NSW GOVERNMENT | Transport for NSW

Centre for Maritime Safety

Boating incidents in NSW

Statistical report for the 10-year period ended 30 June 2016

January 2017

Contents

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1 Introduction

This report examines boating incidents recorded in NSW over the 10 year period from 2006-07 to 2015-16, and will highlight key safety issues. It summarises boating incidents recorded in the 2015-16 financial year, and compares these with the longer-term (10 year) period. Using long-term data for comparisons helps overcome statistical issues caused by wide annual fluctuations in incident numbers. This is especially important with respect to fatalities and fatal incidents, for which numbers often change by 50% or more between successive years.

The report primarily focuses on recreational boating incidents but commercial vessels are also considered. It should be stressed that the data used throughout is based on 'reported' incidents. While the reporting of fatal incidents is likely to be reliable, it is recognised that a large but unknown number of less serious incidents would go unreported each year. It is also recognised that reporting patterns may have changed over time, due changes in data collection and boating regulations. For example, the boating damage threshold for compulsory reporting increased from $100 to $5,000 in 2009. Despite these limitations, the report is able to make valid comparisons and assessments based on the reported data.

The report is aimed at a wide audience – including Government agencies, peak boating bodies and members of the boating public – and provides a solid evidence base for the development of boating policy as well as education and compliance strategies.

The report updates boating safety statistics since the publication of the Transport for NSW reports Boating Incidents in NSW – Statistical report for the 10-year period ended 30 June 2012 and Boating incidents in NSW – Statistical Statement 2014-15.

2 Background of boating activity in NSW

The Sydney International Boat Show, held annually at Sydney's Darling Harbour.

Boating is popular in NSW, where an estimated 2 million people go recreational boating each year (i.e. approximately 25% of the state's population). The state's favourable climate and large range of accessible waterways support a wide variety of boating activities covering paddle, sail and power craft. Recreational boats typically seen on NSW waterways include small tinnies and rowing dinghies, canoes and kayaks, PWC, half-cabin runabouts, waterski and wakeboard boats, large cabin cruisers and sailing vessels of all sizes. NSW has 2140km of coastline and 12,000 square km of navigable waters extending across coastal waters, estuaries, rivers, lakes and dams with State responsibilities extending to 5.5km offshore.

Boating is becoming increasingly popular, driven by changes to leisure patterns and increasing numbers of people reaching retirement age. As at 30 June 2016, there were nearly 240,000 recreationally registered vessels in NSW – an increase of more than 10% over the last 10 years. In addition, there are an estimated 100,000 unregistered vessels like rowing dinghies, canoes, kayaks and off-the-beach sailing craft. Anecdotal evidence suggests that the popularity of 'paddle craft' such as canoes and kayaks – along with stand up paddle boards – has increased sharply in recent years. In addition, large cabin cruisers, wakeboarding boats and PWC (also known as 'jet skis') appear to be increasing in proportion to other vessel types.

A recreational boat driving licence is required to drive a powered vessel at 10 knots or more. A specific PWC driving licence is needed to drive a PWC at any speed. There are approximately 460,000 general boat driving licences held in NSW and 54,000 PWC driving licences. In addition, there are several thousand holders of commercial Certificates of Competency who are automatically deemed to hold a recreational boat and a PWC driving licence.

3 Executive summary

This report examines boating incidents recorded in NSW over the 10 year period from 2006-07 to 205-16. It compares boating incidents in the 2015-16 financial year with those of 10 year period. The report also examines longer-term trends in fatal and total incident rates, back to the 1990s. The report primarily focuses on recreational vessels, but also considers commercial vessels.

Lifejacket wear on small boats remains one of the keys to reducing boating fatalities.

There were 11 recreational and commercial boating fatalities in 2015, which was significantly below the long-term annual average of 17. Long-term downward trends remain evident for both recreational and commercial vessel fatal incident rates. The total number of serious injuries on recreational and commercial vessels (56) was also significantly below the long-term annual average (68.1). Total incident rates continue to fall for both recreational and commercial vessels. There were 257 boating incidents overall in 205-16.

There were 126 recreational fatal incidents over the last 10 years. Among these, the most common incident types were capsizing (33.3%), fall overboard (28.6%) and injury – towing incident (10.3%). The main incident causes were weather conditions (13.5%), excessive speed (8.7%), hazardous waters (7.9%), lack of judgement (7.9%), excess alcohol (5.6%) and no proper lookout (5.6%). 63.5% of these incidents occurred while a vessel was underway, 12.7% occurred during a towing activity and 10.3% occurred while the vessel was anchored, moored or berthed. Open runabouts were the primary vessel for exactly half of all recreational fatal incidents, followed by cabin runabouts (8.7%) and canoes/kayaks (7.9%). Nearly half (47.6%) of all recreational fatal incidents involved a vessel less than 4.8 metres of length. Of the recreational vessel fatal incidents recorded over the last 10 years, 59.5% occurred during the middle of the day and afternoon, 46.8% occurred on a weekend, 63.5% occurred during the warmer months of October to March and 73.0% occurred on what were presumably sheltered waters – i.e. rivers, lakes, estuaries and bays. Among the 144 fatalities recorded over the 10 year period, 86.8% were male.

There were 15 fatal incidents involving just commercial vessels, and a further two fatal incidents involving both a commercial and a recreational vessel, recorded over the last 10 years. Seven of the commercial vessel incidents (46.7%) were of the type "fall overboard", while both of the fatal incidents involving both vessel categories involved a collision between the two vessels. Most commercial vessel fatal incidents (75%) related to vessels greater than 8 metres in length.

Overall lifejacket wear rates have been increasing in recent years and were estimated at 45% in 2015-16. There is evidence that improved lifejacket wear rates are helping to reduce recreational boating fatalities – there has been a long-term decline in the recreational boating drowning fatality rate, but no change in the corresponding non-drowning fatality rate. There is clearly still scope for further work around lifejackets, given that drowning fatalities still make up the majority of recreational boating fatalities. There is also a need for renewed focus around incident contributing factors such as speed, distances-off and boater behaviour. The continued aging of the NSW population poses additional challenges – including safety in small boats and people needing to re-assess their behaviours in response to changing medical and physical circumstances.

4 Safety performance in 2015-16

The safety performance in 2015-16 is assessed by comparing incident statistics for the year against corresponding long-term averages (the 10 year period 2006-07 to 2015-16). Boating fatalities, serious injuries and incidents in 2015-16 were all significantly below the long-term average and both recreational and commercial fatal incident rates continue long-term downward trends.

In 2015-16 there was a relatively high proportion of recreational vessel fatal incidents involving vessels six or more metres in length, and a relatively high proportion recreational vessel serious injury incidents on vessels underway. The overall lifejacket wear rate was 45%, which was up on previous years.

Fatalities down

The total number of recreational and commercial boating fatalities (11) was significantly below the long-term annual average (17). Ten fatalities were recorded on recreational vessels.

A long-term downward trend remains evident for both recreational and commercial fatal incident rates, taking into account increasing vessel numbers.

Serious injuries down

The total number of serious injuries on recreational and commercial vessels (56) was significantly below the long-term annual average (68.1).

Total incidents down

The total number of incidents was significantly below the long-term average, suggesting a continuing gradual improvement in overall boating safety.

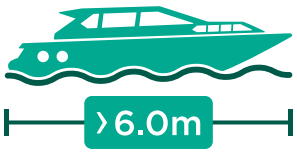
Total incident rates, both for recreational vessels and commercial vessels, continue to fall.

Lower proportion of total recreational vessel incidents during January

The proportion of total incidents recorded in January (10%) was significantly below the 10 year figure (17%).

Serious injuries underway

The proportion of serious injury incidents where the vessel was underway (84%) was significantly above the 10 year figure (62%).



Recreational vessel fatal incidents

The proportion of fatal incidents where the vessel was 6 metres or more in length (78%) was significantly above the 10 year figure (27%).

Total recreational vessel incidents

The proportion of total incidents where the vessel was less than 4.8 metres in length (28%) was significantly above the 10 year figure (19%).

Lifejacket wear rates up

Overall lifejacket wear rate was 45%, up from 41% in 2014-15 and just 9% in 2007.

Children under 12 must always wear a lifejacket in boats less than 4.8 metres in length

There were 11 boating fatalities, 56 serious injuries and 257 boating related incidents recorded in the 12-month period to 30 June 2016 (Table 1). The number of fatalities was down by more than 25% compared to 2014-15, and lower than the long-term average (Table 2). In addition, the recreational vessel fatality rate (per 100,000 vessel registrations) continues a long-term decline (Section 6).

Compared with the previous year, serious injuries were down by nearly 35% and total incidents were down by more than 10%.

Table 1: Fatalities, serious injuries and related incident numbers for the 2015-16 financial year.

Vessel category	Incident category				Total incidents
	Fatalities	**Fatal incidents**	**Serious injuries**	**Serious injury incidents**	
Recreational	10	9	44	32	153
Commercial	1	1	9	8	80
Commercial/recreational	0	0	3	3	24
TOTAL	**11**	**10**	**56**	**43**	**257**
Change on last year*	**-26.7%**	**-28.6%**	**-34.9%**	**-28.3%**	**-10.1%**

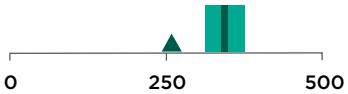
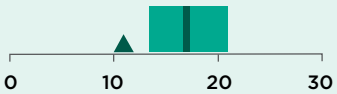
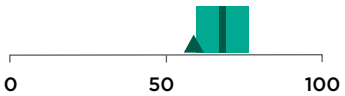
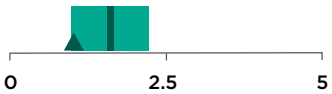
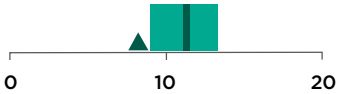
* The % changes do not exactly correspond to the incident data presented in the 2014-15 Statistical Statement, due to one fatality from 2014-15 being found to be non-boating related and a small number of non-fatal incidents being added to RMS records subsequent to that earlier statement being prepared.

In 2015-16, there were 10 incidents involving one or more fatalities (3.9% of total) – which is similar to the long-term proportion (2006-07 to 2015-16) of 4.2%. There were 43 incidents involving serious injury but no fatalities (16.7% of total) – which is also similar to the long-term proportion of 15.8%.

Most of the incidents (153 or 59.5%) involved only recreational vessels. This proportion is significantly less than the long-term figure of 69.9%.

Half cabin runabouts are very popular for fishing inshore waters.

Table 2: Incident Barometer – comparison of 2015-16 against 10 year period (2006-07 to 2015-16) and summary of long-term trends.

Indicator	2015 -16	Average last 10 years (10 yr av.)	2015-16 statistical relationship to 10yr av.	Graph* showing 2015-16 vs. 10yr av.	Long-term trend
Total incidents	257	344.4	Lower		Initial increase; now decreasing
Total fatalities	11	17.0	Lower		Fluctuating
Total serious injuries	56	68.1	Lower		Increasing in line with vessel numbers**
Fatal incidents (recreational) per 100,000 vessels	3.8	5.6	Lower		Decreasing
Fatal incidents (commercial) per 10,000 vessels	1.0	1.6	Similar		Underlying decline
Serious injury incidents (recreational) per 100,000 vessels	13.6	18.8	Lower		Fluctuating**
Serious injury incidents (commercial) per 10,000 vessels	8.1	11.1	Lower		Increasing, partly in line with vessel numbers

*Key:

▲ 2015-16 value ▮ 10 year average ■ Statistical range of 10 year average

** Trends may have been affected by changes in reporting protocols and/or data capture over time.

5 Key numbers – recreational boating incidents

- There were 10 fatalities in 2015-16, arising from 9 recreational vessel incidents. Over the last 10 years there were 144 fatalities arising from 126 incidents.
- There were 44 serious injuries in 2015-16, arising from 32 recreational vessel incidents Over the last 10 years there were 508 serious injuries arising from 424 incidents.
- There were 153 recreational vessel incidents in total in 2015-16 and 2408 over the last 10 years.

5.1 Key findings – recreational boating fatal incidents over the last 10 years

33% of fatal incidents involved **vessel capsize**, followed by fall overboard (29%) and towing incidents (10%).

14% of fatal incidents due to adverse **weather conditions**, followed by excessive speed (9%) and hazardous waters and lack of judgement (both 8%).

64% of fatal incidents occurred while the vessel was **underway**, followed by 13% where the vessel was engaged in a towing activity like waterskiing or wakeboarding and 7% where the vessel was anchored.

50% of fatal incidents primarily related to **open runabouts**, followed by cabin runabouts (9%) and canoes/kayaks (8%).

48% of fatal incidents primarily involved vessels **less than 4.8 meters** in length, followed by vessels 6 to 8 metres in length (18%) and vessels 4.8 to less than 6 metres in length (17%).

87% of boating fatalities were **male**.

47% of fatal incidents occurred on **Saturday or Sunday**. 53% occurred on a weekday.

32% of fatal incidents occurred around the **middle of the day**, (between 10:00am and 1:59pm), followed by 28% in the mid to late afternoon (2:00pm to 5:59pm) and 18% in the evening (6:00pm to 11:59pm).

63% of fatal incidents occurred in the **warmer months** of the year (Oct–Mar). 37% occurred in the cooler months (Apr–Sep).

33% of fatal incidents occurred on a **river**, followed by 18% on open or offshore waters and 17% in a bay.

60% of fatalities involved boaters **aged 30-69**. Boaters aged 70 years-plus accounted for a further 19%.

73% of all boating fatalities are presumed to have **drowned**.

82% of drowning victims were not wearing a **lifejacket**. Up to 90 lives could have been saved if all those presumed drowned had been wearing a lifejacket.

Restrictions apply to where PWC riders may perform irregular manoeuvres.

Facts box – Personal Watercraft (PWC) Update for 2015-16:

In 2015-16 there were (involving a recreational PWC):

- 22 incidents in total;
- 5 serious injury incidents; and
- 0 fatality incidents.

In addition:

- The overall incident rate for recreational PWC (178.1 per 100,000) was statistically similar to the average of the last 10 years (208.8 per 100,000); and
- The serious injury incident rate for recreational PWC (40.5 per 100,000) was significantly below the 10 year average of 71.5 per 100,000.

These 10 year averages have changed little in recent years, and are similar to those given in the report Personal Watercraft Incidents, Compliance and Feedback in New South Wales – Statistical report for the 10-year period ended 30 June 2012.

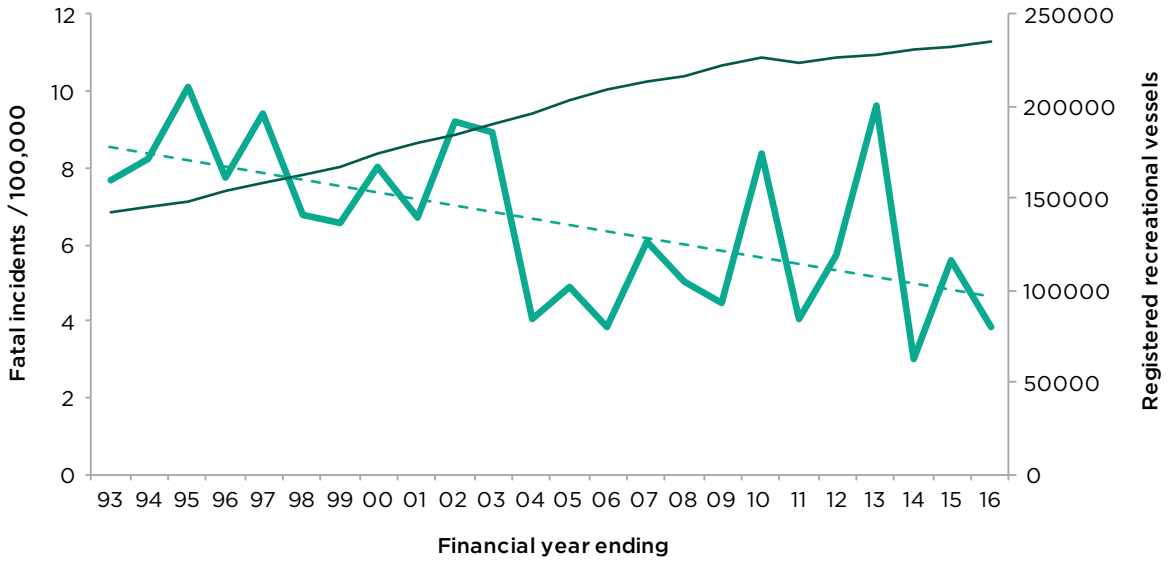
In relation to recreational boating incidents involving at least one PWC over the last 10 years (2006-07 to 2015-16):

- Nearly 80% occurred in the warmer months of October to March.
- More than three-quarters occurred at 12:00 noon or later in the day (and nearly 60% happened at or after 2:00pm).
- More than 25% occurred on the Georges River/Botany Bay waterway.
- Among incident types, collisions with another vessel were by far the most prevalent (46.8% of all incidents). This was followed by falls overboard (9.0%) and collisions with a fixed object (8.5%).
- The most prevalent incident causes were lack of judgement (28.2%), no proper lookout (14.4%) and hazardous waters and excessive speed (each 6.4%).

6 Latest incident trends

There were 3.8 fatal incidents per 100,000 recreational vessels in 2015-16. The recreational vessel fatality rate continues to show a long-term downward trend, while vessel numbers have increased (Figure 1). The fitted trend line shows that the recreational vessel fatal incident rate has dropped from approximately 8.5 per 100,000 vessels to 4.5 per 100,000 over the last 24 years – a decrease of nearly 46%.

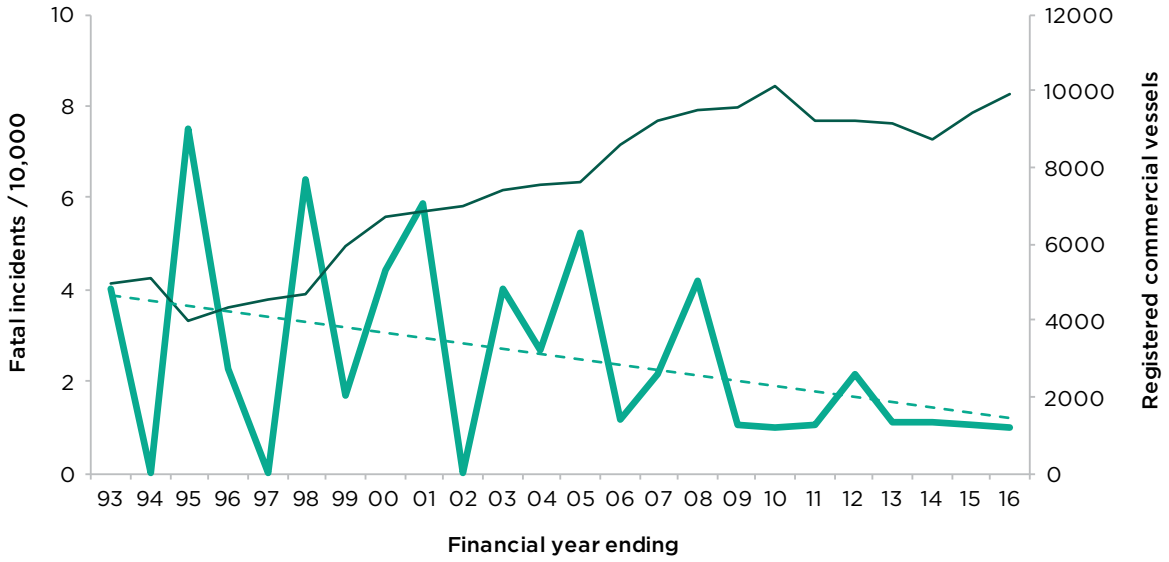
Figure 1: Fatal incidents per 100,000 registered recreational vessels (green line) and corresponding registrations (dark green line).



In addition, the commercial vessel fatality incident rate remains relatively low (1.1 incidents per 10,000 vessels in 2014-15) and is continuing to display an underlying downward trend (Figure 2). At the same time, commercial vessel numbers have been increasing. The fitted trend line shows that the commercial vessel fatal incident rate has dropped from approximately 3.9 per 10,000 vessels to 1.2 per 10,000 over the last 24 years – a decrease of more than 68%.

Even good swimmers should always wear a lifejacket.

Figure 2: Fatal incidents per 10,000 commercial vessels (green line) and corresponding registrations (dark green line)*.



* Trend line fitted to non-overlapping 3-year averages of the data (i.e. '93-'95, '96-'98, etc.).

Overall incident rates for both recreational vessels (Figure 3) and commercial vessels (Figure 4) have also maintained long-term downward trends.

In the case of overall recreational vessel incidents, the fitted trend line (Figure 3) shows that the incident rate has dropped from 154.0 per 100,000 vessels to 87.6 per 100,000 over the last 20 years – a decrease of approximately 43%.

For overall commercial vessel incidents, the fitted trend line (Figure 4) shows that the incident rate has dropped from 140.2 per 100,000 vessels to 60.9 per 100,000 over the last 20 years – a decrease of approximately 57%.

Customers enjoying a jet boat ride on Sydney Harbour. Commercial vessels are required to have a Safety Management System specific to their operations.

Figure 3: Total incidents per 100,000 registered recreational vessels (green line) and corresponding registrations (dark green line).

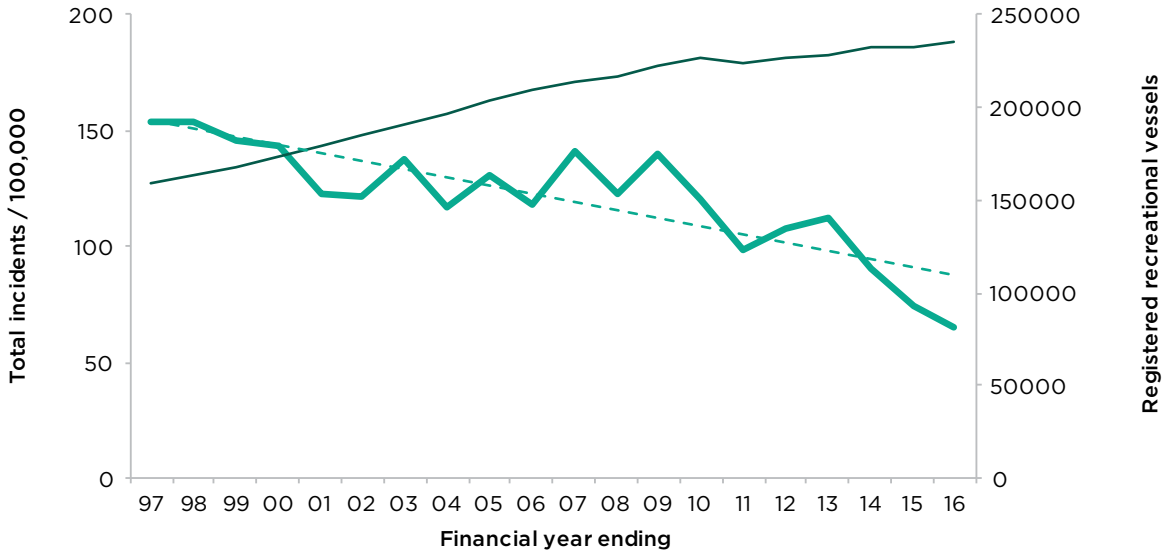
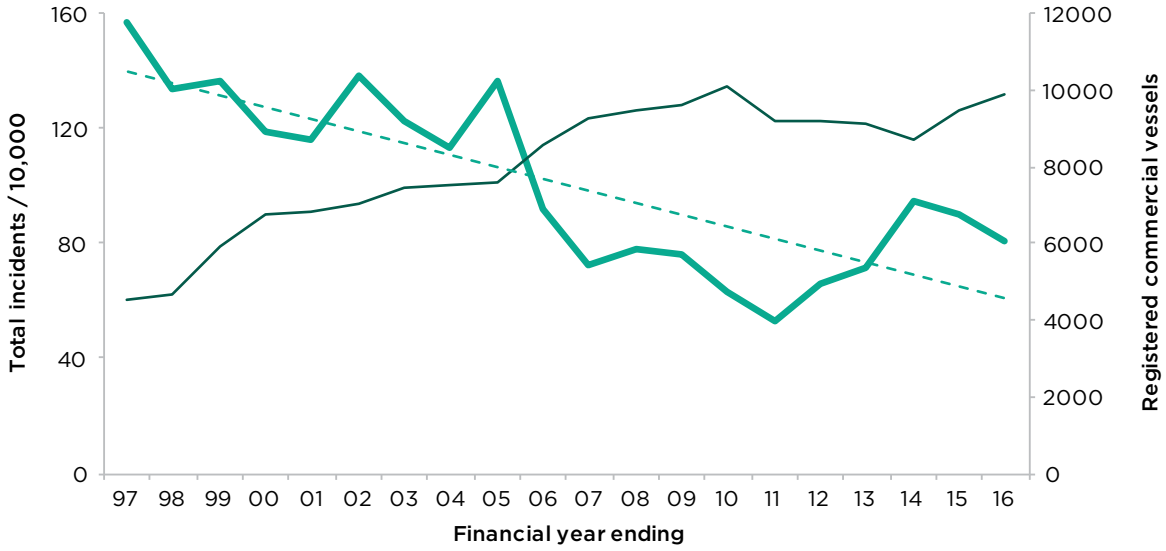


Figure 4: Total incidents per 10,000 commercial vessels (green line) and corresponding registrations (dark green line).



7 Recreational incident patterns

7.1 Incident type

The three most common **fatal incident types** over the last 10 years were:

- capsizing,
- fall overboard and
- injury – towing incident.

These accounted for 91 fatal incidents (72.2% of the total – Table 3).

Incidents where the victim was likely forced into the water (capsize, fall overboard, sinking, swamping, flooding or bar crossing incident) accounted for 87 fatal incidents (69% of the total), while incident types implying some sort of collision accounted for 15 fatal incidents (11.9% of the total) – including persons being hit by a vessel or coming into contact with its propeller (Table 3).

Among the nine fatal incidents recorded in 2015-16, five (55.5%) involved the victim most likely being forced into the water (Table 3) – i.e. capsizing, falling overboard, bar crossing incident, sinking and swamping. This is statistically similar to the corresponding long-term figure (69.0%).

Vessel capsize accounts for a large proportion of fatal incidents. Smaller boats are particularly vulnerable.

Table 3: number and percentage of recreational boating fatal incidents by incident type, for 2015-16 and for the last 10 years (2006-07 to 2015-16).

Incident type	Fatal incidents in 2015-16	2015-16 % of fatal incidents	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
Capsizing	1	11.1	42	33.3
Fall overboard	3	33.3	36	28.6
Injury – towing incident	2	22.2	13	10.3
Collision with fixed object	0	0	6	4.8
Collision with vessel	1	11.1	4	3.2
Person hit by vessel	0	0	4	3.2

Incident type	Fatal incidents in 2015-16	2015-16 % of fatal incidents	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
Bar crossing incident	1	11.1	3	2.4
Sinking	0	0	3	2.4
Swamping	0	0	3	2.4
Injury on board	0	0	2	1.6
Fall in vessel	0	0	1	0.8
Grounding	0	0	1	0.8
Propeller injury	0	0	1	0.8
Other/unspecified	1	11.1	7	5.6
Total	**9**	**100**	**126**	**100**

In no cases (Table 3) was the proportion of fatal incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

The three most common **serious injury incident types** over the last 10 years were:

- injury – towing incident,
- collision with vessel and
- collision with fixed object.

These accounted for 174 serious injury incidents (41.0% of the total – Table 4).

Incidents where the victim was likely forced into the water accounted for 83 serious injury incidents (19.6% of the total – Table 4), which is a much lower than the corresponding proportion for fatal incidents (69.0% – Table 3). However, incident types implying some sort of collision accounted for 168 serious injury incidents (39.6% of the total) – including persons being hit by a vessel or its propeller (Table 4). This percentage is much higher than the corresponding proportion for fatal incidents (11.9% – Table 3).

Collisions are a major source of serious injury on the water.

Among the 32 serious injury incidents recorded in 2015-16, 13 (40.6%) were of a type implying some sort of collision – including those between a person and a vessel and/or its propeller (Table 3). A further eight (25%) involved a situations in which a person was most likely forced into the water.

Table 4: number and percentage of recreational boating serious injury incidents by incident type, for 2015-16 and for the last 10 years (2006-07 to 2015-16).

Incident type	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
Injury- towing incident	3	9.4	76	17.9
Collision with vessel	5	15.6	52	12.3
Collision with fixed object	2	6.3	46	10.8
Propeller injury	5	15.6	30	7.1
Fall overboard	3	9.4	28	6.6
Fire or explosion (fuel)	2	6.3	27	6.4
Capsizing	3	9.4	25	5.9
Injury onboard	3	9.4	21	5.0
Person hit by vessel	0	0	21	5.0
Fall in vessel	1	3.1	20	4.7
Collision with submerged object	1	3.1	13	3.1
Bar crossing incident	0	0	12	2.8
Grounding	1	3.1	11	2.6
Sinking	2	6.3	10	2.4
Swamping	0	0	8	1.9
Collision with floating object	0	0	5	1.2
Fire or explosion (other than fuel)	1	3.1	3	0.7
Carbon monoxide inhalation	0	0	1	0.2
Collision with overhead obstruction	0	0	1	0.2
Hull splitting (structural failure)	0	0	1	0.2
Other/unspecified	0	0	13	3.1
Total	**32**	**100**	**424**	**100**

In no cases (Table 4) was the proportion of serious injury incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

The three most common incident types **overall** during the last 10 years were:

- collision with vessel,
- capsizing and
- grounding.

These together accounted for 1281 incidents (53.2% of the total – Table 5).

Collisions with a vessel alone accounted for more than one-third of all incidents over the last 10 years, and was by far the most common incident type recorded (Table 5).

Incident types implying some sort of collision accounted for 1143 incidents (47.5% of the total – Table 5) over the last 10 years. There were 684 incidents in which the victim was likely forced into the water (28.4% of total). Very similar proportions for these incident groupings were recorded in 2015-16: 48.4% (74 incidents) for collisions and 29.4% (45 incidents) for people forced into the water.

In general, there was a high degree of correlation between the breakdown of incident types recorded in 2015-16 and the breakdown for the last 10 years (Table 5; associated r-squared value = 0.98). The three most common incident types in 2015-16 were identical to those for the whole 10 year period (collision with vessel, capsizing and grounding) and their respective percentages were very similar (Table 5).

Table 5: Number and percentage of total recreational boating incidents by incident type, for 2015-16 and for the last 10 years (2006-07 to 2015-16).

Incident type	Total incidents in 2015-16	2015-16 % of total incidents	Total incidents over last 10 years	Last 10 years % of total incidents
Collision with vessel	54	35.3	807	33.5
Capsizing	18	11.8	308	12.8
Grounding	11	7.2	166	6.9
Collision with fixed object	7	4.6	144	6.0
Injury – towing incident	6	3.9	107	4.4
Fall overboard	8	5.2	106	4.4
Sinking	7	4.6	95	3.9
Swamping	8	5.2	89	3.7
Bar crossing incident	4	2.6	85	3.5
Collision with submerged object	6	3.9	69	2.9
Fire or explosion (fuel)	3	2.0	67	2.8
Fire or explosion (other than fuel)	5	3.3	45	1.9
Person hit by vessel	1	0.7	45	1.9
Collision with floating object	1	0.7	38	1.6
Close quarter	1	0.7	37	1.5
Propeller injury	5	3.3	36	1.5
Injury onboard	3	2.0	31	1.3
Fall in vessel	2	1.3	25	1.0
Hull splitting (structural failure)	0	0	12	0.5
Collision with overhead obstruction	0	0	4	0.2
Carbon monoxide inhalation	0	0	3	0.1
Flooding	0	0	1	0.0
Other/unspecified	3	2.0	88	3.7
Total	**153**	**100.0**	**2408**	**100.0**

In no cases (Table 5) was the proportion of total incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

Figure 10 (Section 7.4) provides further detail on incident type – as it highlights the type(s) of vessel primarily associated with each incident type.

7.2 Incident cause

Six incident causes together accounted for 49.2 % of all fatal incidents recorded over the last 10 years (Table 6). These six incident causes were:

- weather conditions,
- excessive speed,
- hazardous waters,
- lack of judgement,
- excess alcohol and
- no proper lookout.

Individually, each of these causes accounted for at least 5% of all fatal incidents. Given the high percentage of incidents classified under "other/unspecified" (Table 6), the true contribution of these causes was probably even greater.

Fatal incidents directly attributed to human factors (e.g. excessive speed) accounted for 30.2% of all fatal incidents over the last 10 years, while those attributed to environmental factors (e.g. weather conditions) accounted for 28.6% (Table 6). Fatal incidents attributed to a vessel or its equipment (e.g. fault of equipment) were relatively rare – accounting for just 2.4% of fatal incidents over the period.

A particular cause was attributed to five out of the nine fatal incidents recorded in 2015-16, with each of these causes accounting for a single incident (Table 6).

Many boating incidents arise from people being caught out by sudden weather changes. Photo courtesy of John Featherstone – Fishlife Magazine

Table 6: Number and percentage of recreational boating fatal incidents by primary incident cause, for 2015-16 and for the last 10 years (2006-07 to 2015-16).

Incident cause*	Fatal incidents in 2015-16	2015-16 % of fatal incidents	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
Weather conditions (E)	1	11.1	17	13.5
Excessive speed (H)	0	0	11	8.7
Hazardous waters (E)	1	11.1	10	7.9
Lack of judgement (H)	1	11.1	10	7.9
Excess alcohol (H)	0	0	7	5.6
No proper lookout (H)	0	0	7	5.6
Bar conditions (E)	1	11.1	3	2.4
Floating or submerged object (E)	0	0	3	2.4
Inadequate stability (V)	0	0	2	1.6
Overloading (H)	0	0	2	1.6
Tidal conditions (E)	0	0	2	1.6
Fault of equipment (V)	1	11.1	1	0.8
Improper loading (H)	0	0.0	1	0.8
Wash (E)	0	0.0	1	0.8
Other/unspecified	4	44.4	49	38.9
Total	**9**	**100.0**	**126**	**100.0**

* Incident causes classified as follows: (H) – human related; (E) – environmental; and (V) – vessel and/or equipment. Causes recorded in the RMS Eagle incident database were, in the vast majority of cases, specifically recorded as primary causes. However, it is possible that for a small number of incidents, the actual primary cause differed from the cause extracted for this table.

In no cases (Table 6) was the proportion of fatal incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

Five incident causes together accounted for 44.8% of all serious injury incidents recorded over the last 10 years (Table 7). These incident causes were:

- lack of judgement,
- no proper lookout,
- excessive speed,
- wash and
- weather conditions.

Individually, each of these causes accounted for at least 5% of all serious injury incidents. Given the high percentage of serious injury incidents classified under "other/unspecified" (Table 7), the true contribution of these causes was probably even greater.

Serious injury incidents directly attributed to human factors accounted for 41.3% of all serious injury incidents over the last 10 years, and 50% in 2015-16 (Table 7). The three most prevalent serious injury incident causes were all directly human-related, both over the last 10 years (accounting for 34.2% of the total) and in 2015-16 (46.9% of the total).

Serious injury incidents attributed to environmental factors accounted for 20.3% of serious injury incidents over the last 10 years, and 12.5% in 2015-16 (Table 7). As for fatal incidents, the proportions of serious injury incidents attributed to vessel factors were relatively low – 7.3% over the last 10 years and 3.1% in 2015-16 (Table 7).

Table 7: Number and percentage of recreational boating serious injury incidents by primary incident cause, for 2015-16 and for the last 10 years (2006-07 to 2015-16).

Incident cause*	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
Lack of judgement (H)	9	28.1	71	16.7
No proper lookout (H)	3	9.4	48	11.3
Excessive speed (H)	3	9.4	26	6.1
Wash (E)	0	0	23	5.4
Weather conditions (E)	2	6.3	22	5.2
Hazardous waters (E)	1	3.1	19	4.5
Excess alcohol (H)	1	3.1	16	3.8
Fault of equipment (V)	0	0	14	3.3
Inexperience (H)	0	0	10	2.4
Bar conditions (E)	0	0	9	2.1
Floating or submerged object (E)	0	0	9	2.1
Fault of machinery (V)	1	3.1	8	1.9
Navigational error (H)	0	0	4	0.9
Electrical fault (V)	0	0	3	0.7
Inadequate stability (V)	0	0	3	0.7
Restricted visibility (E)	1	3.1	3	0.7
Fault of hull (V)	0	0	2	0.5
Fault of navigational equipment (V)	0	0	1	0.2
Tidal conditions (E)	0	0	1	0.2
Other/unspecified	11	34.4	132	31.1
Total	**32**	**100**	**424**	**100**

* Incident causes classified as follows: (H) – human related; (E) – environmental; and (V) – vessel and/or equipment. Causes recorded in the RMS Eagle incident database were, in the vast majority of cases, specifically recorded as primary causes. However, it is possible that for a small number of incidents, the actual primary cause differed from the cause extracted for this table.

In no cases (Table 7) was the proportion of serious injury incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

Three incident causes together accounted for 40.8% of all recreational boating incidents recorded over the last 10 years (Table 8 and Figure 6). These causes were:

- lack of judgement,
- weather conditions and
- no proper lookout.

Individually, each of these causes accounted for at least 5% of all incidents. Given the high percentage of incidents classified under "other/unspecified" (Table 8), the true contribution of these causes was probably even greater.

Exercising sound judgement and a keeping a careful lookout are vital to avoiding boating incidents.

Incidents directly attributed to human factors accounted for 40.0% of all incidents over the last 10 years, and 39.9% in 2015-16 (Table 8 and Figure 5). Incidents attributed to environmental factors accounted for 26.5% of total incidents over the last 10 years, and 22.9% in 2015-16 (Table 8 and Figure 5). The proportions of incidents attributed to vessel factors were relatively low – 10.5% over the last 10 years and 11.1% in 2015-16 (Table 8 and Figure 5) – although not as low as was the case with fatal incidents (Table 6) and serious injury incidents (Table 7).

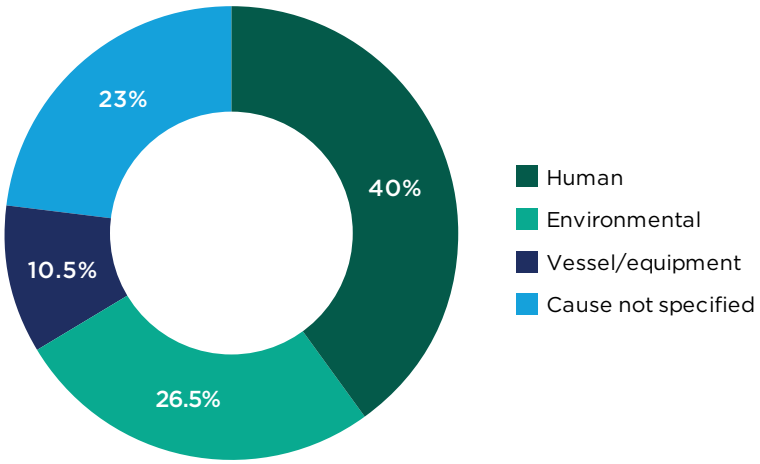
Table 8: Number and percentage of total recreational boating incidents by primary incident cause, for 2015-16 and for the last 10 years (2006-07 to 2015-16).

Incident cause*	Total incidents in 2015-16	2015-16 % of total incidents	Total incidents over last 10 years	Last 10 years % of total incidents
Lack of judgement (H)	33	21.6	421	17.5
Weather conditions (E)	16	10.5	309	12.8
No proper lookout (H)	13	8.5	252	10.5
Hazardous waters (E)	7	4.6	116	4.8
Fault of equipment (V)	2	1.3	95	3.9
Fault of machinery (V)	11	7.2	94	3.9
Excessive speed (H)	7	4.6	92	3.8
Wash (E)	5	3.3	71	2.9

Incident cause*	Total incidents in 2015-16	2015-16 % of total incidents	Total incidents over last 10 years	Last 10 years % of total incidents
Insecure mooring (V)	0	0	66	2.7
Bar conditions (E)	2	1.3	62	2.6
Floating or submerged object (E)	0	0	48	2.0
Inexperience (H)	1	0.7	41	1.7
Excess alcohol (H)	3	2.0	36	1.5
Navigational error (H)	3	2.0	35	1.5
Fault of hull (V)	2	1.3	28	1.2
Tidal conditions (E)	4	2.6	18	0.7
Restricted visibility (E)	1	0.7	14	0.6
Fault of navigation equipment (V)	1	0.7	13	0.5
Inadequate stability (V)	0	0	12	0.5
Electrical fault (V)	1	0.7	11	0.5
Improper loading (H)	0	0	7	0.3
Overloading (H)	1	0.7	6	0.2
Lack of maintenance (H)	0	0	5	0.2
Lack of fuel (H)	0	0	1	0.0
Other/unspecified	40	26.1	555	23.0
Total	**153**	**100.0**	**2408**	**100.0**

* Incident causes classified as follows: (H) – human related; (E) – environmental; and (V) – vessel and/or equipment. Causes recorded in the RMS Eagle incident database were, in the vast majority of cases, specifically recorded as primary causes. However, it is possible that for a small number of incidents, the actual primary cause differed from the cause extracted for this table.

Figure 5: Breakdown of incident causes by human, environmental and vessel/equipment factors for total recreational boating incidents over the last 10 years (N = 2408).



In no cases (Table 8) was the proportion of total incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

The respective incident cause 'profiles' for 2015-16 and for the last 10 years are compared graphically in Figure 6. The data for this figure is directly from the percentage columns in Table 8.

Figure 6: Percentage breakdown of total incidents by cause for 2015-16 and for last 10 years.

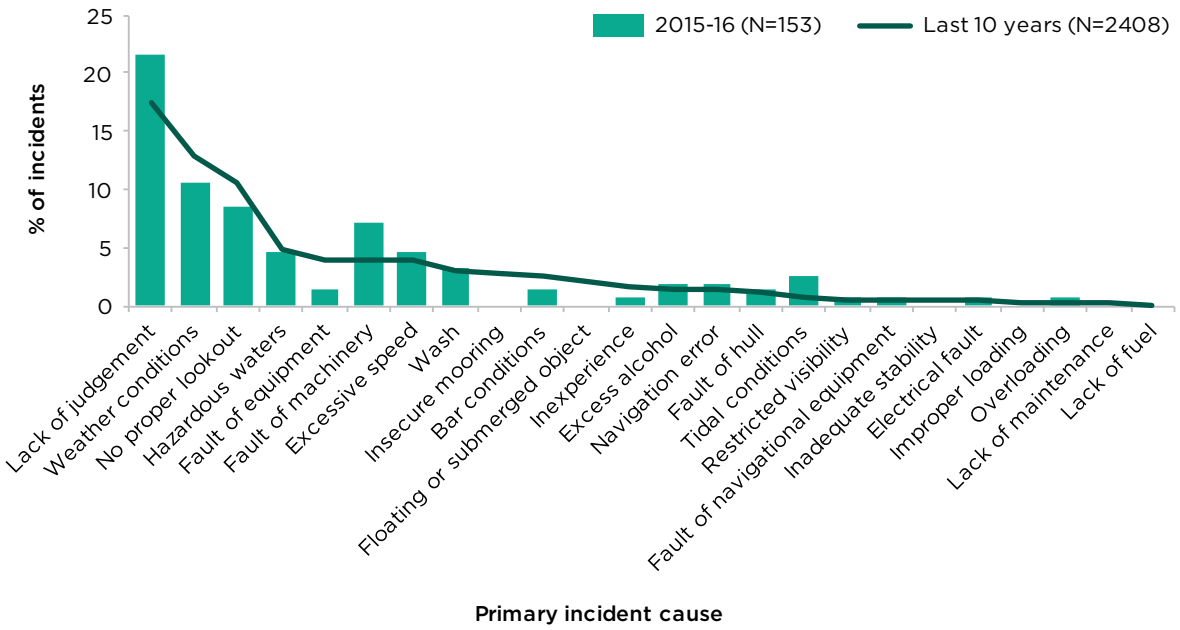


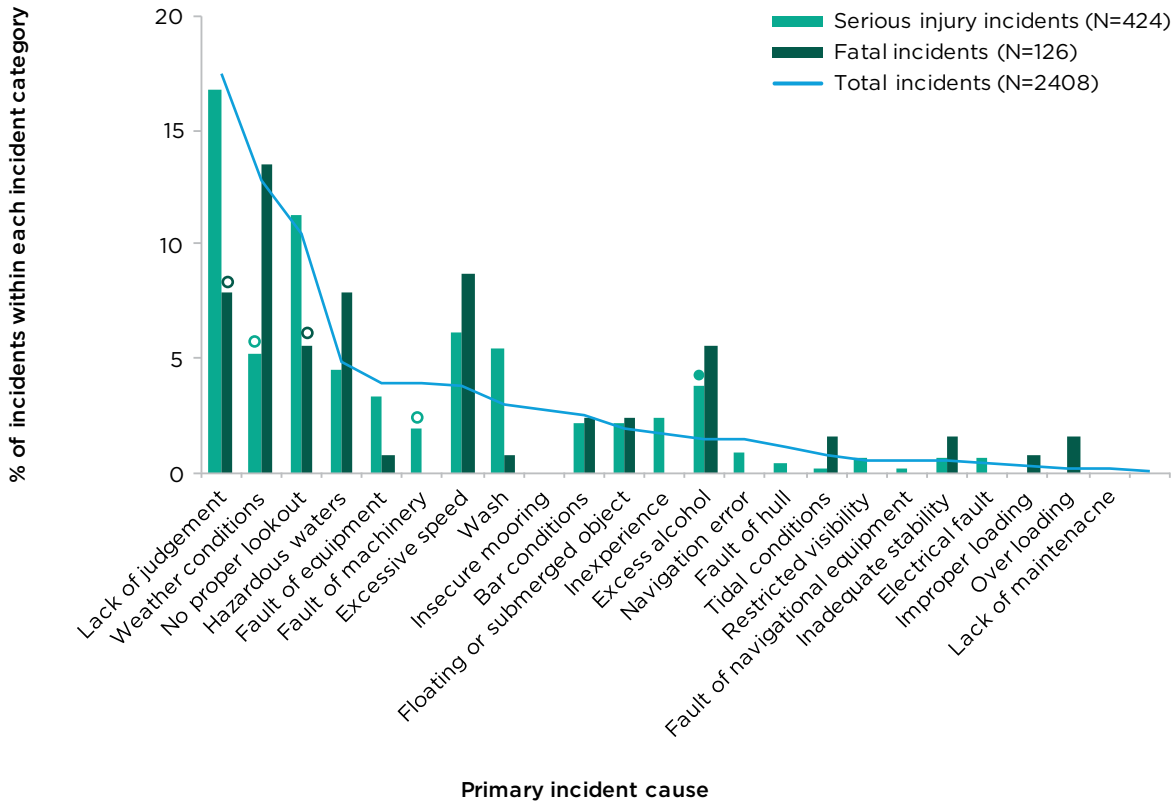
Figure 7 provides a breakdown of incident causes by incident severity, based on data for the last 10 years. It includes data on incident percentages from Table 6 – fatal incidents, Table 7 – serious injury incidents and Table 8 – total incidents. The data is sorted by total incidents, which are shown by the blue line for context.

Figure 7 gives an indication of causes that are relatively more (or less) prevalent amongst either fatality incidents or serious injury incidents as opposed to total incidents – based on whether the dark green (fatal incident) or green (serious injury incident) bars are above or below the blue line (total incidents) for a particular cause.

With fatal incidents, none of the causes accounted for a significantly larger proportion of such incidents than of incidents generally. However, in the case of excessive speed and excess alcohol the differences were close to being statistically significant ($0.05<P<0.1$). Conversely, both lack of judgement and no proper lookout accounted for significantly lower proportions of fatal incidents than was the case with incidents generally (Figure 7).

With serious injury incidents, only excess alcohol accounted for a significantly larger proportion of such incidents than of incidents generally (Figure 7). Conversely, both weather conditions and fault of machinery accounted for significantly lower proportions (Figure 7).

Figure 7: Percentage breakdown of incidents by cause for the last 10 years*, by incident severity.



* Solid circles denote where the proportions of fatal incidents and serious injury incidents are significantly greater than the corresponding proportion of total incidents for a given incident cause (at P<0.05). Clear circles denote where these proportions are significantly less.

7.3 Vessel operation

Most fatal incidents (63.5% over the last 10 years, and 55.6% in 2015-16) occurred when a vessel was underway (Table 9). Towing activity was the next most commonly reported vessel operation, accounting for 12.7% of fatal incidents (16 incidents in all) over the last 10 years (Table 9). Thirteen of the towing incidents (81.3%) were attributed to waterskiing, with the remaining three incidents attributed to either aquaplaning or towing in general.

Safe towing practises include wearing lifejackets, having an observer and staying well clear of shoreline hazards.

Situations in which a vessel was 'secured' in some way (i.e. at anchor, moored or berthed) accounted for 10.3% of fatal incidents over the last 10 years (i.e. 13 incidents – Table 9). Nine of these incidents related to vessels at anchor, while the remaining four involved a berthed vessel (Table 9).

Table 9: Number and percentage of recreational boating fatal incidents by vessel operation, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Vessel operation	Fatal incidents in 2015-16	2015-16 % of fatal incidents	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
Underway	5	55.6	80	63.5
Towing activity	2	22.2	16	12.7
At anchor	0	0	9	7.1
Fishing	0	0	5	4.0
Moored	1	11.1	4	3.2
Crossing a bar	1	11.1	3	2.4
Organised competition	0	0	1	0.8
Other/unspecified	0	0	8	6.3
Total	**9**	**100.0**	**126**	**100.0**

In no cases (Table 9) was the proportion of fatal incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

As with fatal incidents (Table 9), most serious injury incidents occurred when a vessel was underway (Table 10). These incidents accounted for 62.0% of the total number of serious injury incidents over the last 10 years, and an even higher proportion (84.4%) for serious injury incidents recorded in 2015-16 (Table 9).

Incidents in which the vessel was involved in a towing activity were the next most commonly reported, accounting for 21.5% of all serious injury incidents over the last 10 years (Table 10). While the proportion of such incidents in 2015-16 (12.5%) was lower, the difference was not statistically significant. Of the 91 serious injury incidents involving a towing activity recorded over the last 10 years, 40 (44.0%) involved waterskiing, 22 (24.2%) involved aquaplaning and 16 (17.6%) involved wakeboarding. The remaining 13 incidents (14.3%) were not attributed to a particular towing activity.

Situations in which a vessel was 'secured' in some way (i.e. at anchor, moored or berthed) accounted for 5.0% of serious injury incidents over the last 10 years (i.e. 21 incidents – Table 10). Ten of these incidents involved a vessel at anchor, while seven involved a berthed vessel and four a moored vessel (Table 10).

Table 10: Number and percentage of recreational boating serious injury incidents by vessel operation, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Vessel operation	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents*	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
Underway	27	▲ 84.4	263	62.0
Towing activity	4	12.5	91	21.5
At anchor	0	0	10	2.4
Organised competition	0	0	9	2.1
Crossing a bar	0	0	8	1.9
Berthed	0	0	7	1.7
Fishing	0	0	6	1.4
Aground	0	0	4	0.9
Moored	0	0	4	0.9
Fuelling	0	0	1	0.2
Other/unspecified	1	3.1	21	5.0
Total	**32**	**100.0**	**424**	**100.0**

*Symbols indicate cases where the proportion of incidents in 2015-16 is significantly greater (▲) or less (▼) than the corresponding long-term (10 year) proportion (at P<0.05).

As with both fatal and serious injury incidents (Tables 9 and 10), most incidents overall occurred when a vessel was underway (Table 11 and Figure 8). These incidents accounted for 59.0% of total incidents over the last 10 years and 65.4% of those recorded in 2015-16 (Table 11).

Incidents involving a moored vessel were the next most commonly reported, accounting for 11.1% of all incidents over the last 10 years, and 9.2% of all incidents in 2015-16 (Table 11 and Figure 8). The third most common situation was towing activity, accounting for 6.9% of all incidents over the last 10 years, and 4.6% in 2015-16 (Table 11). Of the 165 incidents involving a towing activity recorded over the last 10 years, 73 (44.2%) involved waterskiing, 32 (19.4%) involved aquaplaning and 20 (12.1%) involved wakeboarding. The remaining 40 incidents (24.2%) were not attributed to a particular towing activity.

Situations in which a vessel was 'secured' in some way (i.e. at anchor, moored or berthed) accounted for 19.5% of all incidents over the last 10 years (i.e. 470 incidents – Table 11). Of these incidents, 56.8% involved a moored vessel, 31.1% involved an anchored vessel and 12.1% involved a berthed vessel.

Moored vessels, and vessels otherwise 'secure', are involved in a considerable number of incidents.

Table 11: Number and percentage of total recreational boating incidents by vessel operation, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Vessel operation	Total incidents in 2015-16	2015-16 % of total incidents	Total incidents over last 10 years	Last 10 years % of total incidents
Underway	97	63.4	1421	59.0
Moored	14	9.2	267	11.1
Towing activity	7	4.6	165	6.9
At anchor	11	7.2	146	6.1
Organised competition	6	3.9	78	3.2
Crossing a bar	4	2.6	70	2.9
Berthed	8	5.2	57	2.4
Fishing	1	0.7	42	1.7
Aground	0	0	18	0.7
Fuelling	0	0	4	0.2
Other/unspecified	5	3.3	140	5.8
Total	**153**	**100.0**	**2408**	**100.0**
'Secured'	*33*	*21.6*	*470*	*19.5*

In no cases (Table 11) was the proportion of recreational boating incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

7.4 Vessel type

Open runabouts were by far the most heavily represented vessel type in recreational boating fatal incidents – being recorded as the primary vessel 50% of all such incidents over the last 10 years (Table 12). Three other vessel types each accounted for more than 5% of fatal incidents – cabin runabouts (8.7%), canoes and kayaks (7.9%) and sailing yachts (7.1%).

While the fatal incident data for 2015-16 does not allow a clear statistical comparison with that of the last 10 years, it is noteworthy that sailing yachts were involved in one third of the fatal incidents recorded in 2015-16 versus 7.1% over the last 10 years (Table 12).

In addition to the information in Table 12, an examination of the incident narratives from the vessel incident database shows that there were 11 fatal incidents over the last 10 years involving hi-performance towing or racing vessels (i.e. 8.7% of the total) and two such incidents in 2015-16.

Small open runabouts are heavily represented in boating fatalities. Wearing a lifejacket greatly improves the chances of survival in a sudden capsize or fall overboard incident.

Table 12: Number and percentage of fatal recreational boating incidents by vessel type, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Vessel type	Fatal incidents in 2015-16	2015-16 % of fatal incidents	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
Open runabout	3	33.3	63	50.0
Cabin runabout	2	22.2	11	8.7
Canoe/kayak	0	0	10	7.9
Sailing yacht	3	33.3	9	7.1
Motor cruiser	1	11.1	5	4.0
Inflatable	0	0	3	2.4
Punt	0	0	3	2.4
PWC	0	0	3	2.4
Catamaran (sail)	0	0	1	0.8
Houseboat	0	0	1	0.8
Rowing dinghy	0	0	1	0.8
Other/unspecified	0	0	16	12.7
Total	**9**	**100.0**	**126**	**100.0**

PWC compliance check. PWC have a relatively high number of serious injury incidents.

In no cases (Table 12) was the proportion of fatal incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

Open runabouts were also the most heavily represented vessel type in recreational boating serious injury incidents – accounting for 46.7% of all such incidents over the last 10 years (Table 13). The next most heavily represented were PWC, accounting for 14.9% of serious injury incidents. Two other vessel types each accounted for more than 5% of serious injury incidents (Table 13) – cabin runabouts (7.1%) and sailing yachts (6.8%).

The proportional breakdown of vessel types involved in serious injury incidents during 2015-16 closely corresponds with that of the last 10 years (Table 13).

Table 13: Number and percentage of serious injury recreational boating incidents by vessel type, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Vessel type	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
Open runabout	13	40.6	198	46.7
PWC	5	15.6	63	14.9
Cabin runabout	3	9.4	30	7.1
Sailing yacht	2	6.3	29	6.8
Motor cruiser	3	9.4	18	4.2
Inflatable	1	3.1	11	2.6
Punt	0	0	9	2.1
Catamaran (power)	1	3.1	4	0.9
Canoe/kayak	1	3.1	2	0.5
Houseboat	1	3.1	1	0.2
Other/unspecified	2	6.3	59	13.9
Total	**32**	**100.0**	**424**	**100.0**

In no cases (Table 13) was the proportion of serious injury incidents in 2015-16 significantly different to the corresponding long-term (10 year) proportion.

Open runabouts were the most heavily represented vessel type in recreational boating incidents overall – accounting for 30.6% of all such incidents over the last 10 years (Table 14). Four other vessel types each accounted for more than 5% of total incidents (Table 14) – sailing yachts (20.1%), motor cruisers (20.1%), cabin runabouts (9.1%) and PWC (6.9%).

The proportional breakdown of vessel types involved in recreational boating incidents during 2015-16 broadly corresponds with that of the last 10 years (Table 14 and Figure 8). The same five vessel types each accounted for more than 5% of the total incidents. Although the proportion of incidents accounted for by PWC was significantly higher in 2015-16 (13.7%) than over the last 10 years (6.9%), it should be noted that PWC numbers have increased considerably in recent years and that there were a high number of unspecified vessel hull types in recording 2014-15, which may have caused the 10 year PWC figures to be understated. As a consequence, the information in the PWC facts box (Section 5) should be relied upon instead when considering the results for 2015-16 – as it is derived from a separate examination of all cases of PWC being involved in incidents over the last 10 years.

Table 14: Number and percentage of total recreational boating incidents by vessel type, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Vessel hull type	Total incidents in 2015-16	2015-16 % of total incidents*	Total incidents over last 10 years	Last 10 years % of total incidents
Open runabout	42	27.5	736	30.6
Sailing yacht	27	17.6	484	20.1
Motor cruiser	19	12.4	273	11.3
Cabin runabout	16	10.5	218	9.1
PWC	21	▲ 13.7	166	6.9
Catamaran (sail)	6	3.9	41	1.7
Inflatable	2	1.3	39	1.6
Punt	1	0.7	36	1.5
Catamaran (power)	2	1.3	23	1.0
Houseboat	3	2.0	22	0.9
Canoe/kayak	2	1.3	21	0.9
Rowing dinghy	1	0.7	18	0.7
Sailing vessel (other)	1	0.7	9	0.4
Other/unspecified	10	6.5	322	13.4
Total	**153**	**100.0**	**2408**	**100.0**

*Symbols indicate cases where the proportion of incidents in 2015-16 is significantly greater (▲) or less (▼) than the corresponding long-term (10 year) proportion (at P<0.05).

Figure 8: Percentage breakdown of total incidents by vessel type for 2015-16 and for last 10 years.

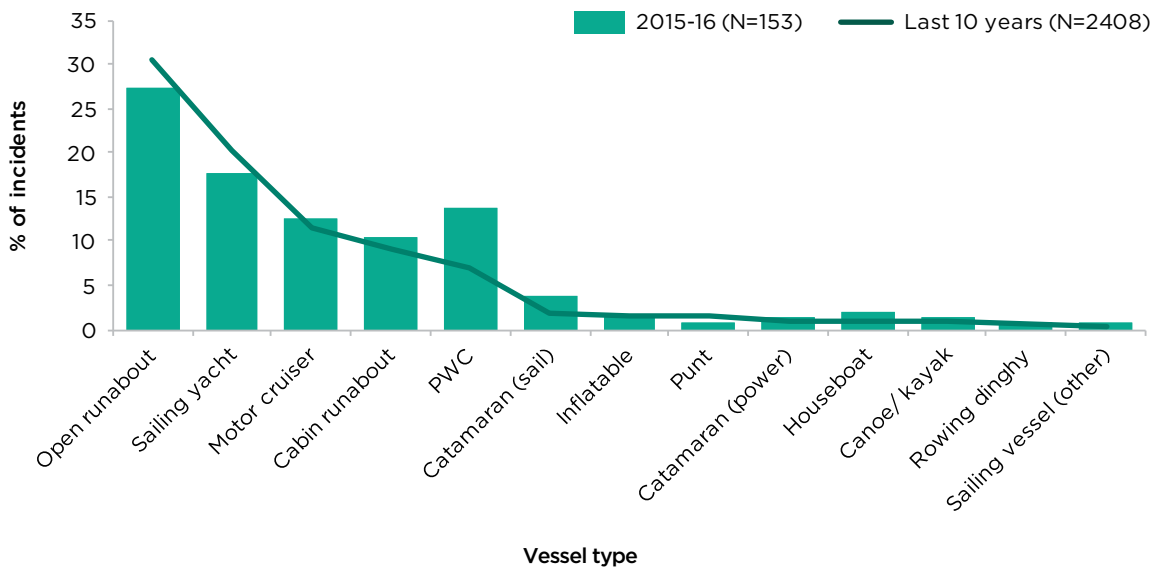
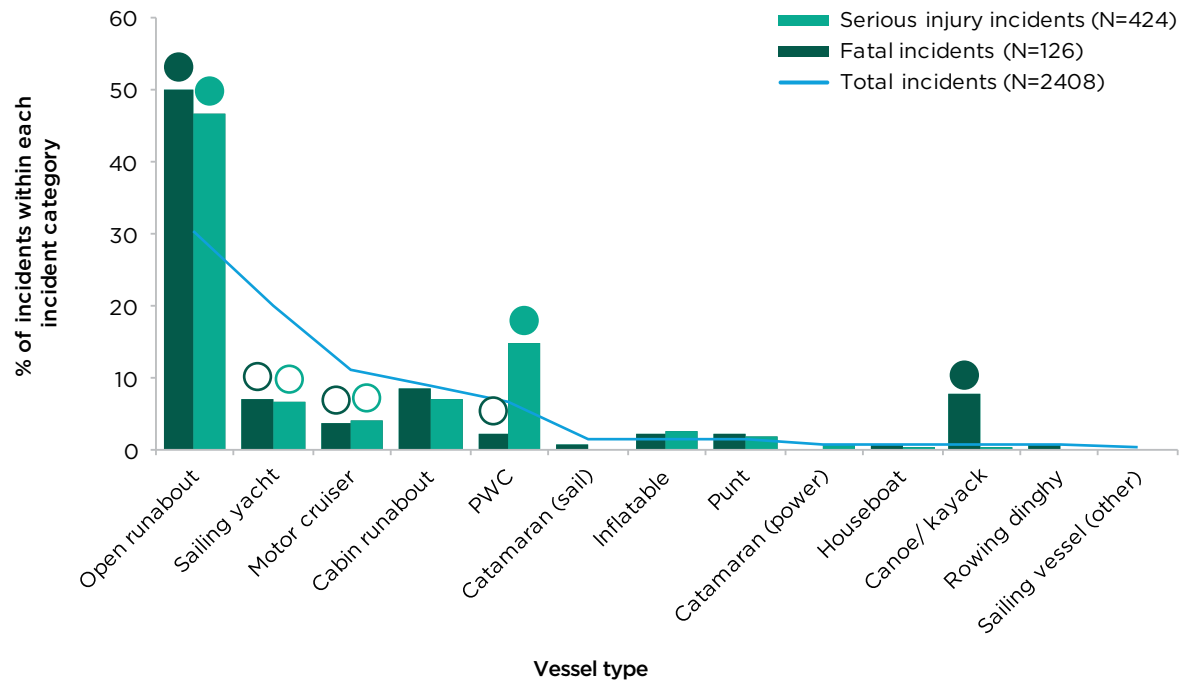


Figure 9 gives an indication of the vessel types that were relatively more (or less) prevalent amongst either fatality incidents or serious injury incidents over the last 10 years – based on whether the dark green (fatal incident) or green (serious injury incident) bars are above or below the blue line (total incidents) for a particular vessel type. The data used in Figure 9 is contained in the right hand columns of Tables 12, 13 and 14.

Open runabouts and canoes/kayaks both accounted for a proportionately greater share of fatal incidents than of incidents generally (Figure 9), with the difference being statistically significant in both cases. Conversely, sailing yachts, motor cruisers and PWC accounted for proportionately fewer fatal incidents than was the case with incidents generally (Figure 9).

A quite different picture is evident with respect to serious injury incidents. PWC accounted for a significantly larger proportion compared to their share of incidents generally, whereas canoes and kayaks only accounted for a small share (Figure 9). For open runabouts, however, the situation is similar to that with fatalities – these vessels accounted for a proportionately greater share of serious injury incidents than of incidents generally (Figure 9). As was the case with fatal incidents, sailing yachts and motor cruisers both accounted for a relatively low proportion of serious injury incidents (Figure 9).

Figure 9: Percentage breakdown of incidents by vessel type for the last 10 years*, by incident severity.



* Solid circles denote where the proportions of fatal incidents and serious injury incidents are significantly greater than the corresponding proportion of total incidents for a given vessel type (at P<0.05). Clear circles denote where these proportions are significantly less.

Figure 10 provides a 'heat map' of incidents in terms of both incident type (Section 7.1) and vessel type. The numbers shown are the raw totals for all recreational boating incidents recorded over the last 10 years.

While Figure 10 does not provide information about relative rates or proportions, it highlights the combinations of incident type and vessel type that have occurred more often than others. It also shows visual differences in the mix of incident types experienced by different kinds of vessel.

For example, while open runabouts were involved in a wide range of incident types, sailing yachts were involved in a much narrower range – most notably collisions, groundings and injuries on board. Motor cruisers had a similar 'incident type profile' to sailing yachts, with the most notable differences being more fire or explosion related incidents and fewer injuries on board. Cabin runabouts had a profile that shared much with open runabouts – and most notably high numbers of capsizing, sinking and bar crossing incidents, along with considerable numbers of collisions and groundings. PWC experienced a very narrow range of incident types – focussed mainly on collisions with vessels and fixed objects as well as persons falling overboard.

Figure 10: Incident numbers over last 10 years by incident type and vessel type*.

Incident type/vessel type	Open runabout	Sailing yacht	Motor cruiser	Cabin runabout	PWC	Catamaran (sail)	Inflatable	Punt	Catamaran (power)	Houseboat	Canoe/kayak	Rowing dinghy	Sailing vessel (other)
Collision with vessel	100	305	115	49	75	26	3	9	4	10	2	9	6
Capsizing	150	9	1	46	6	3	12	7	7	1	12	2	1
Grounding	35	56	29	15	5	2	0	3	0	1	1	0	1
Collision with fixed object	39	23	19	14	17	4	0	2	1	3	1	2	0
Injury – towing incident	75	1	0	7	7	0	0	1	0	0	0	0	0
Fall overboard	45	9	5	7	16	0	1	5	1	0	3	0	0
Sinking	36	8	18	16	2	0	0	0	2	1	0	0	0
Swamping	45	2	5	9	2	0	2	2	1	1	1	1	0
Bar crossing incident	43	3	4	23	3	0	0	0	4	0	0	0	0
Collision with submerged object	30	11	11	5	4	0	1	1	1	0	0	1	0
Fire or explosion (fuel)	33	2	16	1	2	0	0	0	0	0	0	0	0
Fire or explosion (other than fuel)	7	7	17	5	1	1	0	0	1	1	0	0	0
Person hit by vessel	19	0	0	1	8	0	6	0	0	0	0	1	0
Collision with floating object	11	5	11	3	1	1	0	1	0	1	0	0	0
Close quarter	8	8	7	2	1	0	0	1	0	0	1	1	0
Propeller injury	22	0	0	2	0	0	6	3	0	1	0	0	0
Injury onboard	5	12	2	0	4	1	2	0	0	1	0	0	0
Fall in vessel	7	3	1	2	5	0	3	0	0	0	0	0	0
Hull splitting (structural failure)	2	2	2	3	0	0	1	0	0	0	0	0	0
Collision – overhead obstruction	1	1	0	1	0	1	0	0	0	0	0	0	0
Carbon monoxide inhalation	1	0	2	0	0	0	0	0	0	0	0	0	0
Flooding	1	0	0	0	0	0	0	0	0	0	0	0	0

* Larger incident numbers are highlighted in orange/red tones.

7.5 Vessel length

Nearly half of all fatal incidents over the last 10 years (47.6%) are known to have involved vessels less than 4.8 metres in length, and this was by far the most heavily represented length range (Table 15). The situation in 2015-16 was quite different, in that more than three-quarters of fatal incidents (77.8%) are known to have involved vessels 6 metres or more in length – a significantly higher proportion than the 27.0% over the last 10 years (Table 15).

Table 15: Number and percentage of fatal recreational boating incidents by vessel length range, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Vessel length range*	Fatal incidents in 2015-16	2015-16 % of fatal incidents*	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
Less than 4.8 m	2	22.2	60	47.6
4.8 to <6 m	0	0.0	21	16.7
6 to 8 m	5	55.6	22	17.5
Greater than 8 m	2	22.2	12	9.5
Unknown	0	0.0	11	8.7
Total	**9**	**100.0**	**126**	**100.0**
Less than 6 m	*2*	*22.2*	*81*	*64.3*
6 m or greater	*7*	*▲ 77.8*	*34*	*27.0*

* Vessel length ranges partly based on key length cut-offs contained in NSW lifejacket wear laws. Symbols indicate cases where the proportion of incidents in 2015-16 is significantly greater (▲) or less (▼) than the corresponding long-term (10 year) proportion (at P<0.05).

A relatively high number of larger vessels, including yachts, were involved in fatal incidents during 2015-16.

Just over one quarter of all serious injury incidents over the last 10 years (25.9%) are known to have involved vessels less than 4.8 metres in length (Table 16). This was the most heavily represented length range amongst serious injury incidents for which the vessel length was known (Table 16) – but with a percentage that was much lower than the corresponding percentage for fatal incidents (Table 15).

Table 16: Number and percentage of recreational boating serious injury incidents by vessel length range, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Vessel length range*	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
Less than 4.8 m	13	40.6	110	25.9
4.8 to <6 m	4	12.5	65	15.3
6 to 8 m	7	21.9	48	11.3
Greater than 8 m	4	12.5	34	8.0
Unknown	4	12.5	167	39.4
Total	**32**	**100.0**	**424**	**100.0**
Less than 6 m	*17*	*53.1*	*175*	*41.3*
6 m or greater	*11*	*34.4*	*82*	*19.3*

* Vessel length ranges partly based on key length cut-offs contained in NSW lifejacket wear laws.

Just under one fifth of all incidents over the last 10 years (19.4%) are known to have involved vessels less than 4.8 metres in length (Table 17). This percentage was lower than the corresponding percentages for both fatal incidents (Table 15) and serious injury incidents (Table 16).

A broadly similar breakdown for total incidents by vessel length was observed in 2015-16 (Table 17). However, the proportion of total incidents known to have involved a vessel less than 4.8 metres in length (27.5%) was significantly higher than the corresponding proportion for the last 10 years (19.4%).

Table 17: Number and percentage of total recreational boating incidents by vessel length range, for 2015-16 and for last 10 years (2006-07 to 2015-16).

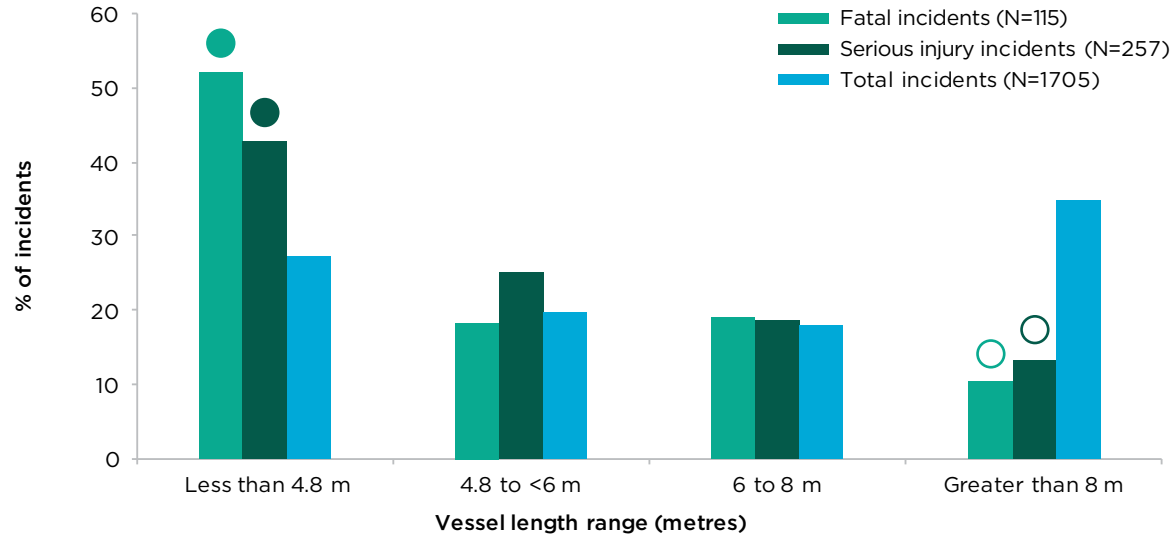
Vessel length range*	Total incidents in 2015-16	2015-16 % of total incidents*	Total incidents over last 10 years	Last 10 years % of total incidents
Less than 4.8 m	42	▲ 27.5	467	19.4
4.8 to <6 m	20	13.1	335	13.9
6 to 8 m	23	15.0	309	12.8
Greater than 8 m	43	28.1	594	24.7
Unknown	25	16.3	703	29.2
Total	**153**	**100.0**	**2408**	**100.0**
Less than 6 m	*62*	*40.5*	*802*	*33.3*
6 m or greater	*66*	*43.1*	*903*	*37.5*

* Vessel length ranges partly based on key length cut-offs contained in NSW lifejacket wear laws. Symbols indicate cases where the proportion of incidents in 2015-16 is significantly greater (▲) or less (▼) than the corresponding long-term (10 year) proportion (at P<0.05).

Figure 11 examines more closely the relationship between incident severity and vessel length. Both fatal and serious injury incidents were significantly over-represented on vessels less than 4.8 metres in length (Figure 11). These vessels accounted for 52.2% of fatal incidents and 42.8% of serious injury incidents where the vessel length was known, versus 27.4% of total incidents.

Conversely, both fatal and serious injury incidents were significantly under-represented on vessels greater than 8 metres in length (Figure 11). These vessels accounted for 10.4% of fatal incidents and 13.2% of serious injury incidents where the vessel length was known, versus 34.8% of total incidents.

Figure 11: Distribution of fatal, serious injury and total incidents across vessel length ranges for the last 10 years*. Only incidents for which the length of the primary vessel is known are included.



* Solid circles denote where the proportions of fatal incidents and serious injury incidents are significantly greater than the corresponding proportion of total incidents for a given vessel length range (at P<0.05). Clear circles denote where these proportions are significantly less.

Large unpredictable waves and strong currents can make crossing ocean bars quite dangerous – check conditions carefully before crossing, and always wear a lifejacket. Photo courtesy of Matt Cormick – local resident.

7.6 Time of day

The majority of fatal incidents over the last 10 years were recorded during the middle of the day and in the afternoon (Table 18 and Figure 12), with 59.5% of such incidents occurring between 10am and 5:59pm. The situation in 2015-16 broadly reflected this pattern (Table 18), and there was no significance difference for any of the time periods between the proportion of fatal incidents in 2015-16 and the corresponding long-term (10 year) proportion.

Table 18: Number and percentage of fatal recreational boating incidents by time of day, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Time period	Fatal incidents in 2015-16	2015-16 % of fatal incidents	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
12:00am – 5:59am	0	0	8	6.3
6:00am – 9:59am	0	0	18	14.3
10:00am – 1:59pm	6	66.7	40	31.7
2:00pm – 5:59pm	2	22.2	35	27.8
6:00pm – 11:59pm	1	11.1	23	18.3
Unknown	0	0	2	1.6
Total	**9**	**100.0**	**126**	**100.0**

As with fatal incidents (Table 18), the majority of serious injury incidents over the last 10 years occurred between 10am and 5:59pm, with 71% of all such incidents occurring within this period (Table 19 and Figure 12). The situation in 2015-16 closely reflected this pattern, with 75% of fatal incidents occurring between 10am and 5:59pm (Table 18) – there was no significance difference for any of the time periods between the proportion of fatal incidents in 2015-16 and the corresponding long-term (10 year) proportion.

Table 19: Number and percentage of recreational boating serious injury incidents by time of day, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Time period	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
12:00am – 5:59am	3	9.4	17	4.0
6:00am – 9:59am	2	6.3	49	11.6
10:00am – 1:59pm	11	34.4	137	32.3
2:00pm – 5:59pm	13	40.6	164	38.7
6:00pm – 11:59pm	3	9.4	56	13.2
Unknown	0	0	1	0.2
Total	**32**	**100.0**	**424**	**100.0**

Correct use of navigation lights greatly reduces the risk of a collision between vessels at night or in poor visibility.

As with both fatal and serious injury incidents (Tables 18 and 19), the majority of recreational boating incidents overall that were recorded over the last 10 years occurred between 10am and 5:59pm, with 65.1% of all such incidents occurring within this period (Table 20 and Figure 12). The situation in 2015-16 closely reflected this pattern, with 76.5% of total incidents occurring between 10am and 5:59pm (Table 20). However, the proportion of incidents in 2015-16 that occurred in the early to mid-morning period, between 6:00am and 9:59pm, was significantly lower (at 5.9%) than the corresponding proportion for the last 10 years (13.2%) – Table 20.

Table 20: Number and percentage of total recreational boating incidents by time of day, for 2015-16 and for last 10 years (2006-07 to 2015-16).

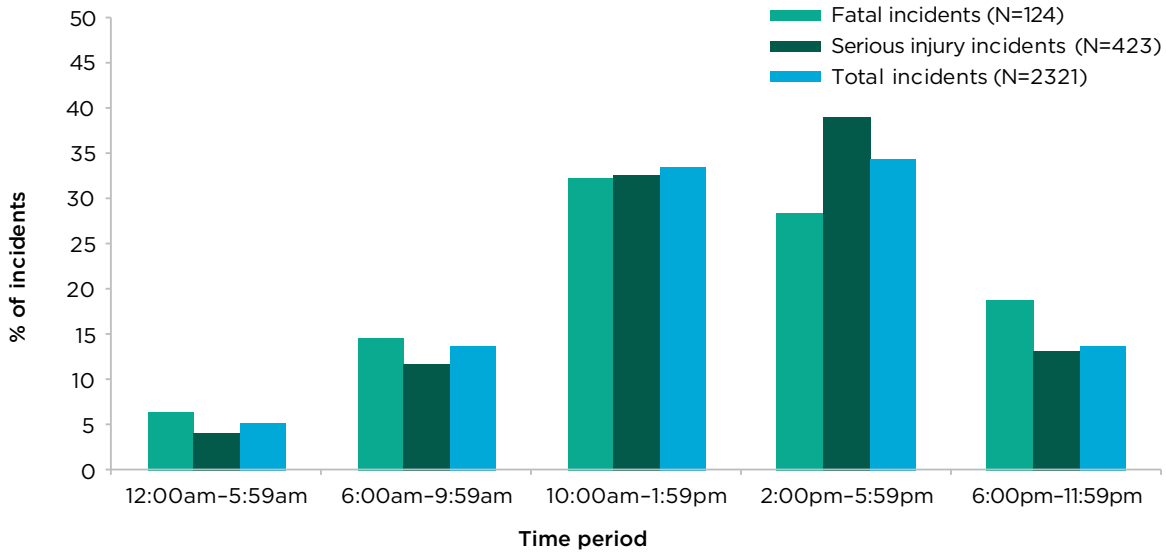
Time period	Total incidents in 2015-16	2015-16 % of total incidents*	Total incidents over last 10 years	Last 10 years % of total incidents
12:00am – 5:59am	5	3.3	121	5.0
6:00am – 9:59am	9	▼ 5.9	317	13.2
10:00am – 1:59pm	59	38.6	775	32.2
2:00pm – 5:59pm	58	37.9	792	32.9
6:00pm – 11:59pm	22	14.4	316	13.1
unknown	0	0	87	3.6
Total	**153**	**100.0**	**2408**	**100.0**

Symbols indicate cases where the proportion of incidents in 2015-16 is significantly greater (▲) or less (▼) than the corresponding long-term (10 year) proportion (at P<0.05).

Figure 12 examines more closely the relationship between incident severity and time of day.

In general, fatal, serious injury and total incidents all had similar distributions across times of the day (Figure 12). While there were slight differences between the proportions of fatal, serious injury and total incidents in the 2:00pm – 5:59pm and 6:00pm – 11:59pm time periods, none of these differences were statistically significant.

Figure 12: Distribution of fatal, serious injury and total incidents by time of day for the last 10 years. Only incidents for which the time is known are included.



7.7 Day of week

Fatal incidents over the last 10 years displayed a distinct weekly pattern, with most occurring towards the end of the week and on the weekend (Table 21). Saturday accounted for the greatest proportion of fatal incidents (27.8%) followed by Sunday with 19.0%. Weekends accounted for nearly half (46.8%) of fatal incidents over the last 10 years and one third (33.3%) of such incidents in 2015-16 (Table 21).

There were no significant differences between the last 10 years and 2015-16 in the respective proportions of fatal incidents for any particular day, or with respect to the weekends only.

Table 21: Number and percentage of fatal recreational boating incidents by day of week, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Day of the week	Fatal incidents in 2015-16	2015-16 % of fatal incidents	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
Monday	0	0	9	7.1
Tuesday	0	0	11	8.7
Wednesday	3	33.3	14	11.1
Thursday	1	11.1	18	14.3
Friday	2	22.2	15	11.9
Saturday	2	22.2	35	27.8
Sunday	1	11.1	24	19.0
Total	**9**	**100.0**	**126**	**100.0**
Weekend only	*3*	*33.3*	*59*	*46.8*

Serious injury incidents over the last 10 years displayed a distinct weekly pattern, with most occurring on weekends (Table 22). Sunday accounted for the greatest proportion of serious injury incidents (28.3%) followed by Sunday with 25.5%. With the exception of Friday (11.8%), each of the weekdays accounted for less than 10%. Weekends accounted for more than half (53.8%) of serious injury incidents over the last 10 years, and a similar proportion (56.3%) in 2015-16.

The weekly pattern of serious injury incidents was broadly similar in 2015-16 to that over the last 10 years, with no significant differences between the respective proportions for any particular day.

Table 22: Number and percentage of recreational boating serious injury incidents by day of week, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Day of the week	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
Monday	1	3.1	39	9.2
Tuesday	2	6.3	33	7.8
Wednesday	2	6.3	37	8.7
Thursday	6	18.8	37	8.7
Friday	3	9.4	50	11.8
Saturday	9	28.1	108	25.5
Sunday	9	28.1	120	28.3
Total	**32**	**100.0**	**424**	**100.0**
Weekend only	*18*	*56.3*	*228*	*53.8*

Weekends and public holidays can be very busy on the water.

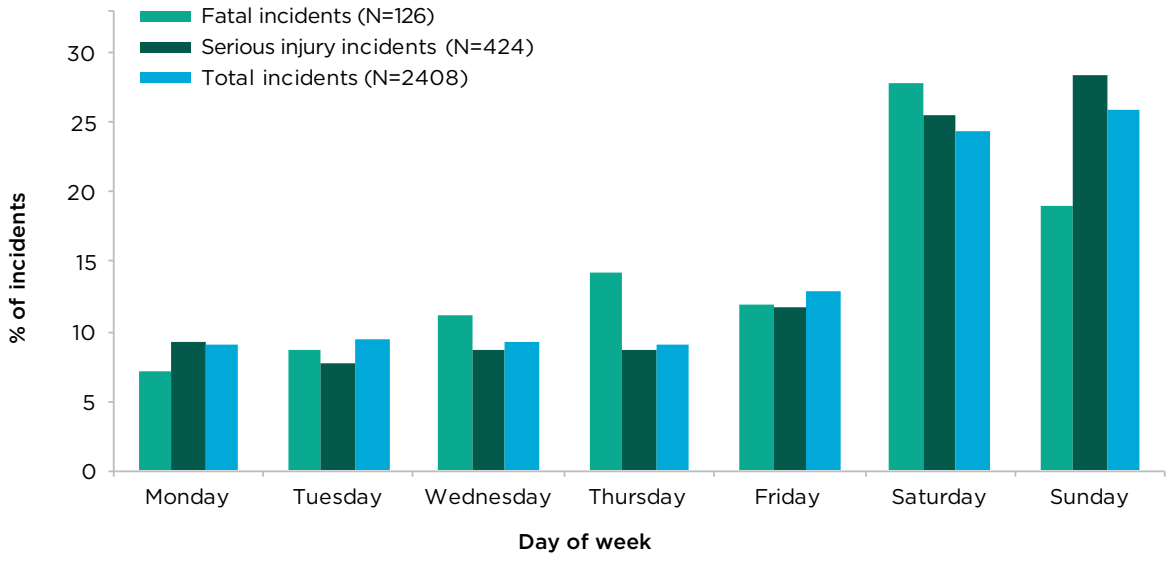
Total incidents over the last 10 years also displayed a distinct weekly pattern (Table 23). Sunday accounted for the greatest proportion of serious injury incidents (25.8%) followed by Sunday with 24.4%. With the exception of Friday (12.9%), each of the weekdays accounted for less than 10%. Weekends accounted for just over half (50.2%) of serious injury incidents over the last 10 years, and a similar proportion (56.2%) in 2015-16.

Table 23: Number and percentage of total recreational boating incidents by day of week, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Day of the week	Total incidents in 2015-16	2015-16 % of total incidents	Total incidents over last 10 years	Last 10 years % of total incidents
Monday	6	3.9	219	9.1
Tuesday	11	7.2	226	9.4
Wednesday	13	8.5	222	9.2
Thursday	20	13.1	220	9.1
Friday	17	11.1	311	12.9
Saturday	42	27.5	588	24.4
Sunday	44	28.8	622	25.8
Total	**153**	**100.0**	**2408**	**100.0**
Weekend only	*86*	*56.2*	*1210*	*50.2*

Figure 13 examines more closely the relationship between incident severity and day of the week. Fatal, serious injury and total incidents all had similar distributions across days of the week (Figure 13). While the proportion of fatalities was slightly higher on Thursdays and slightly lower on Sundays – when compared with the corresponding proportions of incidents overall – neither of these differences were statistically significant.

Figure 13: Distribution of fatal, serious injury and total incidents by day of the week for the last 10 years.



7.8 Month

Fatal incidents over the last 10 years have shown a clear seasonal pattern, with the majority (63.5%) of these incidents occurring between October and March (Table 24 and Figure 14). The corresponding proportion in 2015-16 was very similar (66.7%). The month with the highest number of fatal incidents over the last 10 years was February (23 incidents, 18.3% of total), with all the months between September and February recording 10 or more fatal incidents (Table 14). Conversely, each of the months between March and August recorded fewer than 10 fatal incidents, with the lowest number being in August (4 incidents, 3.2% of total).

Table 24: Number and percentage of fatal recreational boating incidents by month, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Month	Fatal incidents in 2015-16	2015-16 % of fatal incidents	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
Jan	1	11.1	13	10.3
Feb	3	33.3	23	18.3
Mar	1	11.1	7	5.6
Apr	0	0	8	6.3
May	0	0	6	4.8
Jun	0	0	9	7.1
Jul	1	11.1	8	6.3
Aug	1	11.1	4	3.2
Sep	1	11.1	11	8.7
Oct	1	11.1	10	7.9
Nov	0	0	13	10.3
Dec	0	0	14	11.1
Total	**9**	**100.0**	**126**	**100.0**
October – March	*6*	*66.7*	*80*	*63.5*
April – September	*3*	*33.3*	*46*	*36.5*

Serious injuries over the last 10 years have also shown a clear seasonal pattern, with the majority (71.7%) of these incidents occurring between October and March (Table 25 and Figure 14). The corresponding proportion in 2015-16 was very similar (65.6%). The month with the highest number of serious injury incidents over the last 10 years was January (99 incidents, 23.3% of total), followed by December with 56 incidents (13.2% of total). The number of serious injury incidents recorded in January was more than twice the number recorded in any other month except December (Table 25).

Table 25: Number and percentage of recreational boating serious injury incidents by month, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Month	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
Jan	5	15.6	99	23.3
Feb	2	6.3	41	9.7
Mar	6	18.8	44	10.4
Apr	3	9.4	39	9.2
May	1	3.1	13	3.1
Jun	0	0.0	17	4.0
Jul	2	6.3	14	3.3
Aug	4	12.5	19	4.5
Sep	1	3.1	18	4.2
Oct	1	3.1	25	5.9
Nov	1	3.1	39	9.2
Dec	6	18.8	56	13.2
Total	**32**	**100.0**	**424**	**100.0**
October – March	*21*	*65.6*	*304*	*71.7*
April – September	*11*	*34.4*	*120*	*28.3*

Total incidents over the last 10 years show a very strong seasonal pattern, with the majority (68.1%) occurring between October and March (Table 26 and Figure 14). The corresponding proportion for 2015-16 was very similar (66.0%). January had the highest number of incidents over the last 10 years (398 incidents, 16.5% of total), followed by December with 333 incidents (13.8% of total).

The situation in 2015-16 closely followed the 10 year picture. However, the proportion of incidents in January (10.5%) was significantly lower than the corresponding proportion for the last 10 years (16.5%) – Table 26.

Activities such as paddle boarding and kayaking are becoming increasingly popular – especially in the summer months.

Table 26: Number and percentage of total recreational boating incidents by month, for 2015-16 and for last 10 years (2006-07 to 2015-16).

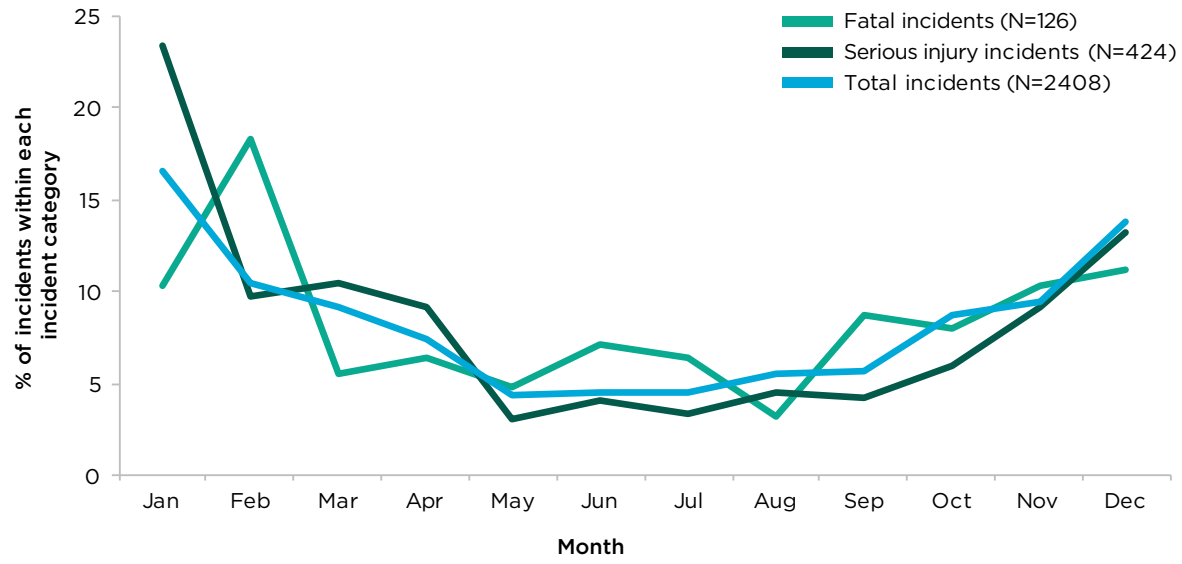
Month	Total incidents in 2015-16	2015-16 % of total incidents*	Total incidents over last 10 years	Last 10 years % of total incidents
Jan	16	▼ 10.5	398	16.5
Feb	20	13.1	252	10.5
Mar	17	11.1	219	9.1
Apr	7	4.6	177	7.4
May	5	3.3	106	4.4
Jun	6	3.9	108	4.5
Jul	8	5.2	110	4.6
Aug	14	9.2	131	5.4
Sep	12	7.8	137	5.7
Oct	15	9.8	209	8.7
Nov	13	8.5	228	9.5
Dec	20	13.1	333	13.8
Total	**153**	**100.0**	**2408**	**100.0**
October – March	*101*	*66.0*	*1639*	*68.1*
April – September	*52*	*34.0*	*769*	*31.9*

Symbols indicate cases where the proportion of incidents in 2015-16 is significantly greater (▲) or less (▼) than the corresponding long-term (10 year) proportion (at P<0.05).

Figure 14 illustrates the seasonal pattern in recreational boating incidents, which is evident for fatal, serious injury and total incidents.

The variation in the strength of the seasonal relationship relates to the greater month-to-month volatility in the fatal incident data (N=126) compared with either the serious injury data (N=424) or total incident data (N=2408). In addition, the data suggests that serious injury incidents may have a slightly more pronounced seasonal trend – in terms of the relative difference between summer and winter – than do fatal incidents (Figure 14).

Figure 14: Percentages of incidents by month based on last 10 years, by incident severity*.



* Strongest seasonal relationship was evident with total incidents (2nd degree polynomial fit, $r^2 = 0.96$), followed by serious injury incidents ($r^2 = 0.87$) and then fatal incidents ($r^2 = 0.45$).

7.9 Waterway type

Fatal incidents over the last 10 years occurred in a variety of waterways, although "river" was the most commonly recorded waterway type – accounting for one third of all fatal incidents recorded over the period (Table 27). This was followed by open or offshore waters (17.5%) and bays (16.7%). Over this period, 73.0% of all fatal incidents occurred in what presumably were sheltered waters – i.e. rivers, lakes, estuaries and bays (Table 27). A further 24.6% appear to have taken place in open waters – i.e. ocean waters, bar entrances and off beaches.

In 2015-16, five of the fatal incidents (55.6% of total) occurred in sheltered waters (Table 27).

Most boating incidents occur on sheltered waters.

Table 27: Number and percentage of fatal recreational boating incidents by waterway type, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Waterway type	Fatal incidents in 2015-16	2015-16 % of fatal incidents	Fatal incidents over last 10 years	Last 10 years % of fatal incidents
River	1	11.1	42	33.3
Open/offshore	2	22.2	22	17.5
Bay	3	33.3	21	16.7
Lake	0	0	17	13.5
Dam	1	11.1	8	6.3
Beach	0	0	5	4.0
Bar crossing	1	11.1	4	3.2
Harbour	0	0	4	3.2
Other/unspecified	1	11.1	3	2.4
Total	**9**	**100.0**	**126**	**100.0**
Sheltered waters	*5*	*55.6*	*92*	*73.0*

Serious injury incidents over the last 10 years also occurred in a variety of waterways, with "river" again been the most commonly recorded waterway type – accounting for 41.3% of all serious injury incidents recorded over the period (Table 28). This was followed by bays (14.6%) and lakes (10.6%). The main difference between the 10 years' data shown in Table 28 and that in Table 27 is that open and offshore waters accounted for a significantly lower percentage of serious injury incidents (8.3%) than they did for fatal incidents (17.5%).

Over the last 10 years, 78.3% of all serious injury incidents occurred in what presumably were sheltered waters (Table 28).

In 2015-16, 25 of the serious injury incidents (78.1% of the total) occurred in sheltered waters – a very similar proportion to that applicable over the last 10 years (78.3% – Table 28). Serious injury incidents reported from rivers alone accounted for 43.8% of the 2015-16 total (Table 28).

Table 28: Number and percentage of recreational boating serious injury incidents by waterway type, for 2015-16 and for last 10 years (2006-07 to 2015-16).

Waterway type	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
River	14	43.8	175	41.3
Bay	3	9.4	62	14.6
Lake	2	6.3	45	10.6
Open/offshore	5	15.6	35	8.3
Beach	1	3.1	33	7.8
Dam	1	3.1	21	5.0

Waterway type	Serious injury incidents in 2015-16	2015-16 % of serious injury incidents	Serious injury incidents over last 10 years	Last 10 years % of serious injury incidents
Harbour	5	15.6	16	3.8
Channel	0	0	13	3.1
Bar crossing	0	0	12	2.8
Other/unspecified	1	3.1	12	2.8
Total	**32**	**100.0**	**424**	**100.0**
Sheltered waters	*25*	*78.1*	*332*	*78.3*
Open waters	*6*	*18.8*	*80*	*18.9*

For total incidents over the last 10 years, the greatest proportion was recorded on bays (27.4%), followed by rivers (24.5%) and open and offshore waters (10.9%) – Table 29. Bays accounted for a significantly higher proportion of total incidents (27.4%) than either fatal incidents (16.7% – Table 27) or serious injury incidents (14.6% – Table 28).

Over the last 10 years, 75.8% of all recreational boating incidents occurred in what presumably were sheltered waters (Table 29). A further 21.1% appear to have taken place in open waters. A similar pattern occurred in 2015-16, with the respective percentages being 72.5% and 23.5% (Table 29).

Table 29: Number and percentage of total recreational boating incidents by waterway type, for 2015-16 and for last 10 years (2006-07 to 2015-16).

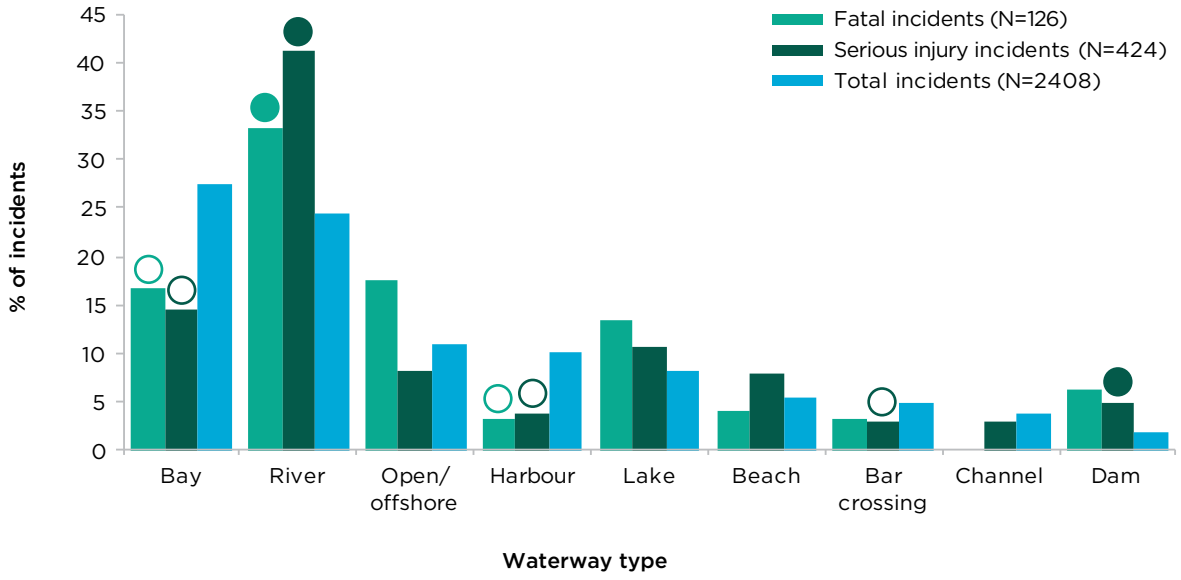
Waterway type	Total incidents in 2015-16	2015-16 % of total incidents	Total incidents over last 10 years	Last 10 years % of total incidents
Bay	49	32.0	659	27.4
River	36	23.5	590	24.5
Open/offshore	25	16.3	263	10.9
Harbour	15	9.8	243	10.1
Lake	9	5.9	197	8.2
Beach	7	4.6	128	5.3
Bar crossing	4	2.6	117	4.9
Channel	0	0.0	92	3.8
Dam	2	1.3	44	1.8
Other/unspecified	6	3.9	75	3.1
Total	**153**	**100.0**	**2408**	**100.0**
Sheltered waters	*111*	*72.5*	*1825*	*75.8*
Open waters	*36*	*23.5*	*508*	*21.1*

Figure 15 examines more closely the relationship between incident severity and waterway type. While fatal, serious and total incidents all had broadly similar distributions among waterway types, there were a number of instances of fatal and/or serious injury incidents being relatively more or less prevalent on particular waterway types.

Both fatal and serious injury incidents were significantly more prevalent on rivers than were incidents generally. A similar pattern was evident on dams, although in this case the difference was statistically significant only for serious injury incidents (Figure 15). Despite this, the data in Tables 27 and 29 indicates that 18.2% of recreational boating incidents on dams had a fatal outcome, a significantly higher proportion than for recreational boating incidents generally (5.2%).

Conversely, on bays and harbours, both fatal and serious injury incidents were significantly less prevalent than were incidents generally. A similar pattern was evident with bar crossings, although in this case the difference was statistically significant only for serious injury incidents (Figure 15). The data in Tables 27 and 29 also indicate that both bays and harbours had significantly lower proportions of incidents resulting in a fatal outcome than for incidents generally (3.2% and 1.6% respectively, versus 5.2%).

Figure 15: Distribution of fatal, serious injury and total incidents by waterway type for the last 10 years*.



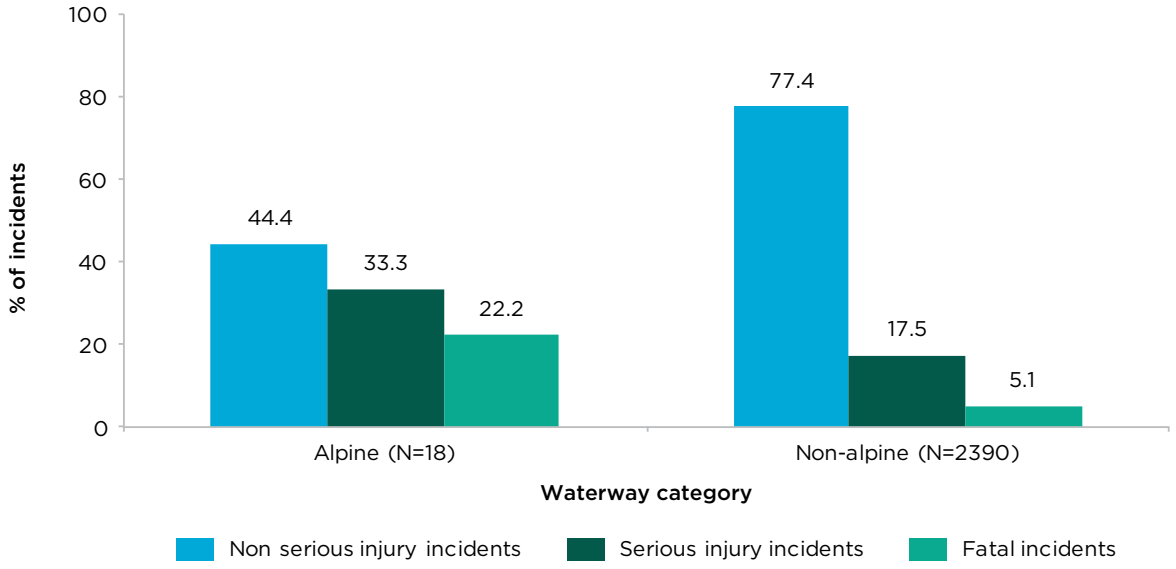
* Solid circles denote where the proportions of fatal incidents and serious injury incidents are significantly greater than the corresponding proportion of total incidents for a given waterway type (at $P<0.05$). Clear circles denote where these proportions are significantly less.

Alpine waters present their own set of risks to boating safety, including cold water and changeable weather.

In addition to the waterway types recorded in the vessel incident database (Figure 15), the entire 10 year's incident data was searched for reference to any of the 'alpine lakes' – a set of specifically legislated waterways on the higher parts of the Great Dividing Range and associated tablelands. These waterways mostly consist of dams and lakes and all have cold water throughout much of the year.

Figure 16 shows there were high percentages of both fatal and serious injury incidents on alpine waters over the last 10 years. Fatal and serious injury incidents together accounted for 55.6% of all incidents on alpine waters during this period, which was significantly greater than the corresponding percentage on non-alpine waters (22.6%) – Figure 16.

Figure 16: Percentage of recreational boating incidents by waterway category (alpine and non-alpine) and severity of incident for the last 10 years.



7.10 Boater age and gender

Fatalities occurred across all age ranges but with some tendency for higher numbers in the young adult to middle age groups (Figure 17) – exactly half of all recreational boating fatalities over the last 10 years were between 30 and 59 years of age.

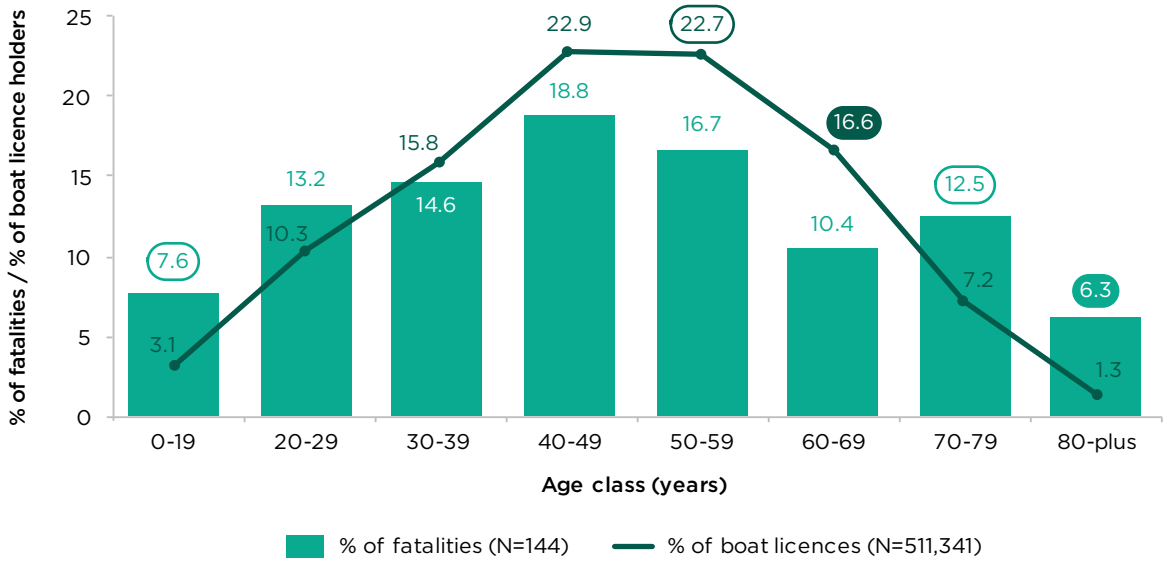
However, when fatalities are considered in the context of boat licence numbers, a different picture emerges, with certain age groups being over or under-represented in terms of fatalities versus licence numbers (Figure 17).

With respect to the individual age groups, people aged 80 years plus were significantly over-represented in recreational boating fatalities (6.3% of fatalities but only 1.3% of licences), while people aged 60 to 69 years where significantly under-represented (10.4% of fatalities versus 16.6% of licences). There was also some indication of over-representation in the 0-19 and 70-79 age ranges, as well as under-representation in the 50-59 age range, but none of these differences were statistically significant at the conventional 0.05% level.

A number of fatalities in recent years have involved older males in tenders. It is important to wear a lifejacket even on short trips.

When broader age ranges are considered, a clear trend of under and over-representation emerges – due to the larger sample sizes and greater consequent statistical power. Although the 30 to 59 age range accounted for 50% of fatalities, this age range is significantly under-represented given that it accounts for 61.4% of licences. Indeed, such under-representation applies across to the even broader 30-69 year age range (60.4% of fatalities versus 78.1% of licences). Conversely, the whole 70-plus age range is significantly over-represented (18.8% of fatalities but only 8.5% of licences).

Figure 17: Percentage of recreational boating fatalities by person's age group for last 10 years, along with corresponding percentages of boat licences held in NSW*.



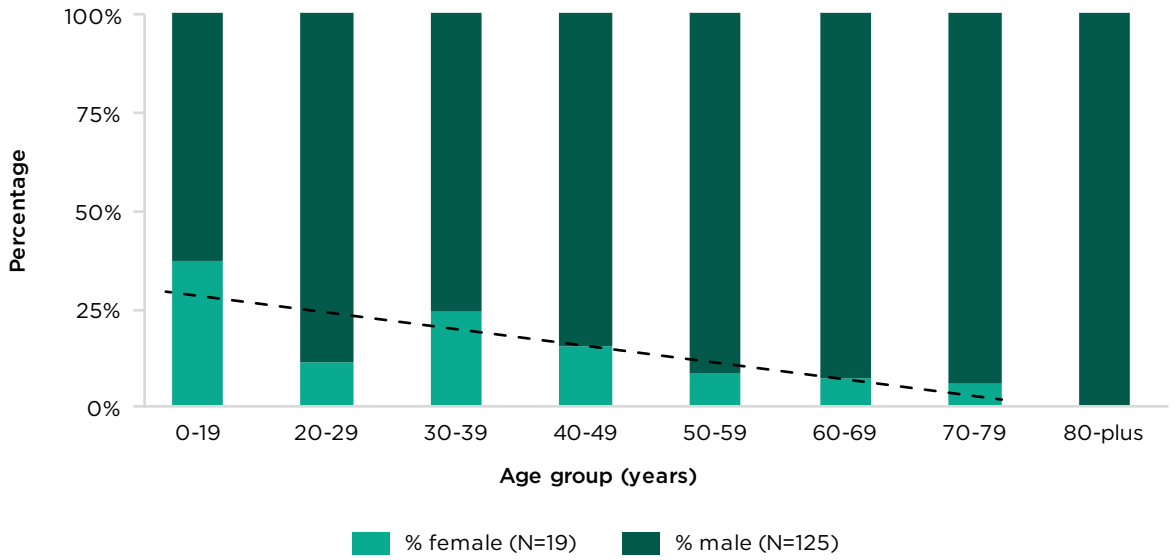
* Licence numbers as at 1 September 2016. Data labels highlighted in solid colour where fatalities were significantly over-represented (light green; P<0.05) or under-represented (dark green; P<0.05) in comparison to licences. Data labels highlighted by outline only where there was some indication of over-representation (light green) or under representation (dark green), but where the result of associated statistical testing was just outside strict significance (0.05<P<0.1).

While six of the fatalities recorded in 2015-16 (60%) were aged 60 years or older, this proportion is not statistically greater than the corresponding proportion for the last 10 years (29.2%).

Of the 144 fatalities recorded over the last 10 years, 125 (86.8%) were male. In 2015-16, all 10 fatalities were male.

While the large majority of fatalities over the last 10 years were male, Figure 18 shows that there is a significant age-related shift in associated gender proportions. Among the 78 fatalities recorded for people aged less than 50 years, the split was 80.8% male and 19.2% female. Among the 66 fatalities recorded for people aged 50 years or older, the split was 93.9% male and 6.1% female – a statistically significant shift. All nine of the fatalities aged 80 years or older recorded during the last 10 years were male.

Figure 18: Gender proportions for fatalities by age group for last 10 years. Position of weighted regression line for % of females also shown*



* Linear regression significant at $P<0.05$. $R^2 = 0.68$, with regression weighted according to number of observations in each age group.

8 Drowning and lifejacket wear

Of the 10 recreational boating fatalities recorded during 2015-16, seven were related to person(s) being forced into the water, essentially due to either capsize or falling overboard. All seven of these people are presumed to have drowned (Table 30), and only two were wearing a lifejacket. This means that seven out of the 10 fatalities (i.e. 70%) are presumed to have drowned, a statistically similar proportion to that of the previous 10 years (72.9%).

Table 30: Summary of recreational drowning and lifejacket wear statistics for 2015-16, with long-term statistics provided for comparison.

Period	Total recreational boating fatalities	Fatalities presumed due to drowning		Drowning victims who were wearing a lifejacket	
		Number	%	Number	%
2015-16	10	7	70.0	2	28.6*
Last 10 years (2006-07 to 2015-16)	144	105	72.9	15	14.3

* It is not possible to make any statistical conclusion about the 2015-16 wear rate in comparison to that of previous years.

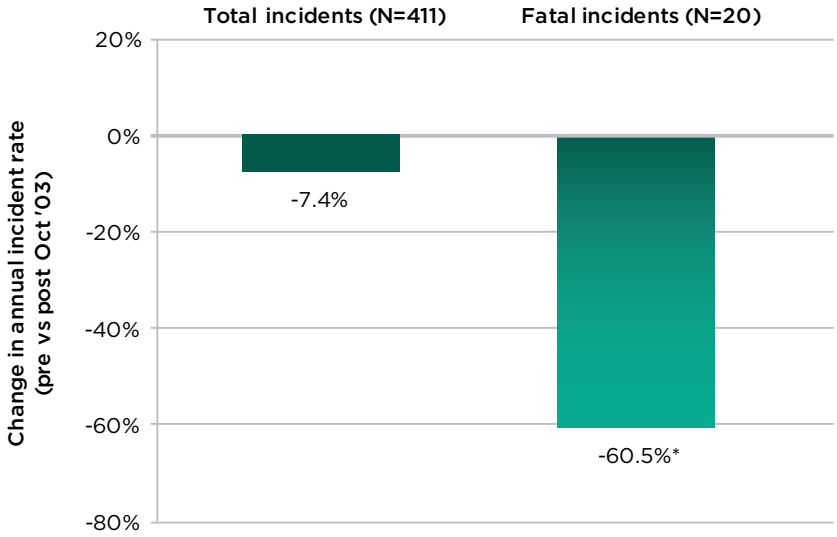
Lifejacket display stand at Sydney International Boat Show.

Of the 105 people presumed drowned since 2006-07, only 15 (14.3%) of these people are known to have actually been wearing a lifejacket (Table 30), *meaning up to 90 lives could have been saved over this period if all presumed drowning victims had been wearing a lifejacket*. This represents 62.5% of all recreational boating fatalities since 2006-07. Of these 90 people, the vast majority (86) are known to have not been wearing a lifejacket, while for four victims, the lifejacket wear status is unknown. Over the last 10 years, 81.9% of those presumed drowned in recreational boating incidents (i.e. 8 out of 10) are known to have not been wearing a lifejacket.

Of the two persons presumed drowned in 2015-16 who were wearing a lifejacket, one may have been trapped beneath an overturned vessel, while the other appears to have been swept off a yacht out at sea during rough conditions.

There was one bar crossing fatality in 2015-16. However, there is a continued trend towards reduced bar crossing fatalities since the compulsory wearing of lifejackets (when crossing ocean bars) was introduced in October 2003 (Figure 19). Since that time (until 30 June 2016), the annual number of bar crossing fatal incidents among both recreational and commercial vessels has declined significantly – falling by 60.5% – from an average of nearly 1.2 per year to less than 0.5 per year. At the same time, the overall number of bar crossing incidents has remained relatively unchanged (17.4 per year before compulsory wear and 16.2 per year since – a decrease of just 7.4%).

Figure 19: Change in bar crossing incidents (for both recreational and commercial vessels) following compulsory lifejacket wear for crossing ocean bars*.

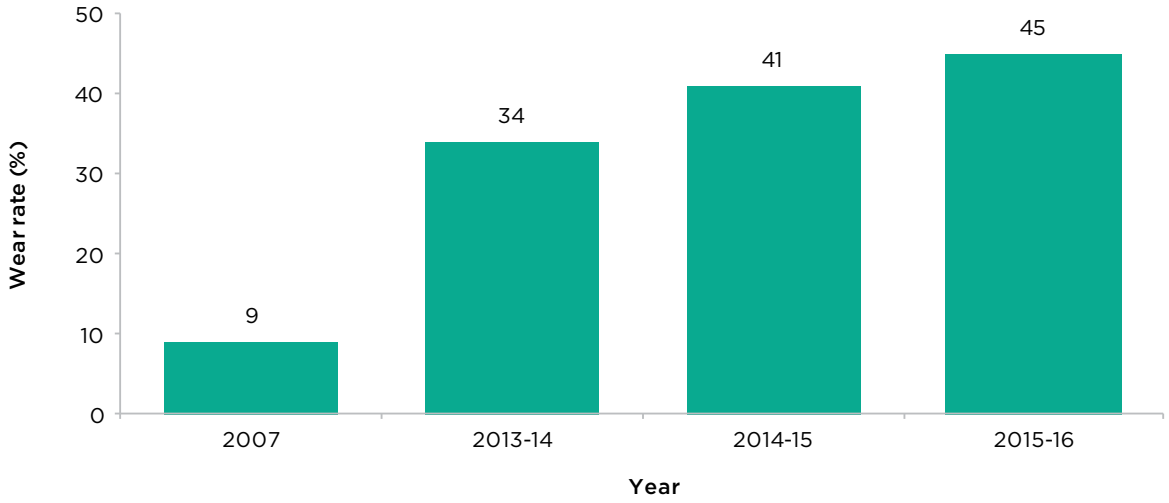


* This decline is statistically significant (2 sample Z-test; P=0.049), based on comparison of two sets of annual fatal incident numbers (pre and post 1 October 2003), with partial year totals extrapolated upwards to equivalent whole year numbers where applicable. Based on data for calendar years 1992 to 2016 inclusive.

Promotion of lifejacket wear through the Old 4 New upgrade program is helping to push up lifejacket wear rates.

The overall lifejacket wear rate was estimated at 45% in 2015-16 (Figure 20), which represents a five-fold increase on the 9% recorded in 2007.

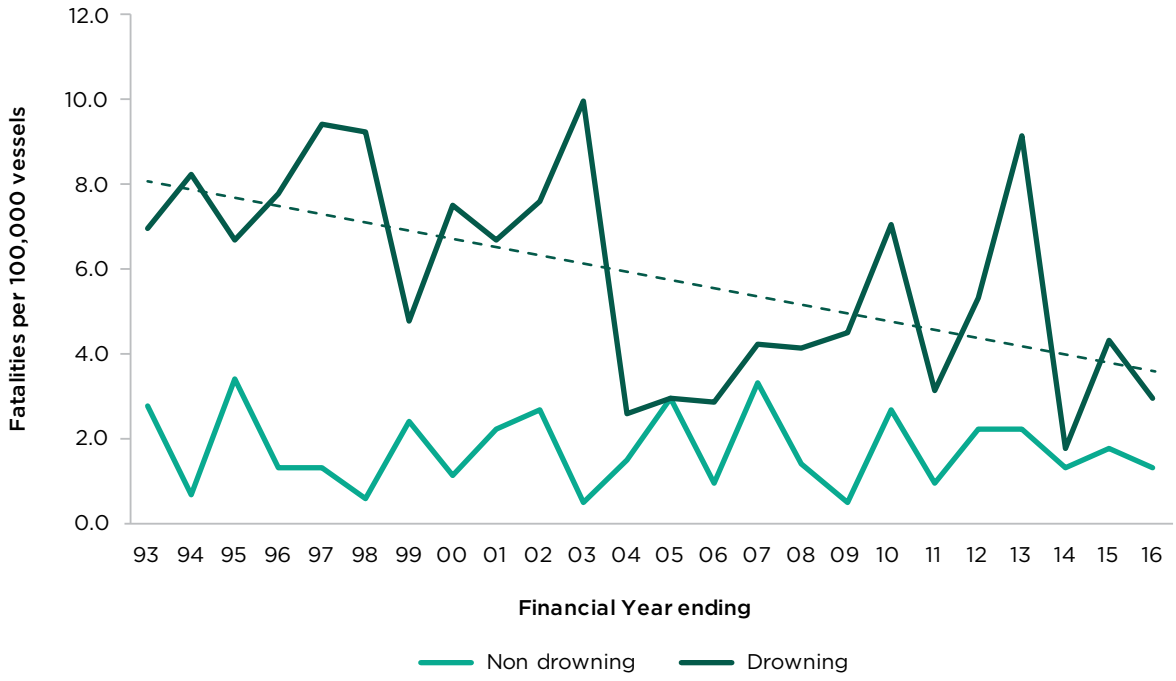
Figure 20: Overall state-wide lifejacket wear rates through time*.



* Data for 2007 from survey done by former National Marine Safety Committee; more recent data from lifejacket wear observational study conducted by Transport for NSW.

At the same time, there has been a long term decline in the rate of recreational drowning fatalities per 100,000 vessels (dark green line – Figure 21). Despite the large year-to-year fluctuations in the rate, this decline is statistically significant. The drowning fatality rate has declined from approximately eight per 100,000 vessels in 1992-93 to less than four per 100,000 vessels in 2015-16 – a reduction of more than 50%. However, there has been no such decline in the non-drowning fatality rate (light green line – Figure 21). Indeed, the non-drowning rate has remained steady at just under two per 100,000 vessels, aside from year-to-year fluctuations.

Figure 21: Long term trends in drowning* and non-drowning fatality rates for recreational boating incidents.



* Linear regression for drowning fatality rate significant at $P<0.05$ ($R^2 = 0.3$).

9 Commercial vessels

Commercial vessels in NSW are now regulated by the Australian Maritime Safety Authority (AMSA) under the Federal Government's *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*. RMS acts as delegate of AMSA for commercial vessels within NSW and is responsible for waterway management. Commercial vessels have stringent requirements for crew qualifications, safety procedures and safety equipment. They are not, however, governed by the lifejacket wear rules applicable to recreational vessels – with the exception of the requirement for lifejackets to be worn when crossing an ocean bar.

There was a total of 104 incidents recorded in 2015-16 involving a commercial vessel (80 'commercial' incidents and 24 'commercial/recreational' incidents – Table 1). The vast majority of these incidents were relatively minor; 92 of the incidents (88.5%) resulted in either no injuries or just minor injuries. This proportion of minor incidents involving a commercial vessel is significantly greater than the corresponding proportion for incidents involving only recreational vessels (73.2%).

Commercial vessel skippers are required to undergo extensive training in gaining their qualifications.

9.1 Incident type

Over the last 10 years, there were 15 fatal incidents involving just commercial vessels and a further two fatal incidents involving a commercial and a recreational vessel. Seven of the commercial vessel fatal incidents (46.7%) were of the incident type "fall overboard". While this is greater than the corresponding percentage for recreational vessel incidents (28.6% – Table 3), the difference is not statistically significant. Capsizing accounted for a further three commercial vessel fatal incidents (20.0%), while propeller injury accounted for two and collision with vessel and fire or explosion (fuel) accounted for one each. Both of the fatal incidents involving both a commercial and a recreational vessel involved a collision between the two vessels.

Over the same period there were 104 commercial vessel serious injury incidents and 17 'commercial/recreational' serious injury incidents. Nearly one third (30.8%) of the commercial incidents involved an injury onboard, while a further 28.8% involved a fall in the vessel. Both these proportions were significantly greater than the corresponding proportions for recreational vessel incidents (5.0% and 4.7% respectively – Table 4) and were far greater than that of the next most prevalent commercial incident type (9.6% for "fall overboard). The most prevalent incident type amongst the commercial/recreational serious injury incidents was "collision with vessel", which accounted for more than half (52.9%) of these incidents. This proportion was significantly greater than the corresponding proportion for recreational incidents (12.3% – Table 4).

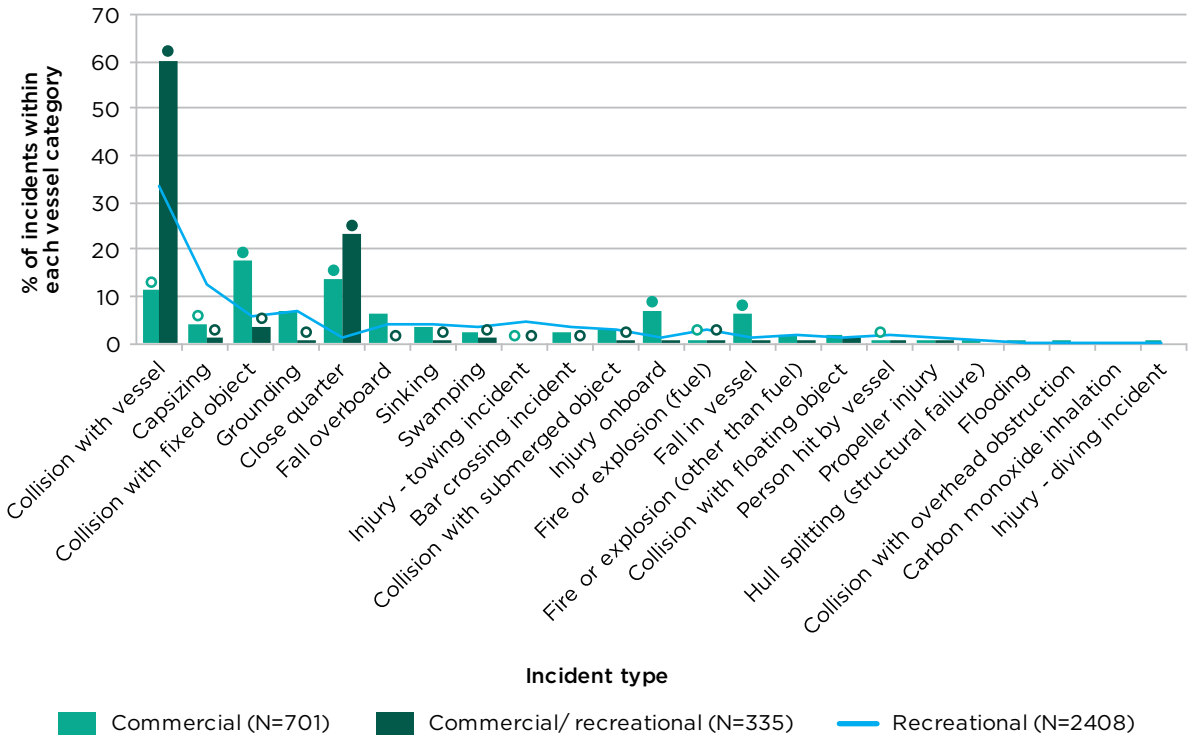
In terms of incidents overall, there were 701 commercial vessel incidents and 335 commercial/recreational vessel incidents over the last 10 years. Figure 22 provides a breakdown of incident types by incident category (commercial, commercial/recreational and recreational). The data is sorted by total incidents and recreational incidents are represented by the blue line for context.

Commercial vessels often have to contend with busy waterways and high passenger loads. Incidents often involve close quarters situations, minor collisions or minor injuries to passengers.

Figure 22 shows that commercial and commercial/recreational incidents both have quite different incident type profiles when compared with recreational incidents.

For commercial vessel incidents overall, the incident types collision with fixed object (18.0%), close quarter (13.6%), injury onboard (6.7%) and fall in vessel (6.4%) were all significantly more prevalent than was the case with recreational incidents, for which the respective proportions were 6.0%, 1.5%, 1.3% and 1.0% (Table 5). Three other incident types were also prominent – collision with vessel (11.7%), grounding (6.7%) and fall overboard (6.1%). While collision with vessel was the third most prevalent incident type recorded for commercial vessel incidents, its prevalence (11.7%) was significantly less than that recorded for recreational vessel incidents (33.5% – Table 5). For commercial/recreational vessel incidents overall, the incident types collision with vessel (60.0%) and close quarter (23.3%) dominated, and were both significantly more prevalent than they were with recreational incidents, for which the respective proportions were 33.5% and 1.5% (Table 5).

Figure 22: Percentage breakdown of incidents by incident type for the last 10 years*, by incident category.



* Solid circles denote where the proportions of commercial incidents and commercial/recreational incidents are significantly greater than the corresponding proportion of recreational incidents for a given incident type (at P<0.05). Clear circles denote where these proportions are significantly less.

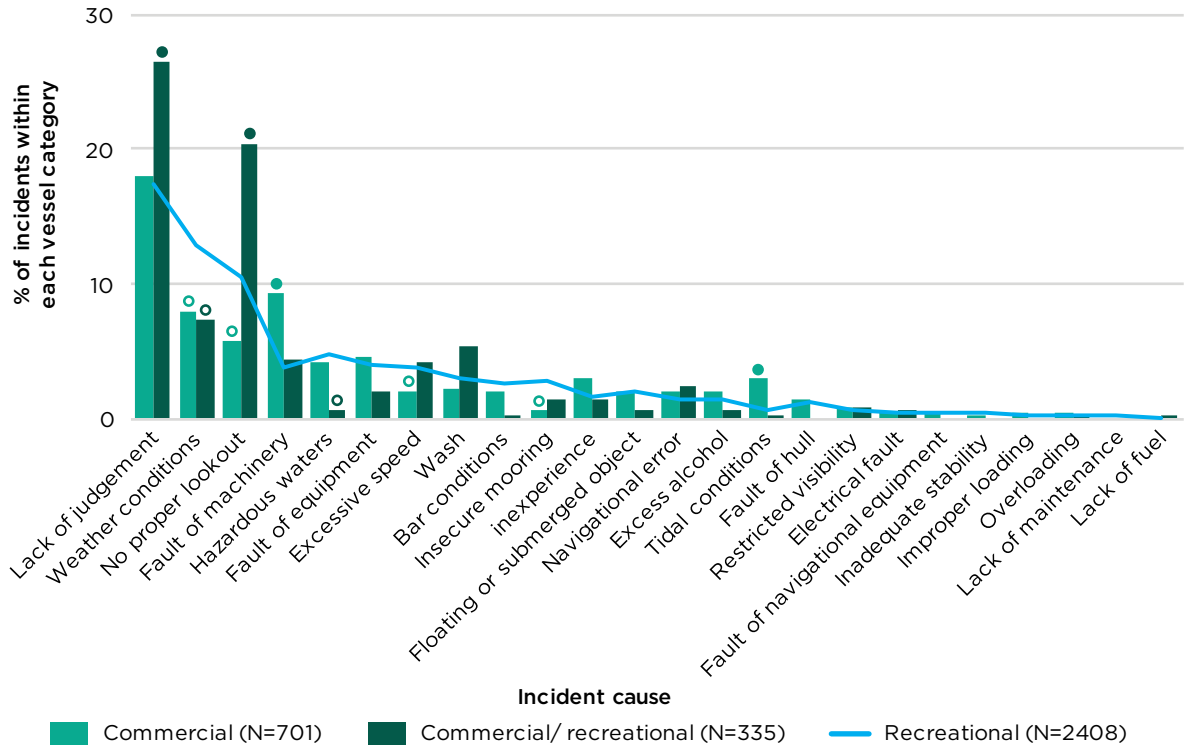
9.2 Incident cause

Among the 104 commercial vessel serious injury incidents recorded during the last 10 years, the most prevalent causes recorded were lack of judgement (15.4%), weather conditions (11.5%), hazardous waters (7.7%), bar conditions (7.7%) and excess alcohol (5.8%). These proportions were all statistically similar to the corresponding proportions for recreational vessel serious injury incidents (16.7%, 5.2%, 4.5%, 2.1% and 3.8% respectively – Table 7). Causes apparently related to rough seas, strong currents and/or bad weather (specifically weather conditions, hazardous waters and bar conditions) together accounted for 26% of commercial vessel serious injury incidents over the last 10 years – a significantly greater proportion than that applicable to recreational serious injury incidents (11.8%).

Figure 23 provides a breakdown of primary incident causes by incident category for all incidents over the last 10 years. The data is sorted by total incidents and recreational incidents are represented by the blue line for context. Figure 23 shows that commercial and commercial/ recreational incidents both have quite different incident cause profiles when compared with recreational incidents.

A small commercial vessel operating in support of a major event.

Figure 23: Percentage breakdown of incidents by incident primary cause for the last 10 years*, by incident category.



* Solid circles denote where the proportions of commercial incidents and commercial/recreational incidents are significantly greater than the corresponding proportion of recreational incidents for a given incident cause (at P<0.05). Clear circles denote where these proportions are significantly less.

For commercial vessel incidents overall, lack of judgement (18.0%), fault of machinery (9.3%), weather conditions (8.0%) and no proper lookout (5.7%) were prominent. Of these, fault of machinery (9.3%) was significantly more prevalent than it was in relation to recreational vessel incidents (3.9% – Table 8). A further incident cause – tidal conditions (3.0%) was also significantly more prevalent than it was in relation to recreational incidents (0.7% – Table 8).

9.3 Vessel type

Houseboats accounted for nearly 30% of the commercial vessel fatal incidents recorded over the last 10 years (Table 31 – 4 incidents). Fishing vessels and open runabouts, with three incidents each, both accounted for a further 20%. There were no fatal incidents recorded on ferries or powered catamarans (Table 31) – which are the two vessel types that account for most large passenger-carrying vessels in NSW.

At the time of writing, there have been no fatalities aboard ferries for many years.

Commercial vessel serious injury incidents were most prevalent on powered catamarans and motor cruisers (both 17.3% – 18 incidents – Table 31). Other prominent vessel types with respect to serious injury incidents were open runabouts (9.6%), inflatables (9.6%), sailing yachts (7.7%) and fishing vessels (6.7%). Ferries accounted for just 2.9% of serious injury incidents (Table 31).

Commercial vessel incidents overall were also most prevalent on powered catamarans (18.0%), followed by motor cruisers (9.7%), ferries (9.3%), fishing vessels (6.0%) and open runabouts (5.6%) – Table 31.

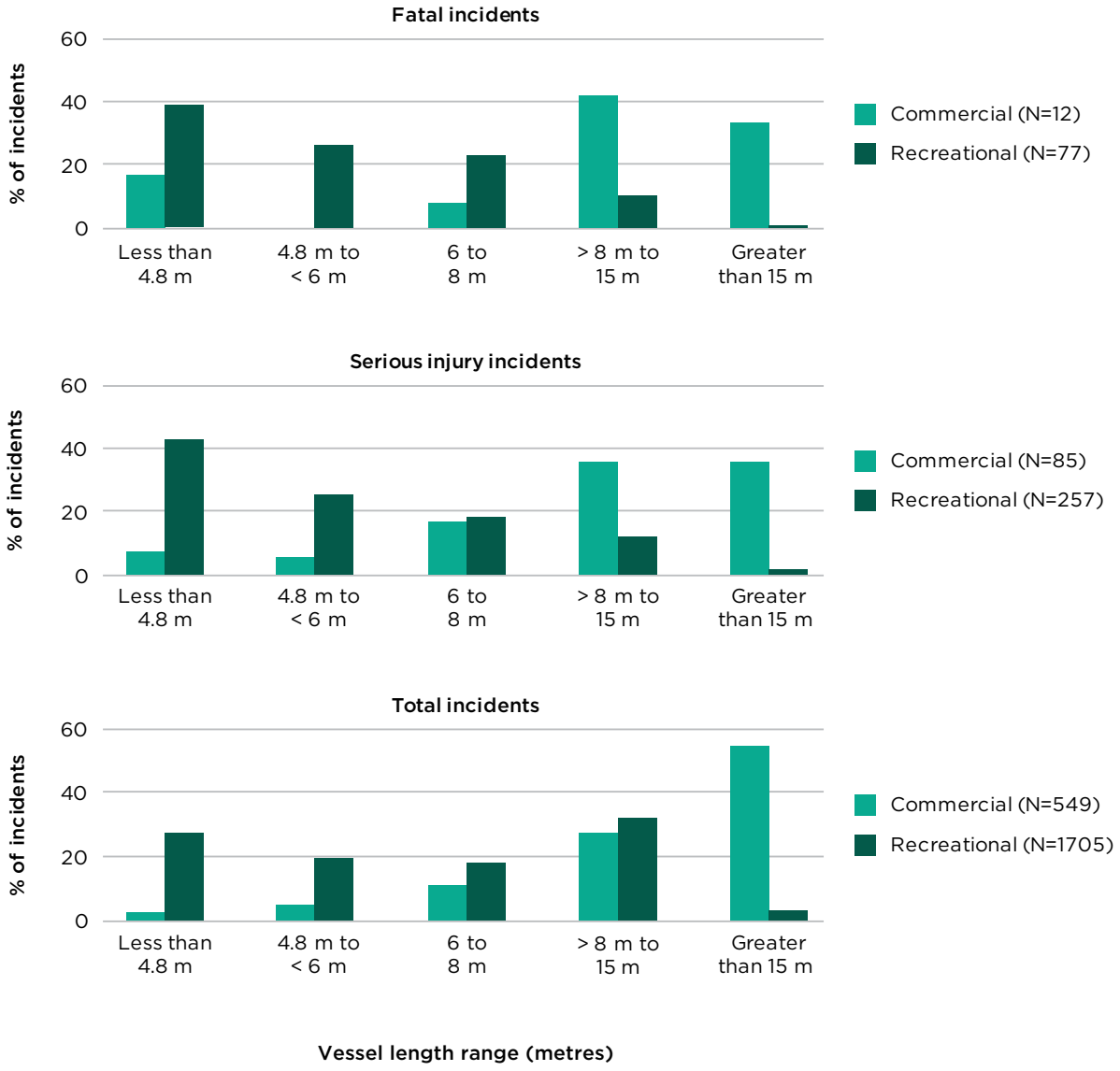
Table 31: Number and percentage of fatal, serious injury and total incidents by vessel hull type for commercial vessel incidents over the last 10 years (2006-07 to 2015-16).

Vessel hull type	Fatal incidents		Serious injury incidents		Total incidents	
	Number	% of total	Number	% of total	Number	% of total
Catamaran (power)	0	0	18	17.3	126	18.0
Motor cruiser	2	13.3	18	17.3	68	9.7
Ferry	0	0	3	2.9	65	9.3
Fishing vessel	3	20.0	7	6.7	42	6.0
Open runabout	3	20.0	10	9.6	39	5.6
Houseboat	4	26.7	2	1.9	30	4.3
Inflatable	0	0	10	9.6	24	3.4
Sailing yacht	0	0	8	7.7	23	3.3
Cabin runabout	0	0	3	2.9	21	3.0
Punt	1	6.7	0	0	14	2.0
Sailing vessel (other)	0	0	1	1.0	8	1.1
Barge	0	0	0	0	8	1.1
PWC	0	0	3	2.9	5	0.7
Catamaran (sail)	0	0	0	0	5	0.7
Tug	0	0	0	0	4	0.6
Dredge	0	0	0	0	2	0.3
Other/unspecified	2	13.3	21	20.2	217	31.0
Total	**15**	**100.0**	**104**	**100**	**701**	**100**

9.4 Vessel length

While a small number of fatal and serious injury incidents occurred on smaller commercial vessels over the last 10 years, the vast majority of commercial vessel incidents have occurred on larger vessels – especially those greater than 8 metres in length (Figure 24). Where the vessel length was recorded, 75% of commercial vessel fatality incidents, 70.6% of corresponding serious injury incidents and 81.6% of corresponding overall incidents related to vessels greater than 8 metres in length. Indeed, more than half of all commercial vessel incidents (54.3%) involved vessels greater than 15 metres in length. Figure 24 clearly shows a very different pattern with commercial vessel incidents than with recreational vessel incidents – which are much more likely to involve smaller vessels.

Figure 24: Percentage of commercial vessel incidents by vessel length range, with corresponding data shown for recreational vessels shown for comparison. Data is for last 10 years, and only includes incidents for which the length of the primary vessel is known.



10 Discussion and conclusions

There is strong evidence that improved lifejacket wear rates are helping to reduce recreational boating fatalities. However, there is clearly still scope for further improvement in this area – given that drowning fatalities still make up the majority of recreational boating fatalities. In addition, the rate of non-drowning fatalities has not improved at all over this period, or indeed since the early 1990s. This points to a need for renewed focus around contributing factors such as speed, distances-off and boater behaviour. The continued aging of the NSW population poses additional challenges – including safety in small boats and people needing to re-assess their behaviours in response to changing medical and physical circumstances.

While fatal incidents are clearly more prevalent in particular circumstances (related to variables such as vessel type, time of day and victim age), identifying situations of elevated risk would be greatly improved by up to date and reliable data on actual boating usage.

10.1 Safety performance and incident trends in 2015-16

Long-term declines in both fatal and total incident rates for recreational vessels provide strong evidence of continued improvement in the overall safety outcomes affecting recreational vessels. While the picture with serious injuries is less clear – in part because of potential changes in reporting processes – the number of serious injuries and the rate of serious injuries were both relatively low in 2015-16.

While the downward trend in the fatality incident rate is encouraging, further examination of the associated fatalities (in terms of drowning versus non-drowning – see Section 8) reveals a clear dichotomy: the drowning fatality rate has declined significantly since the early 1990s while the non-drowning rate has not changed at all (apart from short-term fluctuations). This points to the success of ongoing lifejacket wear campaign work. However, the lack of any improving trend in the non-drowning fatalities suggests that further work may be required around issues like collision avoidance, speed and general boater behaviour.

Wakeboarding is growing in popularity – as with other boating activities, issues related to distances-off, speed and collision avoidance are an important safety consideration.

Not surprisingly, most incidents occur while a vessel is underway. However, the high proportion of serious injury incidents on recreational vessels underway recorded in 2015-16 may warrant further examination – to see if there is any evidence of a shift in the types of injuries occurring that might explain the increase.

There was an unusually high proportion of fatal incidents in 2015-16 involving larger vessels (those 6 metres or more in length) – such as yachts, motor cruisers and cabin runabouts. This suggests a need to broaden the recent safety focus on small boats to include larger boats – where the safety risks may be different but still significant (e.g. Figure 10). The concurrent trends of an aging population, greater disposable incomes and increasing vessel sizes suggest that fatal incidents involving larger vessels may become increasingly common in future years.

Vessels less than 4.8 metres in length accounted for a relatively high proportion of total incidents recorded in 2015-16. While this was not reflected in the fatal or serious injury incidents, it does suggest that there is still a significant set of safety risks associated with smaller vessels, and that they should continue to be a focus of safety campaigns around issues such as lifejacket wear, weather conditions, speed and collision avoidance.

The relatively low proportion of incidents in the early morning during 2015-16 is encouraging – and may reflect better safety-related behaviours by particular boating groups (e.g. anglers and kayakers) who are often active at this time. Likewise, the relatively low proportion of total incidents recorded for January in 2015-16 suggests that the concentrated campaign work over the summer school holiday period may be paying dividends.

The continued increase in lifejacket wear rates (45% in 2015-16) is also good news. Ongoing educative efforts will be required to maintain and further raise the wear rate.

10.2 Key findings on recreational boating fatal incidents over the last 10 years

Data for the last 10 years clearly shows that a large proportion of recreational fatal incidents occurred as the result of persons being forced into the water – primarily because of a vessel capsize or persons falling overboard. Many fatal incidents were also associated with adverse weather or hazardous waters, and half occurred in open runabouts. The finding for open runabouts was mirrored by the fact that nearly half of the fatal incidents occurred in small boats, those less than 4.8 metres in length. Taken together, these findings emphasise the need for improved safety around small boats.

While there were definite patterns in the occurrence of fatal incidents in terms of time of day, day of week and time of year, these patterns are broadly in line with expected vessel activity and don't necessarily point to any increased safety risks.

The ocean (i.e. offshore or open waters) is generally recognised as being relatively hazardous for boating. However, the vast majority of fatal incidents occurred in more sheltered waters, especially in rivers and bays. This reflects the high levels of boating activity on sheltered waters, but also highlights the need to avoid complacency – serious incidents still occur in calm protected waters at seemingly 'safe' locations.

While most boating fatalities involve people in the 30 to 69 age range, the proportion of people killed who were aged 70 or over is significant in the context of likely boating activity. This issue, along with the associated issue of gender (the vast majority of boating fatalities are male) is discussed in more detail in Section 10.3 below.

The key findings related to drownings and lifejacket wear show that lifejacket wear rates are still too low, and that fatalities could be reduced by as much as 63% (90 lives over 10 years) if all the persons presumed drowned had been wearing a lifejacket. Even if it is assumed that wearing a lifejacket would have only saved half these people (i.e. doubled a person's chances of survival – in line with earlier work[1]), fatalities could still be reduced by more than 30% (45 lives over 10 years).

Boating equipment retailers have been playing a key role in getting the message out about wearing lifejackets.

10.3 Long term incident patterns on recreational vessels

While the vast majority of boating incidents do not result in serious injury or fatalities, the many 'minor' incidents still serve to highlight potential safety risks. For every fatal or serious injury incident, there are likely to be many similar incidents in which serious outcomes were (perhaps narrowly) avoided. In essence, minor incidents are potentially translatable into serious or fatal incidents, and insights gained from the analysis of all boating incidents are likely to be valuable in the prevention of fatalities and serious injuries.

Incident type (Section 7.1)

Most fatal incidents recorded over the last 10 years appeared to involve the victim being forced into the water (69%). This figure closely aligns with the proportion of fatalities presumed to have drowned (73% – see Section 8). These figures suggest that there is still considerably more scope to save lives by increasing lifejacket wear rates, a point discussed further under Section 10.4. Most of the remaining fatal incidents (22%) related to some sort of collision or to a towing injury. These incidents often involved a high speed collision between an unprotected person and another vessel, shoreline structures or fixed objects such as trees. While these 'collision and towing' incidents account for a considerable proportion of recreational boating fatalities, reducing their occurrence is potentially more difficult than reducing drowning-related incidents (for which lifejacket wear is an obvious key). This is because these incidents involve a wide range of inter-related factors – including speed, behaviour, experience, shoreline and waterway hazards and boating traffic – with no one simple 'fix all' like lifejacket wear. Given this situation, the best approach is probably an increased focused on education and compliance around speed, distances-off and keeping a proper lookout. The recent regulatory changes, which decreased previous 10 knot speed limits to 6 knots will certainly help, but additional work is needed around high speed boating activities.

1 O'Connor 2008, National Assessment of Boating Fatalities in Australia 1999 – 2004.

With serious injury incidents over the last 10 years, the pattern was almost reversed, with 58% involving some sort of collision or a towing injury and a comparatively low 20% occurring in circumstances where the victim was likely forced into the water. These figures suggest that an increased focus on education and compliance around speed, distances-off and keeping a proper lookout could drive a large reduction in serious injuries. A similar situation occurred with overall incidents, of which 52% involved some sort of collision or a towing injury and 28% occurred in circumstances where a person was likely forced into the water. An important consideration with these percentages is that they relate to large numbers in absolute terms – for example, there were 684 incidents over the last 10 years in which a person was likely forced into the water. While the overwhelming majority of these incidents did not have any serious outcomes, their sheer number warns that any slipping of safety standards or behaviour (e.g. reduced lifejacket wear rates or greater complacency around boat size or weather) could potentially translate into a large relative increase in fatalities. Similarly, if even a very small proportion of the many minor 'collision' type incidents that occur each year instead resulted in a fatality or serious injury (say as a result of poorer attitudes or behaviour), it could have a major impact on the overall fatality or serious injury rate.

Incident cause (Section 7.2)

The main incident causes associated with recreational boating fatalities over the last 10 years point to some key areas where education and compliance efforts need to be focused: checking the weather and water conditions, operating at safe speeds, exercising sound judgement (based on good behaviour, attitude and experience), avoiding alcohol and keeping a proper lookout. The main fatal incident causes also point to the two main types of fatality scenario: weather conditions and hazardous waters allude to drowning fatalities involving small or unsuitable vessels getting into difficulty in rough weather and sinking, capsizing or being swamped; while excessive speed and no proper lookout allude to trauma-related fatalities involving high speed collisions or a person being hit by a vessel or its propeller.

While the primary cause was unspecified in nearly 40% of recreational fatal incidents over the last 10 years, it is clear that both human factors (e.g. excessive speed) and environmental factors (e.g. weather conditions) are far more prevalent than factors attributed to a vessel or its equipment (e.g. fault of equipment). While the statistics do provide a degree of reassurance in relation to vessel and equipment reliability, it is fair to say that nearly all fatal incidents are preventable, and are almost invariably triggered (at least to some degree) by human error, omission or misjudgement: environmental causes often come into play because of poor planning, lack of weather observation/checking or poor choice of vessel for the conditions; and even some equipment-related causes can be traced back to poor maintenance.

The main causes behind serious injury incidents over the last 10 years were similar to those related to fatal incidents, and point to many of the same education and compliance needs – exercising sound judgement, keeping a proper lookout, operating at safe speeds and checking the weather. In addition, the serious injury incident data points to a need for boaters to watch their wash. Vessel wash is often regarded as a nuisance rather than a danger, and is perhaps better known for its environmental implications (such as erosion and property damage) than for its effects on safety. However, wash does cause serious boating accidents – both in small craft (which may be swamped or sunk) and in larger craft (where a person inside the cabin may be injured by sudden and unexpected motion).

The three main causes among overall incidents (lack of judgement, weather conditions and no proper lookout) are all also present as main causes in fatal and serious injury incidents.

Roads and Maritime Services vessel on patrol.

Vessel operation (Section 7.3)

As would be expected, most incidents – including fatal incidents and serious injury incidents – occurred while a vessel was underway. The fact that towing activities accounted for a considerable proportion of fatal incidents (13%) and of serious injury incidents (22%) probably reflects the risks associated with the high speeds and confined riverine environments that usually apply to these activities. The high representation of waterskiing amongst towing incidents may relate to the fact that this activity is normally conducted at much higher speeds than wakeboarding or aquaplaning. The number of towing related incidents, including those involving fatalities and/or serious injuries, underscores the importance of maintaining a safe speed, keeping control, watching out for other vessels and people in the water and keeping a safe distance from hazards such as bankside vegetation and rocks. One issue that is not widely appreciated is the centrifugal force generated when a boat turns sharply with a person being towed; the person can be flung at across the water at a much higher speed than that of the boat, and there is tendency for the person to be forced well wide of the boat's path. These factors greatly increase the chance of the towed person losing control and/or impacting the shore, trees etc.

The proportion of incidents that occurred while a vessel was at anchor, moored or berthed (20% of all incidents and 10% of fatal incidents) highlights a need to guard against complacency even when a vessel is supposedly 'secured'. Fatalities and serious injuries have arisen in a variety of ways on these vessels – for example, people falling or jumping overboard, small dinghies capsizing because someone stands up, mishaps with the anchor rope and fire or explosion related to fuel or cooking gas.

Vessel type and vessel length (Sections 7.4 and 7.5)

Open runabouts featured heavily in incident statistics, being the primary vessel in 50% of fatal incidents, 47% of serious injury incidents and 31% of total incidents. Most open runabouts are less than 4.8 metres in length, and vessels of this size range accounted for a very similar proportion of fatal incidents (48%). When compared with incidents generally (Figure 9), there was a statistically significant association between both fatal and serious injury incidents and open runabouts. Open runabouts are vulnerable to capsize and swamping due to their small size and consequent lack of stability – they can be dangerously affected by weather or sea conditions that would prove little more than an inconvenience to most larger craft. For these reasons, open runabouts are often involved in capsize and swamping incidents (Figure 10) which all too often lead to drowning related fatalities. Open runabouts are also often involved in collisions and towing-related incidents. They are also typically operated at fairly high speeds (i.e. 'on the plane). These factors explain the heavy involvement of runabouts in serious injuries – where trauma, rather than immersion or near drowning is the usual outcome.

Large vessels – in particular yachts and motor cruisers – accounted for a considerable portion of all recreational incidents recorded over the last 10 years (20% and 11% respectively). They did, however, account for relatively few fatal or serious injury incidents over this period. These vessel types are typically involved in relatively minor collisions and groundings that often result in monetary damage rather than injury – and this is underscored by the fact that vessels greater than 8 metres in length have proportionately few fatal or serious injury incidents in comparison to their total incidents (Figure 11).

Kayaks account for a considerable proportion of fatal incidents, but if used properly are ideal for activities such as angling.

The situation was very different with canoes and kayaks, which accounted for a considerable proportion of fatal incidents (8%) but very few of the reported serious injury incidents or incidents in total (less than 1% in both cases). Essentially, the vast majority of canoe and kayak 'incidents' – such as capsize or low speed collisions with other similar craft, fixed objects etc. – are very minor and go unreported. Indeed, capsizes and minor bumps and scratches to the craft itself are often a routine part of canoeing and kayaking. However, the popularity of canoes and kayaks appears to be increasing, and without appropriate safety interventions, the number of fatal incidents is likely to increase. Given that canoes and kayaks can capsize relatively

easily, considerable risk arises if a person is not wearing a lifejacket – especially in deteriorating weather, cold water or if the person is a poor swimmer. In addition, canoes and kayaks sit very low on the water, and can be difficult to see. Their slow speed means they have limited ability to manoeuvre clear of faster or larger vessels. For these reasons, it is important that canoeists and kayakers – as well as stand up paddle boarders – make every effort to be as visible as possible (by choosing a bright hull colour, wearing an easily visible lifejacket and displaying appropriate lights in poor visibility) and to stay well clear of larger vessels.

PWC (also known as 'jetskis') accounted for a relatively high proportion of serious injury incidents over the last 10 years (15%) – which was a much higher proportion than for fatal incidents (2%) or incidents overall (7%). PWC have a set of unique characteristics around their handling, performance and use which help to explain these figures.

PWC are mostly used on very sheltered waters, close to shore, or occasionally in surf zones. Their design minimises the risk of sinking or swamping, and even in the event of a capsize, the occupant(s) can normally scramble back on board. Furthermore, PWC occupants are required to wear lifejackets at all times, and lifejacket wear observational work recently completed by Transport for NSW found an overall lifejacket wear rate of 97% on PWC during the 2015-16 boating season. These factors mean that there are very few drowning-related fatalities on PWC: the occupants are almost always wearing lifejackets, they are usually close to safety and their craft normally stays afloat in a mishap.

PWC are fun to drive, but handle differently to conventional boats.

The situation with serious injury incidents is, however, very different. PWC are fast and highly manoeuvrable and are generally used for 'fun' and thrills. Riders like to do tight high-speed manoeuvres, often in company with other riders. This leaves little margin for error, and collisions are relatively common. In addition, the jet propulsion systems used on these craft mean that they handle differently to other powered craft and have limited off-throttle steering (especially in the older models). The best response in an impending collision (to increase power to steer away) is counter-intuitive. These factors, along with the social context in which PWC are often used – close to shore, in front of friends and family, and by unlicensed persons borrowing the craft from its owner – help explain the high proportion of serious injury incidents involving these craft. The serious injuries associated with PWC typically involve severe trauma associated with collision impacts rather than issues with immersion or near-drowning. Given that PWC account for just over 5% of registered recreational vessels, it is likely that both fatal and serious

injury incident rates associated with these craft will remain highly volatile, and it may require several years to demonstrate the effectiveness of any policy or legislative responses aimed at addressing PWC safety concerns.

The relatively high involvement of canoes and kayaks in fatal incidents, and of PWC in serious injury incidents, contributes to the overall high involvement of vessels less than 4.8 metres in length shown in Figure 11. All PWC and almost all canoes and kayaks come under this length range.

The fact that hi-performance towing or racing vessels accounted for 9% of recreational fatal incidents over the last 10 years is also a concern. These incidents occurred during races or during race preparation/training. While the percentage of overall fatal incidents might not seem high, the fatality statistics represent a high risk considering the portion of overall recreational boating that is directly associated with high speed racing. Issues that need to be addressed in relation to high speed racing include vessel speeds, water hazards (e.g. debris, waves or wash), proximity to other craft and spectators and the protection afforded boat occupants in the event of an accident.

High speed racing demands meticulous attention to safety.

Time-related patterns in incident occurrence (Sections 7.6 – 7.8)

In terms of time of day, day of week and the month, recreational vessel incidents over the last 10 years appear to have followed patterns of likely vessel usage – i.e. more incidents around the middle of the day and through the afternoon, on weekends and during the warmer months.

While the evening to early morning period spanning 6:00pm to 5:59am accounted for fewer fatal incidents (just under 25%) than did the daytime period 6:00am to 5:59pm (nearly 74%), the former figure is noteworthy because this period is mostly in darkness and it is likely that the corresponding portion of vessel usage is much lower than 25%. These results suggest the possibility that night time boating carries a higher relative risk of fatal incidents than boating undertaken during the day – although a more detailed analysis of fatal incidents (in terms of actual darkness) and of corresponding levels of vessel usage would be needed to confirm this. While darkness means less boats on the water (and therefore a lower risk of collision from that perspective) it also means much poorer vision – and the greater chance that a skipper might not see another vessel or other hazard in time to avoid a collision. Indeed, the two most serious

collisions between vessels in recent years, where there were multiple fatalities, both occurred at night. Appropriate vessel speeds, the correct use of navigation lights and the keeping of a proper lookout are the keys to reducing risks around night-time collisions. Other risks are also likely to be heightened at night: people falling in the water are more likely to become disoriented; search and rescue is much more difficult and people are more likely to have been consuming alcohol.

The seasonal pattern in fatal incidents raises an interesting point – the potential benefits of recent lifejacket work (see also discussion below under lifejacket wear). An analysis of fatal incidents for the 10 year period to 2011-12 found no significant seasonal pattern in recreational boating fatal incidents[2], with a 52:48 percentage split between the warmer and cooler parts of the year. The latest analysis (Section 7.8) shows a statistically significant 63:37 percentage spilt for the same parts of the year (October – March and April – September respectively). This shows that recreational boating fatal incidents have become more seasonal in recent years. It is possible that this is due to a lower number of cold water/drowning-related fatalities in the colder months, which might in turn reflect increased lifejacket wear rates and better safety awareness. It makes sense as lifejacket wear rates improve, drowning related incidents would decline (as per Figure 21) while the collision and trauma-related incidents normally associated with 'summer' type boating activities like PWC riding and towing would remain the same, thereby creating the seasonal pattern.

Waterway type (Section 7.9)

Despite the potential ambiguities with respect to waterway type, incident patterns from the last 10 years point to the safety issues related to rivers – where most of the state's towing activities like water skiing, wakeboarding and aquaplaning take place. Rivers are attractive boating environments, with calm smooth waters, pleasant scenery and easily accessible launching points. However, the relatively high proportions of fatal and serious injury incidents recorded on this waterway type highlight the potential dangers – which include narrow channels, hazards like snags and floating debris, cold and/or turbid waters and, at times, strong currents.

The incident patterns also point to safety issues on dams, where sudden changes in weather, changing water levels and deceptively cold waters pose additional hazards. These hazards are especially evident on 'alpine waters' (dams, lakes and rivers specifically defined under boating safety regulations) – where waters are very cold much of the year and snow commonly falls in winter. The statistics suggest that if a boating incident occurs on alpine waters, it is significantly more likely to have a fatal or serious injury outcome than if it occurred elsewhere. For this reason, lifejacket wear is now mandated for all small boats (those less than 4.8 metres in length) on alpine waters. Additional safety precautions that could help address issues on alpine waters, and to some extent on rivers and lakes more generally, include positive flotation for small boats, being aware of and avoiding adverse weather and ensuring reliable means of communication.

Alpine lakes, and to some extent inland waters in general, tend to be less populated, more remote and colder when compared with coastal waters – leading to heightened boating safety risks related to poorer communications, less readily available assistance and shorter survival times.

2 Transport for NSW publication, *Boating Incidents in NSW – Statistical report for the 10-year period ended 30 June 2012*

Boater age and gender (Section 7.10)

Two key findings arise from the distribution of fatalities across the different age groups: (1) the greatest numbers of fatalities occur across the middle adult years, particularly between ages 30 and 59; and (2) the greatest relative safety risk appears to occur in people aged 70 and above – assuming licence numbers are a reasonable proxy for actual vessel usage.

Older boaters should regularly assess their boating activities and always wear a lifejacket.

While there is some indication that young people (those under 30) may also be at increased relative risk, this is complicated by the fact that people under 12 are ineligible to hold a boat licence. Data on actual usage hours would be better than the total number of licences in determining relative risk, particularly in relation to young people.

The findings arising from Figure 17 suggest that boaters pass through a series of life stages, each with its own particular safety considerations and potential safety messages. These are summarised below in Table 32.

Table 32: The 'life stages' of a boater, along with associated safety issues and potential safety messages.

Life stage (age range)	Main safety considerations	Potential safety messages
Youth (0-29 years)	• Inexperience • Risk-taking • Peer group pressure • Young children needing to be supervised	• "Know your limits" • "Watch and learn" • "Step out in style – in an appropriate lifejacket"
Mature adults (30-69 years)	• Perceived ability and experience • Family responsibility • Possible complacency	• "Be a role model" • "Be responsible" • "Take the lead – wear a lifejacket"
Older adults (70-plus years)	• Physical/mental health • Medical conditions • Possible complacency	• "Reassess" • "Play it safe" • "Always wear a lifejacket – even on short trips"

The heavy representation of males in boating fatalities probably relates to higher levels of boating usage – however, the extent to which this applies can only be determined by a survey of vessel usage by gender. Nevertheless, recent licence data does suggest high levels of boating activity by males, who accounted for 85.4 % of licences as at 14 December 2016.

The trend by which males become even more heavily represented with increasing age is supported by the gender breakdown of recent licence numbers. As at 14 December 2016, nearly 21% of licence holders under age 30 are female, versus just 5% of licence holders aged 70 years or more. This trend of increasing male representation with age may be due to males continuing with certain boating activities – for example fishing and yachting – well into retirement. The rapid increase in the popularity in paddle sports like kayaking in recent years may act against this trend in the future, as these sports are popular with both genders.

10.4 Lifejacket wear and drowning-related fatalities

While a variety of factors (Section 7) are involved in the development and unfolding of a recreational vessel incident, lifejacket wear is an over-arching factor in determining the outcome of such incidents, especially where persons end up in the water.

There is clear evidence that overall lifejacket wear rates have increased in recent years in NSW. This has been pushed by the progressive introduction of mandatory wear requirements across a greater range of boating situations and significant education and compliance programs.

Club sailing activities have helped spread the lifejacket wear message out on the water.

The increase in lifejacket wear rates has contributed to the large reduction in drowning fatality rates state-wide since 1993 (Figure 21) and in the large reduction in bar-crossing fatalities since 2003 (Figure 19). If the long term drowning fatality rate data is considered alongside the changes in lifejacket wear rates (Figure 20), it is possible to make some predictions about the degree to which further increases in lifejacket wear rates might reduce recreational boating fatality rates.

In the period during which overall lifejacket wear rates increased from 9% to 45% (i.e. 2007 to 2015-16, with a difference of 36%), the drowning fatality rate decreased from approximately 6 per 100,000 vessels to 3.6 per 100,000 – a decrease of approximately 40%. Assuming these trends were indeed linked causally, and were to continue, the drowning fatality rate would

decrease by approximately 1% for every 1% addition to the overall lifejacket wear rate. This would mean that if the overall lifejacket wear rate were to reach 60%, the drowning fatality rate could fall to about 3.1 per 100,000 vessels; at 80% it could fall to about 2.5 and at 100% it could be about 2.0. Given that the non-drowning fatality rate currently fluctuates around an average of just under two (Figure 21), boosting lifejacket wear rates to 100% would decrease the overall boating fatality rate by about one-third.

Previous work[3] has shown that wearing a lifejacket approximately doubles the chances of survival of people involved in boating accidents involving where at least one person drowned. If, hypothetically, everyone who went boating wore a lifejacket, the current boating fatality rate could fall by as much as 62.5% (Section 8). However, a more likely reduction, based on the doubling of survival odds, would be approximately 31% – a figure that is in very close agreement with the one-third reduction in the overall fatality rate derived above.

10.5 Broad implication for recreational boating safety

Slightly more than 2/3rds of boating fatalities in recent years are presumed due to drowning, while nearly 1/3 are non-drowning related. Most of the latter relate to trauma due to impact injuries. In round figures, having 100% lifejacket wear across all recreational boating activities might reduce the current overall fatality rate of around six per 100,000 vessels to about four per 100,000 (i.e. a 1/3 decrease).

Some additional decrease could be achieved by improving boater's judgement and practice in relation to bad weather – i.e. if fewer vessel operators were caught out by bad weather. This would require further educative work around planning ahead (in terms of weather forecasts etc.) and reacting appropriately to signs of changing weather whilst out boating. However, given the link between adverse weather and incidents involving vessel capsize/swamping or persons falling overboard, there would be considerable overlap between the lives that could be saved by increasing lifejacket wear rates and those that could be saved if more boaters successively avoided bad weather. In essence, better avoidance of dangerous weather situations would prevent some (but not all) of the incidents where lifejacket wear became a life and death matter.

Aftermath of severe weather in June 2016.

3 O'Connor 2008, National Assessment of Boating Fatalities in Australia 1999 – 2004.

Achieving any further reductions in the boating fatality rate beyond this would require additional work on a variety of safety issues – particularly around safe navigation (speed, proper lookout, distances-off and alcohol/drugs). These particular issues around safe navigation are inter-related: if a vessel's speed is reduced, inadequacies in keeping a proper lookout or maintaining a given distance-off are less likely to cause an accident – as there is more time to react. Similarly, a sober person is more likely to react in time to a sudden hazard, and less likely to drive at an excessive speed, than a person affected by alcohol or drugs. Safe speed – i.e. a speed that is safe in the prevailing circumstances – is the key, as it dictates how much time a boat operator has to avoid an unexpected hazard or the distance within which they have to recover in the event of a loss of control.

Allowing for a halving of the current non-drowning recreational fatality rate (down from just under two per 100,000 vessels to say one per 100,000) plus some additional reduction in drowning fatalities due to better avoidance of dangerous weather situations (say one half per 100,000 vessels, i.e. an additional 25% of the decrease that might be expected if the lifejacket wear rate was 100%), means that a realistic medium-term goal would be a fatality rate of around 2.5 per 100,000 recreational vessels. This would correspond to a fatal incident rate of around 2.2 per 100,000 recreational vessels and approximately six fatalities or five fatal incidents per year, based on recent registration numbers.

10.6 Long term incident patterns related to commercial vessels

Commercial vessels are typically used very differently to recreational vessels. They often carry large numbers of passengers and are usually used for longer periods and more often. They may undertake demanding and dangerous tasks (like fish trawling or the installation of foreshore infrastructure) and are often used on busy congested waterways. These factors go a long way to explaining the differences in commercial vessel incident patterns to those related to recreational vessels – even in the absence of comprehensive usage or exposure data.

Commuter ferry on Sydney Harbour.

Incident type (Section 9.1)

It is notable that nearly half of all commercial vessel fatal incidents involved a person falling overboard. While these incidents occurred in a variety of circumstances, common features that emerge are falling from a houseboat or large charter vessel – moored or at anchor – whilst possibly under the influence of alcohol or drugs, and falling from a moving fishing vessel whilst working alone.

With commercial vessel serious injury incidents, and indeed commercial vessel incidents overall, two incident types stand out – fall in vessel and injury onboard – which together accounted for nearly 60% of the serious injury incidents and 13% of the overall incidents. The high proportion of serious injuries related to falls and other mishaps onboard reflects the large number of passengers carried on vessels such as ferries and large charter vessels. These vessels have heavy operating schedules, can get quite crowded and often have multiple decks with stairways etc. On smaller commercial vessels, such as fishing trawlers and Commercial Adventure Vessels (CAVs), injuries or falls on board are more likely to relate to the specific nature of the vessel's operations: with fishing trawlers, the hazards include heavy equipment and slippery pitching decks; on CAVs the hazards relate to sudden impacts associated with radical manoeuvres, high speed and/or choppy water.

Commercial vessels are typically affected by a large number of relatively minor incidents – such as low-speed collisions and close quarter incidents. Many of these types of incident would not normally be reported by recreational vessel operators. Based on the likely hours travelled, and number of passengers carried, commercial vessels are relatively safe. Nevertheless, when a collision at speed or other serious incident occurs, there is the potential for a heavy casualty count – as has been the case with a number of collisions involving commercial vessels in recent years.

Incident cause (Section 9.2)

It is notable that 20% of commercial vessel fatal incidents were attributed to excess alcohol – which highlights the behaviour of both crew and passengers – particularly when there are large groups on board socialising.

The causes of commercial vessel serious injury incidents were broadly similar to those related to recreational vessel incidents. However, causes related to rough seas, strong currents and/or bad weather did stand out – accounting for more than twice the proportion of commercial vessel serious injury incidents than of the corresponding recreational vessel incidents.

Examination of incident causes amongst commercial vessel incidents overall shows that machinery issues are relatively common. This reflects the large and complex engines and ancillary systems onboard many commercial vessels. However, the vast majority of incidents caused by engine or machinery breakdown are relatively minor – typically resulting in delays rather than injury.

Vessel type (Section 9.3)

Nearly half of commercial vessel fatal incidents over the last 10 years occurred on houseboat or fishing vessels. This highlights the issue of people falling or jumping from houseboats as well as the various hazards associated with working on fishing vessels – e.g. heavy machinery, rough seas and working alone.

Powered catamaran vessels, along with motor cruisers, accounted for the greatest proportions of commercial vessel serious injury incidents and incidents overall. However, this probably just reflects the prominence of these vessel types in the commercial vessel fleet rather than any specific risks associated with these vessel types.

However, it is clear that ferries – which are heavily used and carry large numbers of passengers – are relatively safe. There were no fatal incidents onboard ferries over the last 10 years, and only a small number of serious injury incidents. This is likely to be due, in part, to the high standards of incident preparedness and response training and drills required under each ferry's Safety Management System.

Vessel length (Section 9.4)

There are marked differences in the length compositions of vessels involved in commercial vessel incidents versus those involved in recreational vessel incidents. A large majority of commercial vessel incidents involve vessels greater than 8 metres in length. However, this is probably more to do with the size characteristics of the commercial vessel fleet –– which has proportionately many more large vessels than the recreational fleet – rather than any inherent safety risk associated with larger commercial vessels. In addition, the fact that many of the larger commercial vessels carry large numbers of passengers and are heavily used also contributes to their share commercial vessel incidents.

Modern lifejackets come in a range of styles to suit all types of boating activity.

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