
Office of Transport
Safety Investigations

Ferry

Safety Investigation Report

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Rockfish 3 collision with John Cadman 3
Sydney Harbour, NSW
12 December 2021

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FERRY SAFETY INVESTIGATION REPORT

Rockfish 3 collision with John Cadman 3

Sydney Harbour, NSW

12 December 2021

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OTSI is empowered under the *Transport Administration Act 1988* to investigate rail, bus, and ferry accidents and incidents in accordance with the provisions of the *Passenger Transport Act 1990* and *Marine Safety Act 1998*. It also conducts rail investigations on behalf of the Australian Transport Safety Bureau under the *Transport Safety Investigation Act 2003* (Cth).

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Publication of the investigation report

OTSI produces a written report on every investigation for the Minister for Transport, as required under section 46BBA of the *Passenger Transport Act 1990*.

Investigation reports strive to reflect the OTSI balanced approach to investigation, explaining what happened and why in a fair and unbiased manner. All Directly Involved Parties (DIPs) are given the opportunity to comment on the draft investigation report.

The final investigation report is provided to the Minister for tabling in both Houses of the NSW Parliament in accordance with section 46D of the *Passenger Transport Act 1990*. The Minister is required to table the report within seven days of receiving it.

Following tabling, the report is published on the OTSI website – www.otsi.nsw.gov.au – and information on the safety lessons promoted to relevant stakeholders.

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Executive Summary

At approximately 2215¹ on 12 December 2021, the charter vessel *Rockfish 3* collided with the charter vessel *John Cadman 3* in the vicinity of the Sydney Harbour Bridge in Port Jackson, NSW.

At the time of the collision, *Rockfish 3* was travelling to its overnight berth and not carrying passengers. *John Cadman 3* was conducting a passenger charter with 224 passengers on board. The collision resulted in no reported injuries. *Rockfish 3* sustained extensive damage to its starboard side, mast, and rigging. *John Cadman 3* suffered minor scratches to the bow and a broken flagpole.

The two vessels became entangled as a result of the collision and subsequently proceeded together to Aquarium Wharf Darling Harbour, where *John Cadman 3* unloaded its passengers before crew separated the two vessels.

The investigation found that both Masters sighted the other vessel too late to take action to avoid a collision. Several factors were identified to help understand why the Masters did not see the other vessel. These factors included wheelhouse design, use of temporary screens which impacted visibility, illumination of the internal cabin due to lighting during evening operations, and deficiencies in both vessels' execution and understanding of their Safety Management Systems (SMS).

Recommendations have been made to both operators to review their SMS to incorporate any additional operational risks (night-time operations, transit zone operation and look-out) involved in the conduct of passenger charters on Sydney Harbour.

Full details of the Findings and Recommendations of this ferry safety investigation are contained in Parts 3 and 4 respectively.

¹ Times in this report are in 24-hour clock form in Australian Eastern Daylight-saving Time

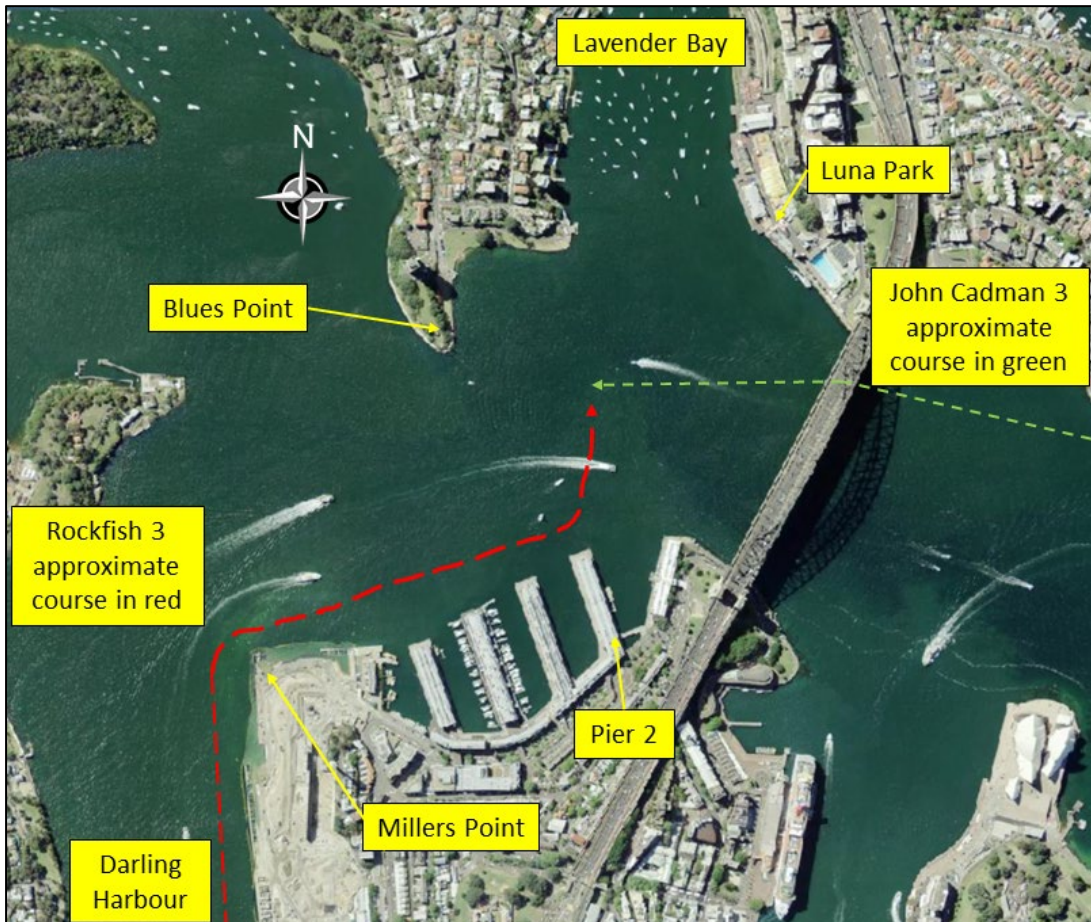
Part 1 Factual information

Events leading up to the occurrence

- 1.1 At approximately 2200 on 12 December 2021, charter vessel *Rockfish 3* departed King Street Wharf in Darling Harbour after disembarking 30 passengers. *Rockfish 3* had completed the second of two four-hour charters for the day and was returning to its overnight mooring in Lavender Bay. On board the vessel was the Master and a deckhand who had both commenced work at 1130 earlier that day.
- 1.2 Following its departure from King Street Wharf, *Rockfish 3* travelled in a northerly direction, close to the eastern (city side) of Darling Harbour. The Master was navigating the vessel from the helm position, located midships near the stern of the vessel. The deckhand was conducting normal duties as part of a standard vessel charter and making preparations for return to their overnight berth.
- 1.3 *Rockfish 3* had its navigation lights illuminated, as well as the internal saloon lights. The crew had earlier lowered the clear plastic screens to provide shelter for the passengers in the saloon/cabin during the charter.
- 1.4 When *Rockfish 3* reached Millers Point, the Master altered course to starboard² (to the east) and sailed near the southern shore of the channel. When the vessel reached the vicinity of Pier 2 Walsh Bay, the Master altered course to port³ (to the north) towards Lavender Bay (see *Figure 1*).
- 1.5 At the time *Rockfish 3* turned to port, *John Cadman 3* was sailing in a westerly direction on the northern side of the channel. *John Cadman 3* had just passed under the Sydney Harbour Bridge on the return voyage to drop off passengers from a charter cruise. Onboard were the Master, Engineer, a General Purpose Hand (GPH), three hospitality staff, two security personnel and 224 passengers.
- 1.6 The crew aboard *John Cadman 3* commenced work at 1330 that day and were nearing the end of their second charter for the day. The Master was alone in the wheelhouse. The Engineer, who routinely assisted the Master with watchkeeping, was away from the wheelhouse conducting engine room rounds at the time of collision. The GPH was in the main cabin assisting with passengers.

² Starboard - the right side of a vessel when viewed from the rear.

³ Port - the left side of a vessel when viewed from the rear.



Source: SIX Maps annotated by OTSI

Figure 1: Approximate course of *Rockfish 3* and *John Cadman 3*

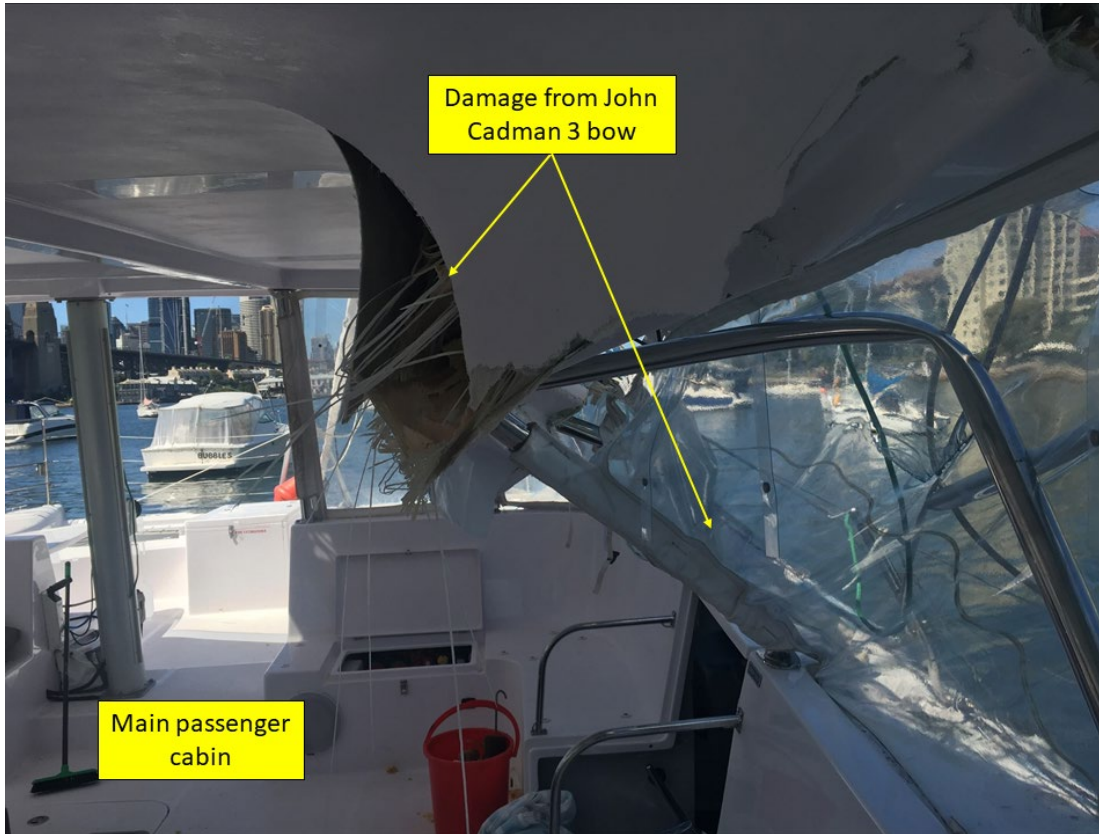
The occurrence

- 1.7 At approximately 2210, *Rockfish 3*'s turn to port resulted in both vessels travelling on converging courses. Both vessels were travelling at a speed of six to seven knots.⁴
- 1.8 About the same time that *Rockfish 3* turned to the north, *John Cadman 3*'s Master later reported that two larger cruisers overtook the *John Cadman 3* at a relatively high speed close to the vessel's port side. The overtaking vessels produced a wash which caused the *John Cadman 3* to moderately roll.
- 1.9 *John Cadman 3*'s Master was concerned about the proximity with which the two vessels overtook and walked to the port bridgeway to look behind the vessel to ensure no other vessels were overtaking. After the Master confirmed that the area was clear, they walked to the starboard bridgeway to do the same. The Master reported at interview that they thought they saw *Rockfish 3* over near

⁴ A knot is a unit of speed equal to one nautical mile per hour, exactly 1.852 km/h.

Walsh Bay as they moved from the port bridgewing but was unsure if it was *Rockfish 3*.

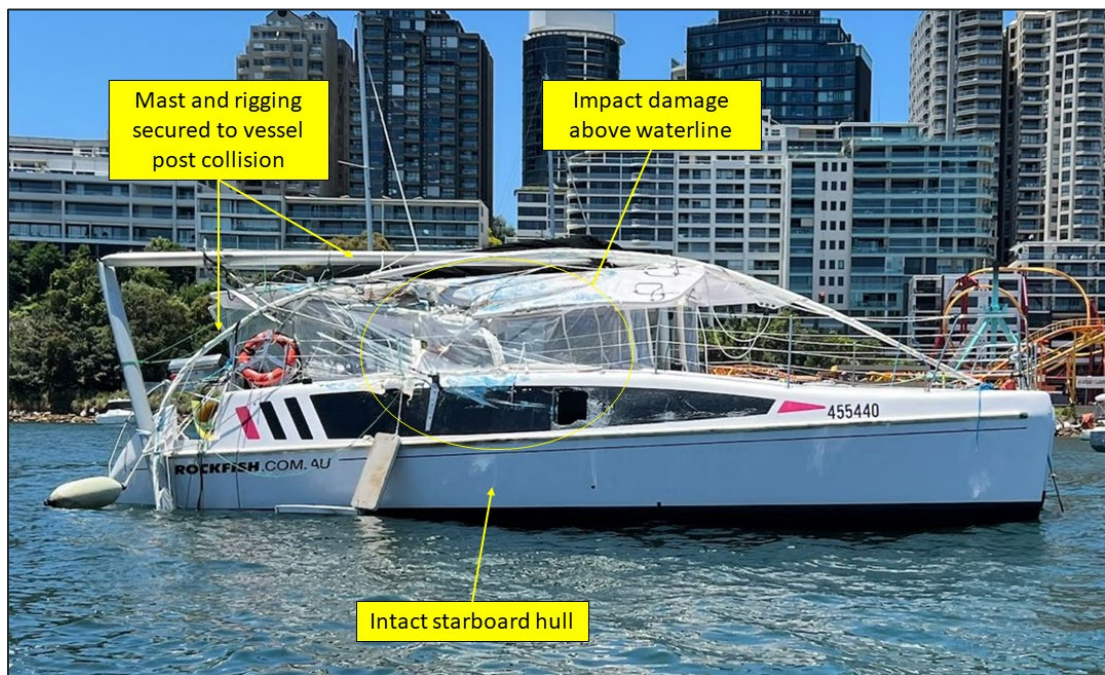
- 1.10 *John Cadman 3*'s Master confirmed there were no vessel/s overtaking on the starboard side then moved back to the main control position midships. As the Master reached the main helm position, they saw *Rockfish 3* at close range on the port bow and on a collision course. The Master attempted to sound the ships horn but miss pressed the button in the dark. The Master placed both engine controls to astern.
- 1.11 It is likely that as *John Cadman 3*'s Master looked behind the vessel, *Rockfish 3* turned to port and began to cross the channel, which placed the vessels on a converging course.
- 1.12 Following *Rockfish 3*'s turn to port, the vessel continued on a northerly course until the deckhand shouted a warning at the last moment, that there was a vessel close to starboard.
- 1.13 *Rockfish 3*'s Master, at the stern of the vessel, saw the larger *John Cadman 3* close to their starboard side and realised they were about to collide at almost right angles. The Master placed the throttles to full ahead, attempting to cross the oncoming vessel's bow. While *Rockfish 3* accelerated, the proximity of the approaching *John Cadman 3* made it clear to the Master that a collision was imminent, and at the last moment they turned hard towards the approaching *John Cadman 3*. The turn to starboard was an attempt to minimise the angle of impact.
- 1.14 *John Cadman 3*'s bow impacted close to midships on the starboard side of *Rockfish 3*. The much larger vessel's bow struck the catamaran above the waterline but did not breach the hull's watertight integrity.
- 1.15 *Rockfish 3* sustained substantial damage to the above-water structure in the vicinity of the passenger accommodation (see *Figures 2 & 3*).



Source: Rockfish charters annotated by OTSI

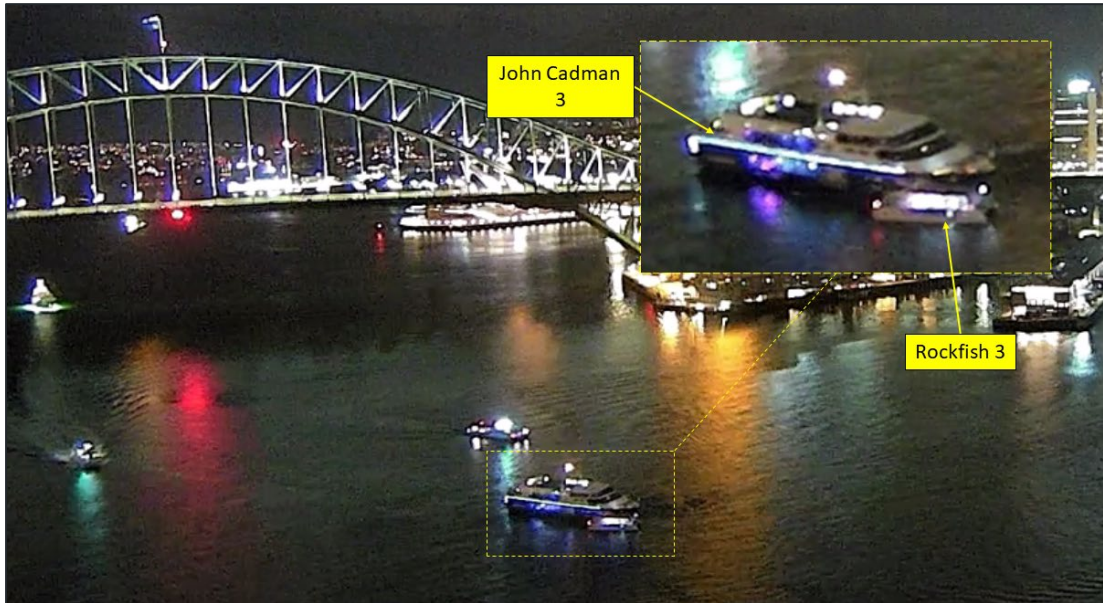
Figure 2: Internal damage to *Rockfish 3* main passenger cabin

- 1.16 The impact also damaged the vessel's rigging and caused the mast to topple and become entangled on the *John Cadman 3*'s bow (see *Figure 4* & cover).



Source: Rockfish charters annotated by OTSI

Figure 3: *Rockfish 3* external damage

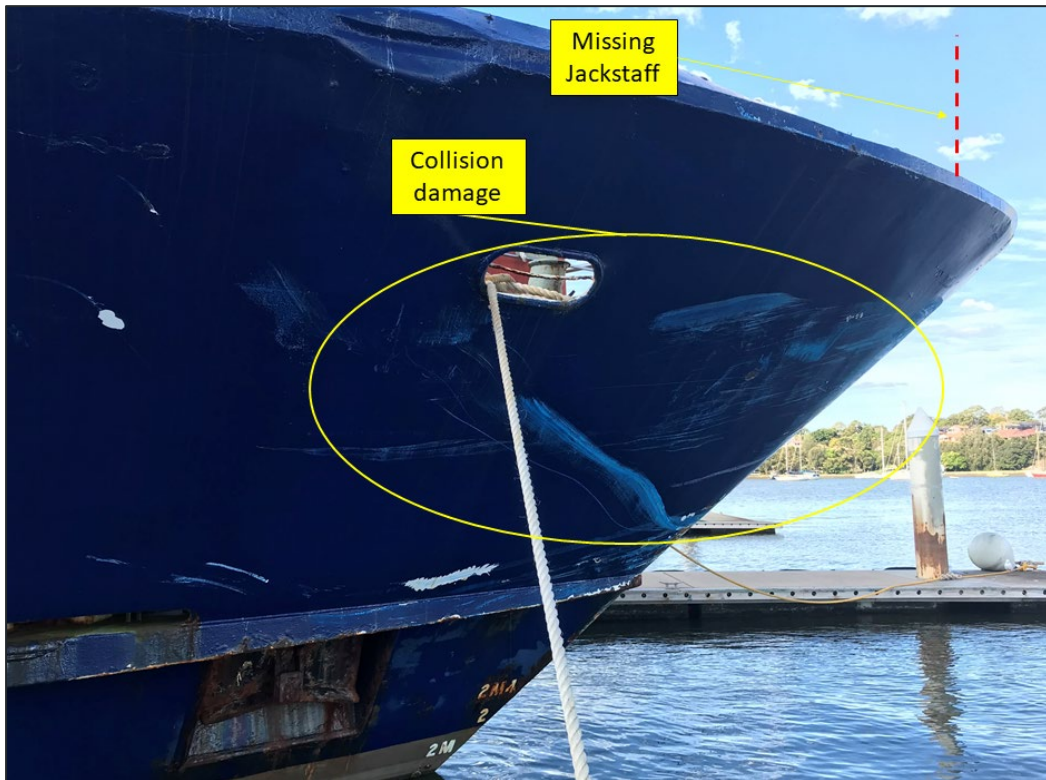


Source: Port Authority NSW annotated by OTSI

Figure 4: CCTV image from Blues Point Tower moments after impact

- 1.17 *John Cadman 3* suffered minor paint scrapes and scratches. The vessel also sustained damage to the Jackstaff⁵ from the fallen mast and rigging (see *Figure 5*).

1. ⁵ A Jackstaff is a short staff or pole at a ship's bow, on which a jack (flag) is hoisted.



Source: OTSI

Figure 5: John Cadman 3 damage

Events following the occurrence

- 1.18 Following the collision, *John Cadman 3*'s Master contacted Sydney Vessel Traffic Service (VTS) by VHF radio on channel 13 and requested assistance. The Master then instructed *John Cadman 3*'s crew to check on their passengers and to see if they could assist the smaller vessel.
- 1.19 *John Cadman 3*'s Master went to the starboard wing and spoke to *Rockfish 3*'s deckhand confirming there were no injuries and no one in the water.
- 1.20 When *Rockfish 3*'s crew realised that they were entangled on the bow of the larger vessel, they assessed the damage to their vessel.
- 1.21 *John Cadman 3*'s Master recognised that a southerly breeze was pushing both vessels towards the shore. The Master placed *John Cadman 3* into gear and steamed slowly into the breeze, maintaining a safe distance from the shore. Once the crew confirmed that the vessels were safe, the Master informed VTS that they would continue to steam slowly towards King Street Wharf, pushing the entangled *Rockfish 3*.
- 1.22 When the vessels reached the wharf, passengers on *John Cadman 3* disembarked. The two crews then disentangled the vessels.
- 1.23 NSW Police Marine Area Command boarded the vessels, interviewed the Masters and breath tested them, with negative results. Once the vessels were separated, *Rockfish 3*'s Master sailed the catamaran to its mooring in Lavender Bay. As the

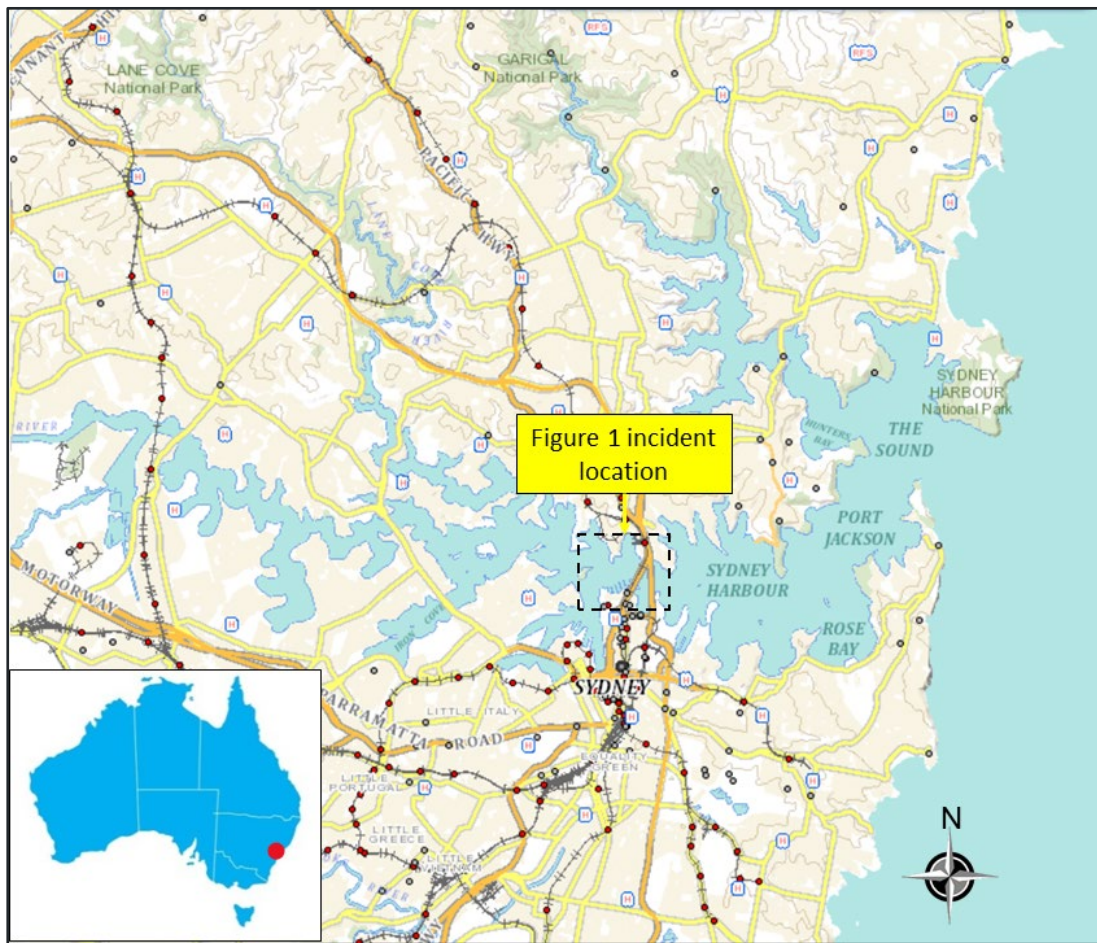
Master could not get the port engine to start due to water ingress from the collision, they transited on one engine with a NSW Police vessel escort.

- 1.24 *John Cadman 3* departed King Street Wharf and transited to berth at Cabarita marina on the Parramatta River, where the crew proceeded to secure the vessel without further incident.
- 1.25 The day following the collision, both Masters submitted incident reports to the national regulator, the Australian Maritime Safety Authority (AMSA).⁶
- 1.26 AMSA passed the incident reports to Transport for NSW (TfNSW).⁷ The TfNSW Maritime Investigations unit reviewed the incident reports and interviewed the Master of *Rockfish 3*, but not the Master of the *John Cadman 3*.

⁶ AMSA was a commonwealth statutory authority and corporate commonwealth entity, established under the *Australian Maritime Safety Authority Act 1990* (the AMSA Act) (Cth). It is the national regulator for domestic commercial vessels in Australia.

⁷ TfNSW was the lead transport agency of the NSW Government at the time of the collision whose functions were set out in the *Transport Administration Act 1988* (NSW).

Incident location

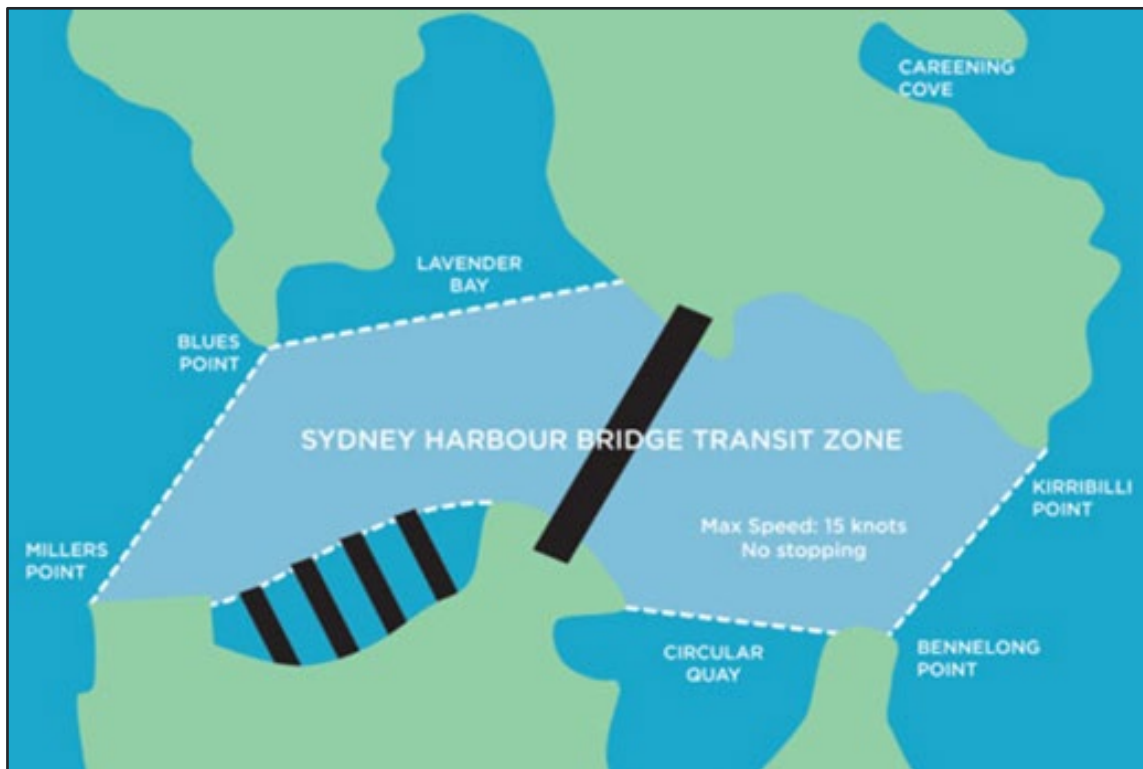


Source: SIX Maps annotated by OTSI

Figure 6: Incident location

- 1.27 The incident occurred in Port Jackson, in the area directly south of Lavender Bay and approximately 400 metres(m) west of the Sydney Harbour Bridge (see *Figure 6*). The relatively narrow waterway where the collision occurred was a recognised high traffic location and was managed as the Sydney Harbour Bridge Transit Zone (see *Figure 7*).

Sydney Harbour Bridge Transit Zone



Source: Transport for NSW

Figure 7: Sydney Harbour Bridge Transit Zone

- 1.28 The Sydney Harbour Bridge Transit Zone was established under NSW legislation⁸ following two fatal collisions⁹ that occurred in the area of water near the Sydney Harbour Bridge. The transit zone acknowledged the potential heightened risk in the vicinity of Sydney Cove and was created as a local waterway management tool to assist the safe navigation of all vessels in the recognised high traffic location.
- 1.29 The transit zone included the area of water around the Sydney Harbour Bridge and was bounded by imaginary lines between Bennelong Point and Kirribilli Point in the east, and from Blues Point to Millers Point in the west. It did not include Lavender Bay, Walsh Bay, or Sydney Cove. Vessels within the transit zone must not travel at a speed greater than 15 knots, anchor, or drift except in an emergency.

⁸ Section 11 of the Marine Safety Act: <https://legislation.nsw.gov.au/view/html/inforce/current/act-1998-121#sec.11>

⁹ Pam Burrigge Collision, 28 March 2007 and Dawn Fraser Collision, 5 May 2007. [Ferry Safety Investigations OTSI \(nsw.gov.au\)](#)

Environmental conditions

- 1.30 The evening of 12 December 2021 was mild and clear with a light southerly breeze of 8 to 10 knots in strength. Observations taken at the Bureau of Meteorology Sydney Harbour (Observatory Hill) weather station, located about 1 km to the south of the incident, recorded a minimum overnight temperature of 15.1 degrees Celsius, with no rain.
- 1.31 The moon was in the Waxing Gibbous¹⁰ phase with an illuminated surface of approximately 64%.

Ferry information

John Cadman 3



Source: Cadman Cruises annotated by OTSI

Figure 8: *John Cadman 3*

- 1.32 *John Cadman 3* was a steel 34.8 m Australian Domestic Commercial Vessel (DCV), in both 1E and 1D survey.¹¹ It was licensed to carry a maximum of 450 passengers and 15 crew (inclusive of hospitality staff).
- 1.33 The marine crew minimum core complement was a Master <35, Marine Engine Driver 1 and one GPH at the time of incident.

¹⁰ Waxing Gibbous phase is between a half moon and full moon. Waxing means it is getting bigger.

¹¹ 1D & 1E are vessel class and service categories of Australian Domestic Commercial Vessels. Class 1 is a Passenger vessel (13 or more passengers). The D (partially smooth water) & E (smooth water) signify operational area limits. For more details see <https://www.amsa.gov.au/>.

- 1.34 *John Cadman 3* was powered by two Yanmar 165 main engines rated at 224kW.¹² Auxiliary power was provided by two Yanmar 6HAL generators, each rated at 150kVA.¹³

Rockfish 3



Source: Rockfish Charters

Figure 9: Rockfish 3

- 1.35 *Rockfish 3* was a 11.6 m fibreglass DCV, in 1D survey. It could carry a maximum of 43 passengers and two crew. The minimum core complement was a Coxswain grade 1.
- 1.36 *Rockfish 3* was normally powered by two 25 hp Yanmar outboard engines, The vessel could also be navigated by wind with conventional sails. At the time of the collision, *Rockfish 3* was using its engines to make way, as such under the collision regulations it was considered a power-driven vessel.

¹² kW or Kilowatt, is a measurement of power equal to 1000 watts.

¹³ kVA or 1000 volt amps.

Operator information

- 1.37 *John Cadman 3* was operated by JCIII Pty Ltd. The vessel was the only one in the fleet and conducted regular day and night-time charters on Port Jackson.
- 1.38 *Rockfish 3* was operated by Rockfish Charters Pty Ltd, which operated a fleet of three charter catamaran vessels. Rockfish Charters conducted day and night charters on Port Jackson.

Crew information

John Cadman 3

- 1.39 The crew on *John Cadman 3* were appropriately qualified. The Master held a Master <35 Certificate of Competency that they had held since 2015. The Master had served on various vessels in several roles for over 30 years.
- 1.40 The vessel log recorded that the crew conducted regular safety drills. The Master said they conducted all the crew training on the vessel.
- 1.41 The Master explained that while the double charter days were long – they started at 1330 and lasted until around midnight – the crew felt rested and were used to the work.

Rockfish 3

- 1.42 The crew on *Rockfish 3* were appropriately qualified. The Master held a Coxswain grade 1, which they had held since December 2019. The Master had completed more than 250 hours in command of vessels in the Rockfish fleet.
- 1.43 The Master said that the long days were a challenge, but they were not fatigued on the night of the collision.

Collision regulations

- 1.44 The International Regulations for Preventing Collisions at Sea 1972, known as the COLREGs, set out, among other things, the ‘rules of the road’ for the sea. These navigation rules were to be followed by vessels at sea to prevent collisions. They applied to both vessels involved in this collision.
- 1.45 The COLREGs defined rules for how vessels must interact to minimise the risk of collision at sea. Several of the COLREGs applied to this incident.
- 1.46 **Rule 1: Application** - this stated that the COLREGS apply upon the high seas and all waters connected therewith that are navigable by seagoing vessels.
- 1.47 **Rule 2: Responsibility** - this rule was of an overriding nature and placed an onus on owners and mariners to avoid immediate danger. The rule provided for a departure from the COLREGS, if required to ensure safety.
- 1.48 **Rule 5: Look-Out** - mandated a requirement for every vessel to always maintain a proper look-out. The look-out must be maintained by all available means

appropriate for the prevailing circumstances and conditions, so as to make a full appraisal of the situation and of the risk of collision.

- 1.49 **Rule 6: Safe Speed** - required all vessels to always proceed at a safe speed, so as to be able to take proper and effective action to avoid a collision. When determining a safe speed, Masters were required to consider visibility, traffic density, and their vessel's handling characteristics (especially stopping distance and turning ability) in the prevailing conditions.
- 1.50 When determining a safe speed at night, a Master was expected to take into account the presence of background lighting (such as from shore lights).
- 1.51 **Rule 7: Risk of Collision** - every vessel was required to utilise all available means appropriate to the prevailing circumstances and conditions to determine if a risk of collision existed. If there was any doubt, such risk was deemed to exist.
- 1.52 **Rule 15: Crossing Situation** - when two power-driven vessels were crossing so as to involve a risk of collision, the vessel which had the other on its own starboard side must keep out of the way and if the circumstances of the case admitted, avoid crossing ahead of the other vessel.
- 1.53 **Rule 16: Action by give-way vessel** - every vessel which was required to keep out of the way of another vessel, must so far as possible, take early and substantial action to keep well clear.
- 1.54 **Rule 17: Action by stand-on vessel** - where one of two vessels was required to keep out of the way (give-way vessel), the other (stand-on vessel) must maintain its course and speed. The stand-on vessel was allowed to take action to avoid a collision as soon as it was apparent that the give-way vessel was not taking appropriate action.
- 1.55 Rule 17 expected the stand-on vessel to take any action to avoid a collision, once the two vessels came into such proximity, that action by the give-way vessel alone would not avoid a collision. This rule did not relieve a give-way vessel of its obligation to keep out of the way.

National Law and Safety Management Systems

- 1.56 Australian Domestic Commercial Vessels (DCV) were governed by rules set out in the National System for Domestic Commercial Vessels. To operate in Australian waters, DCVs required a Certificate of Survey and a Certificate of Operation.¹⁴ The crew who operated these vessels were required to hold Certificates of Competency.
- 1.57 A Certificate of Operation set out the conditions under which a DCV was to operate. It was a condition of a Certificate of Operation that a vessel had an SMS

¹⁴ For further information on Certificate of Survey and Operations, see www.amsa.gov.au

that complied with the requirements of Marine Order 504 (MO504)¹⁵. Under MO504, it was the responsibility of the owner/operator of a DCV to implement and maintain an SMS.

- 1.58 AMSA published Guidelines¹⁶ that outlined what an SMS should cover to ensure that each vessel's SMS was based on a risk assessment of the vessel's specific operations. The Guidelines provided information, checklists and templates to assist operators to develop their SMS. The Guidelines stated that a vessel's SMS *must be tailored to reflect the size and complexity of the specific operation, as well as the risks unique to a vessel and its operation*. At any time, an SMS may be assessed by AMSA.
- 1.59 An SMS represents a systematic approach to managing risks to safety arising from (DCV) operations. It begins with an operator conducting a risk assessment of their operations to identify risks unique to that vessel and its operating environment. The completed SMS should document how a company manages risks to safety for the vessel, its operation and maintenance, and all those on board.

Related occurrences

- 1.60 Previously, two collisions resulting in fatalities have been the subject of OTSI reports. These collisions occurred in the same vicinity of the Sydney Harbour Bridge as the *Rockfish 3 / John Cadman 3* collision.

Pam Burridge¹⁷

- 1.61 On 28 March 2007, the 24 m passenger ferry *Pam Burridge* collided with the 9.15 m timber moto cruiser *Merinda*. The collision occurred at night and approximately 100 m east of the Sydney Harbour Bridge.
- 1.62 As a result of the collision, *Merinda* was effectively cut in two and sunk. Four people on board *Merinda* were fatally injured and the remaining eight were hospitalised.
- 1.63 At the time of the collision, *Pam Burridge's* Master was alone in the wheelhouse. *Merinda's* helmsman was navigating the vessel from inside the main cabin, with the internal cabin lights on and the vessel's navigation lights extinguished.

¹⁵ Federal Register of Legislation - Australian Government. Marine Order 504 (Certificates of operation and operation requirements – national law) 2018 is made under the Marine Safety (Domestic Commercial Vessel) National Law Act 2012 and provides for the: certificate of operation application requirements. criteria for the issuance or renewal of a certificate of operation.

¹⁶ Guidelines for a Safety Management System A guide for domestic commercial vessels to develop their Safety Management System Class 1, 2, 3 and 4 Operations, Australian Maritime Safety Authority, December 2020.

¹⁷ [Sydney Harbour - Pam Burridge - Collision | OTSI \(nsw.gov.au\)](https://www.nsw.gov.au/otsi/sydney-harbour-pam-burridge-collision)

- 1.64 The investigation found that because *Merinda* was not displaying navigation lights as required, it did not become visible to the Master of *Pam Burridge* until it was too late for effective collision avoidance action.
- 1.65 The investigation also found that as *Merinda* was operated from within the lit main cabin, the crew were not maintaining a proper look-out. The positioning and framing of the cabin windows and superstructure also restricted the crew's field of vision. As a result, the crew did not see the approaching *Pam Burridge* and did not take action to avoid collision.
- 1.66 The investigation found that lighting conditions in the vicinity of the Sydney Harbour Bridge at night could vary significantly and detract from crew ability to observe other vessels.
- 1.67 The investigation added that there was an increased risk of collision in the immediate area surrounding the Sydney Harbour Bridge (Transit Zone). The increased risk was due to several factors, including the:
- relative narrowness of the channel in the location
 - convergence of traffic travelling east, west and entering and departing from Sydney Cove and Walsh Bay
 - juxtaposition of commercial and recreational marine traffic
 - variability of lighting at night (night-time environmental conditions).

Dawn Fraser¹⁸

- 1.68 On the morning of 5 January 2007, the 34 m passenger *Dawn Fraser* collided with a small aluminium runabout dinghy that was drifting in a busy channel. The collision occurred west of the Sydney Harbour Bridge, approximately 150 m north-west of Dawes Point.
- 1.69 The collision resulted in both people on the dinghy entering the water. One of them was fatally injured.
- 1.70 The investigation findings included that, *Dawn Fraser* was travelling at approximately 22 knots, in reduced visibility due to glare from the morning Sun. The report also found that the Master was alone in the wheelhouse.
- 1.71 The dinghy was drifting in the busy channel near the Sydney Harbour Bridge. The two people were fishing and not adequately maintaining a look-out.
- 1.72 The investigation also found that the area in the vicinity of the Sydney Harbour Bridge was subject to high traffic flow. The report included a recommendation for the introduction of speed limits and the prohibition of drifting near the Sydney Harbour Bridge (what became the Sydney Harbour Bridge Transit Zone).

¹⁸ [Walsh Bay - Dawn Fraser - Collision | OTSI \(nsw.gov.au\)](#)

Part 2 Analysis

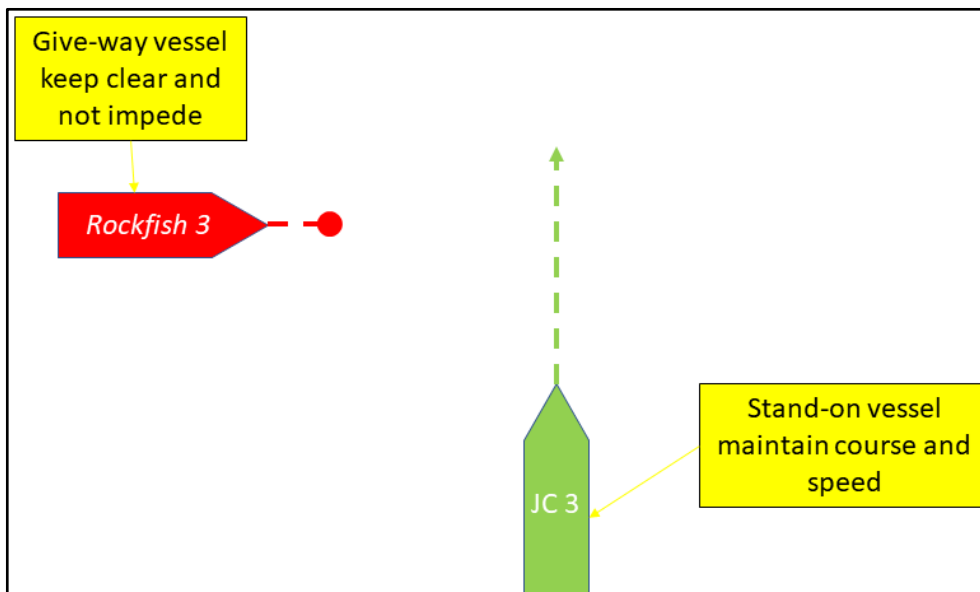
Introduction

- 2.1 The investigation focused primarily on the factors that contributed to the collision: the actions of the crews, environmental conditions, visibility from the helm of both vessels, company risk assessments and SMS.

COLREGS

- 2.2 The COLREGS was a series of rules the purpose of which was to prevent collisions at sea. They were divided into Parts A, B, C, D and E.
- 2.3 **Part A – General (rules 1 to 3)**, was an overarching part that described how the COLREGS were applied, seafarers and owners' responsibility and general definitions.
- 2.4 **Rule 2 – Responsibility**, placed a general duty on all seafarers to continually assess the dangers of navigation when following the rules. It applied to both Masters involved in the collision between *Rockfish 3* and *John Cadman 3*. It described and allowed a departure from the rules, if necessary, to avoid immediate danger and avoid a collision.
- 2.5 **Part B – Steering and Sailing Rules**, was divided into three sections. **Section 1 – Conduct of vessels in any condition of visibility (Rules 4 to 10)** included Rules 5 and 7 which focused on maintaining a look-out and assessing danger.
- 2.6 **Rule 5 – Look-out**, which required every vessel to maintain a proper look-out by sight, hearing as well as all available means appropriate to the prevailing circumstances and conditions. Rule 5 required seafarers to constantly monitor and assess any given situation to determine if a risk of collision existed. Neither vessel involved in the collision met the requirements of this rule.
- 2.7 **Rule 7 – Risk of Collision**, required a vessel's crew to utilise all available means appropriate to the conditions and circumstances, when determining if a risk of collision existed. The rule stipulated that crew must utilise radar equipment if available, it also required systematic observation of detected objects.
- 2.8 Neither vessel involved in the collision saw the other vessel (Rule 5) and thus did not adhere to this rule.
- 2.9 **Section 2 – Conduct of vessels in sight of one another (Rules 11 to 18)**. Rules in this section described how vessels should interact when they were in sight of one another.
- 2.10 **Rule 15 – Crossing Situation**, described how power-driven vessels should manoeuvre when they were crossing, and a risk of collision existed. Rule 15 instructed the vessel with the other on its own starboard side (*Rockfish 3*) to keep clear and not impede the other vessel (*John Cadman 3*).

- 2.11 When a vessel was required to not impede another vessel in the rules it became known as the ‘give-way vessel’ (*Rockfish 3*). **Rule 16 – Action by the give-way vessel**, described how the give-way vessel must take early and substantial action when avoiding a collision. This requirement was so that the other vessel, the stand-on vessel, could properly assess the situation and avoid confusion, minimising the risk of collision.
- 2.12 **Rule 17 – Action by the stand-on vessel**, described when one vessel was required to keep out of the way, the other vessel must maintain their course and speed (see *Figure 10*). If the Master of the stand-on vessel (*John Cadman 3*) found themselves so close that a collision could not be avoided by the give-way vessel alone, they must take such action as would best aid to avoid a collision.



Source: OTSI

Figure 10: Crossing situation

- 2.13 The COLREGS did not include the concept of ‘right of way’. Rule 2 specifically placed a responsibility on both the give-way and stand-on vessels to avoid a collision.
- 2.14 **Section 3 – Rule 19 Conduct of vessels in restricted visibility**, this section stipulated how vessels not in sight of one another and in or near areas of restricted visibility must navigate. The term ‘restricted visibility’ was defined by the rules as, ‘...any condition in which visibility is restricted by fog, mist, falling snow, heavy rain, storms, sandstorms or any other similar causes...’.
- 2.15 **Parts C, D and E**, were more of a technical nature and not included in this report’s analysis. CCTV¹⁹ recordings show that both vessels were displaying the correct navigation lights as expected by the COLREGs, these parts are not considered to have played a part in this collision.

¹⁹ Closed Circuit Television

- 2.16 Following the collision, both Masters were interviewed, with each reporting that they did not see the other vessel until it was too late to avoid collision. The investigation looked at what factors combined to prevent Rule 5 (look-out), and the corresponding crossing rules, from being effectively carried out.

Vessel design and the maintenance of a proper look-out

John Cadman 3

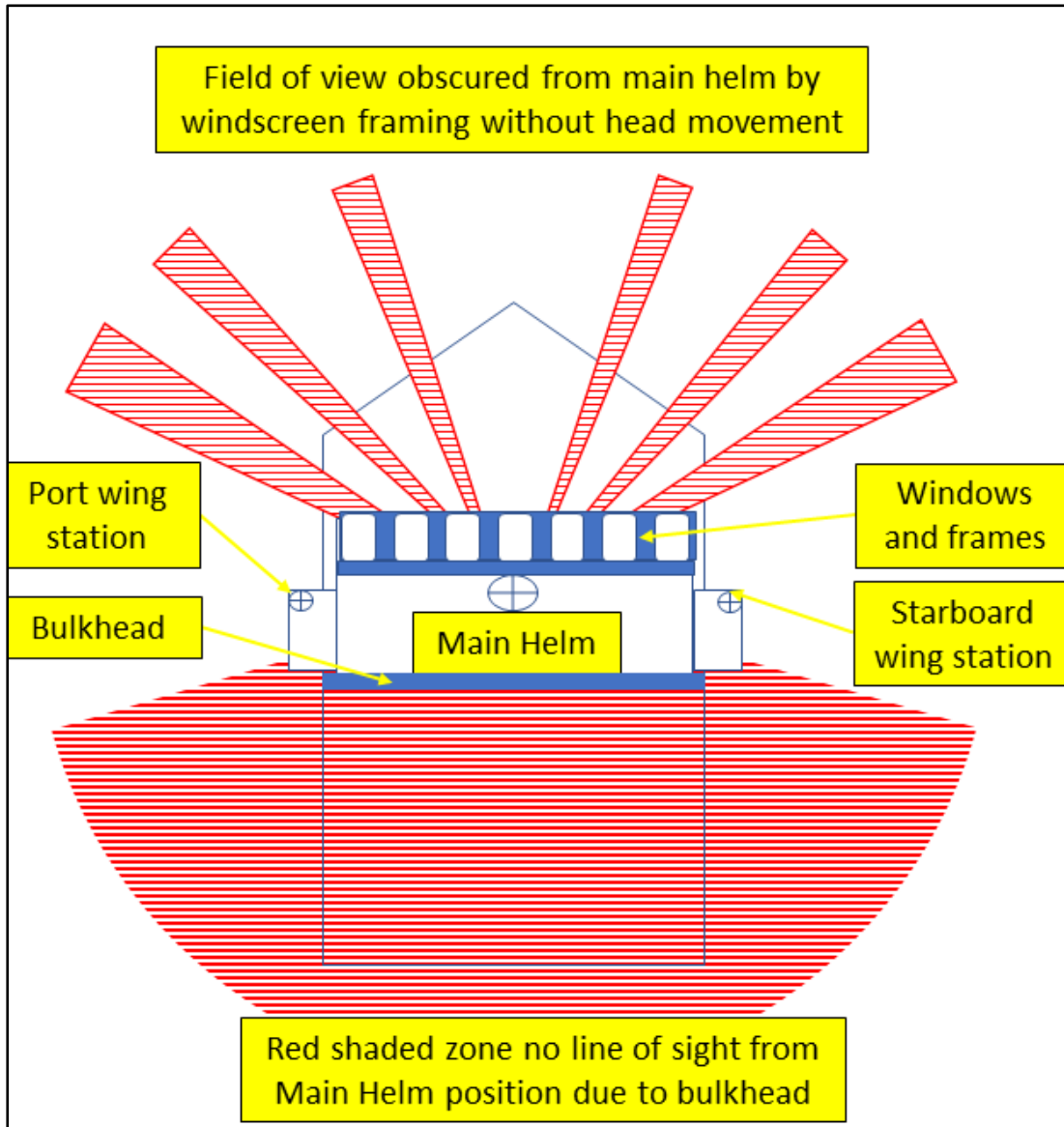
- 2.17 *John Cadman 3*'s wheelhouse was located on the middle deck at the front of the superstructure (see *Figure 8*). The wheelhouse had three control stations: the main helm position and the two bridging stations (port and starboard).
- 2.18 The view from the main helm position, which was located on the centreline of the vessel, was either restricted or blocked due to the vessel's superstructure in several directions. The sleek design of the vessel's forward superstructure resulted in the wheelhouse windows being raked backwards from bottom to top (see *Figure 11*).
- 2.19 The windows were divided by heavy box type frames which obstructed the field of view, posing a challenge to maintaining a look-out from the main helm position. The obstruction to the field of view increased the further from directly ahead one looked, due to the rake of the window and the box design of the frames.



Source: OTSI

Figure 11: John Cadman 3 view to port from main helm station

- 2.20 The view to the rear was non-existent from the main helm station due to a solid bulkhead. If the Master wanted to look behind the vessel, they had to walk to either bridgewing station. The two bridgewing stations provided a view towards the rear and to their respective side (port or starboard). These bridgewing positions were mainly utilised when berthing the vessel. None of the control stations offered a view directly astern.
- 2.21 If a Master did not move their head position or utilise a trained second person as a look-out, the blind spots created by the window framing could hide potential hazards (see *Figure 12*). This restriction in view is also called ‘wooding’ and should be recorded in the Ship’s SMS.

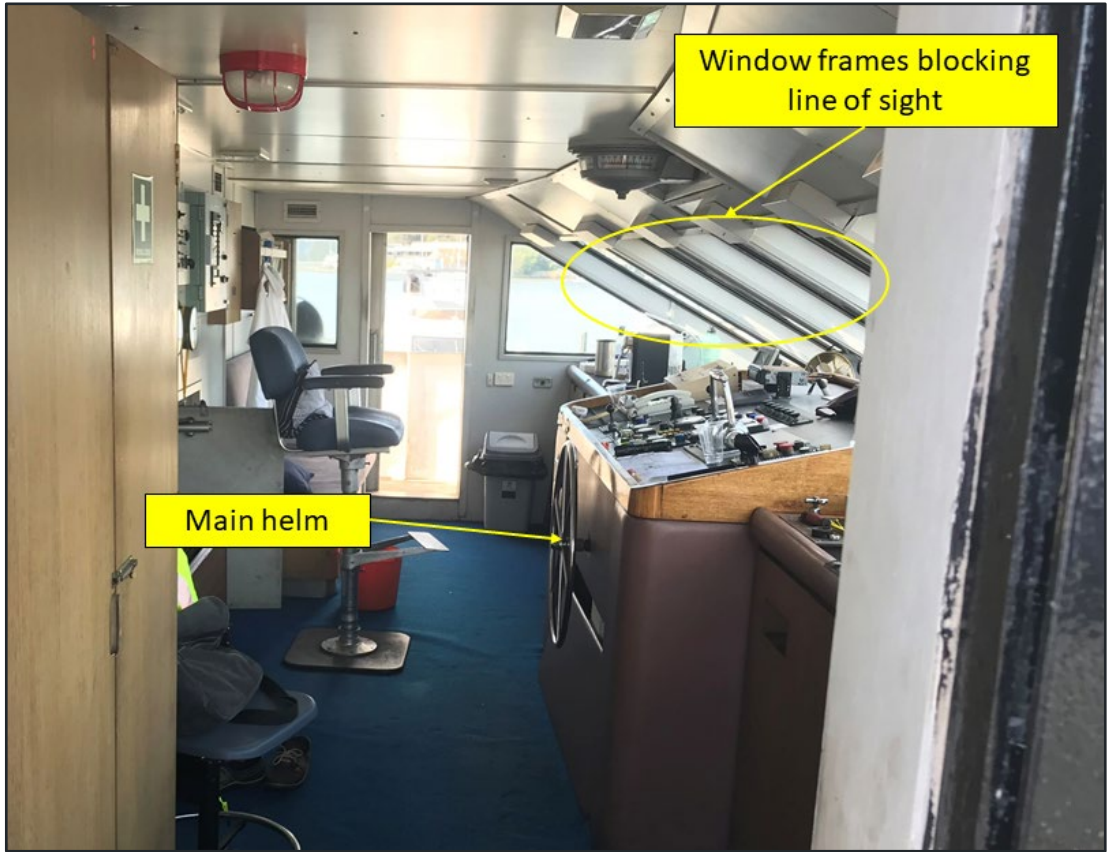


Source: OTSI

Figure 12: Plan field of view from *John Cadman 3* main helm station (not to scale)

- 2.22 The size of the blind spots created by the bridge window framing (wooding) varied depending on the angle of the viewer. For example, if a person stood on the starboard side of the wheelhouse, they had almost no view to the port bow²⁰ (see *Figure 13*).
- 2.23 The blind spots reduced as an observer made their way towards the centreline, but never disappeared.

²⁰ Port bow is the area of a vessel to the left of directly ahead.

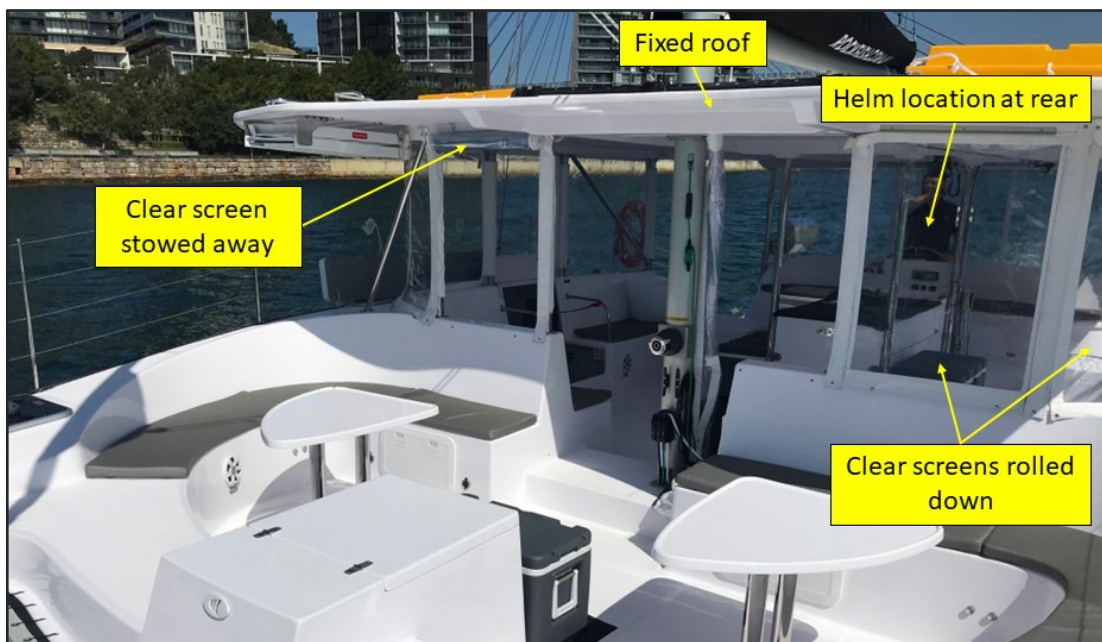


Source: OTSI

Figure 13: View to port from starboard wing station

Rockfish 3

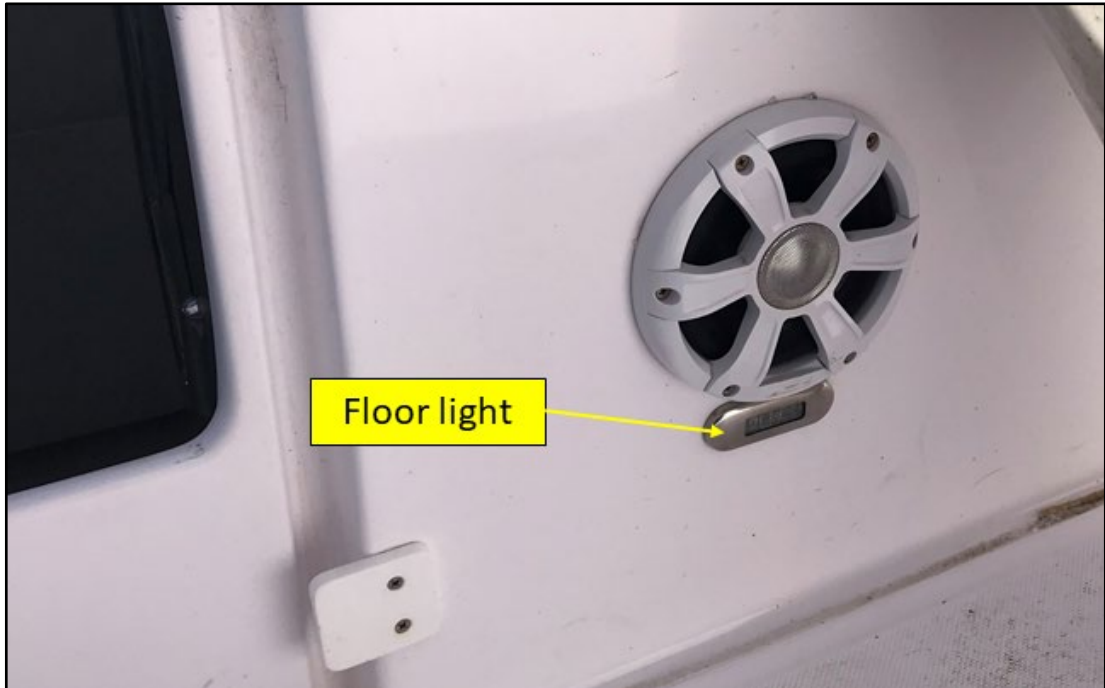
- 2.24 *Rockfish 3*'s helm station was located at the rear of the vessel in the main passenger cabin area. This cabin was protected by a fixed roof but did not have windows and was open to the elements. Attached to the roof were several see-through plastic screens (clears), that could be rolled down to provide protection from wind and rain (see *Figure 14*).
- 2.25 The clears or clear vinyl boat screens were made from polyvinyl chloride (PVC). When new, the clears offered a relatively transparent view in daylight. Improper storage or ageing from the sun and elements could cause the clears to become hazy, significantly reducing transparency, and distorting images viewed through them.
- 2.26 In *Rockfish 3*, when the clears were rolled up, the minimal roof supports provided an excellent field of view from the helm position. When deployed in daylight, the visibility offered by the clears in good condition, while not the same clarity as glass, allowed the crew to sufficiently navigate the vessel.
- 2.27 At night, when cabin lights were illuminated, deployed clears reflected internal lighting and would have offered little to no vision of external hazards. Even with the cabin lights extinguished, light refraction from external sources could show on the clears, reducing visibility compared to angled glass. For this reason, clears were often rolled up to allow improved look-out at night.



Source: Rockfish Charters, annotated by OTSI

Figure 14: *Rockfish 3* looking towards rear showing cabin clears

- 2.28 *Rockfish 3* had several internal floor lights to provide illumination for night operations. The floor lights (see *Figure 15*) assisted passengers and crew to safely walk about the vessel. They offered reduced reflected glare which improved the crew's ability to maintain a proper look-out.



Source: OTSI

Figure 15: Floor light

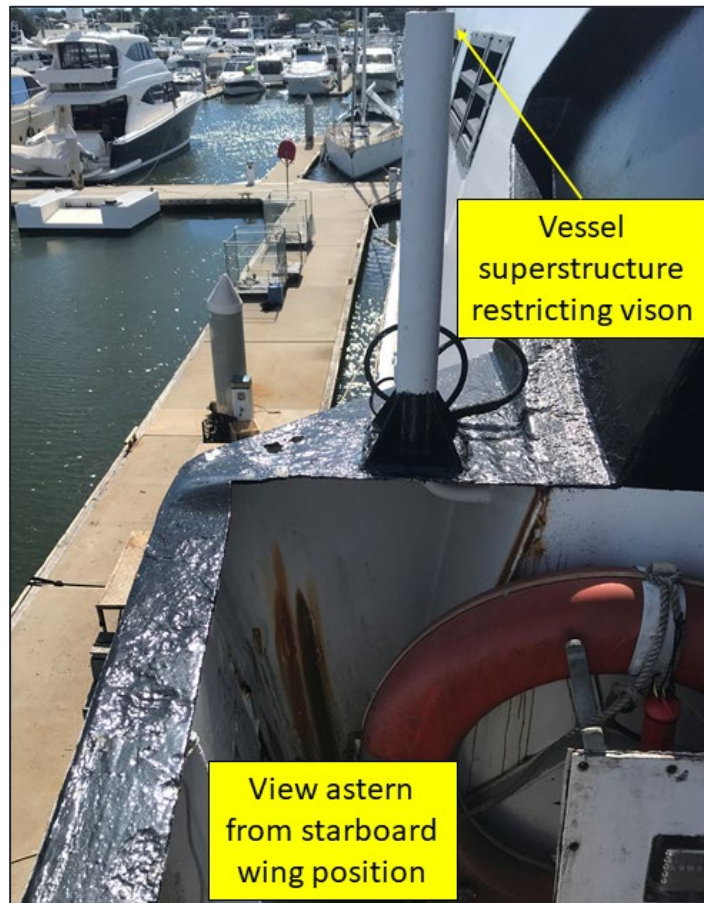
- 2.29 The location of the helm station at the rear of the vessel posed further challenges to the maintenance of a proper look-out when underway. With the helm station at the rear, any passengers moving about the vessel were in front of the Master and could potentially obstruct their line of sight. To navigate safely, a Master would have to constantly move to ensure that potential hazards were seen, monitored, and responded to.
- 2.30 When the clears were deployed, as they were on the night of the incident, the Master had a limited line of sight unaffected by the reflected lighting (see *Figures 18 & 19*). In these circumstances, without the use of a trained look-out, the Master would likely have found maintenance of a proper look-out challenging.

Crew actions

John Cadman 3

- 2.31 During normal operations *John Cadman 3* was navigated with two crew in the wheelhouse: the Master and Engineer (look-out). The Engineer assisted the Master in maintaining a proper look-out. Periodically, the Engineer left the wheelhouse to go to the lower deck to inspect the engine room. Following the completion of the engine room rounds, the Engineer recorded engine readings in a logbook and returned to the wheelhouse.
- 2.32 On the night of the collision, *John Cadman 3* entered the Sydney Harbour Bridge Transit Zone from the east, travelling in a westerly direction. The Master was alone in the wheelhouse as the Engineer was conducting engine rounds.

- 2.33 The Master described during interview that as *John Cadman 3* passed under the Sydney Harbour Bridge, two previously unseen large cruisers overtook the vessel in close proximity. The wash created by those two vessels unsettled *John Cadman 3* causing it to roll. The Master, concerned that the rolling vessel could cause falls among the passengers, walked to the port bridging to look behind the vessel for further overtaking traffic.
- 2.34 When the Master reached the port bridging, they confirmed that no vessels were overtaking on that side. The wing positions offered excellent vision to their corresponding side, but no vision directly astern or towards the opposite side (see *Figure 16*).
- 2.35 The Master then re-entered the wheelhouse and crossed to the starboard bridging, to check that side for overtaking traffic. Once the Master confirmed that no further traffic was overtaking, they walked back towards the main helm position midships.



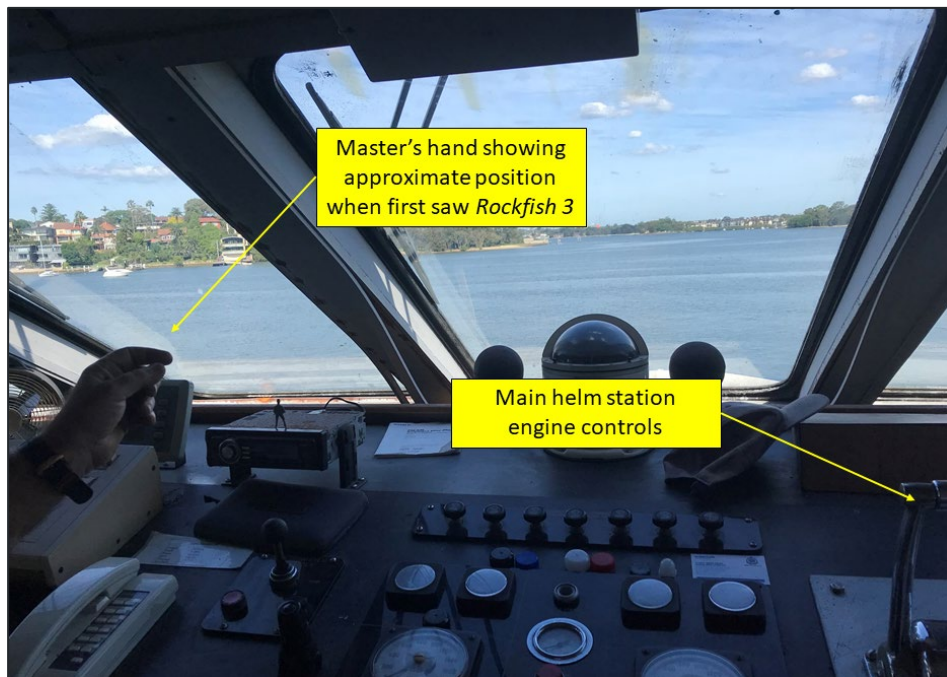
Source: OTSI

Figure 16: Line of sight astern starboard wing station

- 2.36 As the Master returned to the main helm station, their view towards the port bow was obstructed by the vessel windscreen layout (see *Figure 13*). The port bow

was the location *Rockfish 3* approached from. It is likely that *Rockfish 3* was concealed by the window framing and out of the Master's line of sight.

- 2.37 It is also likely that when the Master checked ahead before going to the bridgewing to look astern, *Rockfish 3* was on the port bow to the south of the channel away from *John Cadman 3*'s intended path. The Master was focused on the task of checking behind the vessel and did not perceive any hazards in front of them.



Source: OTSI

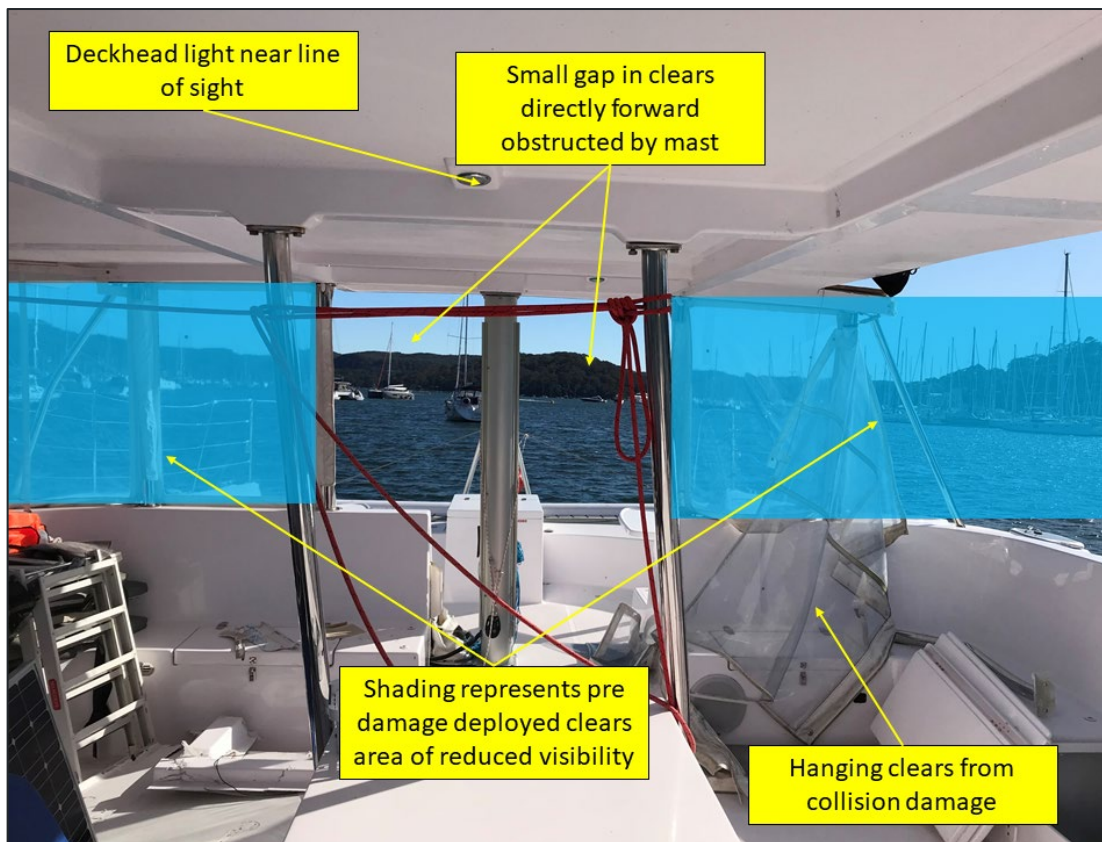
Figure 17: Approximate location of *Rockfish 3* when first sighted

- 2.38 When the Master walked back from the starboard bridgewing station to the main helm, they saw nothing to contradict their assumption that the path ahead was clear.
- 2.39 The Master described that upon reaching the vessel helm, they first noticed *Rockfish 3* close to *John Cadman 3*'s port bow (see *Figure 17*). The Master immediately placed the engine controls in neutral, then astern, to stop the vessel. *John Cadman 3* slowed, but the distance between the two vessels was insufficient to prevent a collision.
- 2.40 The Master attempted to sound the ship's whistle, but in the pressure of the situation and darkness of the wheelhouse, they momentarily mistook what vessel they were on, and missed the activation button.
- 2.41 It is likely that had the Engineer been in the wheelhouse assisting the Master in the maintenance of a look-out, they may have spotted *Rockfish 3* earlier. Earlier recognition of the risk of collision posed by *Rockfish 3* would have given the

Master time to activate the appropriate sound signals and/or take action to avoid a collision.

Rockfish 3

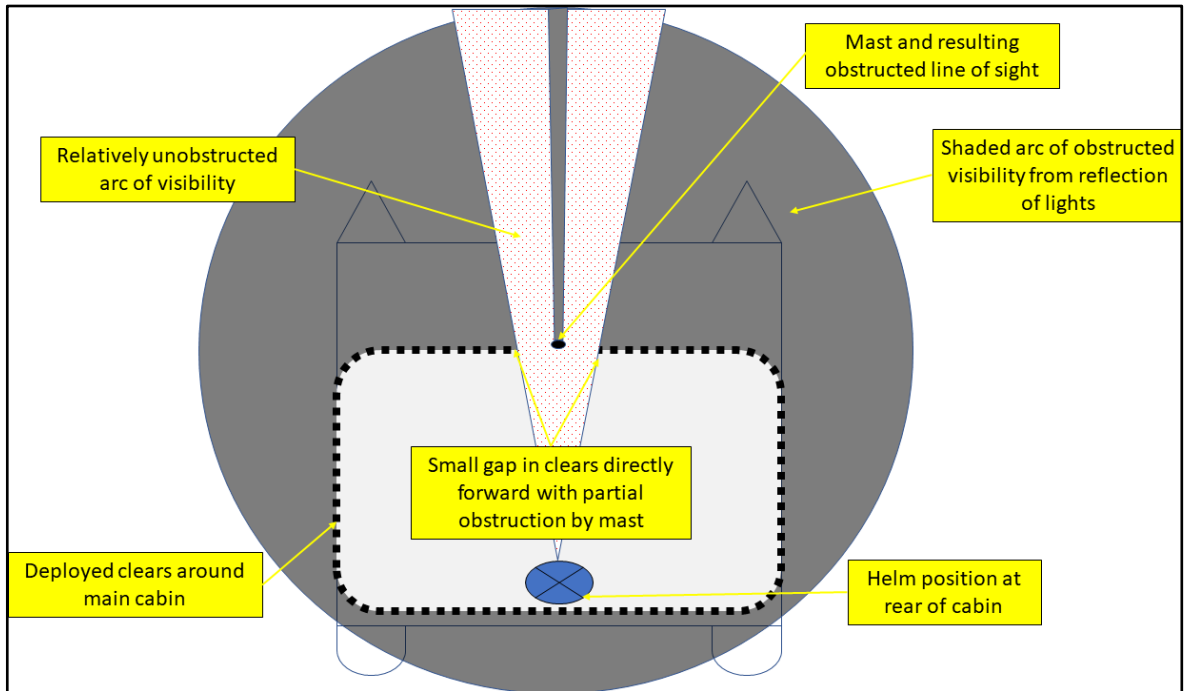
- 2.42 *Rockfish 3's* Master described at interview that they had lowered the clears earlier in the night during the charter. The clears had been lowered to provide some protection from the wind to the passengers. The Master said that during the charter they had the floor lights illuminated, so the passengers could see where they were going as they moved about the vessel.
- 2.43 Just prior to the collision, *Rockfish 3's* crew had disembarked their passengers at King Street Wharf at Darling Harbour. The Master said that when they unloaded the passengers, they turned on the cabin deckhead lights, to improve visibility. When the vessel departed King Street wharf, the Master left the deckhead lights illuminated as the deckhand proceeded to clean and tidy the vessel.
- 2.44 With the vessel clears lowered and cabin lights illuminated, the Master inadvertently reduced their capacity to maintain a proper and effective look-out. The Master was located at the rear of the lit cabin and only had a small area directly in front of them unobstructed by the lowered clears (see *Figure 18*). Either side of this gap, the Master had to look through the reflections on the clears to identify hazards to navigation.



Source: OTSI

Figure 18: View from helm ahead, highlighting reduced visibility with clears in place

- 2.45 With the clears lowered and cabin lights on, *Rockfish 3*'s Master sailed from King Street Wharf effectively with vision only through the gap in the clears, either side of the mast. Hazards in the arc of visibility, concealed by the clears or behind the shadow of the mast, were unlikely to be noticed by the Master at the rear of the vessel (see *Figure 19*) where he was positioned.
- 2.46 The risk posed by the decision to sail with the clears in place and the cabin lights on could have been mitigated by the placement of a trained look-out near the bow. In this incident, the crewman was engaged in cleaning rather than conducting the duties of a lookout.

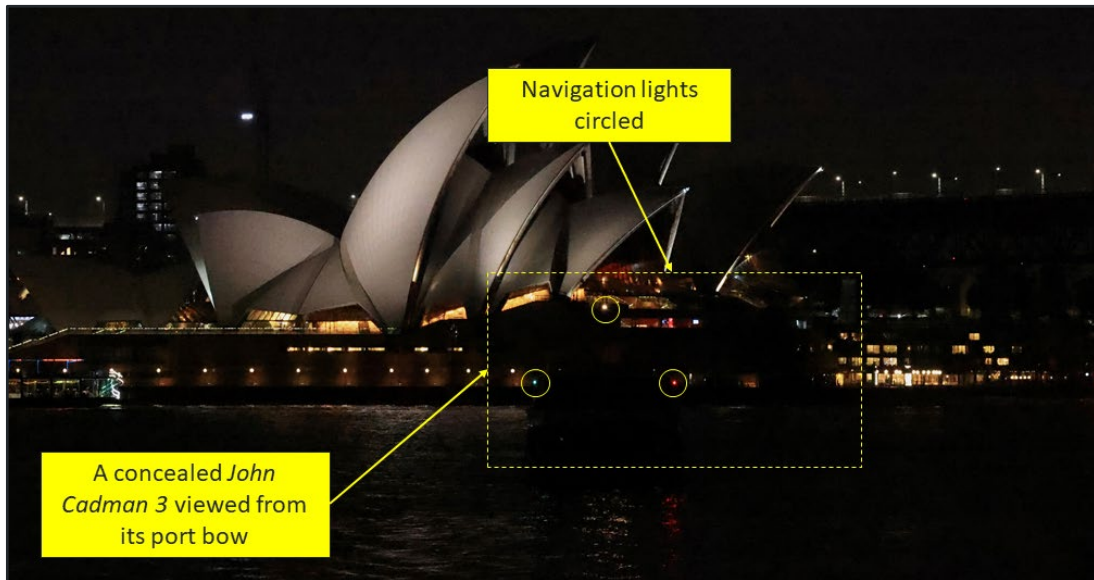


Source: OTSI

Figure 19: Plan representation of limited line of sight with clears in place and cabin lights on (not to scale)

- 2.47 When *Rockfish 3* was sailing towards the east along the southern shore of the Sydney Harbour Bridge Transit Zone, the Master would have had *John Cadman 3* in the port bow sector, and likely obscured by the clears. As *Rockfish 3* turned to port and towards the north, *John Cadman 3* would have momentarily passed through the sector without obstructed vision. *John Cadman 3* was most likely to have been observed by *Rockfish 3*'s Master as she passed through this sector. Once *Rockfish 3*'s turn placed *John Cadman 3* in the arc of visibility behind the clears on the starboard side, the larger vessel again became concealed from the view of *Rockfish 3*'s Master.
- 2.48 Other factors may have led to *John Cadman 3* not being sighted as it passed through the small sector of forward visibility. *John Cadman 3*'s hull was painted a dark blue with a white superstructure. Both the CCTV and photographs from the night of the incident (see *cover and Figure 4*) showed that from the shore and from a height, the white superstructure was easily identifiable.

- 2.49 However, from the lower line of sight of *Rockfish 3*'s Master, *John Cadman 3* with its dark blue hull was hard to identify. Similar images taken at water level reveal that even the white superstructure could disappear in the dark of night and the vessel's navigation lights could become lost in the confusion of background shore lighting (see *Figure 20*).



Source: OTSI

Figure 20: *John Cadman 3* concealed at night

- 2.50 The collision occurred with *Rockfish 3* sailing on a northerly course in the direction of Lavender Bay. On the north-eastern shore of Lavender Bay was Luna Park, an amusement park lit by many lights of varying colours. *John Cadman 3* was sailing towards the west with Luna Park behind from *Rockfish 3*'s perspective.

It is likely that *John Cadman 3*'s navigation lights became lost in the backlight of the amusement park's lighting. The blending in of the navigation lights, in the confusion of the park's lights, further lessened the likelihood that *Rockfish 3*'s Master would have sighted *John Cadman 3*.

- 2.51 The collision occurred due to the ineffective application of COLREGs look-out procedures by both Masters of the involved vessels. This resulted in both Masters not sighting each other in adequate time to avoid a collision.

Hours of work

- 2.52 Both *Rockfish 3* and *John Cadman 3*'s crews carried out two charters on the day of the collision. Both Masters reported during interview that they were rested, not fatigued and that 10 to 12 hour days were normal for them to complete. This shift duration was within AMSA's fatigue management guidelines of a 12-hour maximum duty.
- 2.53 *Rockfish 3*'s crew had commenced work at 1130 and were in the 11th hour of operations when the collision occurred. The Master said at interview that

following the first charter, they had approximately one hour before the next charter commenced. During this hour, they sailed to White Bay and pumped out the sullage tank, then drifted until the scheduled pick up for the second charter at 1800, at King Street Wharf. The crew did not moor the vessel and take a rest break but drifted while still maintaining a look-out for hazards.

- 2.54 *John Cadman 3's* crew commenced work at 1330 earlier that day. The Master reported that they had a short break between charters. The Master also said that the Engineer would normally take the helm and give them a break from steering the vessel during charters.
- 2.55 Navigating a charter vessel on Sydney Harbour demanded a high level of concentration to minimise the risk and likelihood of a collision. It often involved long hours of slow speed sailing on a familiar repetitive anti clockwise course around the harbour, its bays and foreshore. For a Master, often isolated in the bridge, the demands on concentration and vigilance could lead to fatigue.
- 2.56 The familiar and repetitive nature of the work could become monotonous, which could increase the risk of a Master making errors, such as a lapse of concentration or complacency.
- 2.57 Studies have described that long work hours can exacerbate the likelihood of errors occurring if not managed effectively²¹. Guides describe how shift work exceeding 8 hours in duration, especially when combined with repetitive or monotonous work, can increase the risk of accidents, particularly towards the end of a long shift or during the night.
- 2.58 Both crews involved in this collision were working at night and at or near the end of their respective workdays.

Sydney Harbour Bridge Transit Zone and night-time operations

- 2.59 As discussed previously, the Sydney Harbour Bridge Transit Zone was established following several fatalities in the same vicinity. It recognised that the area of water, surrounding the Sydney Harbour Bridge was heavily trafficked, a natural choke point and had variable lighting conditions at night. All vessel traffic travelling from west to east, or vice versa, passed through this channel.
- 2.60 At night, the shadow cast by the Sydney Harbour Bridge made it challenging to identify vessels and hazards. On the northern side of the channel, the amusement park, with its multitude of coloured lights, added to the confusion of backlight a Master could experience while navigating through the area.
- 2.61 On the eastern side of the transit zone was Sydney Cove, the main hub for maritime passenger transport on Port Jackson. Vessels entering and departing Sydney Cove did so in a north-south course, merging with the east-west commercial and recreational marine traffic of the transit zone. This convergence

²¹ Britain., G. (2006). *Managing shift work: health and safety guidance*. Hse Books

could add to the challenging conditions when identifying the intended destination of other vessels in the area.

- 2.62** Operators of DCVs were required by the National Law to assess the conditions their vessels operated in, and to provide controls to mitigate identified risks in their SMS. The Sydney Harbour Bridge Transit Zone was an identified area of increased vessel traffic and therefore risk, which would reasonably be expected to be addressed within both vessels' SMS.

SMS Review

OTSI conducted a review of each company's SMS against the requirements of MO504 and the AMSA guidelines and found the following.

John Cadman 3

- 2.63 The SMS contained a risk assessment that included collision as a risk. The mitigation for the collision risk was identified as being an administrative control, but there was no corresponding procedure included in the SMS.
- 2.64 The company regularly operated charters at night, and on almost every occasion, travelled through the Sydney Harbour Bridge Transit Zone during a charter. However, neither night-time operation nor transit in the Sydney Harbour Transit Zone were identified as potential risks in the SMS.
- 2.65 The SMS did not include the identification, assessment or mitigation for the visibility issues highlighted above for the wheelhouse windows (paragraphs 2.18 to 2.22).
- 2.66 A review of the SMS revealed that it was focused on the technical aspect of operating the vessel. For example, procedures for engine room systems were highly detailed and easy to follow. However, there was little documentation for crew training and general operations such as look out. The SMS included a detailed maintenance plan commensurate with the operational and safety systems that made up the *John Cadman 3*.
- 2.67 The operational environment component of operating the vessel was less detailed. Crew training and induction were addressed through the use of a simple induction checklist. This checklist did not provide information as to what competencies had to be achieved for the crew to be considered competent and able to fulfil their roles on board the vessel. The completion of training and the manner in which it was delivered was at the discretion of the person conducting the training.
- 2.68 The Master stated during interview that training was carried out on an ongoing basis, through toolbox talks and drills. New crew would be walked through procedures by senior crew during normal operations. The Master highlighted that ongoing training of crew was challenging, due to the casual nature of the workforce and staff turnover.

Rockfish 3

- 2.69 *Rockfish 3's* SMS was a small document consistent with the size and nature of the vessel. The document's risk assessment contained no mention of night-time operations, nor transit through the Sydney Harbour Bridge Transit Zone. The use of internal cabin lights and clears at night was not identified as a risk in the SMS.
- 2.70 Maximum work hours for any given day were addressed in the SMS through an instruction that a 12-hour maximum must include a break between charters. The duration of the break was not specified, neither was the form it was to take.

- 2.71 The SMS was generic in places and included procedures that did not correspond with the vessel's equipment or layout. For example, the fire procedure required the use of a fire hose, yet the vessel did not have a fire hose. The procedure for grounding/collision included an instruction to utilise a valve chest and fire hose, but the vessel had neither.
- 2.72 The SMS covered three vessels in the Rockfish fleet. The vessels, while similar in appearance, contained different equipment and layouts, yet shared the one SMS.

Safety actions taken

John Cadman 3

- 2.73 Following the collision, the company and crew conducted a review of their SMS and risk register. This review resulted in several procedural changes and vessel modifications. These included:
- modifications to the wheelhouse window framing to reduce blind spots
 - the addition of double row party lights down both sides of the superstructure to increase the conspicuity of *John Cadman 3* to other vessels
 - changes to crew induction procedure to include the confirmation of competency, through assessment criteria and a questionnaire
 - the development and inclusion of a Transit Zone and reduced visibility look-out procedure. The procedure calls for a lookout to be in the wheelhouse to assist the Master when travelling through the Transit Zone (day or night). It also instructs Masters to utilise extra lookouts as required in time of reduced visibility.

Rockfish 3

- 2.74 Following the collision, the company reviewed their SMS and in February 2022 incorporated a revised policy for night-time charters. The new policy - *Deck Watch - Evening Charter*, highlighted that Sydney Harbour was busy. It recommended that both the Master and deckhand (when carrying one) maintained a lookout for hazards and complied with the collision regulations, while operating during dusk and evening conditions. The policy did not detail how this was to occur.

Part 3 Findings

From the evidence available, the following findings are made with respect to the collision involving the ferries *John Cadman 3* and *Rockfish 3* that occurred in Port Jackson, NSW on 12 December 2021.

Contributory Factors

- 3.1 The operators of the involved vessels did not identify all relevant risks and mitigation strategies when operating in the Sydney Harbour Bridge Transit Zone at night. Neither operator identified the increased risk of collision or the associated visual limitations, including their respective vessel viewing constraints. This resulted in both Masters sighting the other vessel when it was too late to take action to avoid a collision.
- 3.2 Neither vessel involved in the collision saw the other vessel so did not adhere to the relevant COLREGS Rules.
 - The give-way vessel in the crossing situation, did not take early and substantial action to keep well clear.
 - The stand-on vessel in the crossing situation, did not respond in time to the close quarters situation resulting from the give-way vessel's failure to give way.
- 3.3 *John Cadman 3's* Master was focused on the overtaking traffic and did not see the approaching *Rockfish 3* on the port bow.
- 3.4 *John Cadman 3's* Master was alone in the wheelhouse, which limited their ability to maintain a proper look-out in a recognised high traffic location.
- 3.5 *John Cadman 3's* wheelhouse window structure created significant blind spots for the Master, which likely concealed *Rockfish 3*.
- 3.6 *Rockfish 3's* Master was navigating the vessel with lowered clears and internal cabin lights illuminated. Light reflecting off the clears would have significantly reduced the Master's ability to maintain a proper look-out.
- 3.7 *Rockfish 3's* deckhand was primarily focused on preparing the vessel for overnight shut down and was unaware of the approaching hazard.

Other Safety Factors

- 3.8 The Sydney Harbour Bridge Transit Zone was a recognised location of high traffic volume with identified navigational hazards and increased risks during night operations.
- 3.9 *Rockfish 3's* crew were in their 11th hour of continuous operation. While the crew had completed a short break between charters, the preparation requirements for the next charter resulted in the crew not having time to leave the vessel and rest during their duty period.

- 3.10 *Rockfish 3's* SMS did not identify or include mitigation strategies for several known risks. These included night operations, operating within the Sydney Harbour Bridge Transit Zone, use of clears and internal cabin lights. The SMS was generic and was not tailored to the intended operations of the vessel.
- 3.11 *John Cadman 3's* SMS did not identify or include mitigation strategies for some known risks. These included night operations, operations within the Sydney Harbour Bridge Transit Zone, timing of engine rounds and wheelhouse line of sight challenges.
- 3.12 *John Cadman 3's* navigation lights may have blended into the background lighting of Luna Park. This may have detracted from *Rockfish 3's* Master's ability to identify *John Cadman 3* prior to the collision. The variable lighting conditions in the vicinity of the Sydney Harbour Bridge likely exacerbated the ability of a look-out to identify hazards and mitigate risks to safe navigation in a timely manner.
- 3.13 Gaps in the Safety Management Systems (para 2.62 – 2.72) for both involved vessels were not identified prior to the collision.

Part 4 Recommendations

It is recommended that the following safety actions be undertaken by the specified responsible entity.

JC III Pty Ltd

4.1 Review their Safety Management System to ensure that:

- the risk register includes relevant risks encountered during charter operations, specifically identification and mitigation for night operations and look-out
- relevant competency-based crew induction and ongoing refresher training are included.

Rockfish Charters

4.2 Review their Safety Management System to ensure that:

- the risk register includes relevant risks for charter operations, specifically identification and mitigation for extended hours of work, night operations, cabin lights, clears and look-out
- onboard procedures are relevant to the vessel
- relevant competency-based crew induction and ongoing refresher training are included.

Domestic Commercial Vessel Operators

4.3 Review their Safety Management System to ensure that the risks involved in operating in high traffic density areas such as the Sydney Harbour Bridge Transit Zone are assessed for all operating conditions, day and night. Implement mitigation strategies to reduce risks for any of the identified hazards.

Part 5 Appendices

Appendix 1: Sources, Submissions and Acknowledgements

Sources of Information

- JC III Pty Ltd
- Rockfish Charters
- AMSA
- TfNSW
- Port Authority of NSW

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Submissions

The Chief Investigator forwarded a copy of the Draft Report to the Directly Involved Parties (DIPs) to provide them with the opportunity to contribute to the compilation of the Final Report by verifying the factual information, scrutinising the analysis, findings and recommendations, and to submit recommendations for amendments to the Draft Report that they believed would enhance the accuracy, logic, integrity and resilience of the Investigation Report. The following DIPs were invited to make submissions on the Draft Report:

- Rockfish Charters
- JC III Pty Ltd
- TfNSW
- AMSA
- Port Authority of NSW.