AUSTRALIAN TRANSPORT SAFETY BUREAU

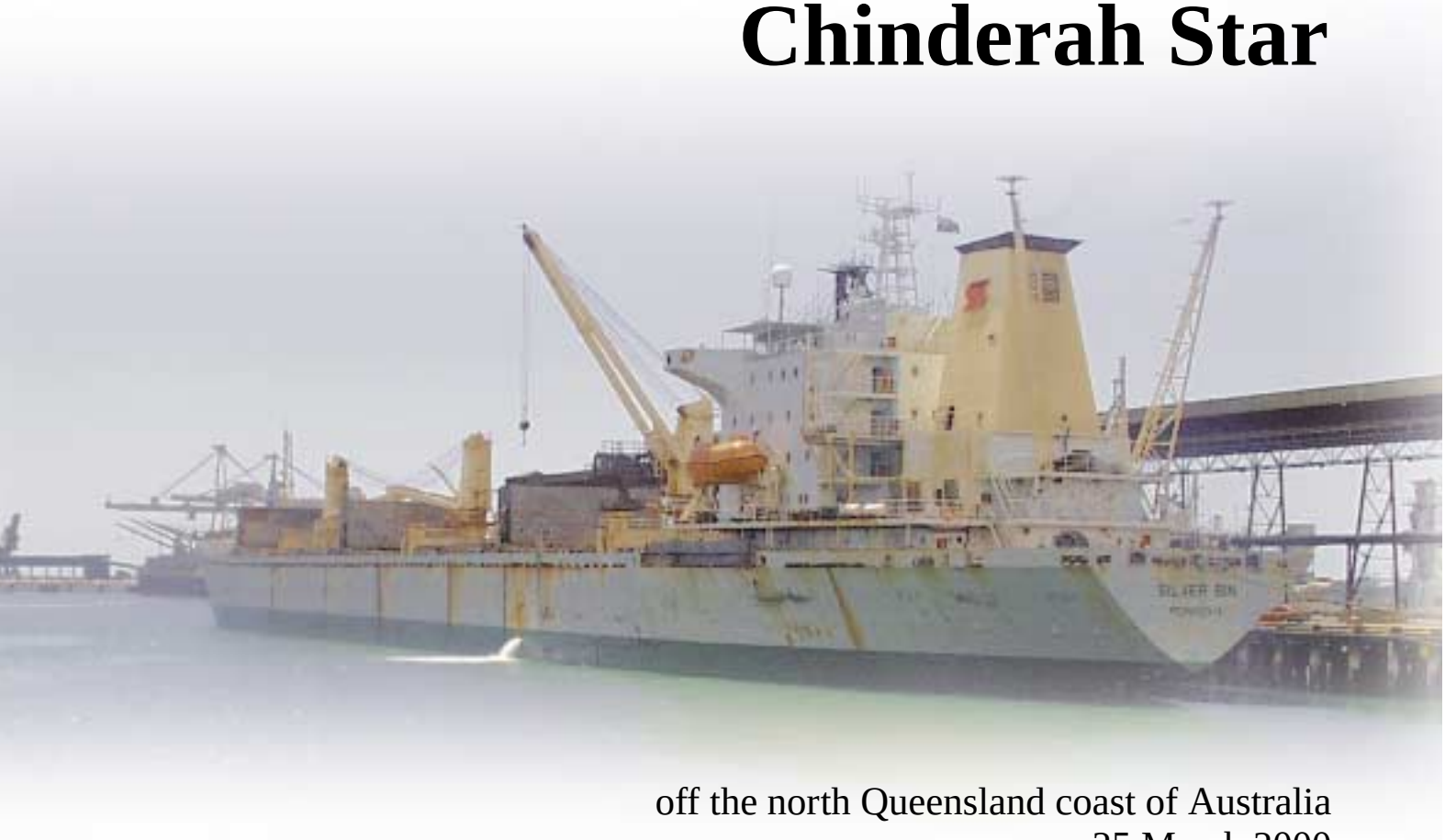
MARINE SAFETY INVESTIGATION
REPORT 156

Independent investigation into the collision between the Liberian flag bulk cargo vessel

Silver Bin

and the fishing vessel

Chinderah Star



off the north Queensland coast of Australia
on 25 March 2000

COMMONWEALTH DEPARTMENT OF TRANSPORT AND REGIONAL SERVICES

Report No 156

Navigation Act 1912
Navigation (Marine Casualty) Regulations
investigation into the collision between the Liberian flag bulk cargo vessel *Silver Bin* and the fishing vessel *Chinderah Star* off the north Queensland coast of Australia on 25 March 2000

Issued by the
Australian Transport Safety Bureau
January 2002

ISBN 0 642 20042 4

Investigations into marine casualties occurring within the Commonwealth's jurisdiction are conducted under the provisions of the Navigation (Marine Casualty) Regulations, made pursuant to subsections 425 (1) (ea) and 425 (1AAA) of the *Navigation Act 1912*. The Regulations provide discretionary powers to the Inspector to investigate incidents as defined by the Regulations. Where an investigation is undertaken, the Inspector must submit a report to the Executive Director of the Australian Transport Safety Bureau (ATSB).

It is ATSB policy to publish such reports in full as an educational tool to increase awareness of the causes of marine incidents so as to improve safety at sea and enhance the protection of the marine enviroment.

 Additional copies of the report can be obtained from:

Inspector of Marine Accidents
Australian Transport Safety Bureau
PO Box 967
Civic Square 2608 ACT

Phone: 02 6274 6088
1800 621372
Fax: 02 6274 6699
Email: marine@atsb.gov.au
Internet address: www.atsb.gov.au

CONTENTS

Figures

FIGURE 1:
***Chinderah Star* in Cairns**

FIGURE 2:
***Silver Bin* in Townsville**

Summary

On the morning of 25 March 2000 the 39 015 tonnes deadweight, Liberian flag, geared bulk carrier *Silver Bin* was heading south to Townsville via the inner route of the Great Barrier Reef. An Australian Reef Pilot, who had boarded the vessel at Booby Island the previous evening, was conducting the navigation of the ship. The sea was slight, with an easterly breeze of less than 10 knots, and no swell. The ship was making headway at just under 12 knots. During the morning, visibility had been reduced by an occasional rain squall. On the bridge with the pilot were the master, third mate and a quartermaster who was hand-steering the vessel.

At 1145, 5 miles[1] north of Chapman Island, the pilot had a radio conversation with a yacht in the area. This conversation was overheard by the skipper of *Chinderah Star*, a prawn trawler, approximately 3.6 miles south of Chapman Island, heading north at 9.2 knots in the shipping channel. The skipper, in the wheelhouse of the trawler, identified the ship on his radar and visually, but did not make radio contact. His two deck hands were asleep in the cabin below.

At 1157 the pilot altered *Silver Bin*'s course to 174° (T) to pass 0.5 miles west of the Chapman Island light. This alteration brought the vessel onto an end-on collision course with *Chinderah Star* now 4.2 miles away. The bridge team on the ship had not seen the north-bound trawler either visually or on their radars.

After the course change, a rain squall moved into the shipping channel from east of Chapman Island, and enveloped *Silver Bin* in heavy rain. The crew of the ship estimated the range of visibility in the heavy rain at 160 m. *Chinderah Star* was also enveloped by the squall and the skipper lost sight of *Silver Bin* both visually and on radar as a result of rain clutter. The crew on *Silver Bin*'s bridge were still unaware of the northbound trawler in the channel despite their visual and radar watch. Neither vessel altered speed or course.

Silver Bin and *Chinderah Star* collided at 1209, 0.5 miles west of the Chapman Island light, the fishing trawler's starboard side making contact with the ship's starboard shoulder under the flare of the bow. The fishing vessel sustained significant damage to the wheelhouse, the starboard trawl boom and along its starboard side. There were no injuries as a result of the collision.

After the collision, radio contact was established between the two vessels and assistance was offered to the fishing vessel by the ship. This was declined and the ship continued on to Townsville. After retrieving the trawl gear that had been left in the water after the collision, *Chinderah Star*'s skipper contacted the trawler's owner. The decision was made to return to Cairns to repair the collision damage.

Both *Chinderah Star* and *Silver Bin* arrived at their respective destinations in the early hours of 27 March 2000.

[1] Miles referred as nautical mile = 1852 m

Sources of information

The master and crew of *Silver Bin*

The pilot of *Silver Bin*

Australian Reef Pilots Pty Ltd

The owner and skipper of *Chinderah Star*

Reef Centre, Mackay, Queensland

Queensland Transport

Electrotech Pty Ltd

Furuno Pty Ltd

Narrative

Chinderah Star

Chinderah Star is a 17.37 m steel prawn trawler of 45.19 GRT (gross registered tons) based in Cairns, Queensland (figure 1). The vessel is registered with Queensland Transport as a class 3B[2] vessel, registration number 2013QB.

Chinderah Star was built in 1980 by Richards and Sons Pty Ltd in Chinderah, New South Wales. It has a beam of 5.29 m and a depth of 2.70 m. A Caterpillar 3408B diesel engine, rated at 186 kW, gives the vessel a service speed of approximately 9.5 knots. The trawler can carry up to 17 000 litres of fuel which gives a maximum range of almost 2 700 miles. *Chinderah Star* is equipped with electronic navigation and fishing aids including; GPS (global positioning system), marine radar, a chart plotter system utilising a DGPS (differential global positioning system), echo sounders and several communication systems including; HF, 27Mhz, VHF, and cellular telephone.

The vessel is of standard prawn trawler design with the wheelhouse located forward and a small galley/saloon aft of the wheelhouse. The crew bunkroom is located immediately below the wheelhouse and is accessed via a companionway leading down from the saloon area.

Aft of the wheelhouse is the trawler work deck with a large catch-sorting tray located above a refrigerated hold. There is a substantial amount of rigging located above the work deck for handling the net and the small aluminium tender stowed on top of the wheelhouse. The rigging includes net spreading booms located on the port and starboard sides, aft of the wheelhouse, which are lowered from their stowed, vertical, positions when trawling.

The deckhouse superstructure is constructed of aluminium and is painted white. The steel hull of the trawler is painted dark blue.

At the time of the incident, the crew of *Chinderah Star* consisted of a skipper and 2 deckhands. The usual routine when prawn trawling consists of 3–4 night 'shots' of the net, each of 3–4 hours duration, with the catch being sorted between each shot. Depending on the quantity, each catch takes about one hour to sort. The deckhands rest between sorting the catches and take a turn at the wheel to relieve the skipper whilst trawling. After a night's fishing is over, the trawler is anchored and the crew rest until the early evening when fishing begins again.

Chinderah Star's skipper holds a skipper grade 3 certificate issued by Queensland Transport. He is an experienced fishing vessel skipper and, at the time of the incident, had been skipper of *Chinderah Star* for the previous 4 prawn seasons. He estimated that he had previously been through the area of the incident approximately 80–90 times.

Silver Bin

Silver Bin is a Liberian flag geared bulk carrier of 39 015 tonnes deadweight at its summer draught of 11.022 m (figure 2). The vessel is owned by *Silver Bin* Navigation Inc. and the registered agents are Southern

---

[2] Seagoing fishing vessel for use in all operational areas up to and including offshore operations (up to 200 miles to seaward of the coast).

Shipping & Enterprises Co. Ltd of Hong Kong. It is classed, ✠[3]I 3/3 E[4] Bulk Carrier ESP[5] Deep sea[6], with Bureau Veritas.

Silver Bin was built in 1986 by Bohai shipyard in the Peoples Republic of China. The vessel has an overall length of 185.95 m, a moulded breadth of 28.40 m and a moulded depth of 15.80 m. The vessel is powered by a 6-cylinder Sulzer 6RLB66 single acting, direct reversing, 2-stroke diesel engine, of 8 169 kW. The main engine drives a single fixed-pitch propeller giving a service speed of 14.5 knots.

The vessel is of standard geared bulk carrier design with 6 holds and 3 gantry cranes, each crane servicing 2 holds. The accommodation superstructure is located aft with the bridge located in the usual position at the top of the accommodation block. The hull is painted green/grey with a darker green 'boot-topping'. The accommodation is painted white.

The pilot

The Australian Reef pilot on board *Silver Bin* held a Master Class 1 certificate of competency, issued by the Australian Maritime Safety Authority, and had 32 years experience at sea at the time of the incident. He had acquired extensive experience as a master of bulk carriers, having had 4 years command experience with an Australian shipping company prior to joining the Queensland Coast and Torres Strait pilot service in 1990. He also had extensive knowledge of the area of the incident having completed more than 300 ship movements through that passage of the inner route of the Great Barrier Reef.

He had been on two weeks leave, until 20 March, when recalled. His first job was to conduct a north bound ship which arrived at Thursday Island at 2200 on 22 March. At 1900 on 24 March he boarded *Silver Bin* off Booby Island.

The incident

Chinderah Star

Chinderah Star left Cairns on 27 February 2000. The trawler had a crew of the skipper and two deck hands and was provisioned with food, fresh water, and fuel. The plan was to arrive off Hay Island for the opening of the East Coast Prawn Fishery on 1 March and then to work the waters around Cape York to arrive off Weipa for the start of the Northern Prawn Fishery on 1 April 2000.

Chinderah Star started trawling on the night of 1 March in the Hay Island area after a passage of about 30 hours. After two days fishing with poor results the skipper decided to move further north to the Sherrard and Chapman Islands area, a passage of about 5 hours. After about a week in this area *Chinderah Star* moved south to the Cape Bedford/Cape Flattery area, a passage of about 20 hours, fished four nights in this area and then moved to Double Island, a 10 hour passage. *Chinderah Star* then moved north, firstly to Eden Reef, 25 hours steaming, for

---

3 Mark assigned when the vessel is built under the survey of an authority other than Bureau Veritas (BV) and is assigned a class equivalent to class described in BV rules.

4 Vessel class, division I ships are to meet the BV rules requirements for construction and scantlings of the hull and essential components relating to propulsion and safety, as applicable. Rating fraction 3/3 is assigned to ships the condition of which is considered satisfactory to BV. Equipment symbol E, placed after the rating fraction indicates that the ship's anchors and chain cables meet the applicable requirements of the BV rules.

5 Enhanced Survey Programme.

6 Notation assigned to vessels which are capable of deep sea navigation in any area and at any period of the year.

about 5 days. On 24 March *Chinderah Star* returned to Hay Island for one night's fishing. Figure 3 shows *Chinderah Star*'s movement in the month prior to the collision.

The skipper and two deckhands had established a routine of three night trawls with most of the intervening days spent anchored. The trawling routine had been to 'shoot away' at about 1850, pick the first 'shot' up at 2300, the second 'shot' at 0300, and the last 'shot' at 0630. The catch was sorted after each trawl by the two deck hands. The skipper said that one of the deckhands normally navigated the trawler during the second 'shot' each evening so he could rest. After the last 'shot' was winched up and sorted in the mornings, the skipper would anchor the trawler for the day and the crew would rest. The skipper said that it was his routine to sleep from about 1100 to 1800 each day.

On the morning of 25 March *Chinderah Star* started for fishing grounds in the Cairncross Islets area. After leaving Hay Island, the skipper kept *Chinderah Star* in the 'two-way route' shipping channel with the autopilot engaged. During the passage he performed some routine work in the wheelhouse while the deckhands were asleep in the cabin below. The weather was calm with very little wind, and no swell. During the morning, the trawler had passed through the occasional rain squall, a common occurrence in the area during the rainy season from December to April.

At 1140[7], *Chinderah Star* was approximately 4.5 miles south of Chapman Island just to the east of the centre of the shipping channel on a heading of almost due north. The trawler's speed was approximately 9.2 knots.

At 1145, *Chinderah Star*'s skipper heard the pilot on *Silver Bin* talking to *Anna Lee* on VHF channel 16. He identified the ship on radar and visually as being about 5 miles (actually 8.6 miles) to the north of his position.

After checking his course, speed and position on the DGPS plotter, the skipper decided that no changes were necessary at that time. He did not attempt to contact the ship using the radio.

At about this time he also noticed a rain squall moving into the area from east of Chapman Island. He thought the squall 'didn't look much' and carried on working in the wheelhouse, modifying the positions of some fishing 'marks' on the plotter charts.

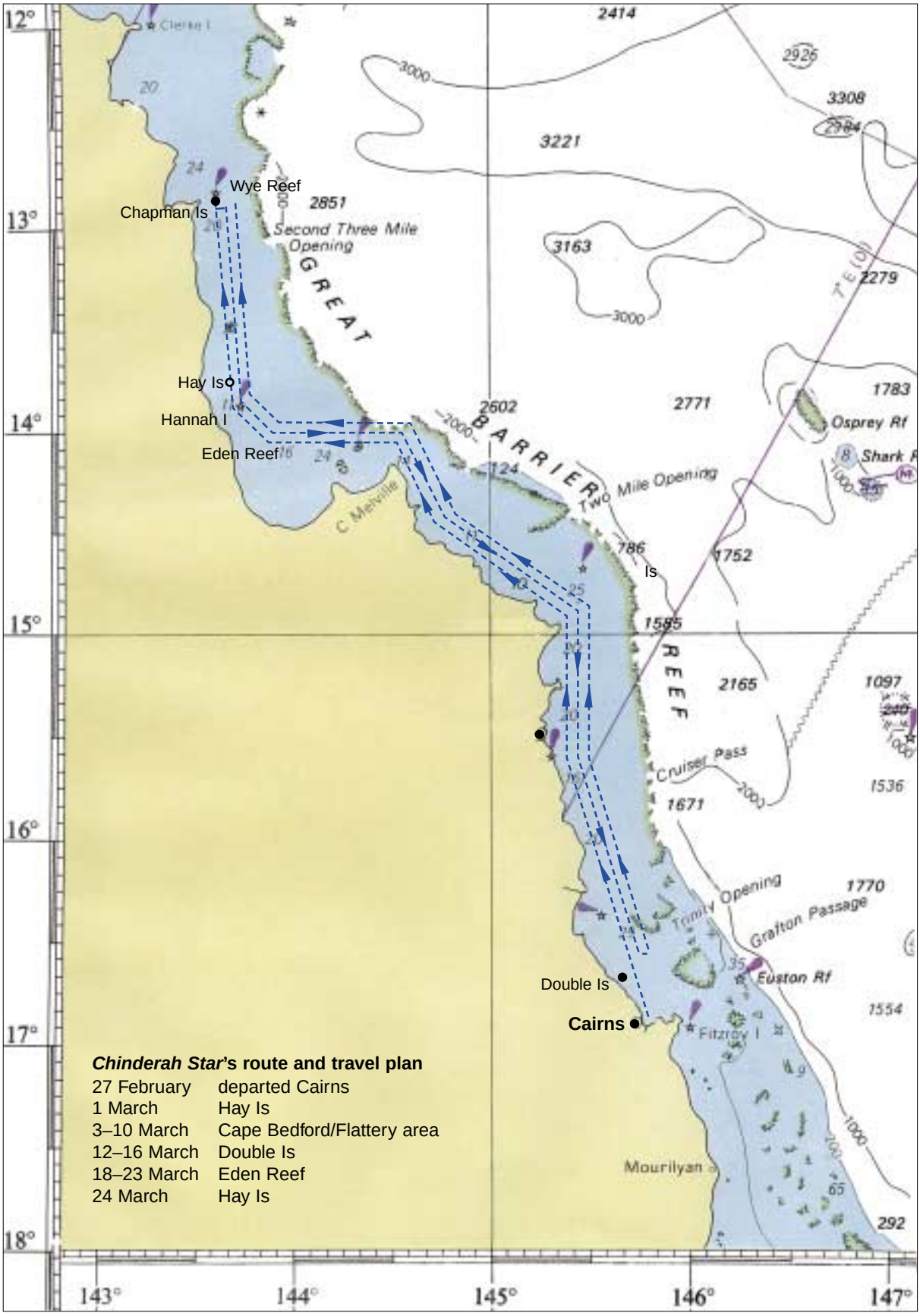
Chinderah Star's skipper knew, from previous experience, that most pilots tended to pass Chapman Island within 3–6 cables of Chapman Island light. He felt that, at this point, where the trawler was negotiating the channel, 'they would be cruising pretty close'. He did not attempt to contact the ship using his VHF radio despite this knowledge.

For the next ten minutes the skipper maintained a watch on the position of the ship both visually and on the radar. At approximately 1155, when *Chinderah Star* was about 1.9 miles south of the Chapman Island light structure, a rain squall moved into the channel and a heavy tropical downpour enveloped the vessel. The skipper stated that he lost sight of *Silver Bin*, now approximately 4.8 miles to the north, both visually and on radar at this time. He maintained the trawler's course and speed with the autopilot engaged. He did not indicate why he did not attempt to contact the ship by radio, alter his course, speed, sound any audible signals, or turn on the trawler's navigation lights at this time, given his perception that the two vessels would be passing at close quarters.

---

[7] All *Chinderah Star*'s positions calculated from time and position of collision and vessel's speed

FIGURE 3:
***Chinderah Star*'s movements from 27 February to 25 March**



Silver Bin

Silver Bin left the port of Bing Bong, in the Gulf of Carpentaria, at 0800 on 23 March 2000 with a part cargo of zinc/lead/silver concentrate. The vessel had a maximum draft of 8.4 m with holds 2 and 4 loaded. The destination port was Townsville, via the inner route of the Great Barrier Reef, where the ship was to load number 5 hold with copper concentrate and the remaining three holds with lead ingots.

After the pilot boarded at 1900 on 24 March, the master/pilot information exchange was completed, the pilot made the mandatory report to Reef Centre and the pilotage through the inner route commenced. The pilot was not presented with a pilot information card on boarding the vessel, nor did the pilot present the master with a written passage plan, preferring to discuss his intentions with the master and lay off his courses directly onto the ship's charts. As the ship was only part loaded, with a deepest draught of 8.4 m, no particular problems were anticipated in relation to the passage south. During the initial discussion the master asked the pilot if the main engine fuel could be changed over from diesel oil to heavy fuel. The pilot agreed and the change over was made. The pilot assumed from this request that the main engine was normally manoeuvred on diesel fuel.

The pilotage proceeded south, without incident, through Gannet Passage, Prince of Wales Channel and Adolphus Channel. Once the ship rounded Wyborn Reef at 0017 on 25 March, the pilot took advantage of a continuous course of 31 miles to get some rest. The pilot returned to the bridge at approximately 0300, when approaching Hannibal Island. After reporting to Reef Centre at 0428, he again took some rest.

The pilot returned to the bridge at about 0650 and negotiated the course alteration off Clerke Island. He observed the weather up to this time as being fine and clear with an easterly breeze of up to 10 knots. Shortly after passing Clerke Island rain showers developed, at times reducing the visibility. The passage progressed without incident past Eel Reef and Restoration Rock.

At 1119, *Silver Bin* passed another vessel, *Great Majesty*, in Lloyd Bay and the pilots on each ship exchanged navigational and weather information on VHF radio. In the course of the conversation, the pilot on *Great Majesty* indicated that he had experienced some rain showers from Bow Reef north, but further south the weather was clear. *Great Majesty*'s pilot also mentioned that he had passed a yacht in the vicinity of Cape Direction.

At 1140, the pilot on *Silver Bin* made a course alteration from 151° (T) to 164° (T) to bring Chapman Island light ahead. The course alteration was made using a radar electronic bearing line (EBL), as the light structure on Chapman Island was intermittently obscured by rain. In anticipation of this manoeuvre, the third mate had set up an EBL on the 3-cm radar set. Both radars were being switched between the 6 mile and 3 mile range as necessary.

At about this time the yacht reported by *Great Majesty* was observed by the bridge team off the starboard bow, on the port tack, heading in an almost parallel course alongside Lansdown Reef. At approximately 1145, the pilot responded to a radio call from the yacht *Anna Lee* on VHF channel 16. The pilot and yacht discussed their respective courses and the pilot indicated to the yacht that they should continue on their current tack as they were presenting the ship with no problems. The yacht also requested a weather report, which

the pilot supplied after switching to VHF channel 12.

Silver Bin continued on the 164° (T) course until it reached a position approximately 3.0 miles to the north of Chapman Island light, with Cape Direction abeam to starboard, then altered course to 174° (T). This course alteration took place at approximately 1157 and the pilot's intention, with this course, was to pass 0.5 miles west of Chapman Island light. The bridge team, at this time, consisted of the pilot, master, third mate and a quarter-master hand steering the vessel.

Immediately after the course alteration to 174° (T), the visibility deteriorated due to the rain squall that had moved in from east of Chapman Island. Both the pilot and the master indicated that the range of visibility was approximately 160 m and that they could just see *Silver Bin*'s bow.

After entering the rain squall, the pilot was alternating between keeping a visual lookout on the port side of the bridge and watching the 3-cm radar. The master and third mate were maintaining a similar watch on the 10-cm radar and visually, through the windows and 'clear-view' screen to starboard of the bridge centre-line.

The pilot felt the bridge team was keeping an effective lookout at this time and that the radars were performing satisfactorily. He clearly recalled seeing, on the 3-cm radar, the land around Cape Direction, the yacht *Anna Lee* (at 0.9 miles), Chapman Island light and a trawler anchored close on the north side of Chapman Island.

At 1200 the third mate fixed a position using radar bearings taken on the 10-cm radar. The ship was almost exactly on the track laid off by the pilot and 2.4 miles north of the Chapman Island light. *Silver Bin* had averaged a speed of 11.73 knots over the previous hour.

Collision

At 1209 the skipper of *Chinderah Star* looked out of the wheelhouse to see *Silver Bin* almost dead ahead 20–30 m away and bearing down on him. He had just enough time to reach across to disengage the autopilot before the two vessels collided.

At 1209 the bridge team on *Silver Bin* felt a slight but noticeable 'thump'. The pilot, master and third mate immediately looked forward to see the trawler very close to the starboard shoulder. The men then moved to the starboard bridge wing and observed the trawler scraping down *Silver Bin*'s starboard side.

After the two vessels had passed clear, the skipper of *Chinderah Star* contacted *Silver Bin* on VHF channel 16. The skipper confirmed that the trawler had collided with the ship. The pilot told the skipper that the ship had not seen *Chinderah Star* and did not know the trawler was there until the actual impact. The skipper indicated that *Chinderah Star*'s crew had not been injured but that the trawler had sustained damage to the starboard trawl boom, wheelhouse visor, starboard gunwhale and hand rails and that a bridge window had also been smashed. After various details had been exchanged, the pilot indicated to the trawler skipper that he would be maintaining a watch on VHF channel 16, in case any assistance was required. *Silver Bin* then continued south.

The rain squall passed approximately 10 minutes after the collision.

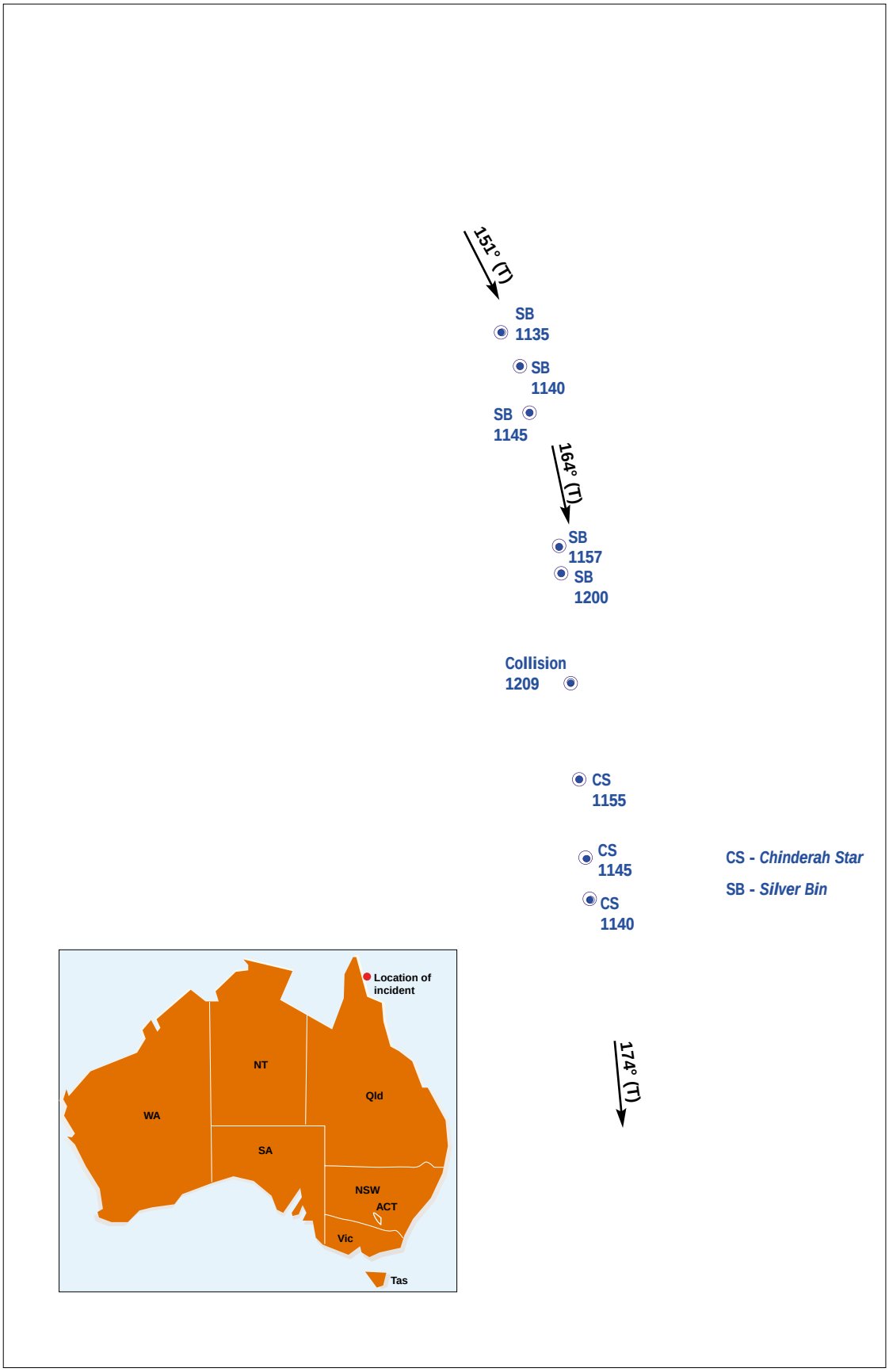
At 1225, the pilot made a call to Reef Centre on VHF channel 18 to report the collision, while the crew inspected *Silver Bin* for damage. The hull paint was found to be scraped at the point of impact under the flare of the starboard bow but there was no structural damage.

After the conversation with *Silver Bin*, the skipper and both deckhands, who had come on deck immediately after the collision, dragged the damaged starboard trawl boom and fishing gear, which had been left trailing in the water below the stern on the starboard side, back on board *Chinderah Star*. The owner of the trawler was contacted and the decision was made to head south to Cairns to repair the damage caused by the collision. *Chinderah Star* subsequently proceeded back to Cairns arriving in the early hours of 27 March.

Silver Bin completed the inner route pilotage at Cairns pilot station at 1430 on 26 March without further incident. At this point the pilot disembarked and proceeded on leave. *Silver Bin* continued on to Townsville arriving at the anchorage in the early hours of 27 March.

Silver Bin and *Chinderah Star* collided at approximately 1209 on 25 March 2000, at a position of 12° 53.0’ S, 143° 35.2’ E, 0.6 miles from Chapman Island light on a bearing of 284° (T) (figure 4). This was the time and GPS position provided by the pilot and master of *Silver Bin*. The position was confirmed by the skipper of *Chinderah Star*.

FIGURE 4:
Portion of chart Aus 834 showing area of collision and vessel's track



Comment and analysis

Evidence

An investigator from the Australian Transport Safety Bureau (ATSB) attended *Chinderah Star* in Cairns on 27 March 2000. Like most fishing vessels of its type, *Chinderah Star* is not equipped with any form of course recorder or automatic data recording device. The skipper of the boat was interviewed and his account of the collision is the only evidence of the course of events as observed from *Chinderah Star*. Both deckhands were below, sleeping, at the time of the collision.

Chinderah Star presented as a well-maintained and well-equipped vessel. Damage was noted to the starboard forward handrails and bulwark alongside the wheelhouse (figures 5 and 6). The handrails and bulwark had been deformed and set-in. The wheelhouse visor had also been deformed and bent downwards on the starboard side of the wheelhouse, with the starboard forward wheelhouse window broken in the process. The starboard trawl boom had already been removed and cut to salvage the top rigged section. It was bent in a number of places including one bend of about 90° adjacent to the net spreader block. This cast brass block had also been cracked in the collision.

The deformed hand rails and wheelhouse visor both showed evidence of contact and light green/gray paint scrapes and flakes were found around these areas and lying on the trawler's foredeck.

Silver Bin was attended by the ATSB investigator in the port of Townsville on 28 March 2000. Various evidence was obtained including copies of the ship's navigation charts, log books, movement book, passage plan, course recorder trace and radar details. The master and third mate were interviewed and the ship inspected. Some fresh scoring was evident in the hull paint on the ship's starboard shoulder (figure 7) but there was no structural damage to framing or hull plating.

The pilot was interviewed in Brisbane on 29 March 2000 at the office of Australian Reef Pilots Pty Ltd. He provided the investigation with a comprehensive written statement and various other documentation including a passage plan at the time of the interview.

A recording of the pilot's radio conversation on VHF channel 18 with Reef Centre at Hay Point reporting the collision was obtained.

Figure 8 is an excerpt from the events and causal factors chart for the incident.

Conflict of evidence

Immediately after the collision, contact was established between the two vessels on VHF channel 16.

In the pilot's report on the incident he stated that, when VHF contact was established, the skipper of *Chinderah Star* had said that he 'had just arrived in the wheelhouse'. The pilot repeated this assertion in his submission in relation to the draft of this report. The skipper of *Chinderah Star*, however, was adamant in his assertion that this statement had not been made and that he had been in the wheelhouse as described earlier.

As channel 16 is not monitored in the area of the collision, there is no objective evidence to resolve the conflicting statements. Neither were recordings made of the radio conversation between the pilot and the yacht.

FIGURE 5:
Damage to starboard side of *Chinderah Star*

FIGURE 6:
Damage to *Chinderah Star*'s wheelhouse

FIGURE 7:
Starboard bow of *Silver Bin*, showing damage to paintwork at point of impact.

Collision

All of the trawler's positions used in the analysis of this incident are based on the agreed position of the collision and the skipper's estimate of the trawler's speed of 9.2 knots. The skipper could not confirm the time of the collision and felt that it had occurred later than 1209; at around 1300.

The pilot's recollection was that the radio conversation with the yacht *Anna Lee* took place at approximately 1145 with the ship 5.2 miles north of Chapman Island light. Allowing that the ship's time and position of the collision and the trawler's speed of 9.2 knots are reasonably accurate, then *Chinderah Star* would have been 3.4 miles south of Chapman Island light. At 1145 *Silver Bin* was 8.6 miles to the north of *Chinderah Star*'s position. This is also consistent with the closing speed of about 20.9 knots and a collision time of 1209.

After losing both radar and visual contact with the ship, the skipper of *Chinderah Star* next saw *Silver Bin* when it was 20–30 m ahead. With a closing speed of about 20.9 knots (10.76 m/s) the skipper would have had under three seconds to react and therefore did not have time to manoeuvre to avoid a collision.

The bridge team on *Silver Bin* were not aware of *Chinderah Star*'s presence off Chapman Island until the collision occurred.

Those on *Silver Bin*'s bridge estimated the visibility at about 160 m, the distance from the bridge front to the bow. Had the skipper seen the bulk carrier at 160 m he would have had just under 15 seconds to react. However, it is apparent he did not sight the other vessel at this distance and, as the visibility in heavy rain is so variable, no conclusion can be drawn with regard to the visibility other than it was 160 m or less.

The damage to *Chinderah Star* and the fresh paint scraping evident on *Silver Bin*, indicate that the two vessels collided almost head on. The point of impact on the ship was on the starboard shoulder under the flare of the bow. First contact would have been the trawler's starboard trawl boom, which was in the stowed position with its top approximately 6 m above the water and 1 m or so outside the line of the starboard bulwark. The damage to the *Chinderah Star*'s wheelhouse visor would indicate that the trawler might have rolled towards the ship at the time of the impact, as the visor is inside the line of the starboard handrails and bulwark which were also damaged in the collision.

Navigating the inner-route of the Great Barrier Reef

All admiralty navigation charts covering areas which include the two-way route contain the following guidance to mariners:

1. The two-way route shown on this chart is not mandatory and it is not a traffic separation route. The International Regulations for Preventing Collisions at sea 1972 apply equally to all vessels whether navigating inside or outside the two-way route.

2. The two-way route indicates the best route for vessels of moderate draught (up to nine metres) having regard to the charted depth and dangers. Larger vessels constrained by draught may be encountered in the two-way route and in its vicinity in certain areas.

3. In accordance with the Safety of Life at Sea convention 1974, all vessels should maintain a listening watch on VHF channel 16.

4. The symbol (⇔) indicates that traffic is free to move in both directions along the route.

When navigating in the two-way route, pilotage is compulsory for all ships over 70 m in length.

The defined area of the two-way route approaching Chapman Island from the north or south narrows considerably with the island to the east and the seabed shelving rapidly towards the mainland to the west forming a

natural ‘bottle-neck’ in the channel. Where the collision occurred west of Chapman Island the charted two-way route is only 9 cables wide with no navigation aids to mark the shoal water on the western side of the channel.

The International Regulations for Preventing Collisions at Sea, 1972, (COLREGS)

> …apply to all vessels upon the high seas and in all waters connected therewith navigable by seagoing vessels.

Rule 9 ‘Narrow Channels’ states inter alia:

> a) A vessel proceeding along the course of a narrow channel or fairway shall keep as near to the outer limit of the channel or fairway which lies on her starboard side as is safe and practicable.
>
> b) A vessel of less than 20 metres in length or a sailing vessel shall not impede the passage of a vessel which can safely navigate only within a narrow channel or fairway.

The designation of the two-way route is at times somewhat ambiguous. The two-way route shown on the charts consists of arbitrary lines shown for guidance. Normally in a narrow channel, vessels are obliged to keep to the starboard side, as stated in the COLREGS. The two-way route adjacent to Chapman Island could be considered to be a narrow channel. With a charted depth of 24 m below datum (Lowest Astronomical Tide), it is deep enough to allow even deep draught vessels to navigate on the starboard side. However, there are places in the two-way route where the shallowness of the defined route means that deep draught vessels may not be able to navigate on the starboard side of the channel and, as they are constrained by their draught, other vessels are obliged to keep clear. Such vessels are required to show deep draught signals. There are still other places in the two-way route where ships that are not constrained by draught need not follow the channel, but may follow alternative routes.

Silver Bin, with a maximum draught of 8.4 m, was following the best passage through the inner route of the Great Barrier Reef for moderate draught vessels as defined by the two-way route. The ship had ample under-keel clearance in the channel adjacent to Chapman Island. However, at the time of the collision the ship was not navigating on the starboard side of the channel as stipulated in Rule 9a) of the COLREGS.

In his submission on the draft report, the pilot stated :

> While I acknowledge that the COLREGS state that you keep to the starboard side in a narrow channel, the area around Cape Direction and Chapman Island requires special care if this is followed. You will note from the chart that the western side of the ‘narrow channel’ in this area is not marked. By comparison the light on Chapman Island is a good clear mark on the eastern side of the channel. It is normal practice when proceeding south to pass close (usually 0.5 miles) off Chapman Island light keeping clear of the unmarked dangers on the western side near Cape Direction. If a south-bound vessel encounters traffic in that area, VHF radio conversations are conducted so as to establish clear passing parameters. On this particular occasion the *Silver Bin* was not on the starboard side of the ‘narrow channel’, for good reasons.

Chinderah Star’s skipper had been alerted to the presence of the bulk carrier at about 1145 by the VHF exchange between *Silver Bin* and the yacht *Anne Lee*. At about that time he also made both radar and visual contact with the ship.

He would have been aware that it was a large vessel constrained by its size and draft from taking evasive action and that it would be keeping well within the two-way route. He was also aware that the two vessels would probably be passing at close quarters, where the channel is particularly narrow, and yet he did not slow *Chinderah Star* nor alter his course when the ship disappeared from his radar screen. At this time, it would have been

sensible for the skipper to make contact with *Silver Bin* by radio to agree a safe passing manoeuvre even if he felt that he had already been identified by the ship.

The skipper of *Chinderah Star* was navigating the trawler to starboard of the centre of the channel prior to the collision. He should have been fully aware that, with a draught of between 1.5–2 m, the trawler could have safely navigated either inshore of the charted shipping channel, or closer in to Chapman Island. Having identified the ship, and knowing from previous experience the line normally taken by pilots past Chapman Island, the skipper would have been prudent to alter the trawler's course to port or starboard to allow the ship the fullest use of the channel, in accordance with Rule 9b) of the COLREGS.

Keeping a look-out

The COLREGS contain specific requirements for keeping a look-out and actions to avoid collisions. Rule 5 'Look-out' states:

> Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and the risk of collision.

In the case of the collision between *Silver Bin* and *Chinderah Star*, crew on both vessels were obliged to maintain a proper look-out by all available means and thereby avoid a collision. Both vessels were equipped with radar and both vessels were said to be maintaining a visual lookout prior to the collision.

The pilot was satisfied with the use of the bridge resources and felt that the navigation of the ship was being performed competently. The pilot knew from experience that heavy rain could be expected and it would restrict visibility and reduce the effectiveness of the radar. He also knew that at that time of year there were concentrations of trawlers heading north for the opening of the Gulf of Carpentaria prawn fishing season, and that it was common to see 40 to 50 fishing vessels each day.

Why no one on the bridge of *Silver Bin* saw *Chinderah Star* either visually or on radar cannot be determined. The evidence that the skipper of the trawler saw the bulk carrier at about 1145 before entering the rain squall would suggest that *Chinderah Star* was in sight and may therefore indicate that the lookout by those on *Silver Bin* was not effective.

Visual

Silver Bin's bridge team would have had an effective 'height of eye' of approximately 18 m at the ship's draught of 12.4 m. Allowing that *Chinderah Star*'s wheelhouse is 3 m, and other structures up to 6 m, above sea level, the trawler was theoretically visible to the crew on the ship's bridge from a distance of up to 10.3 miles. Thus the trawler could have been visible to the ship from about 1140.

Chinderah Star's skipper stated that he identified the ship visually at approximately 1145 (this is the time that the pilot recalled having the radio conversation with *Anna Lee*) from a calculated distance[8] of 8.6 miles. Given that his height-of-eye in the trawler's wheelhouse would have been approximately 3 m, only the top of the ship's accommodation block, funnel and superstructure would have been visible at this time, on a bearing of approximately 351° (T) from his position.

8 Calculated by ATSB

The pilot, master, third mate and helmsman on *Silver Bin* were maintaining an organised visual look-out; however they did not see the northbound trawler prior to their course alteration at 1157. Even allowing for the trawler's relatively small size and the variable conditions of visibility at the time, the crew on *Silver Bin*'s bridge had 17 minutes from 1140 to 1157 when the trawler, with its white wheelhouse and superstructure, would have been visible on an approximate bearing of 171° (T) from their position.

A short time after the ship altered course at 1157, both vessels were enveloped by the rain squall. After entering the heavy downpour, the visibility was degraded to the point where a visual sighting of the ship or the trawler by the crew of the other vessel was precluded.

With reduced visibility, the ship had the option of placing a lookout on the bow; although at full speed and with visibility less than 200 m, a lookout on the bow would have been unlikely to provide sufficient warning to avoid collision. Nevertheless, this option does not appear to have been considered.

Radar

Chinderah Star's 3-cm wavelength radar set was operating prior to the collision. The trawler's skipper stated that he identified *Silver Bin* coming across Lloyd Bay at 1145 although his estimation of the ship's range was incorrect. Both of *Silver Bin*'s radar sets were also in operation and both were more than twice the power of the set on board *Chinderah Star*. Despite their higher power, *Chinderah Star* was not identified on either the 3 or 10-cm wavelength radar sets prior to the collision. The pilot felt that an effective radar watch was being maintained and the ship's radar sets were being competently operated. He clearly remembered seeing, on the 3-cm radar, the echo returns of a trawler anchored close on the northern side of the island, and Cape Direction on the ship's starboard side after the ship had entered the rain squall.

Chinderah Star, with a steel hull and wheelhouse constructed of aluminium, should have presented a target with good radar reflectivity. Both radar sets on board *Silver Bin* would normally be expected to detect the fishing boat prior to the change of course to 174° (T) at approximately 1157 and before the vessels entered the rain squall. Once enveloped by the rain, the 3-cm wavelength radar on board the ship would have experienced some performance degradation due to signal attenuation and clutter from the droplets of rain in the air, although the pilot's observations of various targets on the 3-cm radar at this time indicate that the radar set was not rendered totally ineffective by the rain. Similarly, the limited power of the 3-cm radar set fitted on *Chinderah Star* may explain why the skipper lost the ship on his radar monitor after entering the squall.

The International Convention for the Safety of Life at Sea (SOLAS) requires that vessels over 10 000 gross registered tonnes must be fitted with 2 radar sets one of which must be capable of operating in the 9 GHz frequency band (3-cm wavelength or X-band). Ten cm wavelength, or S-band radar, is normally fitted as the second radar set required. One of the reasons S-band radar is fitted is to overcome the problem of rain clutter. The longer 10-cm wavelength radar experiences less interference due to rain as a result of the relatively small rain water droplet diameter compared with its operating wavelength.

Silver Bin's 10-cm radar was fitted when the ship was commissioned in 1986. Records of maintenance carried out on the set were not available. Over a period of time, most radar sets experience some performance degradation due to the falling efficiency of their magnetrons. However marine radars are

required to be fitted with a 'performance monitor'. The performance monitor allows the efficiency of the radar to be checked against its new or 'as installed' condition. Regular checks using the performance monitor function of a radar set will indicate the need to periodically renew the magnetron or make other adjustments. *Silver Bin*'s 10-cm radar was equipped with a performance monitor, but it was unclear when this check was last performed.

When the third mate took radar bearings to fix the ship's position at 1200, he used the 10-cm radar and this is evidence that the set was indeed performing satisfactorily in the rain.

Assuming that the gain and clutter settings on the radar sets were correct for the conditions, why *Silver Bin*'s bridge team did not detect *Chinderah Star* on either of their radar displays prior to the collision is a matter for some conjecture. Both the master and the pilot indicated that they were using the radars on the 6 mile range on the previous course of 164° (T). After altering course to 0174° (T) and entering the rain squall, both radars were being switched between the 3 and 6 mile ranges.

At approximately 1152, *Chinderah Star* would have been within 6 miles of *Silver Bin* and consequently within the set range of the ship's radars. There was an opportunity at this time for the bridge crew to identify the trawler in the shipping channel, although with the preparations for the imminent course change, their attention would have been focused on this activity.

It is a requirement on ships to have the radar display set up to show a heading line or marker. This line is an electronically generated graphical representation of the ship's heading on the radar screen and extends from the ship's position (which may be either the centre of the display or offset) to the edge of the display. After the ship's change of course at 1157, *Chinderah Star* was in a position dead ahead of *Silver Bin* and on a reciprocal course. The heading lines on the ship's radar monitors may have obscured any radar return from *Chinderah Star* at this time. It is usual radar operating practice to regularly 'suppress' the heading line to check for any targets that may be obscured, and the pilot stated that despite suppressing the heading line on a number of occasions he failed to sight *Chinderah Star* on the 3-cm radar which he was monitoring.

In submissions on the draft report made by both the pilot and the owners of *Silver Bin*, it was suggested that the trawler may not have been visible on radar because of the 'blind sector' in *Silver Bin*'s radar's scan ahead of the vessel. This may have been the situation once the trawler was within a few hundred metres or so of the vessel's bow, however radar manufacturers advise that there is no blind sector effect at the distances discussed above.

Conduct of vessels in restricted visibility

Rule 19 of the COLREGS, 'Conduct of Vessels in Restricted Visibility', 'applies to vessels not in sight of one another when navigating in or near an area of restricted visibility' and states inter alia:

> c) Every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of restricted visibility. A power-driven vessel shall have her engines ready for immediate manoeuvre.

With regard to 'Safe Speed' Rule 6 of the COLREGS states inter alia:

> Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions.

In determining a safe speed the following factors shall be among those taken into account:

a) By all vessels:

i) the state of visibility;

ii) the traffic density including concentrations of fishing vessels or other vessels;

iii) the manoeuvrability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions;

And further:

b) Additionally, by vessels with operational radar:

i) the characteristics, efficiency and limitations of the radar equipment;

ii) any constraints imposed by the radar range scale in use;

iii) the effect on radar detection of the sea state, weather and other sources of interference;

iv) the possibility that small vessels, ice and other floating objects may not be detected by radar at adequate range;

v) the number, location and movement of vessels detected by radar;

vi) the more exact assessment of the visibility that may be possible when radar is used to determine the range of vessels or other objects in the vicinity.

Neither the skipper of *Chinderah Star*, nor the bridge crew on *Silver Bin* made the decision to slow their vessels after entering the rain squall. This was in spite of the fact that the visibility was severely limited. The COLREGS do not specifically quantify 'safe speed' but stipulate that vessels must proceed at a speed which would allow them to take evasive action in sufficient time to avoid a collision. Given the fact that the collision occurred in conditions of very limited visibility with little time to respond to an imminent collision situation, neither vessel can be considered to have been proceeding at a 'safe speed'.

The pilot had considered the option of slowing the ship but was hesitant to recommend this course of action to the master. He felt that the rain squall would pass quickly and believed that it would be necessary to change the main engine over to diesel fuel for the manoeuvre, an operation taking some time. In the circumstances, however, it would have been normal for the pilot to consult with the master, to reduce speed and to ensure that the main engine was ready for manoeuvring as required by the COLREGS. (Under these circumstances it would not, in fact, have been necessary to change over the fuel to slow the main engine for a limited period of time). The master did not indicate that he considered any particular course of action as a result of the limited visibility and was relying on the pilot's experience and judgment of the situation. The master was, however, ultimately responsible for the safe navigation of his ship.

Sound signals in restricted visibility

In reduced visibility vessels are obliged to sound appropriate audible signals, Rule 35 of the COLREGS 'Sound Signals in Restricted Visibility' states inter alia:

> In or near an area of restricted visibility, whether by day or night, the signals prescribed in this Rule shall be used as follows:
>
> a) A power driven vessel making way through the water shall sound at intervals of not more than 2 minutes one prolonged blast.

Both *Silver Bin* and *Chinderah Star* were obliged to sound audible signals after entering the limited conditions of visibility of the rain

squall. Neither vessel sounded any signal with the crew of each vessel deciding that the situation did not warrant this important safety action.

Given that *Chinderah Star*'s skipper knew of the ship ahead, he was remiss in not sounding the trawler's whistle. Once again it would seem that his actions were modified by his assumption that the ship had already identified *Chinderah Star*, and was tracking the trawler's position in the channel.

As *Chinderah Star* had not been identified ahead of the ship in the channel, the pilot's assessment of the risk of collision was nil and thus he did not recommend that the whistle be sounded. The master of *Silver Bin* did not indicate why he did not take the initiative and sound the whistle. The effectiveness of sound signals in reduced visibility is significantly lessened if proceeding at full speed, but at slow speed it is considerable. The sounding of such signals is, however, a requirement and combined with a safe speed is a proven defence against collision.

In submission, the pilot stated that:

> '...I usually defer to the master on the matter of reducing speed and sounding fog signals in reduced visibility'. Also …… 'While this is fact (the absence of sound signals), it is only conjecture that the sounding of any audible signals would have prevented a collision.'

The pilot on *Silver Bin* had been reporting regularly to REEFCENTRE. REEFCENTRE monitors reporting ships and hence the pilot would have been confident that no 'reporting ship' (ships over 70 m) would have been in the region of Chapman Island. But the pilot was fully aware that trawlers may well have been in the area.

While the master had a responsibility to ensure his vessel was navigated in accordance with the COLREGS, the pilot also has a duty to conduct the vessel safely in the prevailing conditions, consistent with the COLREGS.

Prima facie, neither the bridge team on *Silver Bin*, particularly the master and pilot, nor the trawler skipper properly assessed the risks of collision and they lacked caution in not obeying the COLREGS. There was good warning of the presence of heavy rain and time to slow the vessels to a safe speed and to sound fog signals.

Fatigue

The pilot and the members of the ship's crew on the bridge of *Silver Bin* were adequately rested prior to the incident. The pilot had just come off a period of leave and had completed one pilotage northbound before the *Silver Bin* pilotage. He had documented his hours of work and rest during the previous pilotage and during that of *Silver Bin*. The record would indicate that he was sufficiently rested at the time of the collision.

When interviewed, the skipper of *Chinderah Star* indicated that he had had a 'reasonable' sleep the previous night. However, the vessel had been fishing throughout that night and, in a statement made soon after the collision, he stated that he had been called at 0300, after having some two hours sleep. In addition, the first month's fishing had been poor with the skipper navigating the trawler between fishing spots, mainly during daylight, for more than 100 hours. Often these were times when he would normally have been resting with the routine of night fishing and daytime resting well established. The skipper was unable to provide information about his working hours during this period so a quantitative analysis of his level of fatigue was not possible.

In the fishing industry, crews of fishing vessels, consisting of only two or three, often fish all night then move between fishing

grounds during the day, leaving little time for effective rest. While fishing, on passage or resting, they are still required, under the COLREGS, to keep an effective lookout around the clock. Consequently fatigue is frequently a contributing factor in incidents involving fishing vessels.

In this incident it is not possible to accurately assess the effects of fatigue on the decisions and actions taken by the skipper of *Chinderah Star* on the morning of 25 March 2000.

However, in the Inspector's opinion the evidence of the hours that he would likely have been working over the previous 26 days, taken with the little sleep which he clearly had the previous night, strongly suggests that the skipper would have been experiencing a degree of fatigue. What is important to stress is that people who are suffering from even a mild degree of fatigue display a measurable decrement in their performance[9], even though they may not consider themselves to be tired.

[9] ATSB road safety research suggests that performance deficits equivalent to 0.05 percent blood alcohol content may be experienced by individuals after 17 to 19 hours of sleep deprivation.

Conclusions

These conclusions identify the different factors contributing to the incident and should not be read as apportioning blame or liability to any particular organisation or individual.

The following factors are considered to have contributed to the collision between *Chinderah Star* and *Silver Bin* at approximately 1209 on 25 March 2000.

1. The skipper of *Chinderah Star* did not make radio contact with *Silver Bin* after identifying the ship at 1145, both visually and on radar, and ascertaining that there was a possibility that the vessels would be passing at close quarters where the channel is particularly narrow.

2. The skipper of *Chinderah Star* should have been aware that the ship ahead was a large vessel constrained by its size and draft from taking evasive action yet he did not slow *Chinderah Star* nor alter his course when the ship disappeared from his radar screen.

3. *Silver Bin* and *Chinderah Star* were both enveloped by a tropical rain squall at approximately 1157, 12 minutes prior to the collision. The density of the rain was such that the range of visibility was limited to approximately 160 m or less. The heavy rain would have significantly degraded the performance of the 3-cm radar sets on both vessels.

4. Neither vessel was proceeding at a ‘safe speed’ after entering the rain squall.

5. Neither vessel sounded any audible signals after entering the rain squall.

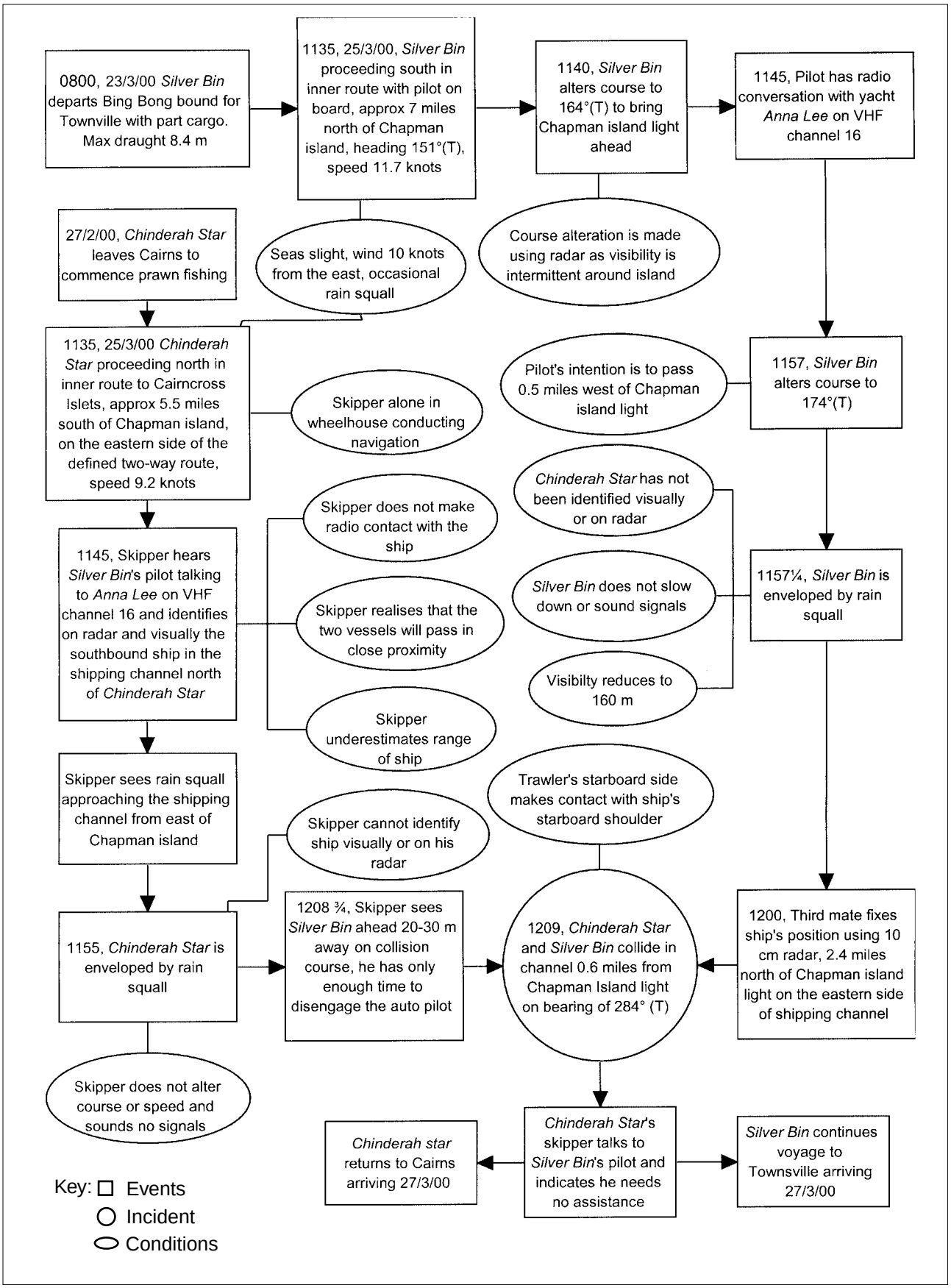
6. The look-out, both visual and on radar, on *Silver Bin* was ineffective in that *Chinderah Star* was not identified at any time prior to the collision.

7. Even during the rain squall, *Chinderah Star* should have been visible on *Silver Bin*’s 10-cm radar, particularly if the ship’s heading line was periodically suppressed.

8. In the absence of quantitative evidence, it cannot be definitely stated that fatigue affected the decisions made and the actions taken by the skipper of *Chinderah Star*. However, in view of the evidence which was available, the Inspector considers that it was most probably a significant factor.

9. Prima facie, neither the bridge team on *Silver Bin*, particularly the master and pilot, nor the skipper of *Chinderah Star*, properly assessed the risks of collision and lacked caution in not acting in conformity with the COLREGS.

FIGURE 8:
***Silver Bin/Chinderah Star* collision events and causal factors chart**



Submissions

Under sub-regulation 16(3) of the Navigation (Marine Casualty) Regulations, if a report, or part of a report, relates to a person's affairs to a material extent, the Inspector must, if it is reasonable to do so, give that person a copy of the report or the relevant part of the report. Sub-regulation 16(4) provides that such a person may provide written comments or information relating to the report.

A copy of the draft report was forwarded to:

The master of *Silver Bin*

The pilot aboard *Silver Bin*

The skipper of *Chinderah Star*

The owner of *Chinderah Star*

The manager of Southern Shipping Enterprises (agent for *Silver Bin*)

The Chief Executive Officer, Australian Maritime Safety Authority

Submissions were received from Norton White, solicitors for the owners and the master of *Silver Bin*, and from the pilot.

Owners and master of Silver Bin

The text has been amended to incorporate, in essence, the points raised in submission by the owners and master of *Silver Bin*.

The pilot

Where appropriate, amendments to the text of the draft report were made as a consequence of the pilot's submission. Other points raised by the pilot are reproduced below:

> Conclusion 2. - The only possible cause of the collision particularly when you also include the trawler's failure to react to my VHF conversation with the yacht, if he in fact heard it and if in fact he sighted the *Silver Bin* visually and/or by radar.
>
> Conclusion 4. – Unless 'safe speed' is quantified this conclusion cannot be accepted.
>
> Conclusion 5. – While this is fact, it is only conjecture that the sounding of any audible signals would have prevented the collision.
>
> Conclusion 6. – Totally rejected

Recommendations

1. That all fishing industry bodies, together with State and Territory authorities draw the attention of fishing vessel skippers and owners to ATSB Safety Bulletin No.01 (Attachment 1) highlighting the risks to fishing vessels from large trading ships and to the limitations of ships' radar.

2. That Australian ship managers, pilot services and Australian shipping agents note and distribute as widely as possible to vessels, ATSB Safety Bulletin No.02 (Attachment 2). The bulletin draws attention to the dangers of over-reliance on radar, the possible short-comings of radar, and the importance of maintaining a proper visual lookout in all conditions.

Silver Bin

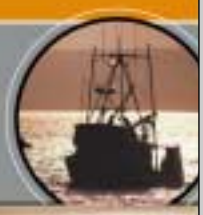
Name	*Silver Bin* (formerly *E Mei Shan*)
IMO No.	8827454
Flag	Liberian
Classification Society	Bureau Veritas
Vessel type	Geared Bulk Carrier
Owner	Silver Bin Navigation Inc., Monrovia
Year of build	1986
Builder	Bohai Shipyard, Jinxi, China
Gross tonnage	24277
Summer deadweight	39015 tonnes
Length overall	195.00 m
Breadth, moulded	28.40 m
Depth	15.80 m
Draught (summer)	11.022 m
Engine	Sulzer 6RLB66, 6-cylinder, 2-stroke, single acting
Engine power	8 165 kW
Service speed	14.5 knots
Crew	25 (Chinese)

Chinderah Star

Name	*Chinderah Star*
Registration Number	2013QB
Survey Authority	Queensland Transport
Vessel type	Prawn trawler, class 3B
Owner	D.Maden, Cairns
Year of build	1980
Builder	Richards and Sons Pty. Ltd., Chinderah, NSW
Construction	Steel hull, aluminium deckhouse
Gross tonnage	45.19
Length overall	17.37 m
Beam	5.29 m
Depth	2.70 m
Engine	Caterpillar 3408B, 4-stroke diesel
Engine power	186 kW
Service speed	9.5 knots
Crew	3 (Australian)

Safety Bulletin 01

Ships and Fishing Vessels



Ships and Fishing Vessels

At about 0110 on 21 June 2000 a fisherman from Iluka, New South Wales, was killed when his 14 m trawler was run down and sunk by a 181 m long, 42 717 tonne deadweight bulk carrier.

The collision highlights:

1. the risks faced by fishermen from large ships;
2. the limitations of radar; and
3. the mutual obligation of all people at sea to observe the International Regulation for Preventing Collisions at Sea, 1972 (Colregs).

The Risks

Since June 1995, the Australian Transport Safety Bureau has investigated fourteen collisions between trading ships and Australian fishing vessels. In all these cases, the fact that a collision occurred indicates that the lookout aboard the trading ship, both visual and by radar for whatever reason, was ineffective. In a few cases it is probable that the lookout was non-existent. Regardless of any failure on the part of the trading ship to keep a proper lookout:

- Only three involved fishing vessels engaged in fishing.
- Seven involved fishing vessels not engaged in fishing, but en route between fishing grounds.
- Four involved fishing vessels anchored in open water.
  - On three of the four vessels at anchor no lookout was maintained and the crewmembers went to bed despite being anchored in open waters in recognised shipping lanes,
- In twelve incidents, the fishing vessel failed to maintain a proper lookout
  - In four of the incidents, a contributory factor was that the person keeping watch on the fishing vessel had no training, did not understand the obligations placed on a fishing vessel by the Colregs and did not understand how to use the radar.
  - The number of crew typically employed on fishing boats was two or three, which for a sustained 24-hour operation is insufficient to fish and maintain a proper lookout required by the Colregs.

Until 21 June, Australian fishing vessels had been lucky as no fatalities had occurred.

Figures from the UK show that since 1991, at least 19 fishermen are known to have died as a direct result of collisions. In 1998, five fishermen were killed in four collisions involving merchant vessels and British registered fishing vessels.

The Limitations of Radar

RADAR operates by transmitting electro-magnetic signals in the form of pulses from an antenna. Radar reflective objects, which lie in the path of this transmission reflect the signal, which is received by the same antenna in the form of a return signal (echo).

Radar technology has developed to the extent where radars are reliable aids to both navigation and collision avoidance. They do, however, have limitations. Radars are not 'all seeing eyes'.

It is important for fishermen to understand what these limitations are.

The weakest detectable echo, which a radar can display, is one which is just stronger than the radar receiver noise level.

The display of this echo is dependent on the following four factors.

1. The correct setting up of the radar display.
2. The siting of the vessel's radar antenna.
3. The target.
4. The weather conditions at the time of using the radar.

Australian Transport Safety Bureau
PO Box 967,
Civic Square ACT 2608
www.atsb.gov.au
1800 621 372

All these factors are very important, but the target and weather conditions are crucial to fishermen.

The target
The echo response received from a target depends upon the following four factors:
(a) size,
(b) shape,
(c) composition and
(d) aspect

(a) size
Targets presenting a large surface area to the radar signal will be detected easily and at long range. Small targets of limited surface area, which are not very high, may not be detected, if at all, until much closer to the source radar.

(b) shape
A smooth shaped object (hull of a fishing vessel) gives a poor radar detection response as compared to a rough shaped object (rocky coastal out crop).

(c) composition
Metal objects give a better radar response than wood.

Fibreglass objects are transparent to radar signals and will not be displayed on a radar screen.

Small vessels, particularly of wooden or other non-metallic construction, can have a large number of separate reflectors (metal masts, booms, engine and other metallic reflectors). None of these are large enough to provide a constant echo. The close proximity of masts rigging, engine etc., acting as reflectors, can also make the vessel a 'multiple' reflector target. This characteristic can result in either an enhanced echo or the return echoes cancelling each other out. A very small change in relative distance from the radar antenna can make the difference between being seen – 'in phase' – and not being seen –'out of phase'.

Similarly, the phase of the radar signal and echo can be affected by skipping or bouncing off the sea surface resulting in signals that may subtract from each other as described above.

(d) aspect
A target beam on to the radar transmission is more likely to give a radar return than a target lying at an angle of 45° to the transmission.

Weather conditions at the time of using the radar
Waves themselves form targets, which when reflected and picked up by the radar, form 'sea clutter'. 'Sea clutter' varies widely with the sea state. Return echoes from rain showers (rain clutter) can have the same effect. Small vessels are more likely to be consistently lost in clutter than are large vessels.

Rain, fog, high humidity and an air temperature lower than the sea temperature will also reduce the radar detection range.

The Regulations

The Colregs apply to all vessels at sea.

The requirement to keep a proper look-out is a mutual obligation for all vessels at sea.

> *Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and risk of collision.*

In short every vessel must keep a lookout, whether fishing or not.

Although power-driven vessels and sailing vessels must keep out of the way of vessels 'engaged in fishing', fishing vessels must, so far as possible keep out of the way of a vessel not under command or a vessel restricted in her ability to manoeuvre.

A vessel carrying certificates as a fishing vessel is only a 'restricted' vessel when actually engaged in fishing. It is not restricted when its nets are on the surface or when it is on passage to or from fishing grounds.

Vessels are only considered to be engaged in fishing when fishing with nets, lines, or trawls or other fishing apparatus which restrict manoeuvrability, but does not include a vessel fishing with trolling lines or other fishing apparatus which does not restrict manoeuvrability.

Please remember

If you cannot see a long way visually then the radar cannot generally detect targets at a long range either.

To improve the radar detection of small vessels you should fit as a minimum:

- **a metal corner radar reflector mounted 'in the catch water position'; or**
- **an octahedral cluster of corner reflectors;**

as high as possible above the water line.

Proper understanding and observation of the Colregs and a listening watch on channel 16 VHF can protect your life and your boat.

Safety at sea is like safety on the road. You should assume everybody else is a potential danger – an idiot – and act accordingly.

End note

The vulnerability of fishing vessels has been highlighted in a number of Incidents at Sea reports. The problems created by working lights were highlighted in Report 35 (September 1991) and Report 49 (December 1992). Since June 1995, the issue of fishing boats maintaining a lookout or the limitations in radar in detecting small vessels has been highlighted in the following reports:

81 (June 1995)
94 (July 1996)
98 (September 1996)
103 (November 1996)
104 (November 1996)
106 (December 1996)
116 (April 1997)
125 (September 1997)
131 (April 1998)
144 (February 1999)

Acknowledgements

ATSB is grateful to Mr Ian Smith, Manager Ship Simulator at the Australian Maritime College and Mr John Pothen, Teacher (Ship Simulator) at the Sydney Institute of Technology for advice on radar.

Safety Bulletin 02

Ships and Fishing Vessels

An open letter to all Masters, and bridge watch-keepers

Collisions with fishing vessels

The safety of fishermen and people in small boats is a continuing concern in terms of safety at sea. In the course of your voyages you encounter many types of fishing operations from dug out canoes, with sometimes a candle or oil lantern, to large fishing/factory ships. In and around the Australian coast fishing vessels tend to be less than 20 m in length with a crew of two or three. They often exhibit very bright working lights, though these should be shielded in order to ensure that the fishing lights required by the Colregs can be seen clearly.

Since January 1991, the Australian Transport Safety Bureau has reported on, or is in the process of investigating, 21 incidents of collision between trading ships and small fishing or pleasure craft. Fishermen claim that 'near-miss' situations are common and from time to time, incidents are reported to the ATSB.

That these incidents occur is evidence that fishing vessels and other small craft are not being detected visually or by radar by the watch keeping personnel on board trading vessels. There is an obligation on the part of all vessels at sea to maintain a proper lookout. The fact that in some cases the crews of fishing vessels do not maintain a lookout and do not carry radar reflectors, even though their boats may provide a very poor echo, does not excuse trading ships in any failure to keep a proper lookout.

The following summary underscores the main issues and demonstrates that there are normally no mitigating factors to explain the vast majority of collisions. The only explanations are the lack of a proper visual lookout, or an over reliance on radar detection in circumstances where the radar set has either not been set-up properly, maintained properly or monitored with sufficient diligence.

- Eighteen collisions occurred in clear weather.
- Three collisions occurred in conditions of heavy rain and poor radar detection conditions.
- Fourteen occurred in darkness, five in full daylight and two occurred in the half-light of twilight.
- Eleven collisions occurred between midnight and 0400 in the morning.
- Seventeen collisions involved commercial fishing vessels and four involved yachts or pleasure craft.
- Five of the seventeen fishing vessels were actually engaged in fishing, four were at anchor and eight were in transit.
- Seven small vessels on steady courses were being overtaken by the trading vessel and had been in sight for some time.
- Six vessels were not making way (five were at anchor and one drifting).

Australian Transport
Safety Bureau
PO Box 967
Civic Square ACT 2608
www.atsb.gov.au
1800 621 372

The Australian coast generally enjoys good visibility and has relatively light traffic. It seems probable that watch-keeping officers:

- may be lulled into a sense of false security;
- attentiveness (arousal) is reduced in the clear conditions and they may easily become bored;
- lose track of time in open sea conditions;
- rely too much on radar to the detriment of a proper systematic visual look out.

Radar

As professional mariners, certificated officers hold qualifications as radar observers. However, I must stress the importance of having the radar properly tuned to its optimum performance with both gain and clutter controls correctly set.

In investigating the 21 incidents two critical issues of radar observing seem to emerge.

When using ARPA, assessments of a target's course and speed are made too quickly. Also, it must be realised that where there is a proportionately small amount of relative movement, such as in an overtaking situation, ARPA readings may be inconsistent.

Small vessels, particularly of wooden or other non-metallic construction, can have a large number of separate reflectors (metal masts, booms, engine and other metallic reflectors). None of these is large enough to provide a constant echo. The close proximity of masts rigging, engine etc, acting as reflectors on a small vessel moving in the swell causes multiple reflections. This characteristic can result in either an enhanced echo or in the return echoes cancelling each other out. A very small change in relative distance from the radar antenna can make the difference between a fishing vessel returning a strong signal 'in phase' – or returning a weak or nil signal –'out of phase'.

Similarly, the phase of the radar signal can be affected by multi-path signals due to reflection off the sea surface, resulting in signals that are 'out of phase'.

Conclusion

You may think that a collision cannot happen to you. Experience suggests that accidents of all types can happen to anyone. The best people have the worst accidents.

Australian authorities have taken action against fishermen for the failure to observe the Colregs. They have also prosecuted a ship's master and watch-keeping officer for failure to observe the Rules.

A few minutes failure to keep a proper watch can result in the death of a fisherman and tragedy for the family. For you it can mean lengthy police interviews, delay to the ship, arrest and possible criminal charges which could result in a heavy fine or jail.

Please keep this letter in mind wherever you may be. Under normal conditions of visibility around Australia, there is no substitute for a proper visual lookout supplemented by sensible use of a well set up radar.

Kym Bills
Executive Director

3 August 2000

PS For further information on ATSB's marine casualty and incident reports visit our web site at www.atsb.gov.au

www.atsb.gov.au

1800 621 372

ISBN 0 642 20042 4

Silver Bin. 01 .2002