got dark, but his intended return time that day was not discussed with his family. Likewise, the passenger simply told his wife that he was going fishing off Waitarere Beach and did not discuss when he intended to return.

3.52 This is not considered good practice and a prudent skipper should, at a minimum, always advise someone of where they are heading and when they intend to be back. In the event that a skipper changes their intentions, the person they advised should be updated.

3.53 MNZ publishes the *Radio handbook for coastal vessels* book, which contains information on giving voyage or trip reports, and states:

*Ship stations are encouraged to give coastal stations details of their voyages in a trip report (TR), to facilitate possible search and rescue operations.*
*The TR comprises:*

*On departure:*

*The abbreviation TR*
*Name and call sign of the ship*
*Port of departure*
*Port of arrival and, if possible, estimated time of arrival (ETA)*
*Number of persons on board*

*On arrival:*

*The abbreviation TR*
*Name and call sign of ship*
*Port and, if possible, estimated time of departure (ETD)*

*Every effort should be made to call notifying arrival at a safe anchorage or at the end of the voyage. However, unless a vessel is reported as overdue the absence of a closing TR will not initiate a search or other follow up action.*

3.54 Nationally, the standard protocol for Coastguard units to deal with trip reports is in keeping with the MNZ *Radio handbook for coastal vessels*.

# Environment

3.55 The skipper was known to always check the weather forecast via the internet before venturing out and it is believed this is what he did on this occasion.

3.56 The forecast given at 3.20 am on 16 March 2009, valid to 11.59 am, was:

*Variable 5 knots, becoming southwest 10 knots late morning, then turning northeast tonight. Smooth sea, becoming slight late morning. Fine weather. Swell – forecast to midnight Thursday: Northwest half a metre developing late Wednesday.*

3.57 The forecast was then issued again at 6.00 am, without change.

3.58 Local recreational fishermen who were out fishing that day described a light north-east wind that turned north-west and picked up at around 11.00 am, with a 50–75 cm wind-chop and no swell.

3.59 The increase in wind-chop coincides with the estimated time that ***Viper 1*** foundered.

3.60 National Institute of Water and Atmospheric Research (NIWA) have provided a detailed report of the weather which can be found in Appendix 2.

3.61 Tides for the area were:

0140 hours 3.2 m

0716 hours 0.8 m

1321 hours 3.0 m

1940 hours 0.8 m

3.62 The tidal conditions are not considered to be a contributory factor in this accident.

## Ability to communicate distress

3.63 It is always good practice to assess the risks of any recreational activity and develop a contingency plan to mitigate such risks. In the maritime environment, if a person finds themselves in the water, one of the key factors to survival is the ability to communicate their position to emergency services by the fastest means available. This will aid the search and rescue services not only to know of the distress, but also to direct the appropriate resources to the distress position.

3.64 There are several methods of communicating distress, such as:

| | |
|---|---|
| Very High Frequency (VHF) radio (portable or fixed) | VHF radio is a good way of relaying a distress message to the emergency services when close to land. However, there are some disadvantages. If it is a fixed radio, and the boat sinks rapidly there may not be time to make a mayday call. Once the boat has sunk the radio is rendered inoperable.<br><br>This was the case with the sinking of *Viper 1*, although the radio was found to be turned off at the time the vessel foundered.<br><br>Portable VHF radios may be kept on the person and used in the water, however, they need to be waterproof and have sufficient range to communicate with search and rescue services. Given the close to shore location in this accident, a hand-held VHF radio would have been useful.<br><br>*Viper 1* was also fitted with a Citizen Band (CB) radio. It is unusual for one of these to be used in a marine environment. This radio was also found to be turned off at the time *Viper 1* foundered and sank. |
| Cell phones | Cell phones are an option, however, if the phone is not protected from the water it is likely to fail.<br><br>Use of a cell phone is also reliant on the cell phone's range and network.<br><br>Cell phones are not designed for maritime emergencies and the use of one in a dynamic environment such as a choppy seaway may be difficult.<br><br>The skipper and passenger were both carrying cell phones but it is unknown if these were in waterproof containers.<br><br>The cell phones were not used that day, and when called later in the evening went directly to voicemail, suggesting they were inoperable. |

**Maritime distress flares (rocket, hand-held and smoke)**

Flares are a good communication option. Red rocket flares are designed so they can be used both day and night. While they do not pinpoint a person's location, they give a general search area if seen by a passing ship or person ashore.

They should not be used if an aircraft is in the immediate vicinity. Burning time is about 40 seconds, and they are visible for up to 15 km during the day and up to 40 km at night.

Hand-held flares are good for indicating a distress position for approaching search and rescue craft by sea and air, and they do pinpoint a person's position by way of the red flare's illumination.

Smoke flares are useful for signalling during daylight hours. They are a good means of pinpointing a location by way of a bright orange smoke signal, but are of no use after dark.

*Viper 1* was equipped with a Pains Wessex flare kit, which contained one orange smoke flare and two hand-held red flares. These flares expired in August 2000. The smoke flare was in reasonable order and may have worked, however, the two hand-held flares were significantly corroded and could not be relied on to work.

The flare container was found to have floated up into the bow of the vessel and would have been difficult, if not impossible, for the skipper and passenger to recover. This type of equipment should be stowed where it can be easily accessed in the event of a capsize or foundering.

**Hand-held signal equipment**

Hand-held strobe lights are an option. They are visible for 2.4–3 km at night. In this accident's circumstances the skipper and passenger may possibly have been visible from shore and to another vessel or aircraft in the vicinity.

*Viper 1* was equipped with strobe lights, although these would only have been of use after dark.

**Distress beacons**

With the advent of modern communication under the Global Maritime Distress Safety System (GMDSS) the use of an emergency beacon, such as a 406 MHz Personal Locator Beacon (PLB) or a 406 MHz Emergency Position Indicating Radio Beacon (EPIRB), is a reliable way of alerting search and rescue services that a person is in distress and requires immediate assistance.

Some EPIRBs and PLBs are equipped with a Global Positioning System (GPS) input. The GPS position is sent with the distress beacon signal, thus providing search and rescue services with a pinpoint geographical location of the distress position. EPIRBs and PLBs are readily available to purchase for recreational or commercial use in New Zealand.

An EBIRB or PLB was not carried on board *Viper 1*. If one was carried, the skipper or passenger could have alerted emergency services of their distress immediately.

Had they been using a GPS-integrated PLB or EPIRB emergency services would have known of their location within a few minutes of the beacon being activated.

3.65 Once in the water the skipper and passenger had no way of communicating their distress to emergency services or other vessels in the area. They were then in the position of relying on someone to realise they were overdue, which invariably extended the time they were in the water before any rescue effort commenced.

## Lifejackets

3.66 A lifejacket is a device that when used in the water is designed to provide specific buoyancy to position and maintain an unconscious person’s head and keep their airways clear of the water.

3.67 Lifejackets, if properly worn and in good condition, provide much more support than other types of Personal Flotation Devices (PFD) and are specifically designed for in-water sea survival.

3.68 The additional buoyancy provided by a lifejacket will make it easier to maintain an in-water sea survival position. Using a lifejacket means you use less energy, which is important in a sea survival situation.

3.69 Generally, lifejackets are rated to provide either 100 (EN395 standard) or 150 (EN396 standard) Newtons (n) of buoyancy. The buoyancy ratings are intended for different sea areas and conditions.

3.70 The 100 n lifejacket has a buoyancy of no less than 100 n for the average adult and is intended for use in relatively sheltered waters, such as small lakes or harbours where the conditions can be expected to be calm. It is not designed for use in the open sea or large lakes, where there is the potential for it to be rough.

3.71 The 150 n lifejacket is intended for offshore use (open sea) and is fitted with retro reflective tape, a whistle, and on some lifejacket brands an optional light. These lifejackets can be made from inherently buoyant material, or have gas operated chambers – commonly known as an inflatable lifejacket.

3.72 Another type of lifejacket, known as SOLAS lifejackets, is compulsory on commercial ships and is intended for emergency use in all weather conditions. SOLAS lifejackets are equipped with retro reflective tape, a whistle and a light, and some are also fitted with splash hoods to keep the head and airways protected in rough sea conditions.

3.73 In New Zealand lifejackets and buoyancy aids are allocated a rating from 401 to 406 in accordance with the New Zealand Standard 5823. These ratings relate directly to the requirements for lifejackets contained in the sections 401 to 406 of the standard.

## Standards

3.74 The lifejackets worn by the skipper and the passenger were rated as 402 sheltered waters lifejackets. These were manufactured in accordance with New Zealand Standard 5823:1989.

3.75 This standard was superseded in 2001 by New Zealand Standard 5823:2001, and again in 2005 by New Zealand Standard 5823:2005.

3.76 The 1989 New Zealand Standard 5823:1989 provided the following standards and definitions:

*Sheltered Waters Lifejacket: A buoyancy aid worn on the body which is intended to maintain the wearer in a safe floating position and for use in sheltered waters where early rescue may be anticipated. Lifejackets may incorporate provision for protection against hypothermia.*

*402.1: Scope – This section sets out the requirement for lifejackets anticipated for use in small boats in sheltered waters where early rescue may be expected.*

3.77 The standard does not provide a further definition of "sheltered waters", although it is most likely that this is intended to describe waters that are protected from the weather. This would include small lakes, harbours, estuaries etc, and does not refer to the open sea in which ***Viper 1*** was operated.

3.78 The phrase "where early rescue may be anticipated" is somewhat ambiguous, but is most likely intended to describe situations where other vessels or support craft are likely to be present. For example, this could include such things as an organised yacht race, a joint fishing trip involving two or more vessels, or an occasion where the participants have radio contact with other vessels nearby.

3.79 There is no evidence of any circumstances that would have given the skipper and passenger a reason to anticipate early rescue.

3.80 The minimum buoyancy of a 402 sheltered waters lifejacket is prescribed in the standard as:

| | |
|---|---|
| *40kg and over* | *71n* |
| *22kg to 40kgs* | *49n* |
| *12kg to 25kg* | *40n* |
| *10kg to 15kg* | *35n* |

3.81 The lifejackets worn by the skipper and passenger were both designed for people over 40 kg and had a minimum buoyancy of 71 n.

Photograph 23
The lifejacket worn by the skipper.


Photograph 24
The label on the skipper's lifejacket.


Photograph 25
The lifejacket worn by the passenger.


Photograph 26
The label on the passenger's lifejacket.

3.82 401 open waters lifejackets are more suitable for the area in which ***Viper 1*** was operating. In previous standards open waters lifejackets were referred to as "coastal lifejackets", however, the New Zealand Standard definition did not change and describes open waters lifejackets as being:

*A buoyancy aid worn on the body which is intended to maintain the wearer in a safe floating position and for use in rougher waters than for the inshore-waters* [previously sheltered waters] *lifejacket. It may incorporate provisions for protection against hypothermia.*

*401: Scope – This section sets out the requirements for lifejackets anticipated for use in boats in <u>open-waters</u> where <u>early rescue may not</u> always be expected.*

3.83 401 lifejackets also have a righting requirement that the lifejacket shall:

*(a) Not tilt the wearer forward*

*(b) Turn or roll the wearer so that the wearer's mouth is brought clear of the water within 5 seconds and stabilise the wearer in a backwards inclined position. While in this position the buoyancy aid shall:*

*(i) Not ride-up to such a degree as to cause excessive discomfort to the wearer, or impede respiration.*

*(ii) Have no tendency to ride-up to such a degree that the potential exists for it to continue over the wearer's head.*

*(iii) Hold the nose and mouth of the wearer well clear of the water.*

3.84 A 402 inshore waters (sheltered waters) lifejacket standard does not have a righting requirement to the same extent and specifies that:

*The distribution of buoyant material shall be such that the personal floatation device will safely support the wearer. Any tendency for the wearer to be tilted forward from vertical in the water shall be considered to be unsafe.*

3.85 A 401 open waters lifejacket has the following minimum buoyancy.[2]

| BODY MASS | MINIMUM BUOYANCY INHERENT | MINIMUM BUOYANCY INFLATABLE |
|---|---|---|
| 40 kg and over | 100 n + 10% | 150 n |
| 22–40 kg | 75 n + 10% | 90 n |
| 12–25 kg | 60 n + 10% | 60 n |
| 10–15 kg | 60 n + 10% | 60 n |

3.86 This differs slightly from the earlier New Zealand Standard 5823:1989 which simply required that all 401 lifejackets had a minimum buoyancy of 100 n.

3.87 Inflatable 401 lifejackets would have provided the skipper and passenger with more than twice the buoyancy than the 402 lifejackets they were wearing.

3.88 Buoyancy is a significant factor contributing to how long a person can survive in an in-water situation. The more buoyancy a person has, the less energy they need to expend in keeping themselves afloat. The less energy a person expends in this manner, the more energy they have for keeping themselves warm, keeping their airways clear, and expelling aspirated water from their lungs.

## Autopsy report

3.89 The autopsy report recorded the cause of death as drowning.

## Drowning and hypothermia

3.90 Drowning can result through either submersion or immersion. Drowning by submersion results from a person being fully beneath the water. Drowning by immersion results from a person becoming so tired or hypothermic that they can no longer expel aspirated water.

3.91 The term "hypothermia" refers to body core cooling. The body core consists of the vital organs, including the heart, brain, lungs and abdominal organs. To remain in good health these are kept at a constant temperature of 36.9°C. When the core temperature drops to 35°C a person is considered to be suffering from hypothermia.

3.92 During an in-water sea survival period, conservation of body heat and energy is paramount to ensure that the person in the water has the maximum possible survival time.

3.93 Several factors affect survival time and the onset of hypothermia.

| | |
|---|---|
| Initial immersion or cold shock | When the body is subject to cold water immersion there is a great risk of drowning within the first 3 minutes. This is due to the fact that when the body first falls into cold water it reacts by involuntarily gasping and shivering.[3] As the body's skin begins to cool, muscles tense and shiver – this produces more body heat, but results in a loss of dexterity and motor control. During this period there is a greater risk of water entering the airways, resulting in drowning. It can also cause a person to have a heart attack. After 3 minutes the body starts to adjust to the cold water immersion and control of body function is regained. |

[2] The 10% is a quality assurance buffer to compensate for variance in buoyancy material batch consistency.
[3] In water below 15°C the effects of immersion become life threatening, and the lower the temperature, the more severe the symptoms of cold shock.

**Sea conditions** The rougher the sea the more chance there is that a person may drown due to water entering the airways. As the sea conditions on the day of this accident were choppy, the risk of drowning was increased as it became more difficult to keep their airways clear of water.

**Age and fitness** In general terms, the fitter the person is the more chance of in-water survival. Young children cool quicker than adults.

The skipper and passenger were both in their 50s and of average fitness for someone that age.

**Clothing** The more clothing worn the better insulated the person is in the water. On the day of this accident the occupants entered the water wearing minimal clothing, namely singlets and shorts. This put them at a disadvantage as water conducts body heat away up to 26 times faster than air of the same temperature.

As clothing acts as a barrier to heat loss while in the water, the lack of clothing worn by the skipper and passenger is considered to be relevant.

The lifejackets worn would have provided some protection from the cold, although that would be minimal.

The investigation could not determine whether or not any spare clothing was carried.

**Body build** The fat layer beneath the skin acts as an important insulator against heat loss. Consequently a fit, heavier built person may survive longer in cold water than a fit person of slight build.

**Swimming** Attempting to swim is not effective for the maintenance of body heat when immersed in cold water for the following reasons.

Exercise causes the skin's blood vessels to dilate (open up) causing greater heat loss than heat production, resulting in heat loss and the onset of hypothermia. In-water survival techniques recommend that swimming is kept to a minimum.

Swimming will use valuable energy, which could be better used in keeping the body warm. Once the energy levels fall fatigue may then become a factor, reducing the in-water survival time.

Swimming can cause water to enter the airways – this can result in the onset of drowning by the lungs filling with water.

Recommended in-water survival swimming techniques

If a person needs to swim it is recommended that the following techniques are used.

Swim on your back using arms only as a means to propel through the water. Do not use legs as a means to propel as leg muscles use a lot of energy, resulting in an individual becoming exhausted quickly. For maximum heat conservation cross your legs. If the sea condition is such that water is splashing over your nose and mouth it is paramount that these are covered by whatever means are available. If the lifejacket/PFD is fitted with a splash hood this should be donned immediately, or alternatively use a cupped hand to cover the airway.

Two people: Swim in a line on your back with the forward person putting their feet under the armpits of the other person. Both people use their arms to propel through the water. As with a single person, do not use legs as a means of propulsion. If the sea conditions are such that the airways are being exposed to water, each person can use their opposite arm for swimming, namely one uses the right the other the left as a means of propulsion. The free hand can be used to cover the airways for protection.

Three people: The same as two – namely the lead person's feet under the armpits of the second person, the second person's feet under the armpits of the third person. Swim together using arms only as a means of propulsion, protect the airway if needs be.

| | |
|---|---|
| Alcohol | Alcohol was not a factor in this accident. |
| In-water period | The longer a person is in the water the more exposed that person is to the onset of hypothermia. |

3.94 The biggest risk to the skipper and passenger, once in the water, was the onset of hypothermia, which results in the deep body temperature falling, a lapse into unconsciousness and subsequent drowning.

3.95 It will never be known what sea survival techniques, if any, the skipper and passenger employed, although, understandably, they may have made a considerable effort to swim to shore.

3.96 During an in-water sea survival period, conservation of body heat and energy is paramount to ensure that the person in the water has the maximum possible survival time.

3.97 For conservation of body heat several methods can be used, depending on the number of people in the water. For a single person the Heat Escape Lessening Posture (HELP) can be used.

3.98 This is achieved by placing the arms across the chest to protect the armpits and flexing the legs to protect the groin area. If possible wear headgear, and remain still in the water. The HELP position will result in a 50% increase in survival time.

Figure 2
HELP position.

3.99 If there are two or more people the huddle position is recommended to conserve heat. This again results in a 50% increase in survival time.

Figure 3
Huddle position.

## In-water period

3.100 It is unknown precisely when *Viper 1* foundered and the men found themselves in the water. Although, as shown by the stability test, it is unlikely the vessel would have been able to remain afloat for more than an hour at sea without water being removed from the boat, which is unlikely given that the bilge pump was turned off and the vessel was underway.

3.101 As previously mentioned, this would have put the skipper and passenger in the water at around 11.00 am.

3.102 The passenger was wearing an older style analogue watch. The watch battery had been replaced some years ago by a jeweller who advised that it would no longer be waterproof.

3.103 The watch was found to have stopped working at 5.30 pm on the day of this accident, which infers the passenger was in the water prior to this time.

3.104 If the skipper and passenger found themselves in the water around 11.00 am, as estimated, they were in the water for approximately 10.5 hours before they were reported overdue.

3.105 They were recovered around 1.32 am and 2.14 am the following morning, making their total in-water time somewhere between 14.5 hours and 15 hours and 15 minutes.

3.106 The water temperature on the day was around 18˚C–19˚C.

3.107 The chart[4] below provides a guideline of expected survival times when immersed in water.

| WATER TEMPERATURE | EXHAUSTION OR UNCONSCIOUSNESS | EXPECTED SURVIVAL TIME |
|---|---|---|
| 21–27°C | 3–12 hours | 3 hours – indefinitely |
| **16–21°C** | **2–7 hours** | **2–40 hours** |
| 10–16°C | 1–2 hours | 1–6 hours |
| 4–10°C | 30–60 minutes | 1–3 hours |
| 0–4°C | 15–30 minutes | 30–90 minutes |
| <0°C | Under 15 minutes | Under 15–45 minutes |

[4] Chart information taken from the United States Search and Rescue Task Force website http://www.ussartf.org/cold_water_survival.htm.

# 4. CONCLUSIONS

**Note:** These are not listed in order of importance.

4.1 The repairs, modifications and deterioration of *Viper 1's* transom resulted in the vessel leaking extensively, rendering it unseaworthy.

4.2 It is likely that the leaks and ingress of water resulted in *Viper 1* foundering and subsequently sinking.

4.3 It is highly unlikely that *Viper 1* would have been able to remain afloat for more than an hour.

4.4 This accident highlights the danger of do-it-yourself repairs and modifications and a lack of maintenance.

4.5 Vessel owners should take heed that any water ingress generally means one thing – the vessel is leaking. Although it is common for vessels to take on a small amount of water in rough seas, when a vessel is consistently taking on water the source of the leak should be identified and repaired by a qualified and reputable agent.

4.6 This accident also illustrates the danger of using recreational vessels of this size and type in the open sea, and the need to be prepared for an emergency situation. If a vessel sinks and the occupants find themselves in the water it is paramount that the appropriate emergency equipment is carried and is readily available to maximise the chance of rescue and survival.

4.7 *Viper 1* and the occupants were not adequately prepared for an emergency situation.

4.8 The failure of the skipper to log a trip report or let someone know when they would be back extended the time the two men were in the water and reduced their chances of survival.

4.9 The vessel sank so rapidly that the VHF radio could not be used. The cell phones were not used, as they were most likely inoperable. If any of the following had been available upon the sinking of *Viper 1*, a search and rescue response could have been co-ordinated almost immediately after the foundering. This would have greatly increased the survival chances of the skipper and passenger and the chances of them being rescued.

- EPIRB or PLB – particularly one with integrated GPS
- hand-held VHF – either waterproof or kept in a waterproof covering which permits its use without removal
- marine distress flares.

4.10 It was a hot day and the skipper and passenger found themselves in the water with virtually no warning. They were not warmly dressed and the lack of clothing put them at a disadvantage. Wearing extra clothing would have been an advantage in terms of in-water survival time.

4.11 Although wearing a lifejacket at all times is good safe practice, a 401 open waters lifejacket, such as an inflatable, would have been more appropriate in this case and would have increased the chances of survival.

# 5. RECOMMENDATIONS

5.1 It is recommended that MNZ, working through the National Pleasure Boat Safety Forum:

(a) Continue to promote to the recreational boating community the importance of proper vessel maintenance, in particular:

i. the danger of do-it-yourself type repairs or modifications

ii. the necessity to regularly check the structural integrity of older aluminium vessels

iii. that consistent water ingress is indicative of a leak which should be repaired by a professional before the vessel is used again.

(b) Continue to promote, in line with the National Recreational Boating Safety Strategy, the carriage of effective emergency equipment by way of:

i. a national safety awareness campaign

ii. the introduction of legislation making the carriage of communications equipment in recreational craft compulsory.

(c) Continue to promote throughout the recreational boating community:

i. the safe use of lifejackets/PFDs

ii. the correct method of in-water survival techniques

iii. the effects of hypothermia and the steps that can be taken to reduce its onset

iv. the need for trip reporting

v. the need to be prepared for any emergency situation, and the value of assessing risks and implementing contingency plans to mitigate such risks.