# RESPECT THE RIVER:
# NSW RIVERS RESEARCH REPORT

HAWKESBURY RIVER
MACQUARIE RIVER
MURRUMBIDGEE RIVER
NEPEAN RIVER

EVERYONE CAN BE A LIFESAVER
Royal Life Saving
ROYAL LIFE SAVING SOCIETY - AUSTRALIA

NSW GOVERNMENT

## ABOUT ROYAL LIFE SAVING

Royal Life Saving is focused on reducing drowning and promoting healthy, active and skilled communities through innovative, reliable, evidence based advocacy; strong and effective partnerships; quality programs, products and services; underpinned by a cohesive and sustainable national organisation.

Royal Life Saving is a public benevolent institution (PBI) dedicated to reducing drowning and turning everyday people into everyday community lifesavers. We achieve this through: advocacy, education, training, health promotion, aquatic risk management, community development, research, sport, leadership and participation and international networks.



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The views expressed herein do not necessarily reflect the views of the NSW Government.


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# 43

Between 1 July 2005 and 30 June 2015
43 people drowned in the Hawkesbury, Macquarie, Murrumbidgee and Nepean rivers

## LOCATIONS

- 35% Hawkesbury River
- 35% Murrumbidgee River
- 21% Nepean River
- 9% Macquarie River

## ACTIVITIES

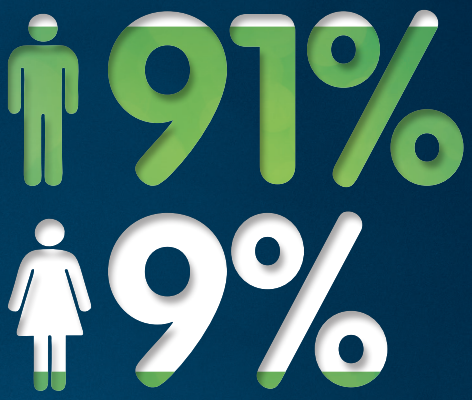
- 49% Swimming/Recreating
- 12% Boating
- 9% Fall
- 9% Unknown

## AGE

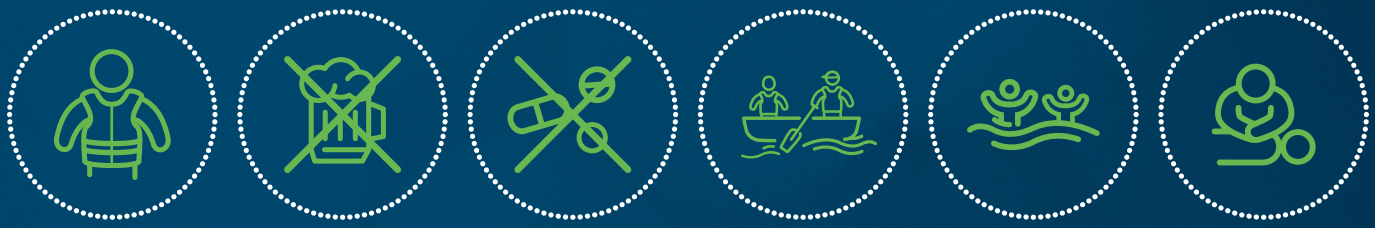
- 26% 25-34 years
- 23% 18-24 years
- 14% 35-44 years

**ALCOHOL WAS KNOWN TO BE INVOLVED IN 56% OF CASES**
Of these, 50% had BAC greater than or equal to 0.05%

**DRUGS WERE KNOWN TO BE INVOLVED IN 28% OF CASES**
Of these, 42% legal drugs, 33% illegal substances, 25% both




## PREVENTION STRATEGIES



- WEAR A LIFEJACKET
- AVOID ALCOHOL AROUND WATER
- DO NOT SWIM OR TAKE A BOAT OUT UNDER THE INFLUENCE OF DRUGS
- BE PREPARED & CHECK WEATHER CONDITIONS
- NEVER GO ALONE
- LEARN HOW TO SAVE A LIFE

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## Table of Contents

## Table of Figures

## DID YOU KNOW?

- Between 1 July 2005 and 30 June 2015, 43 people drowned in the Hawkesbury, Macquarie, Murrumbidgee and Nepean rivers
- Males accounted for 90.7% of all drowning deaths
- More than a quarter of deaths occurred among people aged 25-34 years (25.6%), followed by people aged 18-24 years (23.3%)
- More than half of those who drowned were born in Australia (55.8%), with 37.2% born in another country. Of these, the most common countries of birth were India (18.8%), Iran (12.5%) and Sudan (12.5%)
- Aboriginal and Torres Strait Islander people accounted for 4.7% of deaths
- Almost half of all drowning deaths occurred in summer (48.8%), with a further 27.9% occurring in spring
- Drowning deaths peaked on the weekends, with 25.6% of incidents occurring on Saturdays and 20.9% on Sundays
- Two thirds of deaths occurred in the afternoon, between 12:01pm and 6pm (67.4%)
- A total of 15 drowning deaths occurred in both the Hawkesbury and Murrumbidgee Rivers, accounting for 34.9% of all deaths each. There were 9 recorded deaths in the Nepean River (20.9%) and 4 in the Macquarie River (9.3%)
- Two thirds (67.4%) of deaths occurred in inner and outer regional areas
- Almost half of incidents occurred while swimming and recreating (48.8%), making it the leading activity prior to drowning
- More than half of drowning deaths were known to have involved alcohol (55.8%). Of these, 50.0% recorded a BAC greater than or equal to 0.05%
- More than a quarter of cases were known to have involved drugs (27.9%). Of these 41.7% were legal drugs, 33.3% were illegal and in 25.0% of cases both legal and illegal drugs were detected
- Among those who drowned, 12 people were known to have a pre-existing medical condition (27.9%), most commonly cardiac conditions
- Among the drowning deaths known to have occurred while boating, 80.0% were not wearing a lifejacket
- Among the deaths, 2 multiple fatality events (MFEs) were recorded, each claiming the lives of 2 people

## EXECUTIVE SUMMARY

Rivers are the leading location for drowning in Australia, with more people drowning in New South Wales (NSW) rivers than any other state. Previous research revealed the top ten river drowning blackspots around the country, with three of the top ten in NSW. These were the Hawkesbury River (number five), the Murrumbidgee River (number six) and the Macquarie River (number ten).

In order to educate people about the hidden hazards at inland waterways, Royal Life Saving launched the 'Respect the River' program in 2015. The program has four key safety messages; wear a lifejacket, avoid alcohol around water, never swim alone and learn how to save a life; designed to reduce the risks of strong currents, submerged objects and steep or crumbly banks.

In order to gain a greater understanding of drowning deaths in NSW, four rivers (Hawkesbury River, Macquarie River, Murrumbidgee River and Nepean River) were investigated. This report will identify key trends related to demographics, time of drowning deaths, location, activity and important risk factors.

All unintentional, fatal drowning deaths which occurred between 1 July 2005 and 30 June 2015 in the Hawkesbury, Macquarie, Murrumbidgee or Nepean rivers in NSW were included in this report. Information for this report has been collected from State and Territory Coronial Offices, the National Coronial Information System (NCIS) and media reports.

Exclusions from this data include: drowning deaths known to be as a result of suicide or homicide, deaths from natural causes, animal attack, or hypothermia where known. All information presented is about drowning deaths or deaths where drowning was a factor. This report contains information correct as at 10 July 2016. As of this date, 93% of cases were closed (i.e. no longer under coronial investigation).

Between 1 July 2005 and 30 June 2015 (a period of 10 financial years), 43 people drowned in the Hawkesbury, Macquarie, Murrumbidgee and Nepean Rivers, with males accounting for 90.7% of deaths. A total of 15 drowning deaths occurred in both the Hawkesbury and Murrumbidgee Rivers over the ten years, accounting for 34.9% of all deaths each. There were 9 recorded deaths in the Nepean River (20.9%) and 4 in the Macquarie River (9.3%).

More than a quarter of deaths occurred among people aged 25-34 years (25.6%), followed by people aged 18-24 years (23.3%). More than half of those who drowned were born in Australia (55.8%), with 37.2% born in another country, of which, 93.8% were from non-English speaking countries. The most common countries of birth, excluding Australia, were India, Iran and Sudan. Additionally, 4.7% of deaths occurred among Aboriginal or Torres Strait Islander people.

Almost half of all drowning deaths occurred in summer (48.8%), with incidents peaking on weekends. More than a quarter of incidents occurred on a Saturday (25.6%), with a further 20.9% occurring on a Sunday. Two thirds of deaths occurred in the afternoon, between 12:01pm and 6pm (67.4%) and in inner and outer regional areas (67.4%). Swimming and recreating was the leading activity prior to drowning (48.8%), followed by boating (11.6%), an unexpected fall into water (9.3%) and an unknown activity; indicating the drowning was unwitnessed and the person was alone at the time (9.3%).

More than half of drowning deaths were known to have involved alcohol (55.8%). Of these, 50.0% recorded a BAC greater than or equal to 0.05%; deemed to be a contributory amount. More than a quarter of all cases were known to have involved drugs (27.9%). Of these, 41.7% were legal drugs, 33.3% were illegal substances and in 25.0% of cases both legal and illegal drugs were detected. The most common illegal drugs recorded were cannabis and methamphetamine. Among those who drowned, 27.9% of people were known to have a pre-existing medical condition, most commonly cardiac conditions. Among drowning deaths related to boating, 80.0% of people were not wearing a lifejacket.

Important implications for drowning prevention stem from the findings of this report. Public awareness campaigns need to target high risk populations, including males, young and middle-aged adults, and people born overseas. As well as tailoring safety messages to particular age groups, culturally appropriate resources need to be developed to ensure optimal acceptability within the target demographic. Deploying safety messages at times of heightened risk is another important learning from this report, with an increased number of drowning deaths recorded during summer, on the weekend and during the afternoon.

Given the significant proportion of incidents which took place outside of major cities, the importance of basic lifesaving skills and a working knowledge of cardiopulmonary resuscitation (CPR) should not be underestimated. Inland waterways are not patrolled by lifeguards and are often located some distance away from medical services, meaning bystanders are often the only source of help available. In the case of an emergency, assistance from bystanders may change the outcome of a drowning event in an isolated area. Public rescue equipment may assist in facilitating safe rescues along NSW rivers, similar to existing programs run along the coastline.

Alcohol and drug consumption are key risk factors in drowning deaths in rivers, yet remain a significant issue. Campaigns such as Royal Life Saving's 'Don't let your mates drink and drown', highlight the risks of the Australian culture of drinking while swimming, boating or fishing and urge men to look out for one another. Not wearing a lifejacket was another important risk factor, despite previous research showing the inherent value of lifejackets. The continued promotion of lifejackets is vital, along with more general boating safety messages which should emphasis the hidden hazards at inland waterways.

Drowning deaths occur every year in rivers around the state, including the Hawkesbury, Macquarie, Murrumbidgee and Nepean Rivers. This report has identified high risk populations, locations and activities, as well as times of heightened risk. In order to prevent such events in the future, drowning prevention strategies will need to be targeted and specific, noting the differences in local environments and communities.

# NEXT STEPS

## Policy, Programs and Advocacy

- Continue to promote Royal Life Saving's 'Respect the River' program throughout NSW river systems, focusing on the Hawkesbury, Macquarie, Murrumbidgee and Nepean Rivers
  - Tailor the messages of the 'Respect the River' program where required to ensure individualised solutions which target local problems
- Deliver community events designed to promote river safety and engage with local communities
- Develop culturally appropriate resources to be used in specific ethnic and cultural groups across NSW, ensuring that messages are tested using focus groups to ensure optimal acceptability
- Deploy safety messages through social and traditional media to engage communities that use and live along these key river systems. Messages must be deployed at times of heightened risk, for example, during summer, across weekends and during the afternoon. Safety messaging should include:
  - Encourage all people to swim or recreate with a friend, rather than going alone, regardless of age or experience
  - Reinforce the need to avoid alcohol when around water, highlighting the impacts on coordination, judgement, reaction times and risk taking behaviour
- Utilise local resources – such as public pools; teachers of swimming and water safety; local schools and community groups to promote river safety messages.
- Expand alcohol safety messages to include the consumption of illicit drugs, or using drugs in combination with alcohol
- Promote the benefits of wearing a lifejacket, utilising existing partnerships, as well as forming new relationships with local authorities where required
- Advocate for boating safety campaigns to extend beyond coastal environments, fulfilling the need for key education messages to reach users of inland waterways
- Remind users of inland waterways of the importance of learning CPR, particularly in regional and remote areas of NSW where access to timely medical assistance may be limited
  - Encourage all river users to learn basic rescue techniques, in addition to learning and regularly updating, vital CPR skills
- Explore the concept of publically available rescue equipment at key locations along the investigated rivers, for example, at popular swimming sites
- Conduct safety audits of those locations identified within the fatal drowning data that are high risk
  - Identify key stakeholders and share audit findings. Stakeholders may include local catchment authorities, land owners and neighbouring local governments

## Research Agenda

- Continue to collect drowning data for all NSW rivers, allowing trends and risk factors to be identified and monitored over time
- Explore the rationale behind risk taking behaviour in key age groups (18-34 years), including attitudes to alcohol and drug consumption around water, as well as lifejacket usage, using focus groups or individual interviews
- Investigate the existing signage at NSW rivers, including any perceived barriers to adherence, including a lack of clarity, language barriers, lack of maintenance or misplaced information
- Conduct qualitative research with local community groups who recreate within and along these key river systems to identify usage patterns and examine their perceptions of and attitudes towards risk

## BACKGROUND

Drowning deaths occur in a variety of aquatic locations, including inland waterways, such as rivers, creeks, lakes and dams, coastal locations, such as beaches and oceans, and domestic environments, such as backyard swimming pools. Rivers are the leading location for drowning in Australia, with more people drowning in New South Wales (NSW) rivers than any other state (1).

Previous research revealed the top ten river drowning blackspots around the country, with three of the top ten in NSW. These were the Hawkesbury River (number five), the Murrumbidgee River (number six) and the Macquarie River (number ten) (1).

In order to educate people about the hidden hazards at inland waterways, Royal Life Saving launched the 'Respect the River' program in 2015. Rivers often look calm and serene from the surface, with flat, still water, leading people to underestimate the unseen dangers. Inland waterways are not patrolled by lifeguards and weather conditions can change rapidly. There may be strong currents, submerged objects and steep or crumbly banks (2). The program has four key safety messages; wear a lifejacket, avoid alcohol around water, never swim alone and learn how to save a life (3).

The Hawkesbury and Nepean Rivers are located within the Hawkesbury-Nepean catchment (4). The Hawkesbury River is more than 100km in length, running through Brooklyn, Wiseman's Ferry, Richmond and Windsor (5). The Nepean River runs through Penrith and Camden and is home to the Bents Basin State Conservation Area, which is located south of Penrith and is a popular site on the river for swimming, fishing and camping (6).

The Macquarie and Murrumbidgee Rivers both lie within the Murray-Darling Basin. The Macquarie River is within the Macquarie-Bogan catchment, in central-west NSW (7, 8). It begins in the Great Dividing Range south of Bathurst, before joining the Barwon River near Brewarrina (7, 8). The Murrumbidgee River is within the Murrumbidgee catchment and begins in the Kosciuszko National Park within the NSW Snowy Mountains, continuing to its junction with the Murray River near Balranald (9-11). It is approximately 1609 kilometres in length, with 66 kilometres running through the Australian Capital Territory (ACT) (9, 10). Key recreation sites along the Murrumbidgee River include beaches, such as Wagga Beach and reserves, such as Wiradjuri Reserve (12).

In order to gain a greater understanding of drowning deaths in NSW, these four rivers (Hawkesbury River, Macquarie River, Murrumbidgee River and Nepean River) were investigated. This report will identify key trends related to demographics, time of drowning deaths, location, activity and important risk factors.

## AIMS

This study aimed to:

- Gain a better understanding of the scale of drowning in NSW rivers (Hawkesbury River, Macquarie River, Murrumbidgee River and Nepean River) across a ten year period
- Identify key trends related to demographics (sex, age, ethnicity), time of drowning deaths (season, day of the week, time), location (specific river, remoteness classification), activity and risk factors (alcohol and drug consumption, lifejacket usage)
- Propose recommendations going forward, including targeted prevention strategies and suggested next steps regarding policy, programs and advocacy

# METHODS

All unintentional, fatal drowning deaths which occurred between 1 July 2005 and 30 June 2015 in the Hawkesbury, Macquarie, Murrumbidgee or Nepean rivers in NSW were included in this report. As part of the Murrumbidgee River runs through the ACT, drowning deaths occurring in the ACT section of the Murrumbidgee River were also included.

Information for this report has been collected from State and Territory Coronial Offices, the National Coronial Information System (NCIS) and media reports. It has been collated and analysed by the Royal Life Saving Society – Australia. Royal Life Saving uses a media monitoring service (both electronic and print media) all year round to identify drowning deaths in the media. The information is then corroborated with information from the NCIS, police and Royal Life Saving State and Territory Member Organisations before being included in this report.

All care is taken to ensure that the information is as accurate as possible. Please note that the figures from more recent financial years may change depending upon the outcomes of ongoing coronial investigations and findings. This report contains information correct as at 10 July 2016. As of this date, 93% of cases were closed (i.e. no longer under coronial investigation).

Exclusions from this data include: drowning deaths known to be as a result of suicide or homicide, deaths from natural causes, shark and crocodile attack, or hypothermia where known. All information presented is about drowning deaths or deaths where drowning was a factor.

The crude drowning rate was calculated using ten year NSW population figures between June 2006 and June 2015 from the Australian Bureau of Statistics (ABS) (13).

The remoteness classification was defined by the Australian Standard Geographical Classification – Remoteness Area (ASGC-RA) system (14). The distance between the incident and residential postcode was determined using Google Maps (15). A distance of less than 100km was considered 'not a visitor', more than 100km but within the same state was 'visitor - intrastate', a different state was 'visitor - interstate' and an overseas residential postcode as 'visitor – overseas'. In cases where the incident or resident postcode was unknown, this was entered as 'unknown'.

The time of drowning was coded into four bands: early morning (12:01am to 6am), morning (6:01am to 12pm). Afternoon (12:01pm to 6pm) and evening (6:01pm to 12am).

Some activities with only a small number of applicable cases were grouped for the purposes of reporting. The activities of 'fishing' and watercraft' were grouped with 'other'.

A Blood Alcohol Concentration (BAC) greater than or equal to 0.05% (0.05 grams of alcohol per 100 millilitres of blood) was considered relevant and contributory to the drowning death. Additionally, for the purposes of this report, all prescribed medications were considered to be legal. Illicit drugs, such as cannabis and methamphetamine, were considered illegal drugs.

Lifejacket use was considered in cases where a drowning death involved boating, with information on usage and suitability taken from the coronial finding or inquest finding and police reports on the NCIS.

Data were analysed using SPSS Version 21 (16). Descriptive statistics were utilised, as well as chi squared analysis. Statistical significance was deemed $p<0.05$. Chi squared analysis was conducted without the 'unknown' variable (e.g. the presence of alcohol was calculated using the 'yes' and 'no' variables only).

# RESULTS

## Overall

Between 1 July 2005 and 30 June 2015 (a period of 10 financial years), 43 people drowned in the Hawkesbury, Macquarie, Murrumbidgee and Nepean rivers, resulting in a crude drowning rate of 0.06 deaths per 100,000 population. It should be noted that this rate only includes drowning deaths which occurred in one of the four rivers being investigated but all of the NSW population over the equivalent time period.

## Demographics

The number of drowning deaths each year across the four rivers ranged from a high of 6 deaths in 2006/07, 2008/09 and 2011/12, to a low of 2 deaths in 2009/10. The crude drowning rate over this time ranged from 0.03 deaths per 100,000 population to 0.09 deaths per 100,000 population (Figure 1).

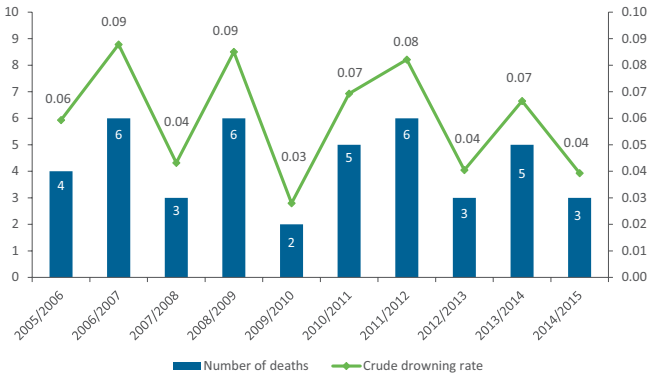


Figure 1: Drowning deaths in NSW rivers by financial year with crude drowning rate, 2005/06-2014/15

## Sex and age

Males accounted for 90.7% of all drowning deaths, with females accounting for 9.3%. More than a quarter of deaths occurred among people aged 25-34 years (25.6%), followed by people aged 18-24 years (23.3%) and 35-44 years (14.0%) (Figure 2).

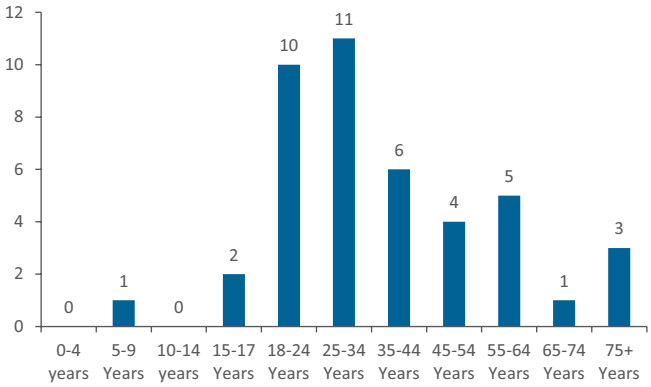


Figure 2: Drowning deaths in NSW rivers by age, 2005/06-2014/15

## Ethnicity

More than half of those who drowned were born in Australia (55.8%), with 37.2% born in another country. Of these, the most common countries of birth were India (18.8%), Iran (12.5%) and Sudan (12.5%) and a total of 93.8% were from non-English speaking countries (Figure 3). Additionally, 4.7% of deaths occurred among Aboriginal or Torres Strait Islander people.

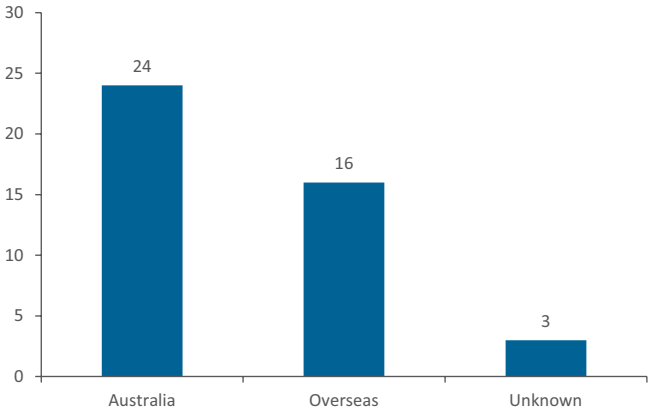


Figure 3: Drowning deaths in NSW rivers by country of birth, 2005/06-2014/15

## Time of drowning deaths

### Season

Almost half of all drowning deaths occurred in summer (48.8%), with a further 27.9% occurring in spring. A total of 10 deaths (23.3%) occurred across autumn and winter combined (Figure 4).

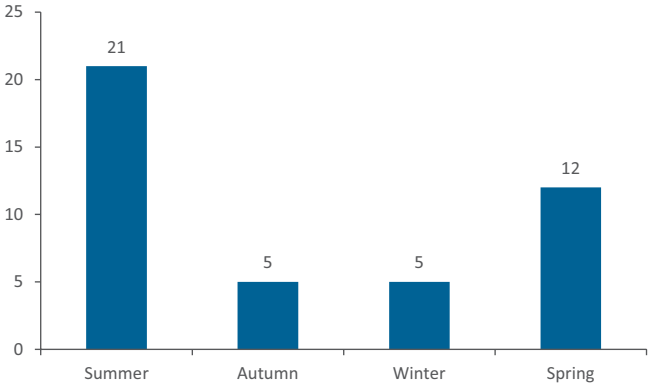


Figure 4: Drowning deaths in NSW rivers by season, 2005/06-2014/15

### Month

Aligning with the seasonal trends in drowning, the highest number of deaths occurred in the warmer months. Almost a quarter of deaths occurred in January (23.3%), followed by November and December (14.0% each) (Figure 5).

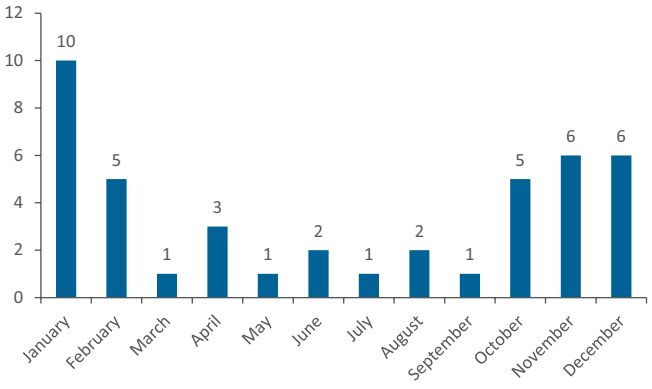


Figure 5: Drowning deaths in NSW rivers by month, 2005/06-2014/15

### Day of the week

Drowning deaths peaked on the weekends, with 25.6% of incidents occurring on Saturdays and 20.9% on Sundays. The lowest number of incidents occurred on Mondays and Tuesdays (7.0% each) (Figure 6).

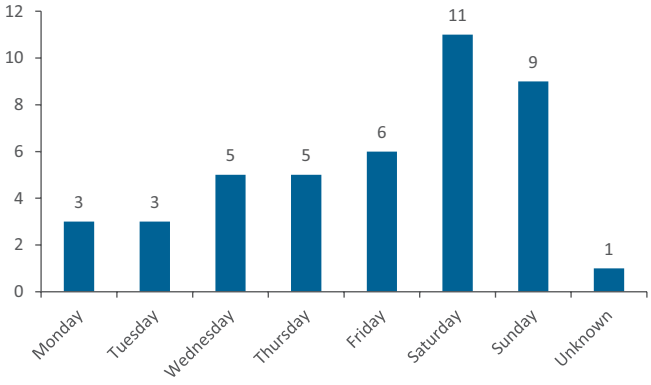


Figure 6: Drowning deaths in NSW rivers by day of the week, 2005/06-2014/15

### Time

Two thirds of deaths occurred in the afternoon, between 12:01pm and 6pm (67.4%). A further 23.3% occurred during the evening hours (6:01pm to 12am) (Figure 7).

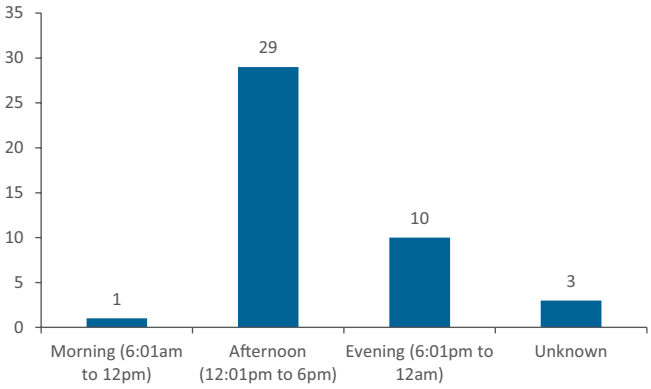


Figure 7: Drowning deaths in NSW rivers by time, 2005/06-2014/15

## Location and activity

### Location

A total of 15 drowning deaths occurred in both the Hawkesbury and Murrumbidgee Rivers over the ten years, accounting for 34.9% of all deaths each. There were 9 recorded deaths in the Nepean River (20.9%) and 4 in the Macquarie River (9.3%) (Figure 8).

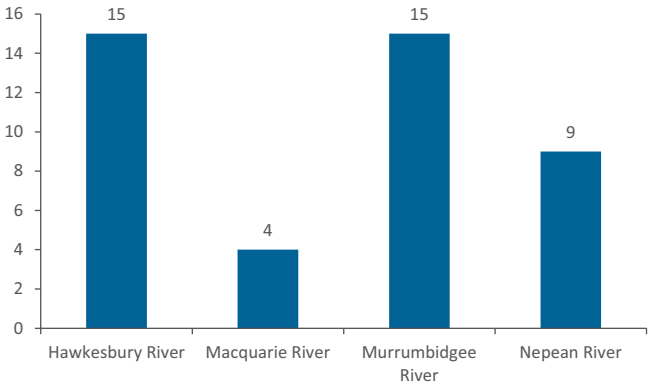


Figure 8: Drowning deaths in NSW rivers by name of river, 2005/06-2014/15

### Remoteness

More than a third of deaths occurred in inner regional areas (37.2%). An additional 30.2% occurred in both major cities and outer regional areas (Figure 9).

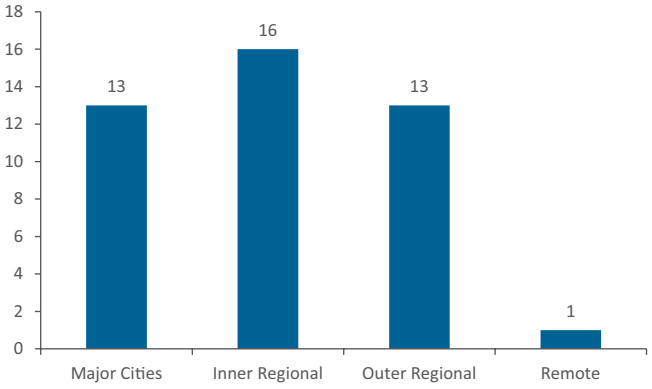


Figure 9: Drowning deaths in NSW rivers by remoteness classification of incident, 2005/06-2014/15

### Activity

Almost half of incidents occurred while swimming and recreating (48.8%), making it the leading activity prior to drowning. A further 11.6% of incidents occurred while boating and 9.3% following an unexpected fall into water. The activity was unknown in 9.3% of cases (Figure 10).

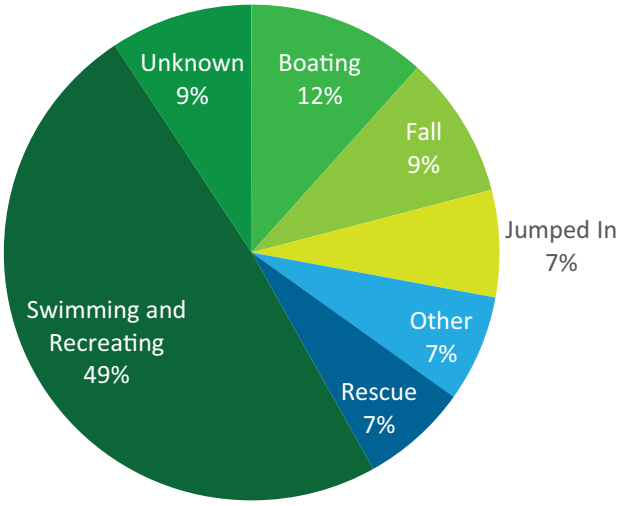


Figure 10: Drowning deaths in NSW rivers by activity, 2005/06-2014/15

## Risk factors

### Alcohol

More than half of drowning deaths were known to have involved alcohol (55.8%). However, this information was not available for all incidents, with 23.3% of cases missing relevant toxicology details (Figure 11). No statistical differences were observed regarding the presence of alcohol and the overall demographics of drowning deaths (sex, age, country of birth), time of drowning deaths (season, time), location of drowning deaths (name of river, remoteness) or activity prior to drowning.

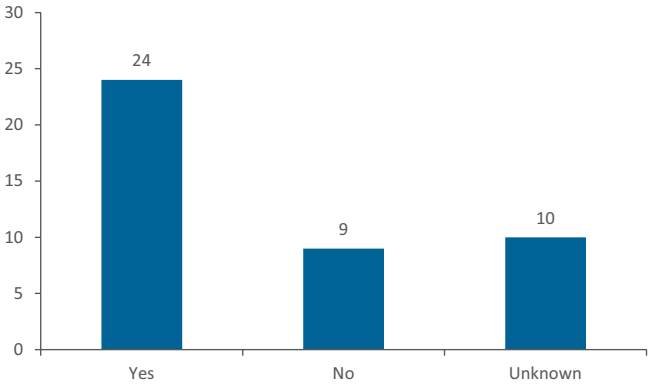


Figure 11: Drowning deaths in NSW rivers by presence of alcohol, 2005/06-2014/15

Of the 24 deaths where alcohol was known to be present, half (50.0%) recorded a BAC greater than or equal to 0.05%. As such, these cases were deemed to have involved a contributory amount of alcohol (Figure 12). Similarly, no statistical differences were observed regarding the relevance of alcohol and the overall demographics of deaths, time of deaths, location or activity.

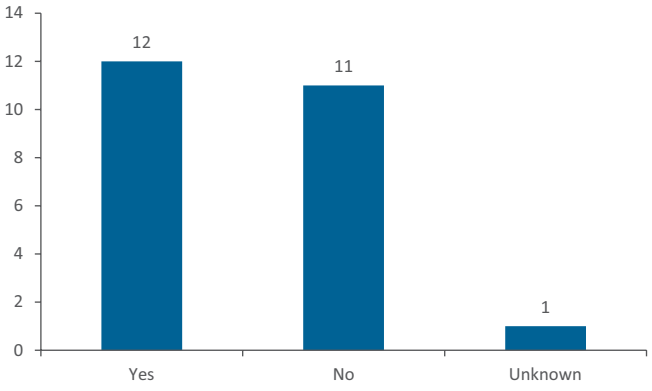


Figure 12: Drowning deaths in NSW rivers by relevance of alcohol, 2005/06-2014/15

### Drugs

More than a quarter of all cases were known to have involved drugs, including both legal and illegal drugs (27.9%). Information on the presence of drugs was not known for all incidents, with this information unknown in 23.3% of cases (Figure 13). Drowning deaths among people aged 35-44 years were significantly more likely to have involved drugs compared to other age groups ($X^2$=7.0, p<0.01). No other significant differences were observed regarding the consumption of drugs.

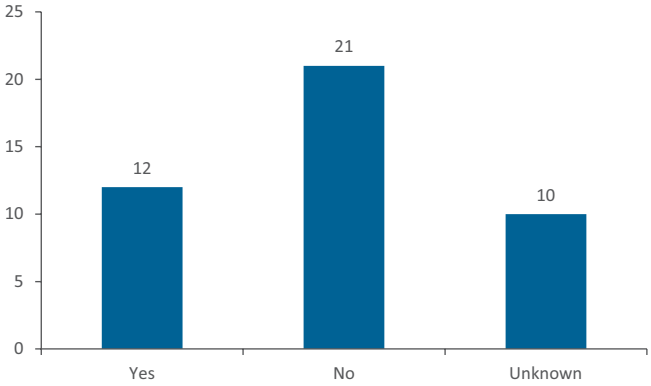


Figure 13: Drowning deaths in NSW rivers by presence of drugs, 2005/06-2014/15

Of the 12 deaths where drugs were known to be present, 41.7% were legal drugs, 33.3% were illegal substances and in 25.0% of cases both legal and illegal drugs were detected. The most common illegal drugs recorded were cannabis and methamphetamine (Figure 14).

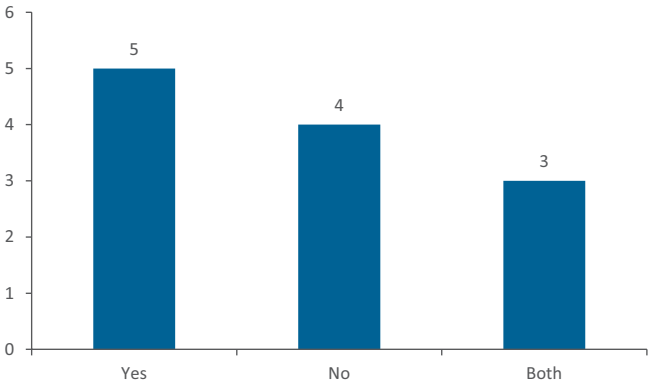


Figure 14: Drowning deaths in NSW rivers by legality of drugs, 2005/06-2014/15

## Pre-existing medical conditions

Among those who drowned, 12 people were known to have a pre-existing medical condition (27.9%). The reported medical conditions included cardiovascular disease and other cardiac conditions, as well as mental health disorders, genetic conditions and substance abuse (Figure 15).

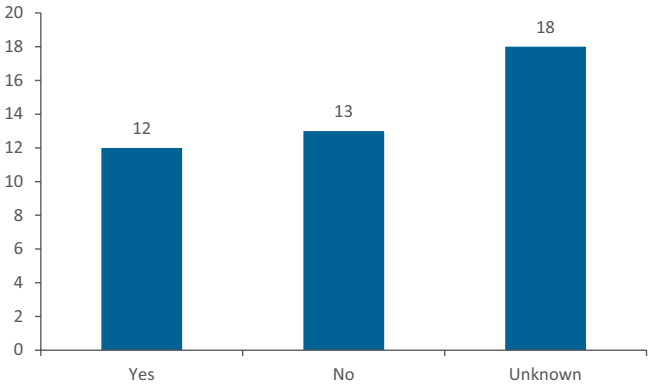


Figure 15: Drowning deaths in NSW rivers by presence of pre-existing medical conditions, 2005/06-2014/15

## Lifejacket usage

Among the 5 drowning deaths known to have occurred while boating, 80.0% were not wearing a lifejacket at the time of the incident. This information was not available in one case (Figure 16).

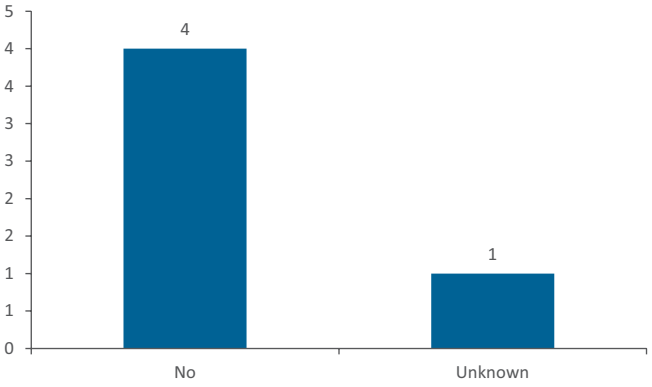


Figure 16: Drowning deaths in NSW rivers by lifejacket usage while boating, 2005/06-2014/15

# Other factors

## Multiple fatality event (MFE)

Among the drowning deaths, 2 multiple fatality events (MFEs) were recorded, each claiming the lives of 2 people. Of these, 2 occurred while swimming and recreating and 2 while boating (Figure 17).

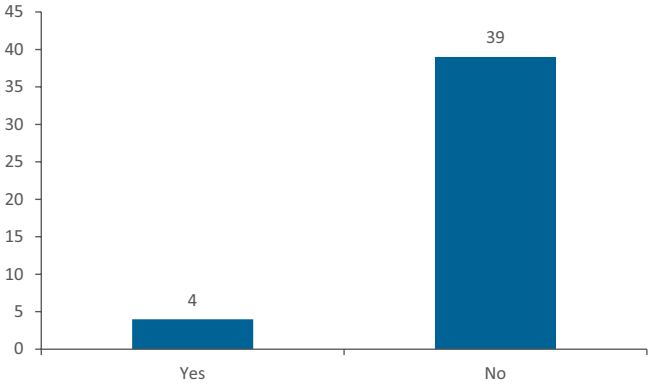


Figure 17: Drowning deaths in NSW rivers by multiple fatality event, 2005/06-2014/15

## Hawkesbury River

The Hawkesbury River is more than 100km in length, running through Brooklyn, Wiseman's Ferry, Richmond and Windsor. It is located within the Hawkesbury-Nepean catchment.

Between 1 July 2005 and 30 June 2015, 15 people drowned in the Hawkesbury River.

### Demographics

Males accounted for 93.3% of all drowning deaths in the Hawkesbury River. More than half of people who drowned were aged 18-34 years (60.0%), while over a quarter (26.7%) were 55 years or older and a further 13.3% were aged 35-54 years (Figure 18).

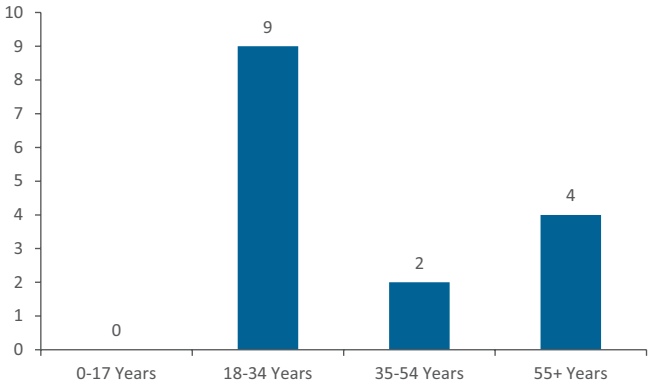


Figure 18: Drowning deaths in the Hawkesbury River by age, 2005/06-2014/15

More than half of deaths occurred among people born in Australia (53.3%), with 46.7% born overseas, including 28.6% of these in India (Figure 19).

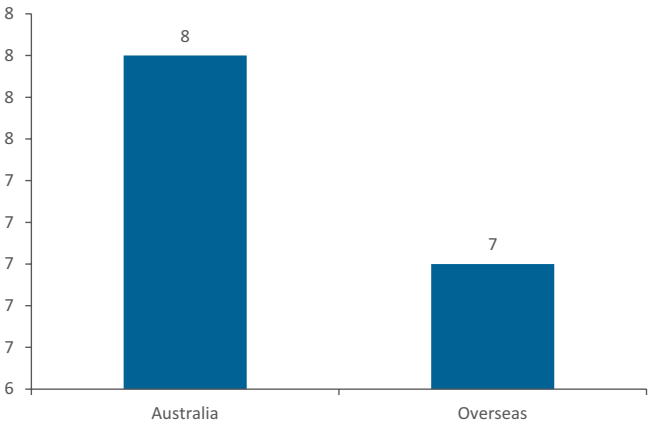


Figure 19: Drowning deaths in the Hawkesbury River by country of birth, 2005/06-2014/15

### Time of drowning deaths

Drowning occurred throughout the year in the Hawkesbury River, with just over a quarter occurring during summer, winter and spring (26.7% each) (Figure 20). Drowning deaths in the Hawkesbury River were significantly more likely to occur in winter than any other season ($X^2$=5.1, p<0.05).

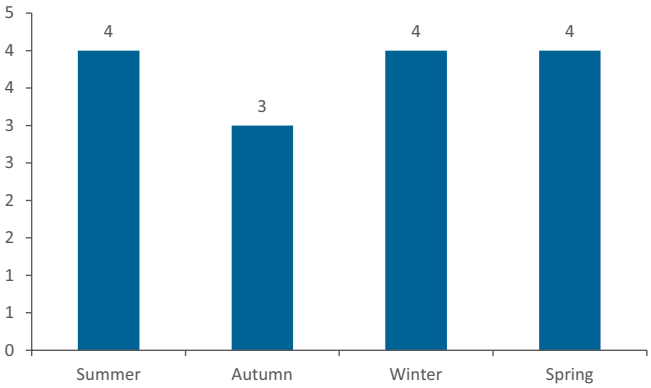


Figure 20: Drowning deaths in the Hawkesbury River by season, 2005/06-2014/15

The highest number of drowning deaths occurred on weekends, with 20.0% of incidents occurring on both Saturdays and Sundays (Figure 21).

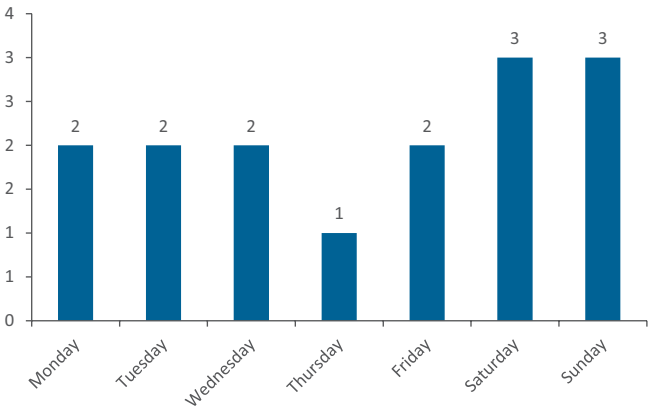


Figure 21: Drowning deaths in the Hawkesbury River by day of the week, 2005/06-2014/15

More than half of deaths occurred in the afternoon, between 12:01pm and 6pm (60.0%). The time of drowning was unknown for one case (Figure 22).

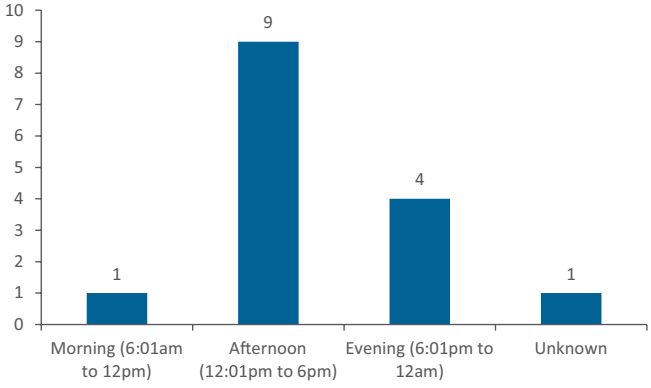


Figure 22: Drowning deaths in the Hawkesbury River by time, 2005/06-2014/15

## Location and activity

Of the 15 drowning deaths in the Hawkesbury River, 26.7% occurred at Windsor and a further 20.0% occurred at Wiseman's Ferry.

Among drowning deaths in the Hawkesbury River, almost half occurred in areas classified as inner regional (46.7%) and a third in outer regional areas (33.3%) (Figure 23).

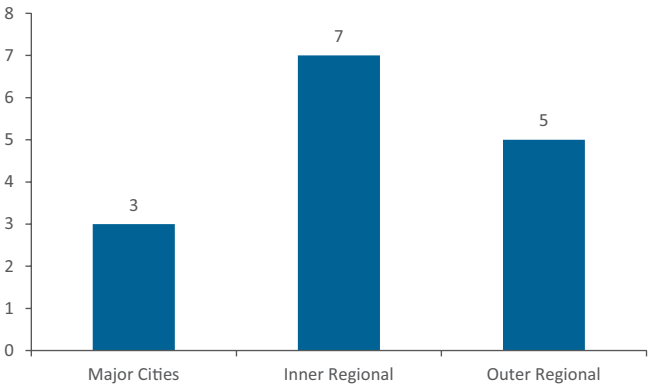


Figure 23: Drowning deaths in the Hawkesbury River by remoteness classification of incident, 2005/06-2014/15

A third of deaths occurred while swimming and recreating (33.3%), making it the leading activity prior to drowning in the Hawkesbury River. A further 26.7% of incidents occurred while boating and 13.3% following an unexpected fall into water or a jump into water (Figure 24). Drowning deaths in the Hawkesbury River were significantly more likely to occur while boating than while undertaking any other activity ($X^2$=4.8, p<0.05).

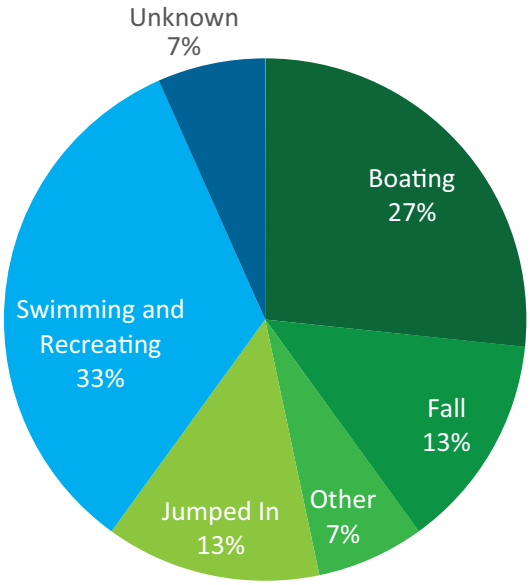


Figure 24: Drowning deaths in the Hawkesbury River by activity, 2005/06-2014/15

## Risk factors

Two thirds of deaths were known to involve alcohol (66.7%), with alcohol deemed to be contributory in 70.0% of these cases (BAC ≥0.05%) (Figure 25).

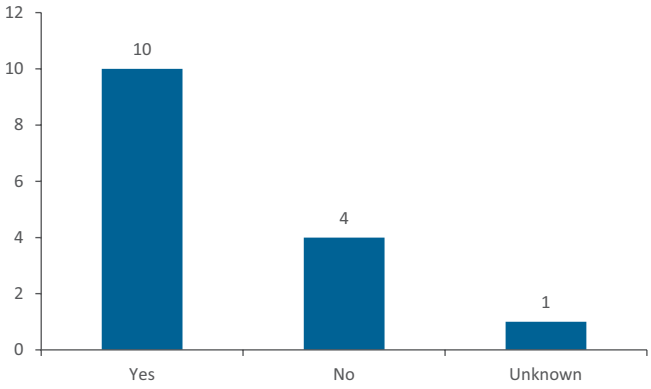


Figure 25: Drowning deaths in the Hawkesbury River by presence of alcohol, 2005/06-2014/15

Almost half of deaths were known to involve drugs (46.7%). Of these, 28.6% involved legal drugs, 57.1% illegal drugs and 14.3% both legal and illegal substances (Figure 26).

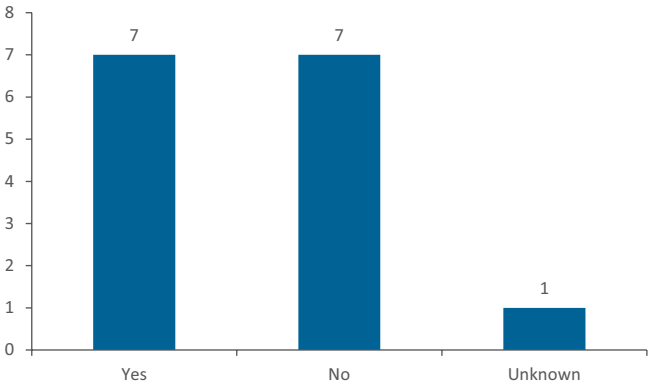


Figure 26: Drowning deaths in the Hawkesbury River by presence of drugs, 2005/06-2014/15

## Macquarie River

The Macquarie River is within the Macquarie-Bogan catchment, in central-west NSW. It begins in the Great Dividing Range south of Bathurst, before joining the Barwon River near Brewarrina.

Between 1 July 2005 and 30 June 2015, 4 people drowned in the Macquarie River. When compared to the other rivers in NSW included in this report, the number of recorded deaths is low. As such, caution is advised when interpreting the results in this section of the study.

### Demographics

Males accounted for three quarters (75.0%) of drowning deaths, with all cases involving people born in Australia (100.0%).

### Time of drowning deaths

Three quarters of drowning deaths occurred in summer (75.0%), with 50.0% of incidents occurring on weekends (Saturday or Sunday). Half of incidents (50.0%) occurred in the afternoon, between 12:01pm and 6pm.

### Location and activity

Of the 4 drowning deaths in the Macquarie River, 50.0% occurred at South Dubbo Weir.

Half (50.0%) of the drowning deaths occurred in areas classified as 'inner regional', with the remaining incidents recorded in outer regional or remote areas.

Half of deaths in the Macquarie River occurred following an attempted rescue (50.0%). Other identified activities included swimming and recreating (25.0%) and boating (25.0%) (Figure 27).

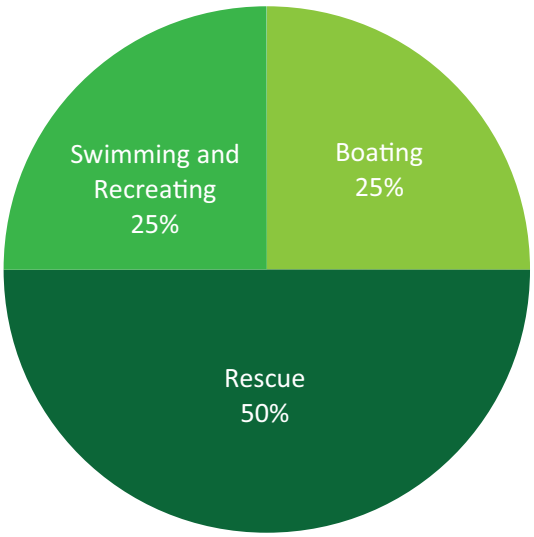


Figure 27: Drowning deaths in the Macquarie River by activity, 2005/06-2014/15

### Risk factors

Alcohol was known to be present in 25.0% of cases. However, this information was not available in a further 50.0% of cases (Figure 28).

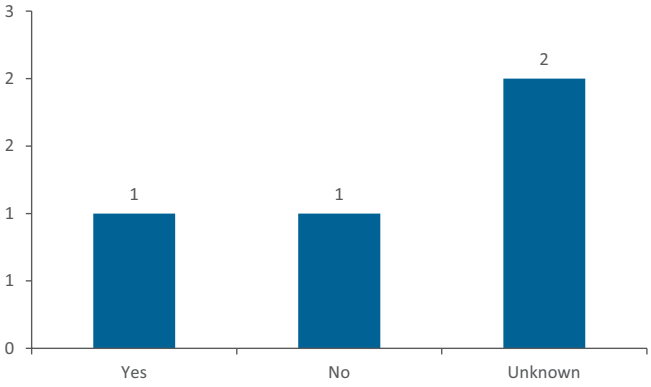


Figure 28: Drowning deaths in the Macquarie River by presence of alcohol, 2005/06-2014/15

No drowning deaths in the Macquarie River were known to involve drugs, although this information was not available in 50.0% of cases (Figure 29).

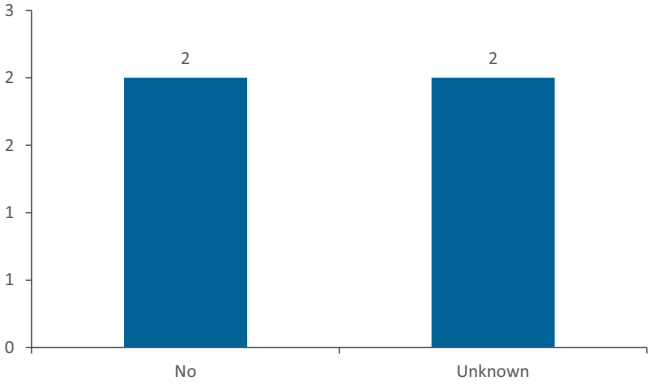


Figure 29: Drowning deaths in the Macquarie River by presence of drugs, 2005/06-2014/15

## Murrumbidgee River

The Murrumbidgee River is more than 1600km in length and is located in the Murrumbidgee catchment. It begins in the Kosciuszko National Park and continues to its junction with the Murray River near Balranald.

Between 1 July 2005 and 30 June 2015, 15 people drowned in the Murrumbidgee River. It should be noted that 2 of these deaths (13.3%) occurred within the ACT.

### Demographics

Males accounted for 93.3% of drowning deaths in the Murrumbidgee River. People aged 18-34 years were the leading age group for drowning, accounting for 40.0% of deaths, followed by people aged 35-54 years (33.3%) (Figure 30).

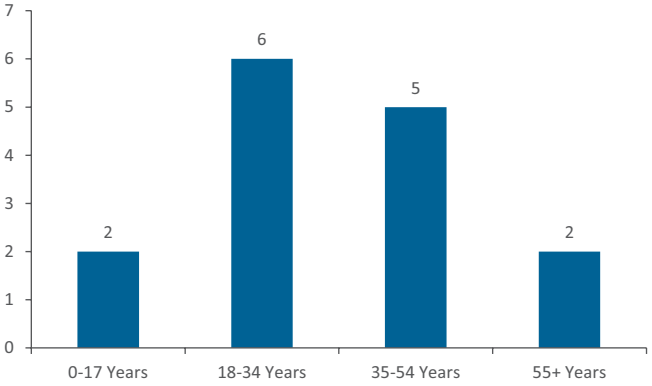


Figure 30: Drowning deaths in the Murrumbidgee River by age, 2005/06-2014/15

Two thirds of deaths occurred among people born in Australia (66.7%), with a third (33.3%) born overseas (Figure 31).

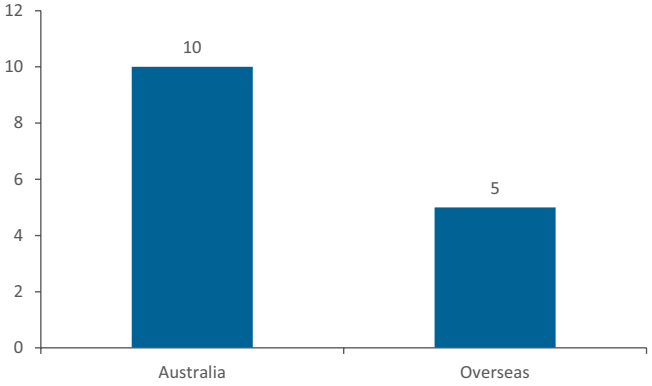


Figure 31: Drowning deaths in the Murrumbidgee River by country of birth, 2005/06-2014/15

### Time of drowning deaths

In the Murrumbidgee River, 80.0% of drowning deaths occurred in summer, with a further 13.3% occurring in spring (Figure 32). Drowning deaths in the Murrumbidgee River were significantly more likely to occur in summer than any other season ($X^2$=9.8, p<0.01).

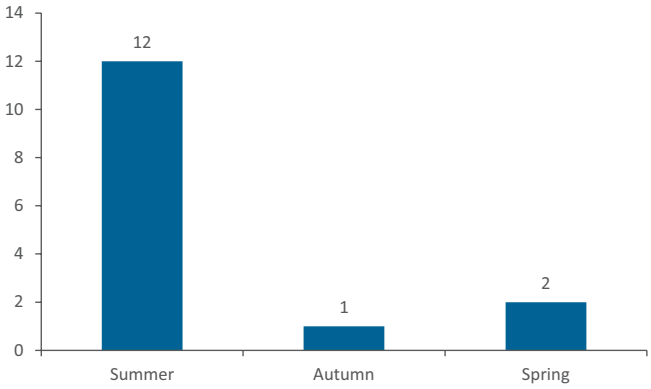


Figure 32: Drowning deaths in the Murrumbidgee River by season, 2005/06-2014/15

The highest number of drowning deaths occurred on weekends, with 26.7% of incidents occurring on both Saturdays and Sundays (Figure 33).

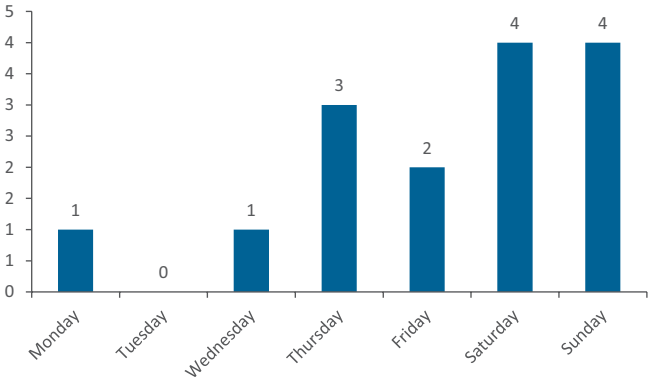


Figure 33: Drowning deaths in the Murrumbidgee River by day of the week, 2005/06-2014/15

The majority of deaths occurred in the afternoon, with 86.7% of incidents occurring between 12:01pm and 6pm (Figure 34).

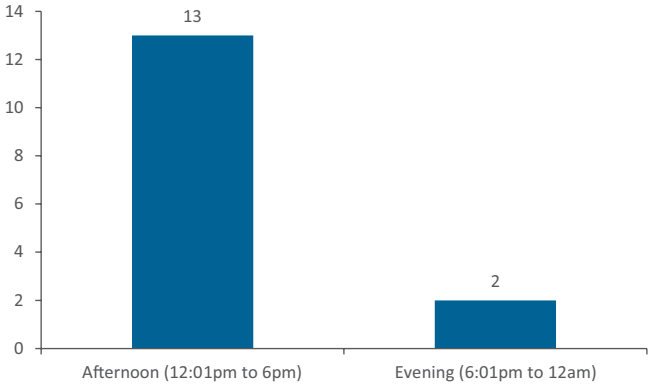


Figure 34: Drowning deaths in the Murrumbidgee River by time, 2005/06-2014/15

## Location and activity

Of the 15 drowning deaths in the Murrumbidgee River, 33.3% occurred at Wagga Wagga (including Wagga Wagga Beach) and 20.0% occurred at Darlington Point.

Among drowning deaths in the Murrumbidgee River, 46.7% occurred in both inner regional and outer regional areas. Only one incident occurred in an area classified as a 'major city' (Figure 35).

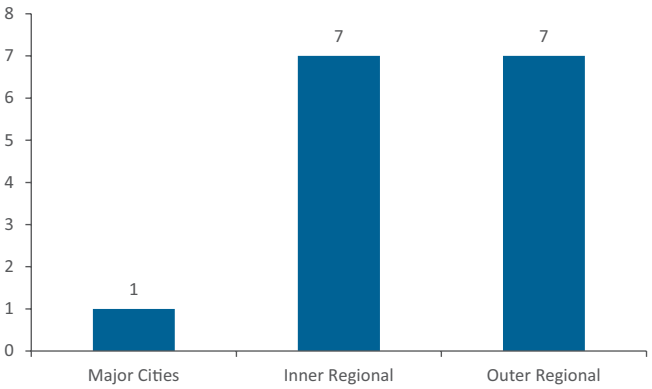


Figure 35: Drowning deaths in the Murrumbidgee River by remoteness classification of incident, 2005/06-2014/15

The leading activity prior to drowning in the Murrumbidgee River was swimming and recreating, accounting for almost three quarters of deaths (73.3%) (Figure 36). Drowning deaths in the Murrumbidgee River were significantly more likely to occur while swimming and recreating than while undertaking any other activity ($X^2$=6.0, p<0.05).

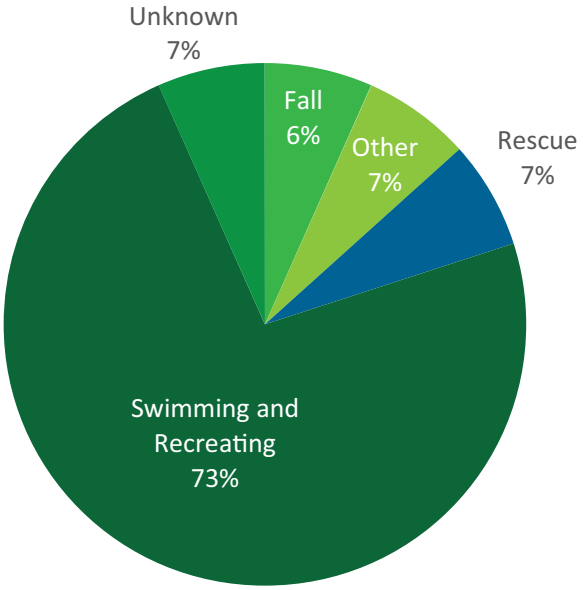


Figure 36: Drowning deaths in the Murrumbidgee River by activity, 2005/06-2014/15

## Risk factors

More than half of deaths were known to involve alcohol (55.3%), with alcohol deemed to be contributory in 37.5% of these cases (BAC ≥ 0.05%) (Figure 37).

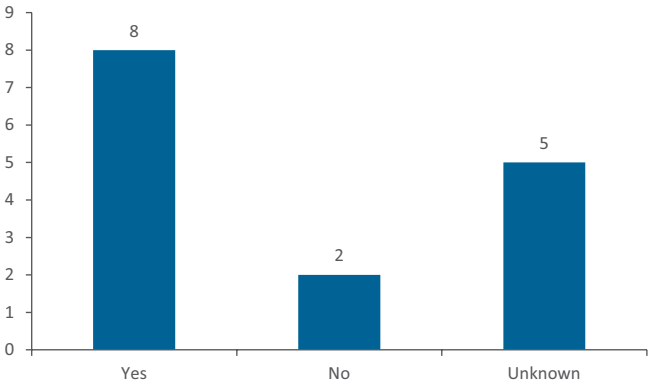


Figure 37: Drowning deaths in the Murrumbidgee River by presence of alcohol, 2005/06-2014/15

Drugs were known to be present in more than a quarter of cases (26.7%). Of these, 50.0% involved legal drugs and the remaining 50.0% involved both legal and illegal drugs (Figure 38).

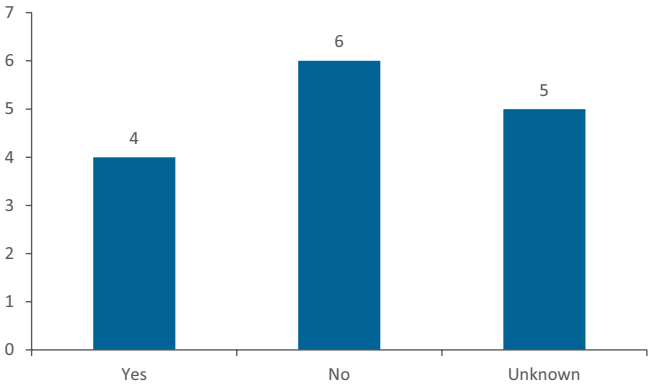


Figure 38: Drowning deaths in the Murrumbidgee River by presence of drugs, 2005/06-2014/15

## Nepean River

The Nepean River runs through Penrith and Camden and is home to the Bents Basin State Conservation Area. It is located within the Hawkesbury-Nepean catchment.

Between 1 July 2005 and 30 June 2015, 9 people drowned in the Nepean River.

### Demographics

Males accounted for 88.9% of drowning deaths in the Nepean River. More than half of people who drowned were aged 18-34 years (55.6%), followed by people aged 35-54 years and 55 years and over (22.2% each) (Figure 39).

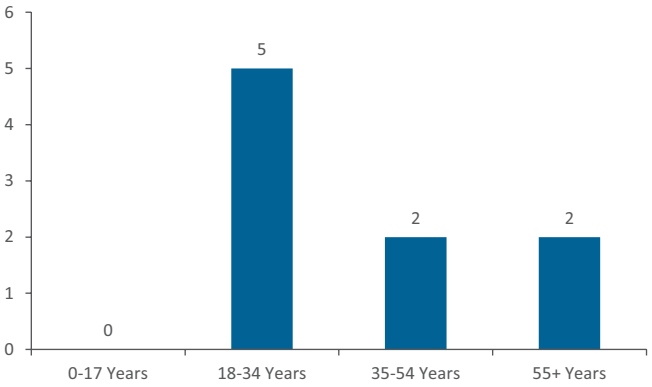


Figure 39: Drowning deaths in the Nepean River by age, 2005/06-2014/15

Almost half of deaths occurred among people born in a country other than Australia (i.e. born overseas) (44.4%) (Figure 40).

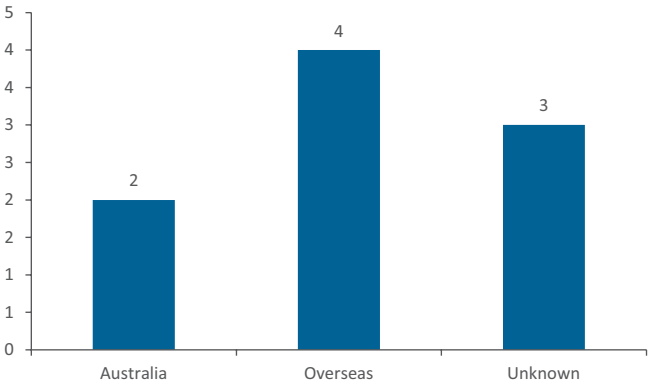


Figure 40: Drowning deaths in the Nepean River by country of birth, 2005/06-2014/15

### Time of drowning deaths

The most common time of year for drowning in the Nepean River was spring, accounting for more than half of deaths (55.6%). A further 22.2% of deaths occurred in summer (Figure 41). Drowning deaths in the Nepean River were significantly more likely to occur in spring than any other season ($X^2$=4.3, p<0.05).

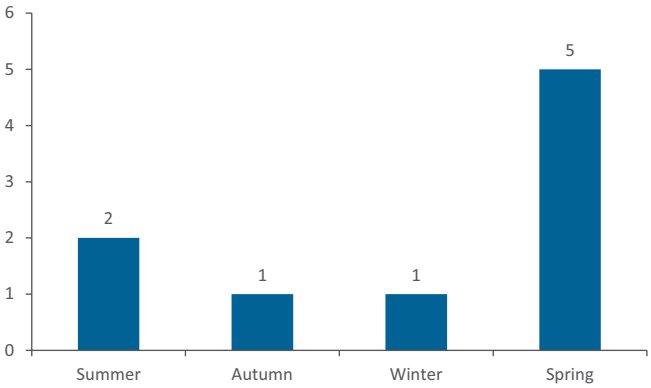


Figure 41: Drowning deaths in the Nepean River by season, 2005/06-2014/15

The highest number of incidents occurred on Saturdays, accounting for a third of incidents (33.3%), followed by Fridays (22.2%) (Figure 42).

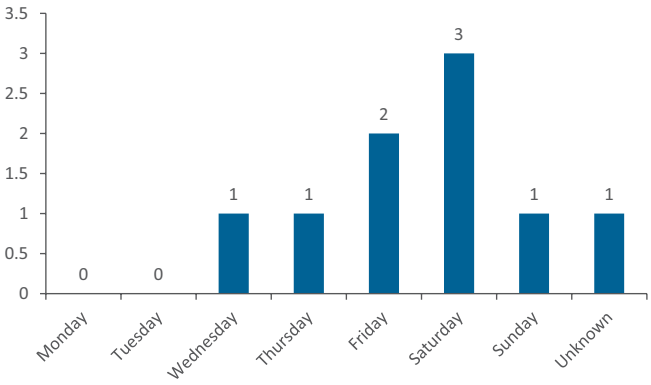


Figure 42: Drowning deaths in the Nepean River by day of the week, 2005/06-2014/15

More than half of deaths occurred during the afternoon (55.6%), between 12:01pm and 6pm, with a third (33.3%), occurring in the evening (Figure 43).

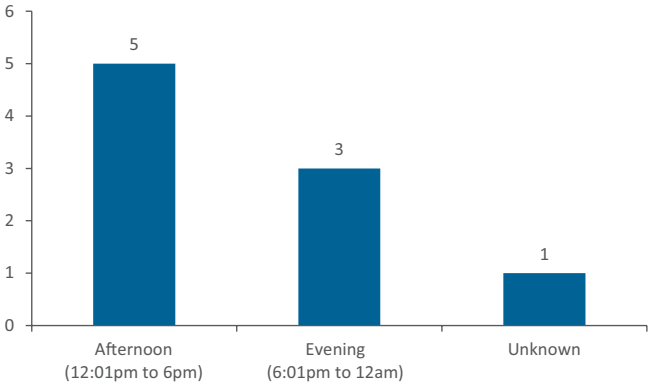


Figure 43: Drowning deaths in the Nepean River by time, 2005/06-2014/15

## Location and activity

Of the 9 drowning deaths in the Nepean River, 22.2% occurred in each of the following locations: Greendale, Penrith and Wallacia.

All drowning deaths in the Nepean River occurred in areas classified as 'major cities' (100.0%).

Almost half of people who drowned were swimming and recreating prior to drowning (44.4%). In 22.2% of cases the activity was unknown (Figure 44).

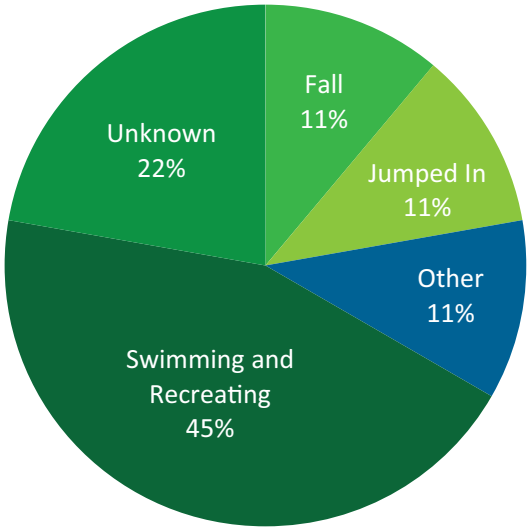


Figure 44: Drowning deaths in the Nepean River by activity, 2005/06-2014/15

## Risk factors

Alcohol was known to be present in more than half of drowning deaths (55.6%), with the level of alcohol recorded deemed to be contributory in 40.0% of these cases (BAC ≥ 0.05%) (Figure 45).

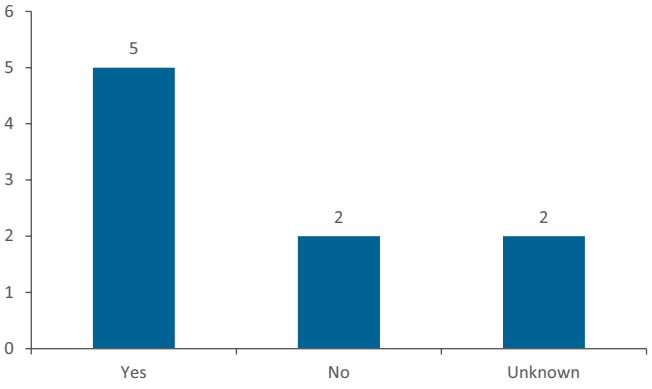


Figure 45: Drowning deaths in the Nepean River by presence of alcohol, 2005/06-2014/15

Drugs were known to be present in 11.1% of cases. However, this information was unavailable in 22.2% of cases (Figure 46).

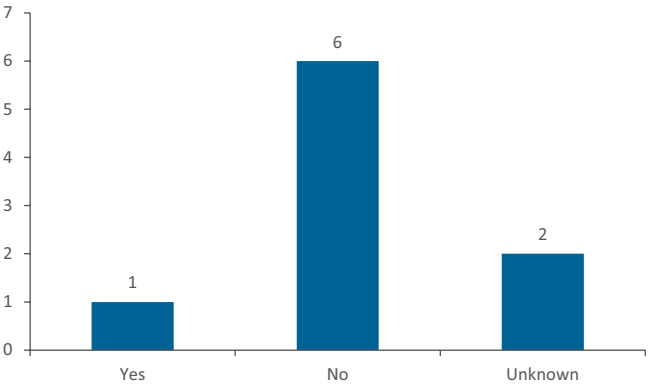


Figure 46: Drowning deaths in the Nepean River by presence of drugs, 2005/06-2014/15

# DISCUSSION

## Overall

The number of people drowning in each of the four rivers investigated (Hawkesbury River, Macquarie River, Murrumbidgee River and Nepean River) fluctuated over the study period, as did the crude drowning rate. Males are overrepresented in river drowning deaths, with young and middle-aged adults most commonly involved. It is interesting to note that there were no recorded drowning deaths among children aged 0-4 years or 10-14 years, and only one death among children between the ages of 5 and 9 years. It is clear that drowning deaths in rivers in NSW is largely an issue involving adolescents and adults, rather than young children.

Although Australia was the most common country of birth, more than a third of deaths occurred among people born overseas, highlighting the importance of drowning prevention strategies targeting people of all ethnic backgrounds. The most common countries of birth, excluding Australia, were India, Iran and Sudan, with almost all deaths among those born overseas occurring in people from a non-English speaking country. Indigenous people were also overrepresented in drowning deaths, with almost 5% of deaths occurring in Aboriginal or Torres Strait Islander people despite only making up 2.9% of the NSW population.

Although drowning deaths occurred in all seasons, the largest number of incidents was recorded in summer during the warmest months of the year. People most commonly drowned on the weekend, with deaths peaking on Saturdays and Sundays. More people drowned in the afternoon than during any other time of day. While drowning incidents were recorded throughout the year, this information identifies times of heightened risk, namely during the afternoon, on weekends, in summer.

The Hawkesbury and Murrumbidgee Rivers recorded the highest number of drowning deaths (15 deaths each), followed by the Nepean River (9 deaths) and the Macquarie River (4 deaths). The Royal Life Saving National Fatal Drowning Database contains all unintentional drowning deaths, beginning in the year 2002/03. Although outside the scope of this study, the number of drowning deaths during the years preceding this study was also examined. While the number of deaths per financial year was similar across three of the investigated rivers (Hawkesbury River, Murrumbidgee River and Nepean River) when the years before and during this study were compared, the number of drowning deaths in the Macquarie River differed more significantly. The highest number of drowning deaths in the Macquarie River occurred in 2003/04 (3 deaths) and as such, these deaths were not included in this report as the financial year fell outside of the studied time period.

The remoteness classification of incidents was largely determined by the geographical location of the rivers, with two thirds of incidents occurring in inner and outer regional areas. Given the significant proportion of incidents which took place outside of major cities, the importance of basic lifesaving skills should not be underestimated. Inland waterways are not patrolled by lifeguards and are often located some distance away from medical services.

Without expert trained assistance at hand, bystanders are often the only source of help available, highlighting the need for all individuals to have an understanding of basic rescue techniques. In order for bystanders to be able to attempt a rescue without putting themselves in danger, rescue equipment is required. Publically available rescue equipment may assist in facilitating safe rescues along NSW rivers. Although similar programs are already in place along the NSW coastline (17), these projects have not yet been expanded to include inland waterways.

In addition, emergency services may not be able to respond quickly, or at all, to incidents occurring in inland waterways. All people should have a working knowledge of cardiopulmonary resuscitation (CPR) and make sure they update their skills regularly in case of an emergency.

The leading activity prior to drowning was swimming and recreating, accounting for almost half of all deaths. Boating was another common activity, signifying the need for boating safety campaigns to extend beyond coastal environments. In a number of cases, the activity prior to drowning was unknown, suggesting the person was alone at the time and the incident was not witnessed. All people, regardless of age or experience, are advised against swimming alone. If an emergency situation arises, no one is around to either call for help or provide assistance themselves.

Alcohol and drug consumption are important risk factors in drowning deaths in rivers. More than half of drowning deaths were known to involve alcohol, with half of these involving a level of alcohol deemed contributory to the drowning event (BAC $\geq$ 0.05%). Alcohol consumption is known to lead to greater risk taking behaviour, impair judgement, coordination and reaction time, as well reducing the effectiveness of CPR should it be needed (18). Alcohol consumption continues to be a significant issue regarding drowning deaths in rivers. In comparison to many coastal environments, such as patrolled beaches, inland waterways often exist in less controlled locations, where regulations limiting alcohol consumption do not exist.

Acknowledging the burden of drowning on young and middle-aged males, Royal Life Saving's most recent campaign focused on males and the consumption of alcohol around inland waterways. The campaign 'Don't let your mates drink and drown', highlighted the risks of the Australian culture of drinking while swimming, boating or fishing and urged men to look out for one another (19).

Drugs were known to be present in more than a quarter of drowning deaths, with legal (prescription and over the counter medicines) and illegal (illicit or recreational substances) drugs reported. In some cases, people were found to have consumed both legal and illegal drugs. Of particular concern are people aged 35-44 years, who were significantly more likely to have consumed drugs compared to other age groups. Prescribed medicines should be taken as directed by the appropriate healthcare professional and this is particularly important for people with epilepsy (20). However, the consumption of illegal drugs is concerning, particularly the use of cannabis and methamphetamine.

More than a quarter of people who drowned had a pre-existing medical condition, most commonly cardiac conditions. It is important for people of all ages and fitness levels to be aware of their own limitations and attend regular medical check-ups to ensure medical conditions are diagnosed, treated and monitored according to best practice.

The majority of people who were boating prior to drowning were not wearing a lifejacket, although this information was not available in all cases. Previous research has shown the value of lifejackets, finding that they double the chance of survival once immersed in water (21). It would be worth investigating why people are choosing not to wear a lifejacket when boating on rivers and whether the reasons are different among those recreating in coastal environments, for example, do people perceive inland waterways to be safer than coastal waters and therefore, decide that a lifejacket is not needed in these types of aquatic environments?

## Comparison between rivers

The highest number of drowning deaths occurred in the Hawkesbury and Murrumbidgee Rivers, with 15 deaths recorded in each. In both of these rivers, males accounted for over 90% of incidents. Almost 90% of deaths occurred in males in the Nepean River and 75% in the Macquarie River. It should be noted that with only four recorded deaths in the Macquarie River during the study period, trends within this river system should be interpreted with caution.

People aged 18-34 years accounted for the largest number of deaths in the Hawkesbury, Murrumbidgee and Nepean Rivers, aligning with broad trends observed across all river systems combined, where the leading age groups for drowning were people aged 25-34 years and 18-24 years. The burden of drowning in inland waterways, namely rivers, in NSW falls disproportionately on young adults, highlighting the need for targeted prevention strategies aimed at this demographic.

The Macquarie River was the only river system where all those who drowned were born in Australia. In the Hawkesbury and Murrumbidgee Rivers, this proportion was between half and two thirds of people, while approximately a fifth of people who drowned in the Nepean River were born in Australia. However, the Nepean River was the only river where information on country of birth was not available in all cases, leading to a third of cases classified as 'unknown'. The differences in country of birth can be used to design prevention campaigns that are specific to unique cultural groups, ensuring optimal uptake of messaging within local communities.

More people drowned in summer than any other season in the Macquarie and Murrumbidgee Rivers. In the Nepean River the highest number of people drowned during spring, while drowning occurred more regularly throughout the year in the Hawkesbury River. Significant differences were observed regarding the season of drowning and the various river systems. Deaths in the Murrumbidgee River were significantly more likely to occur in summer, while deaths in the Nepean were more likely to occur in spring and in the Hawkesbury, deaths were more likely in winter.

The proportion of people drowning on the weekend was similar to those drowning on a weekday across all rivers, despite the difference in the number of days falling into each category (five weekdays per week compared to two weekend days per week). Across all rivers, more people drowned during the afternoon than any other time of day. All deaths in the Nepean River occurred in major cities, while inner and outer regional areas accounted for the highest number of deaths in the Hawkesbury, Macquarie and Murrumbidgee Rivers.

Identifying the most common locations for drowning along each river will assist in targeting localised messaging. It would also be worth investigating the most popular locations for swimming and recreating along each river and whether or not these align with the most common locations for drowning. That is, are the most common drowning locations also the most popular recreation sites, or are they the most common locations for other reasons, such as more dangerous conditions or more limited access to emergency aid and medical assistance.

Swimming and recreating was the leading activity prior to drowning in the Hawkesbury, Murrumbidgee and Nepean Rivers, all of which also recorded falls into water. Boating was a popular activity in the Hawkesbury River, while the proportion of 'unknown' activities was highest in the Nepean River. Drowning deaths in the Murrumbidgee River were significantly more likely to occur while swimming and recreating, while deaths in the Hawkesbury were more likely to occur while boating.

There was substantial variation in the proportion of cases involving alcohol and drugs when the different river systems were examined. The proportion of drowning cases where alcohol was known to be involved ranged from 25% in the Macquarie River, to almost 70% in the Hawkesbury River. Alcohol was present in approximately half of drowning deaths which occurred in the Murrumbidgee and Nepean Rivers. The proportion of deaths known to involve drugs was highest in the Hawkesbury River and lowest in the Macquarie River, although the Macquarie River also recorded the highest proportion of 'unknowns'.

Pre-existing medical conditions were present in a third of drowning deaths in the Murrumbidgee and Nepean Rivers and more than a quarter of incidents in the Hawkesbury River. It is difficult to gain a greater understanding of the role of pre-existing medical conditions in the Macquarie River, as this information was not available for any of the relevant cases.

## CONCLUSION

Drowning deaths occur every year in rivers around the state, including the Hawkesbury, Macquarie, Murrumbidgee and Nepean Rivers. This report has identified high risk populations, locations and activities, as well as times of heightened risk. Drowning deaths most commonly occurred during summer, on the weekend and during the afternoon.

Males are overrepresented in river drowning deaths, particularly between the ages of 18 and 34 years. A significant proportion of deaths occurred among people born overseas, most commonly from non-English speaking countries. The Hawkesbury and Murrumbidgee Rivers recorded the highest number of deaths, with the most common locations for drowning along each river identified. Alcohol and drug consumption are important risk factors for drowning, along with not wearing a lifejacket while boating, and recreating alone in often isolated environments.

In order to prevent such events in the future, drowning preventions strategies will need to be targeted and specific, noting the differences in local environments and communities. By identifying areas of increased risk regarding specific populations, locations and activities, finite resources can be more adequately utilised and distributed across the state.

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## ROYAL LIFE SAVING NSW CONTACT DETAILS:

Royal Life Saving maintains a network of offices throughout NSW to save lives in the community through education programs, vocational training, health promotion initiatives, aquatic risk management services, community development and participation in sport.

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