

# Drowning in Rivers, Creeks, Lakes and Dams

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A 10-year analysis:  
2011/12 to 2020/21



**ROYAL LIFE SAVING**  
AUSTRALIA

## 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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Australian Government

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### > OUR VISION

# A water-loving nation free from drowning.



[RoyalLifeSaving.com.au](https://RoyalLifeSaving.com.au)

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### ACKNOWLEDGEMENT OF COUNTRY

Royal Life Saving Society – Australia acknowledges the Traditional Owners of our national office in Ultimo, Sydney are the Gadigal people of the Eora nation. We pay our respects to Australia's First Nations cultural and spiritual connections to water, and acknowledge the land where we work, live, and play always was and always will be Aboriginal land.



**ROYAL LIFE SAVING**  
AUSTRALIA

924

## PEOPLE DROWNED IN RIVERS, CREEKS, LAKES AND DAMS 2011/12 TO 2020/21



**34%**  
of all drowning deaths  
in Australia



**92**  
people every year



**80%**  
of all drowning deaths  
were males

### Top age groups

**18%**

25 – 34 years

**14%**

35 - 44 years

**12%**

45 - 54 years

### Where

**73%**

river/creek

**27%**

lake/dam

**5%**

national parks/state  
conservation areas

### Distance travelled



**40%** drowned within 0 - 20km of where they lived

## When



**39%**  
Summer



**44%**  
Afternoon



**32%**  
During school holidays



**7%**  
During public holidays

## Activity



**22%**  
Swimming & recreating



**19%**  
Fall into water



**17%**  
Boating & watercraft



**8%**  
Flood-related

## Top inland locations for drowning



## ➤ EXECUTIVE SUMMARY

This report presents an update on the two previous reports that Royal Life Saving has published on drowning deaths in rivers and creeks [1], lakes and dams [2]. Rivers, creeks, lakes and dams are a focus area of the Australian Water Safety Strategy 2030 [3], with the goal to reduce drowning deaths by half in these locations by 2030.

This analysis reported more than a third of drowning deaths occur in rivers, creeks, lakes and dams (hereafter referred to as 'inland' waterways), and overall, 25% of total drowning deaths occurred in rivers/creeks, continuing to be the leading location for drowning in Australia.

The fatal drowning rate across all inland locations has remained steady at 0.4 per 100,000 population, accounting for 94 deaths each year. Key populations that are drowning at inland waterways include males aged between 25 and 44 years, and people born overseas.

The top 10 river drowning blackspots across Australia have not changed drastically over this ten-year period. The Murray River remains the leading river blackspot for drowning across New South Wales (NSW), Victoria (VIC) and South Australia (SA), with the Yarra River in Melbourne (VIC), Hawkesbury River in Sydney (NSW), the Murrumbidgee River in ACT and the Swan River in Perth, Western Australia (WA) accounting for the top five deadliest rivers in Australia. The top three lakes/dams for drowning include Lake Eildon in VIC, Lake Macquarie and St Georges Basin in NSW.

Visitation data has provided new insights into frequency and exposure of people attending inland waterway locations around the country. This information allows better targeting of prevention strategies to the people who actually go to those locations, including both locals and domestic visitors. On average, people spend about two hours at an inland waterway. While the highest number of people who drowned at inland waterways live within 20km, 21% were visitors who had travelled 100km or more, indicating there is a need to increase awareness and promotion of safety in, on and around inland water among both travellers and locals alike. Sadly, 9% of people drowned at their place of residence, most frequently among young children and people aged 65+ years due to an unintentional fall into water.

School holidays, especially in the summer, were a prime time for drowning among both children and adults (32% overall, 54% during the summer) and a further 7% occurred on public holidays (including long weekends). This indicates an increased risk when people are off school and work, and may be away on holiday with family and friends.

Fifty-eight per cent of drowning at inland waterways occurred in locations classified as inner and outer regional area, with a further 12% in remote and very remote locations. Royal Life Saving research has found that drowning rates in regional and remote locations are higher than in major city locations [3, 4]. This study reported that 5% of inland waterway drowning was recorded to have occurred in National Parks / State Conversation areas and a further 5% drowned at a waterfall or swimming hole. These locations are often in more isolated and remote locations that may be difficult to raise the alarm and take longer for emergency services to get to due to mobile reception and accessibility.

This study has provided a current analysis of inland waterways, including rivers, creeks, lakes and dams which have been reported on separately in the past. While much has been done in the past 10 years to increase knowledge, awareness and prevention efforts around rivers specifically, the overall rates of drowning at inland waterways have not changed. This report has identified new themes including visitor profiles, specific locations (e.g., national parks and waterfalls) and summer drowning trends.

It is hoped that the findings from this report will enhance existing drowning prevention initiatives and identify any new areas or risk factors to better target drowning prevention strategies and partnerships focusing on reducing inland waterways by half by 2030.

## ➤ BACKGROUND

Royal Life Saving's first report exploring drowning deaths in rivers was published in 2014, presenting a 10-year analysis (2002/03 – 2011/12) of drowning deaths that occurred in rivers and creeks [1, 5]. This provided the first comprehensive analysis of river drowning identifying the burden of drowning relative to other aquatic locations, who drowns in rivers, where river drownings occur, and other key risk factors such as alcohol and flooding.

This report was the catalyst for a body of research exploring fatal drowning and drowning risk in river locations led by Dr Amy Peden as part of a PhD partnership between Royal Life Saving and James Cook University [6]. This research informed the development of a national river drowning prevention campaign 'Respect the River' and underpinned subsequent inland waterway safety campaigns, in particular targeting males and risk-taking behaviour (such as Make The Right Call).

Informed by this research, inland waterways, specifically rivers, were included as a priority area for reducing drowning in the Australian Water Safety Strategy 2016-2020 [7], a 34% decrease was reported in 2019 against the baseline [8]. Despite this reduction, rivers and inland waterways remain a target location for drowning prevention. The Australian Water Safety Strategy 2030 identifies priority areas for reducing drowning, with rivers and lakes included as one of the 15 focus areas to target as part of drowning prevention efforts by 2030 [3].

While rivers and creeks had been examined, a gap was identified in knowledge of drowning in lakes and dams, as the other key inland waterway locations where people drown. A report published by Royal Life Saving in 2020 focused on lakes and dams (2008/09 to 2017/18), reported the highest rates of drowning in lakes and dams occurred among young children (0 – 4 years) and people living in remote and very remote locations [2].

A subsequent journal article was published comparing the differences in drowning profile between river and lakes [9]. Key differences were found including: children were more likely to drown in a lake or dam, compared to adults; drowning deaths in lakes and dams occurred most frequently in the morning, compared to a higher number of deaths in the evening at rivers; and a higher proportion of alcohol-related deaths were reported in rivers compared to lakes





Timeline of research, policy and advocacy focusing on inland waterways 2014-2022

### What we have learnt

- Rivers as a single location (as opposed to other locations) are the leading contributor to Australia's unintentional fatal drowning burden.
- Being male, consuming alcohol, flooding and living outside of major cities were identified as contributing factors for drowning in rivers.
- Rivers and lakes have different age and activity risk profiles for drowning.
- Risk of drowning is significantly elevated for both lakes and rivers in very remote areas, when compared to major cities.
- Both males and females are attending inland waterways and consuming alcohol, however research suggests that females are more risk averse and may not enter the water as frequently as males [10].



## Geography

- The top 10 longest rivers in Australia make up over 12,000km of waterways [11]
- The Murray-Darling River Basin (Murray River and the Darling River) is the longest continuous river system in Australia covering more than one million square kilometres, or about 14 per cent of Australia, flowing down most of the east-coast of Australia [12].

## AIMS

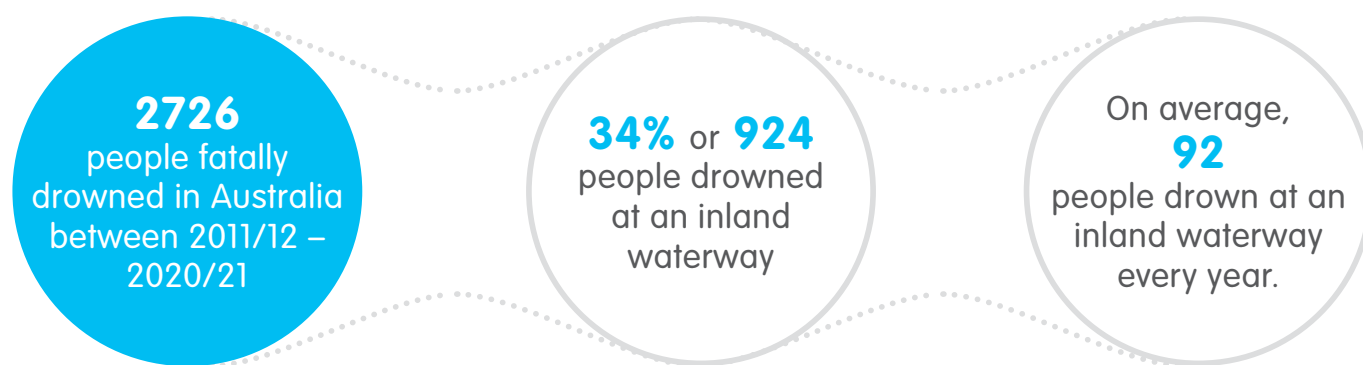
### The aims of this study were to:

- Provide an update on fatal drowning occurring in both rivers and lakes across Australia
- Identify new trends for drowning at inland waterway locations
- Provide recommendations for drowning prevention across research, policy and advocacy aligning to the Australian Water Safety Strategy 2030

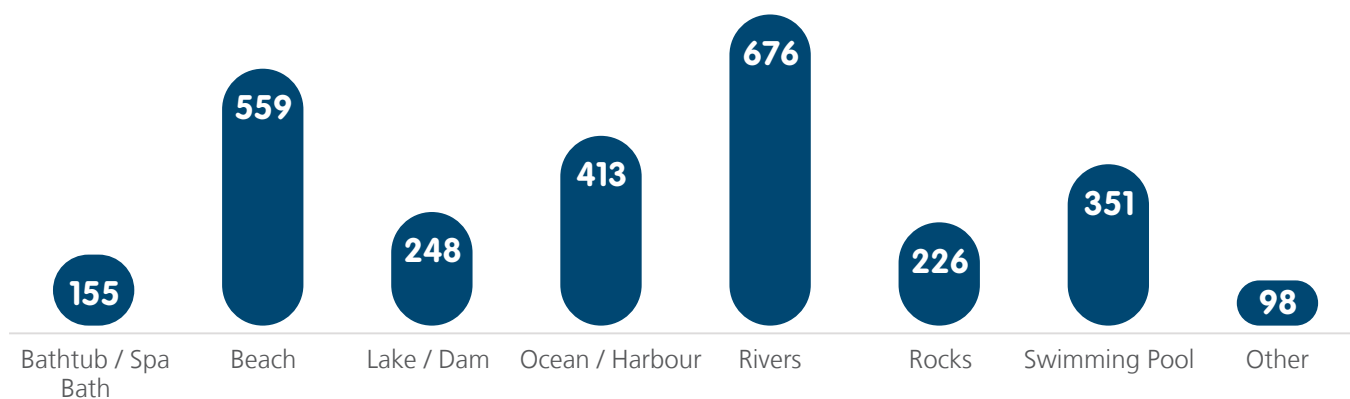


Murray River

## > RESULTS

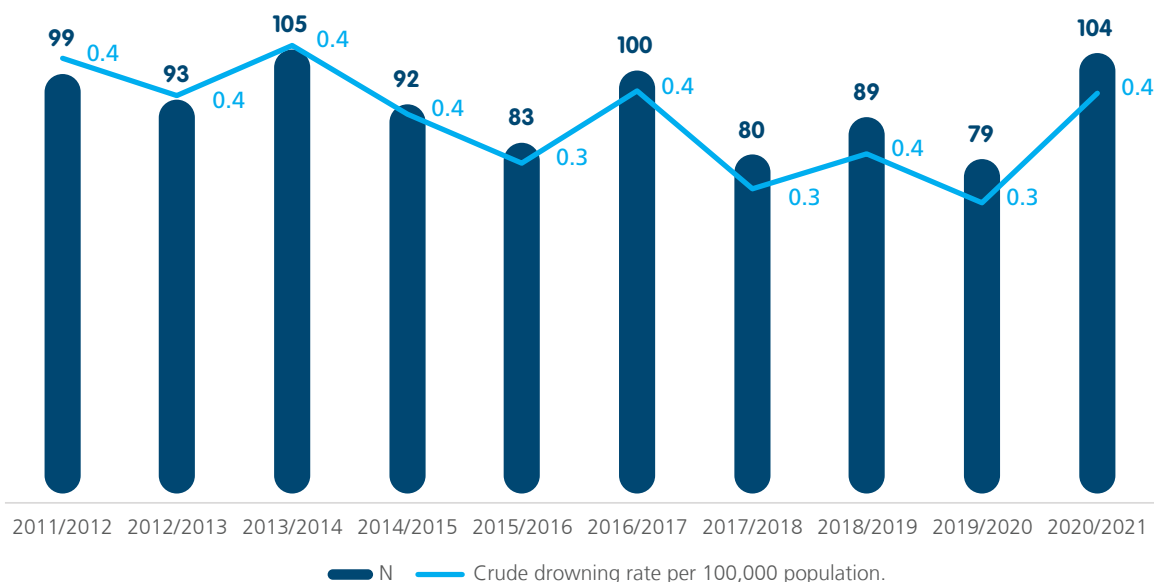


Number of drowning deaths by location 2011/12 to 2020/2

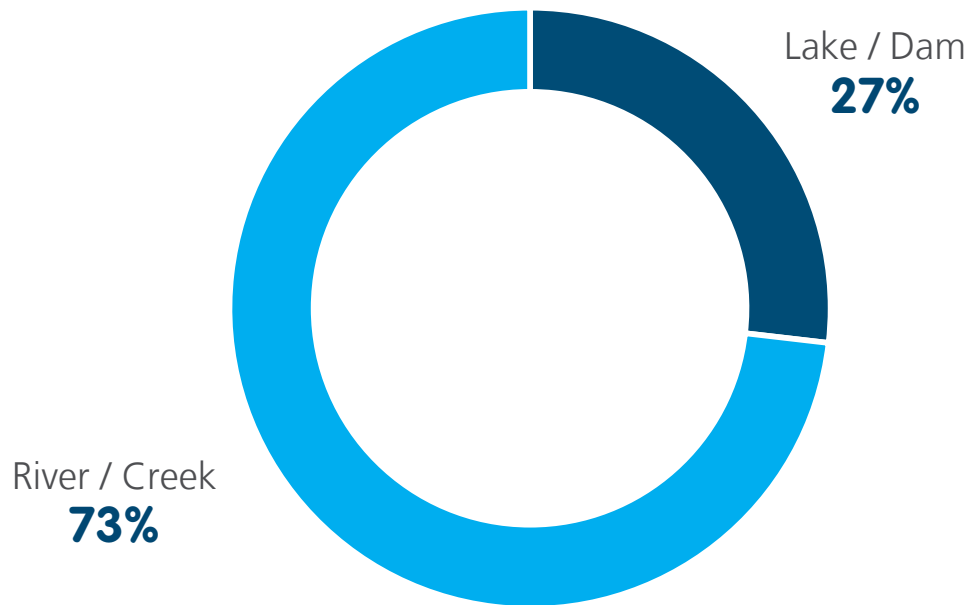


The highest number was recorded in 2013/14 (n=105) and the lowest number in 2019/20 (n=79), however this was followed by the second highest recorded in 2020/21 (n=104). Drowning rates for rivers and lakes have remained steady over the past decade, at a crude rate of 0.4 deaths per 100,000 population.

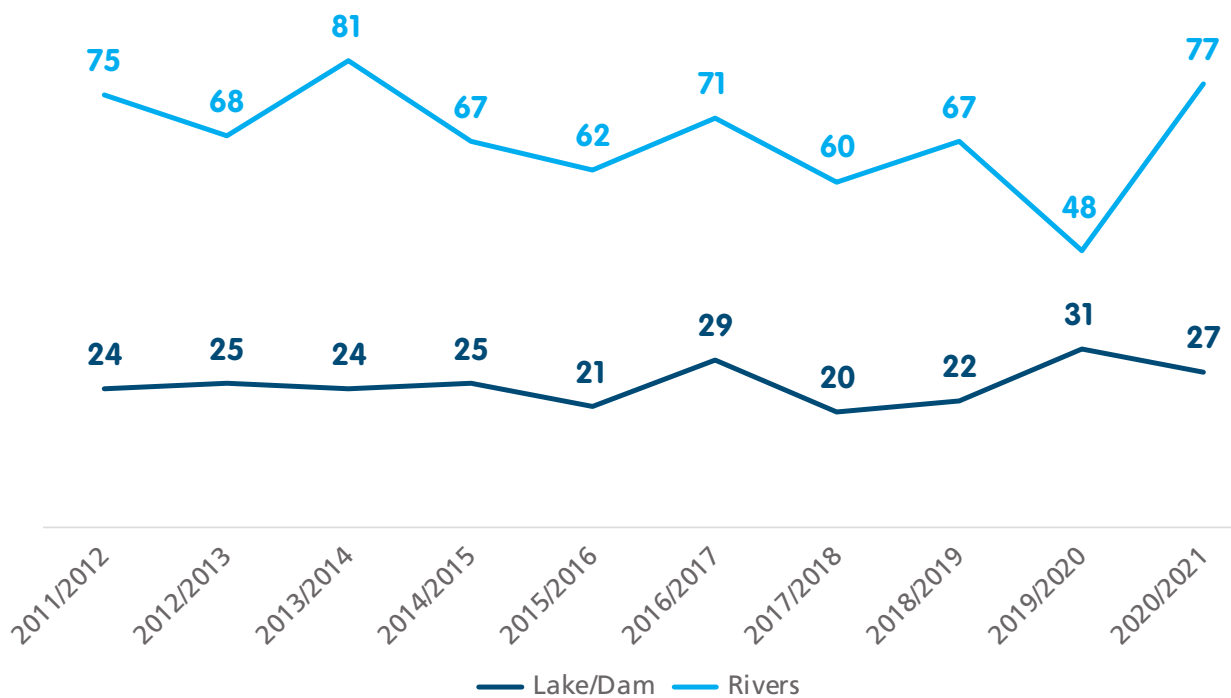
Unintentional drowning deaths and crude drowning rates at inland waterway locations



Breakdown of inland drowning deaths by waterway type



Number of drowning deaths by waterway type and financial year 2011/12 to 2020/21



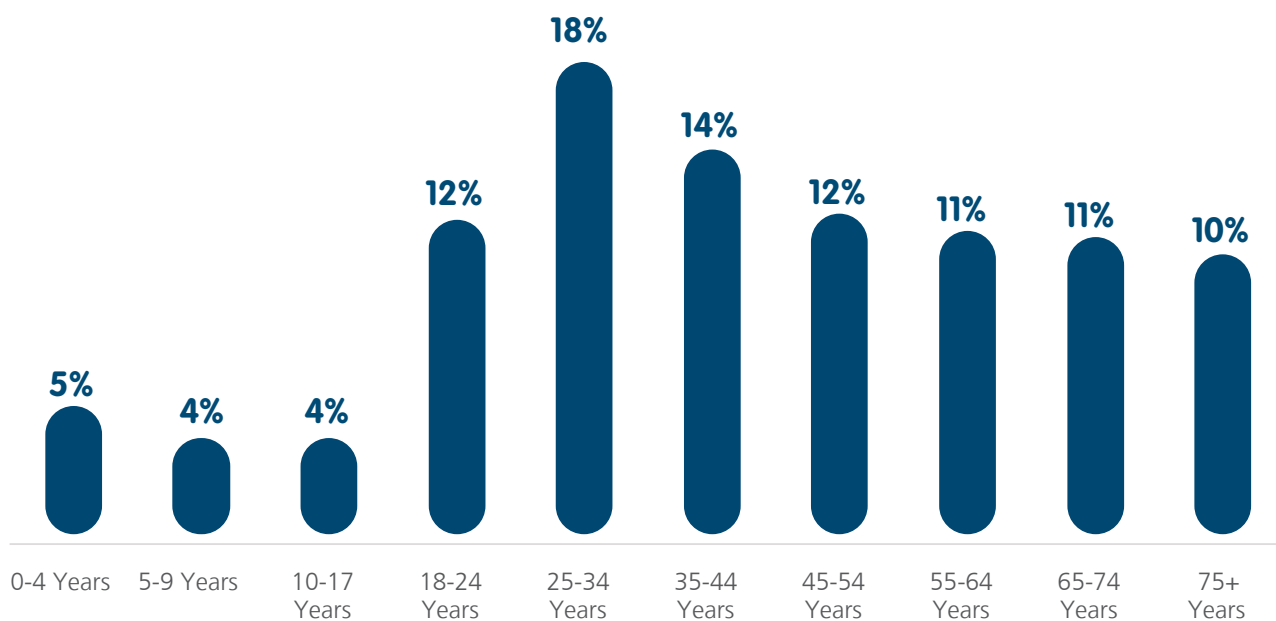
## > WHO IS DROWNING



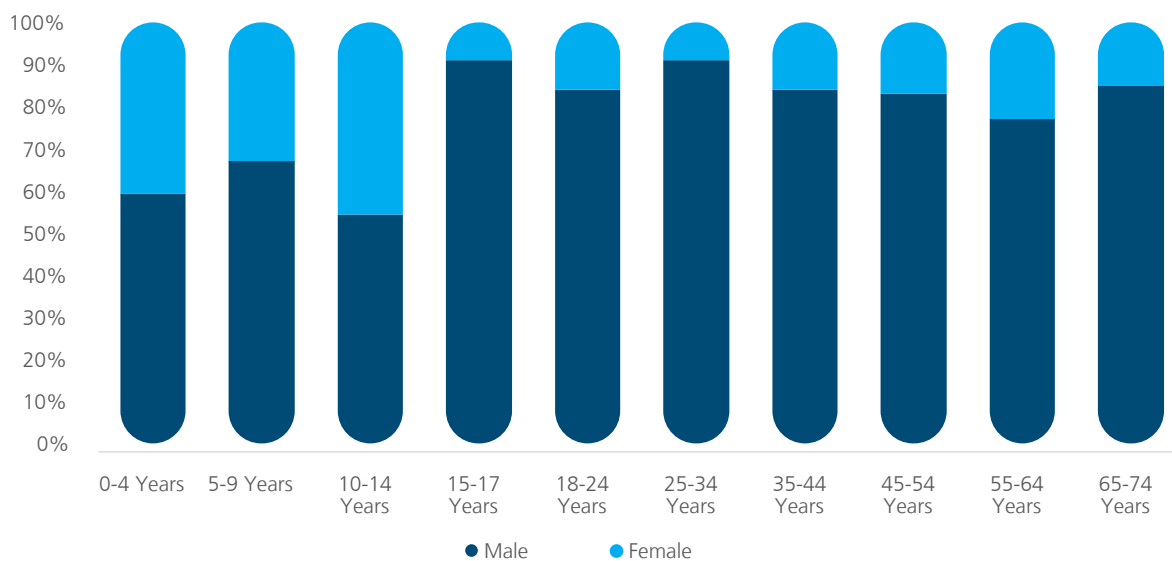
**81%**

of all drowning deaths in inland waterways were males

Drowning deaths at inland waterways by age group 2011/12 to 2020/21

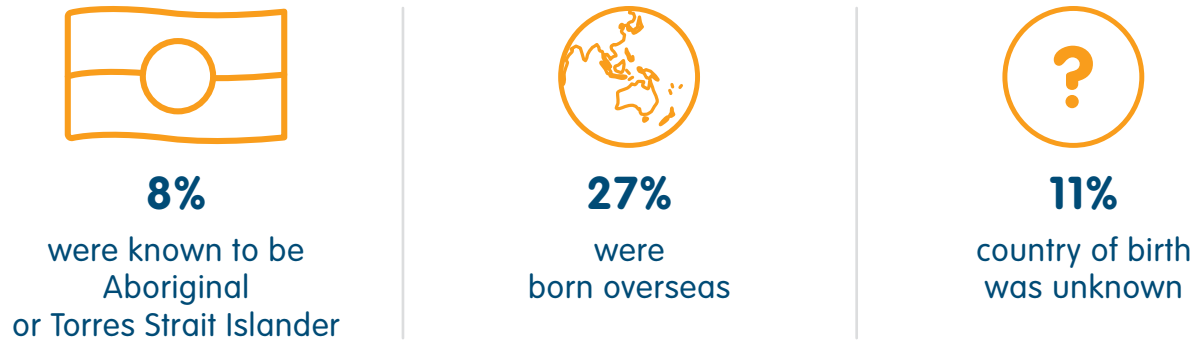


Drowning deaths at inland waterways by age group and sex



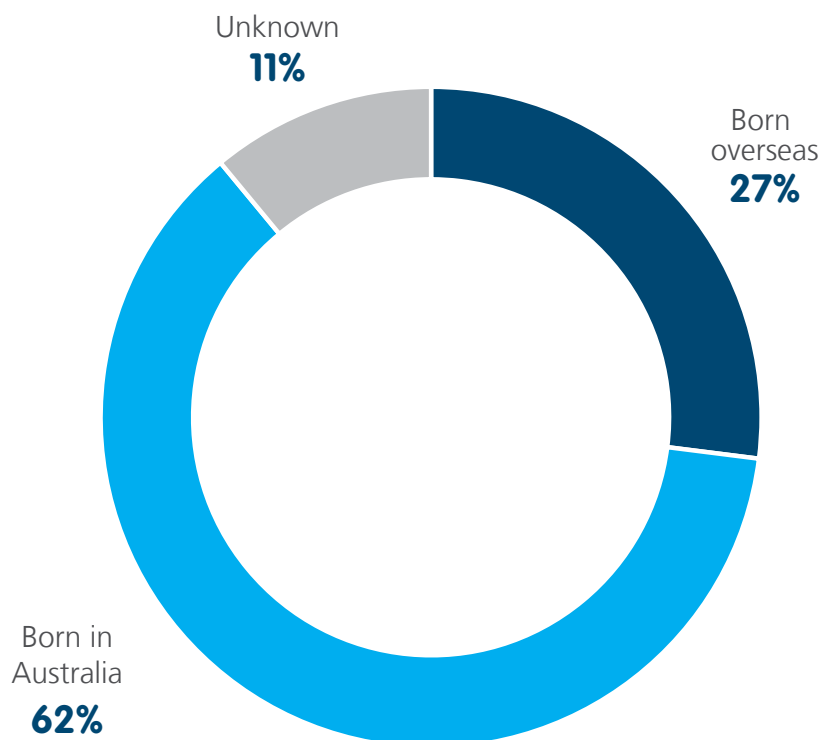
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Country of birth



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Drowning deaths at inland waterways by country of birth



## Child drowning at inland waterways

- > 110 children aged 0 - 17 years drowned at inland waterways.
- > On average, 11 children drown at an inland waterway every year.
- > More females than males drowned among children aged 0 - 14 years when compared to all other age groups.
- > Drowning among children under five most commonly occurred due to an unintentional fall, compared to older children who were swimming and recreating.

### Children 0 – 4 years

50%

drowned in a dam

35%

drowned within the home environment

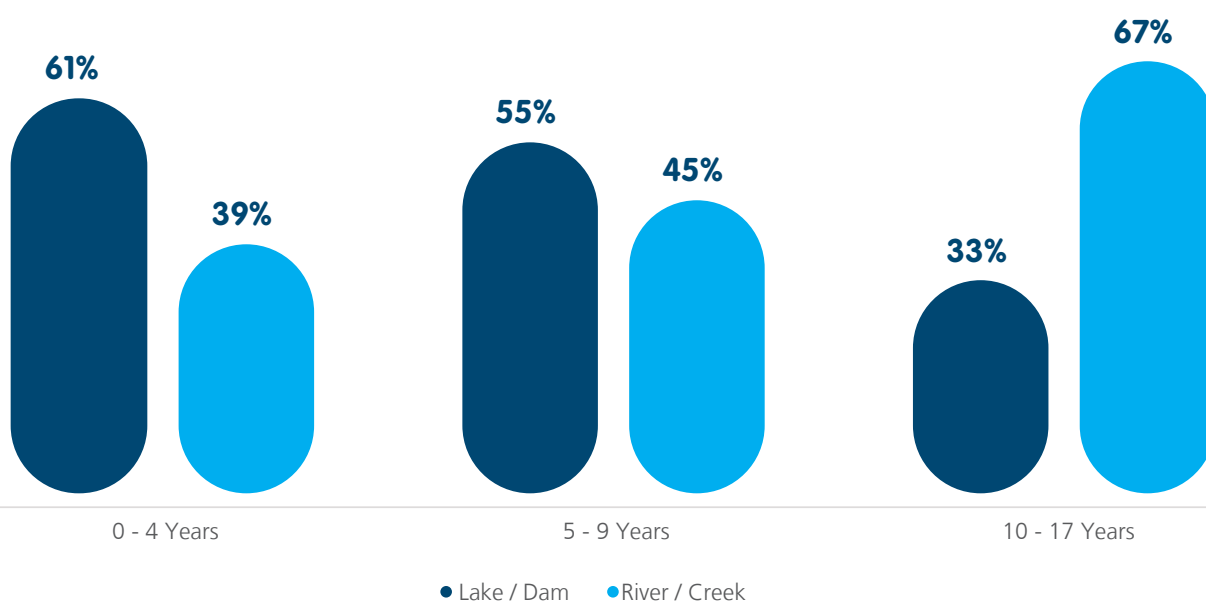
31%

drowned within 5km from home

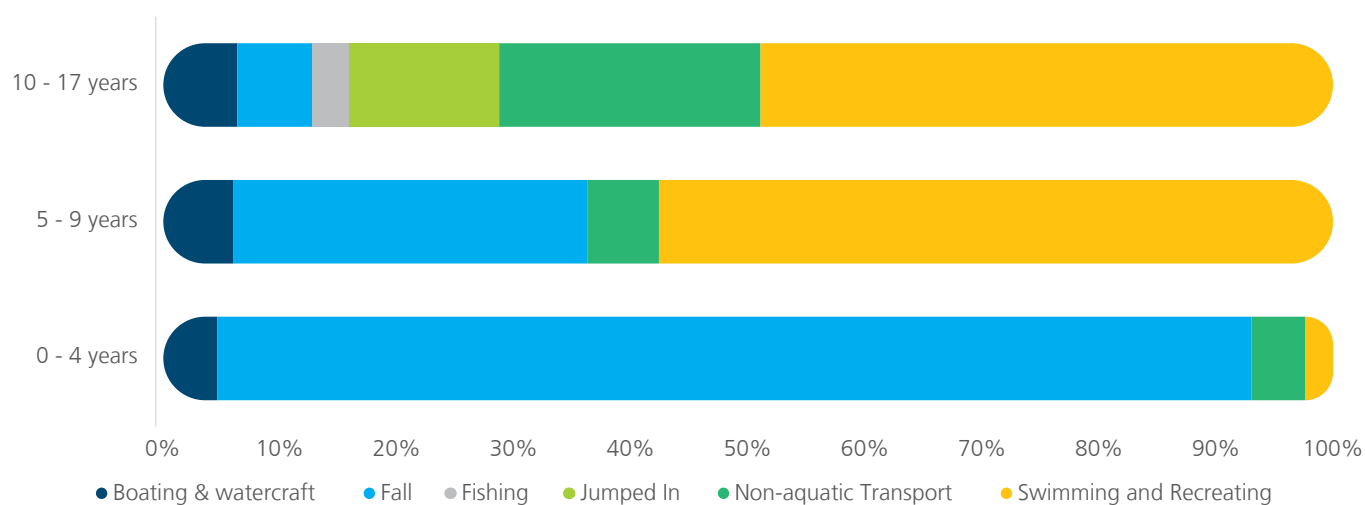
86%

were due to a fall into water

Child drowning at inland waterways by age group and type of waterway



### Child drowning at inland waterways by age group and activity being undertaken prior to drowning



Children aged 0 - 9 years were more likely to drown in a lake or dam than older children aged 10 - 17 years who were more likely to drown in a river or creek.



## > WHEN AND WHERE DO PEOPLE DROWN?

Drowning in rivers and lakes most commonly occurred



**39%**

in Summer

15% January / 14% December



**21%**

on a Sunday

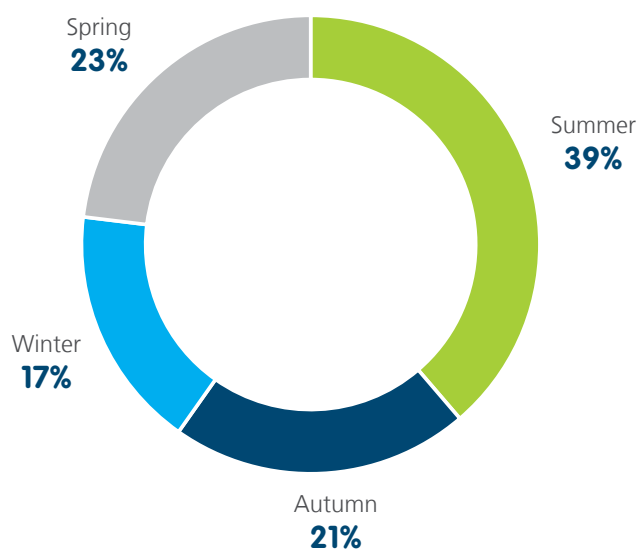


**44%**

in the afternoon

There were no differences in season, month, day or time of drowning when analysed by location.

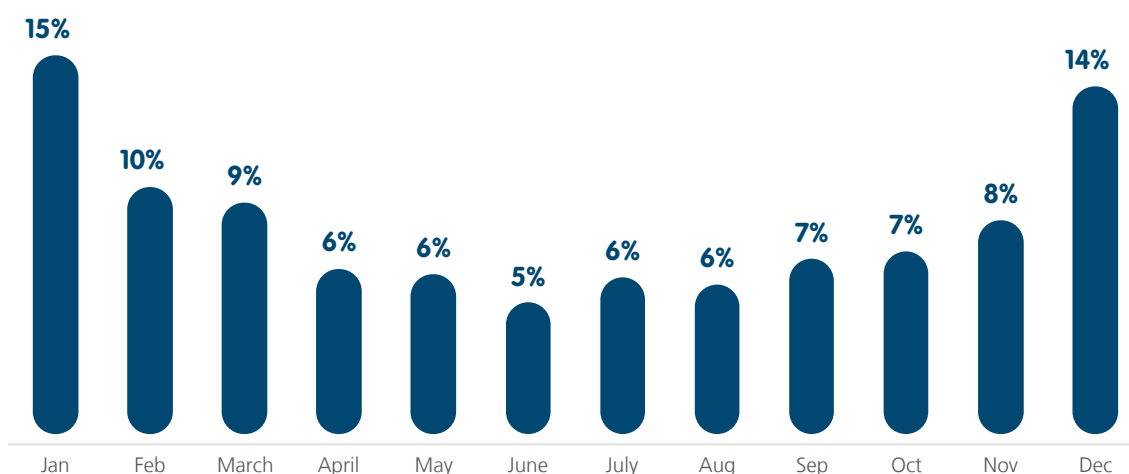
Drowning deaths at inland waterways by season



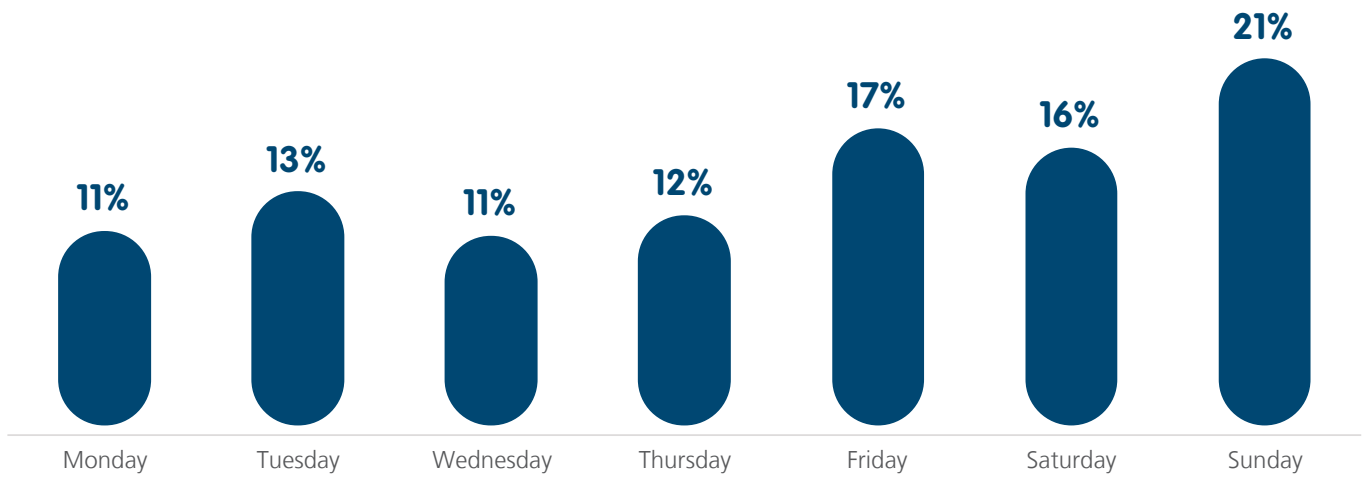
### Holidays

- > 7% of drowning deaths were recorded to have occurred on public holidays, which also included public holiday long weekends.
- > 32% of drowning deaths were recorded to have occurred during the school holiday period (both adults and children)
- > 34% of drowning deaths among children aged 5 – 17 years occurred during a school holiday period for their state of residence.

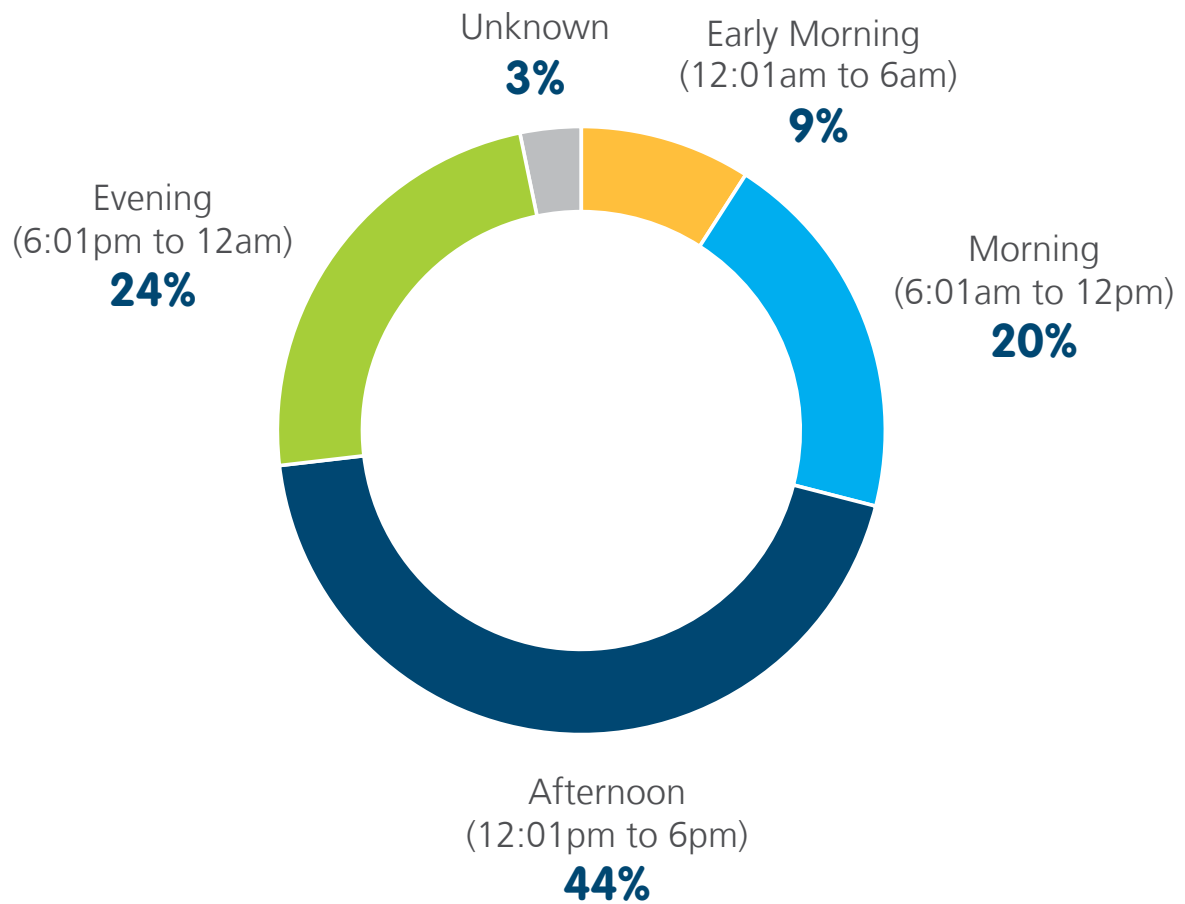
Drowning deaths at inland waterways by month



Drowning deaths at inland waterways by day of the week



Drowning deaths at inland waterways by time of the day



## Summer drowning at inland waterways

- > 55% occurred during the school holidays
- > 10% occurred on public holidays
- > 49% occurred in the afternoon
- > 32% occurred when swimming and recreating, more than any other time of the year
- > 33% of people were 50km or further away from home when they drowned, people are more likely to travel further in the summer time
- > There was no difference in time of drowning or alcohol involvement during the summer when compared with other times of the year

Drowning at inland waterways most commonly occurred during summer, consistent with general drowning trends.



**81%**  
were male

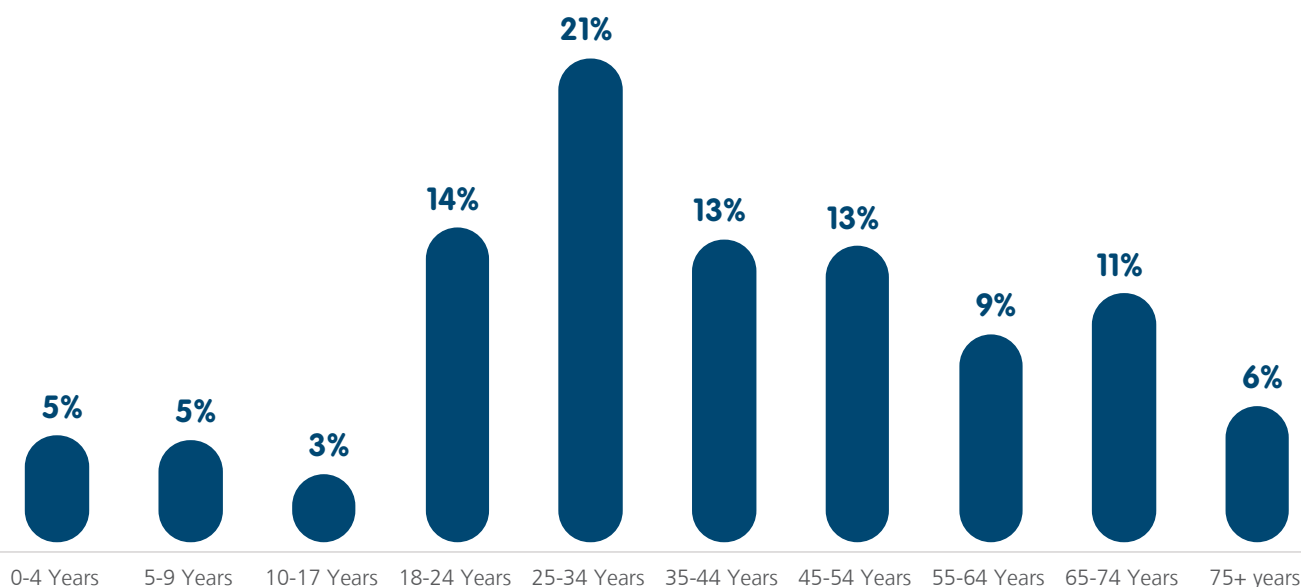


**21%**  
25 – 34 years

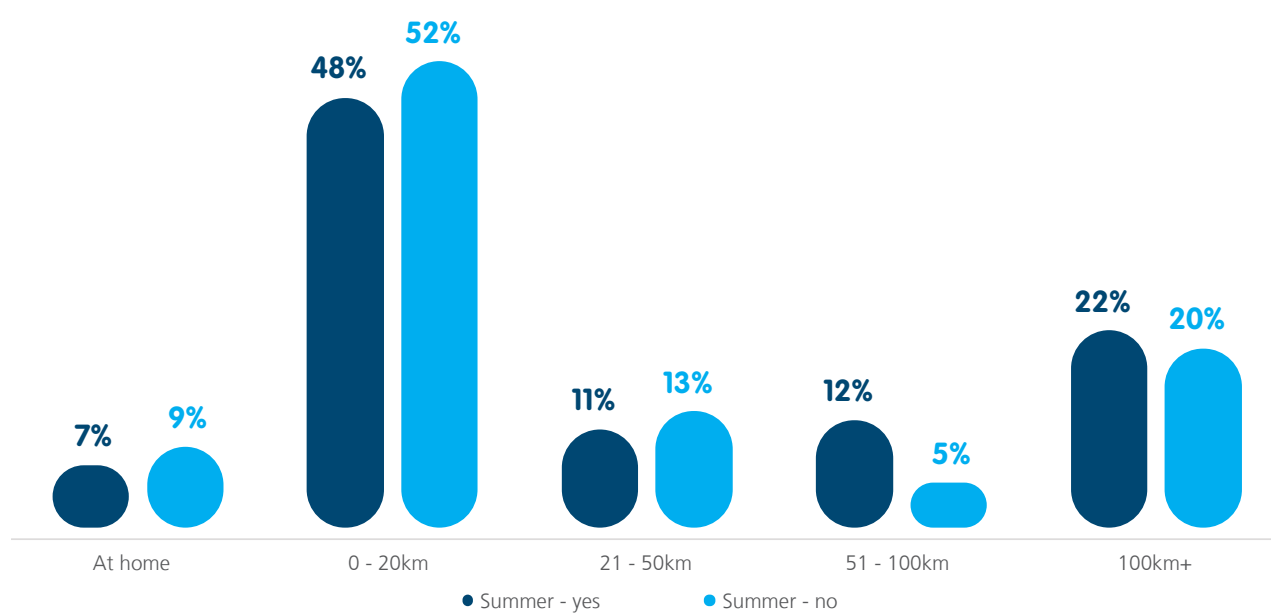


**32%**  
were of people born overseas

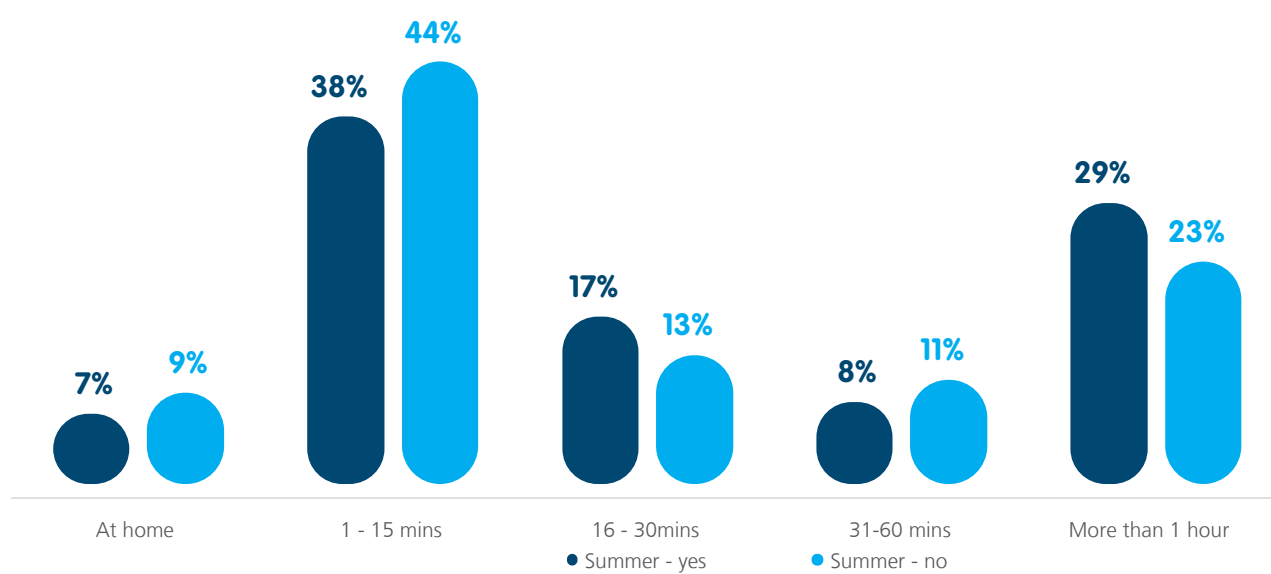
Drowning deaths at inland waterways during the summer by age group



### Drowning deaths at inland waterways during the summer by distance travelled from home (km)



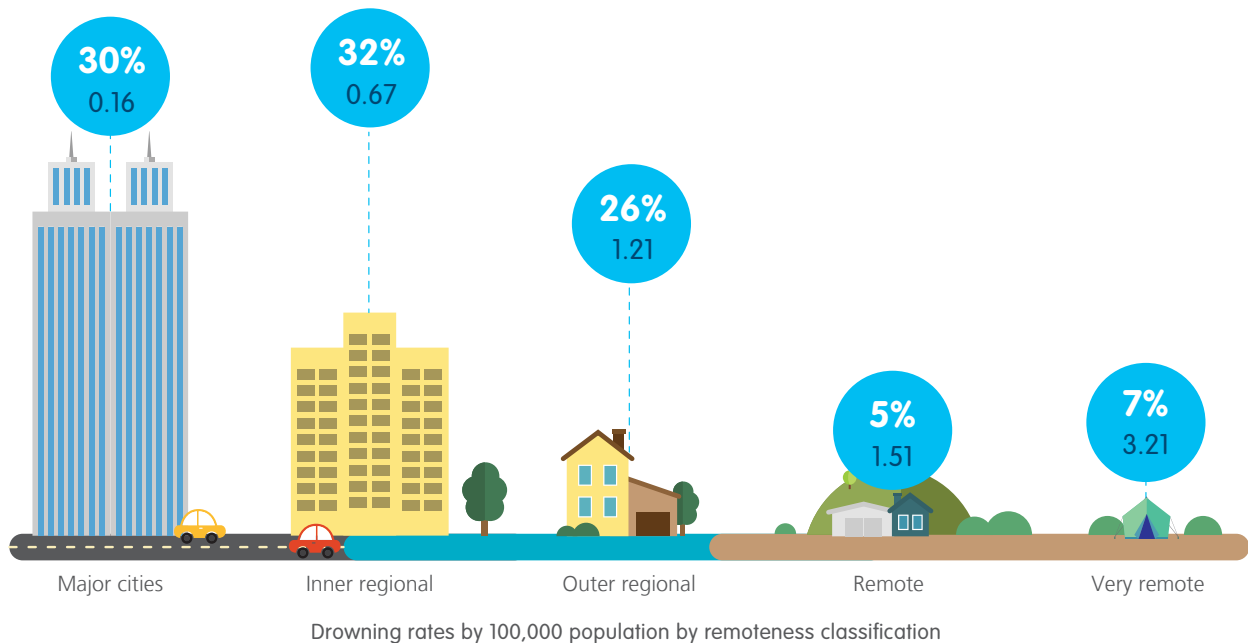
### Drowning deaths at inland waterways during the summer by time travelled from home (minutes)



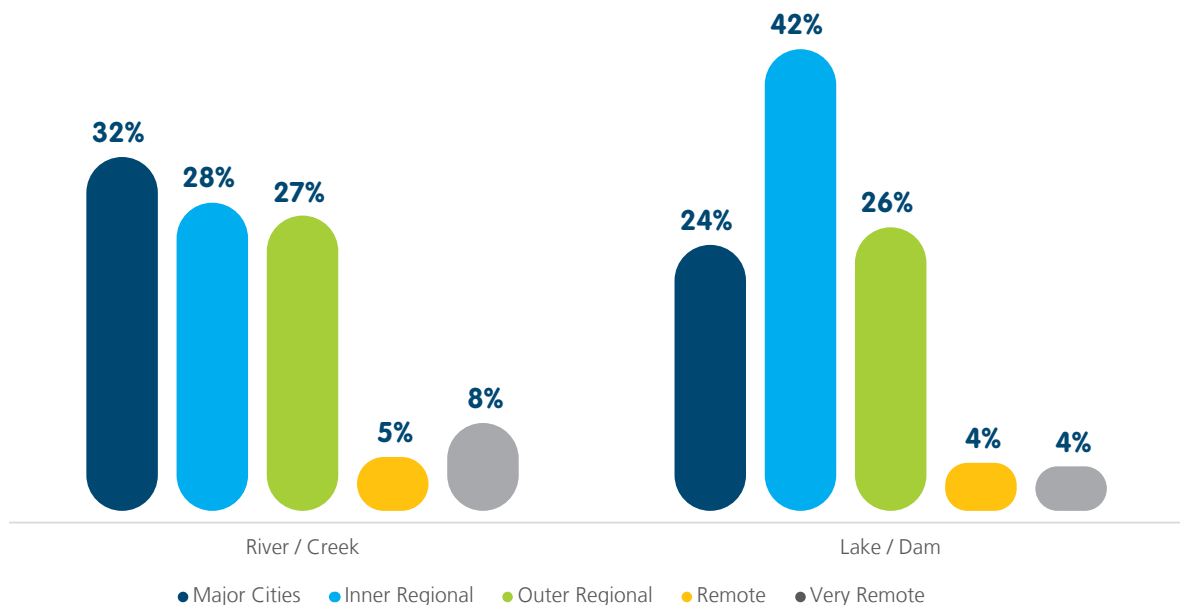
## > WHERE ARE PEOPLE DROWNING?

### Remoteness of drowning location

The largest proportion of drowning deaths at inland waterways occurred at locations classified as inner regional (32%) followed by major cities (30%) but the highest drowning rates were recorded in very remote and remote locations.



### Drowning deaths at inland waterways by waterway and remoteness classification



### Specific Locations

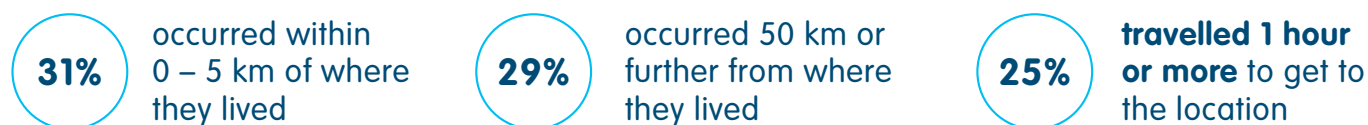




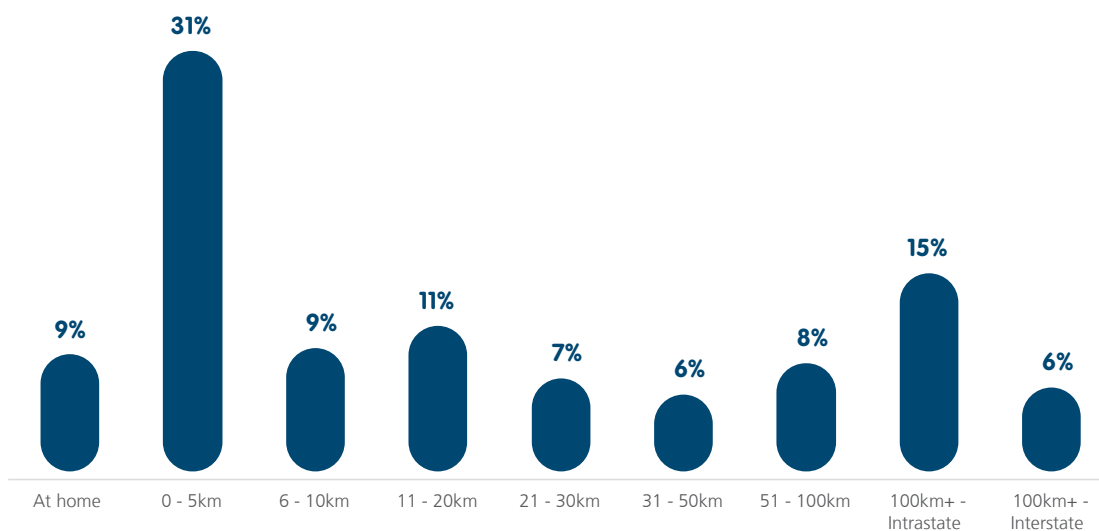
Cataract Dam, Launceston, Tasmania

## Visitor Status

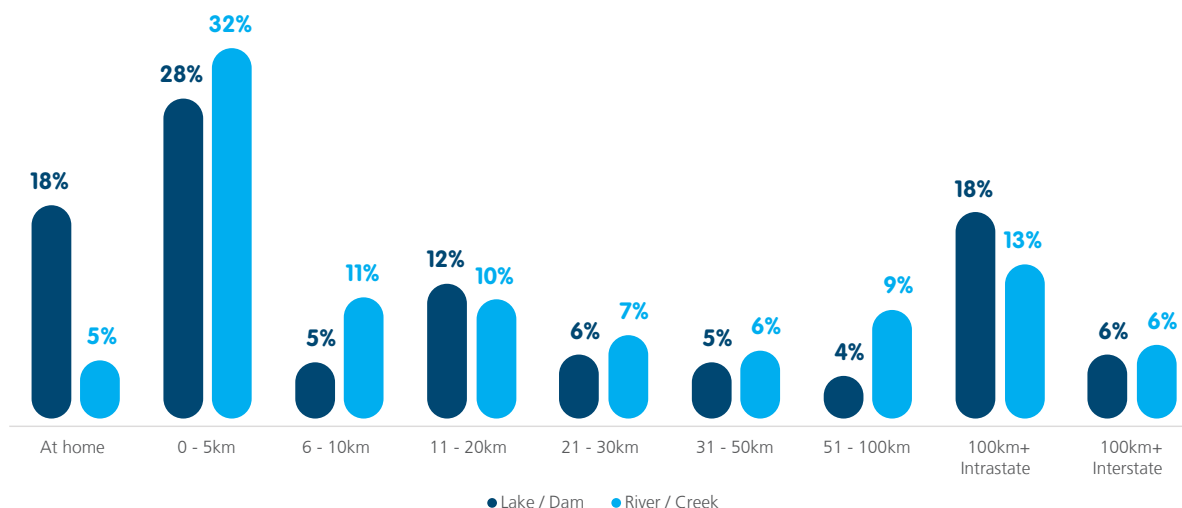
### How far are people from home to their location of drowning



### Drowning deaths at inland waterways by distance travelled from home (all year around)



### Drowning deaths by type of inland waterways and distance travelled from home (all year around)



## What do we know about the people going to inland waterways?

### Snapshot of Visitation trends in and around selected Inland Waterways

01-October-2019 and 31-December-2022



#### Who is attending?

Most people who go to inland waterways are aged between 25 and 54 years

28% are born overseas



#### When

Summer is the peak time (January recorded the highest number of people visiting)

2 hours on average spent at an inland waterway

Most common time is in the afternoon (12pm - 6pm)

People spend longer at an inland waterway location during the summer

Attendance to inland waterways increased over 2021/22 after the lifting of COVID-19 travel restrictions in 2020 and 2021.

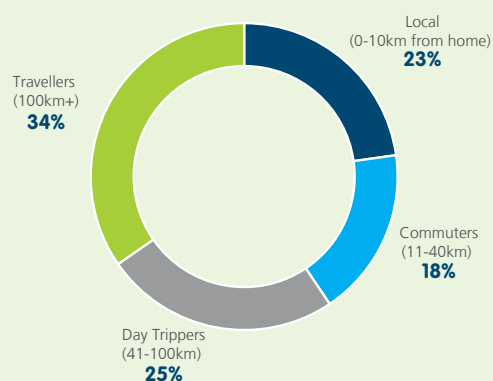


#### Where do they travel from?

The highest number of visitors to inland waterways were people who travelled 100km or more from where they lived.

Locals were most likely to visit inland waterways on a weekday compared to other visitors

There was no difference when broken down by season

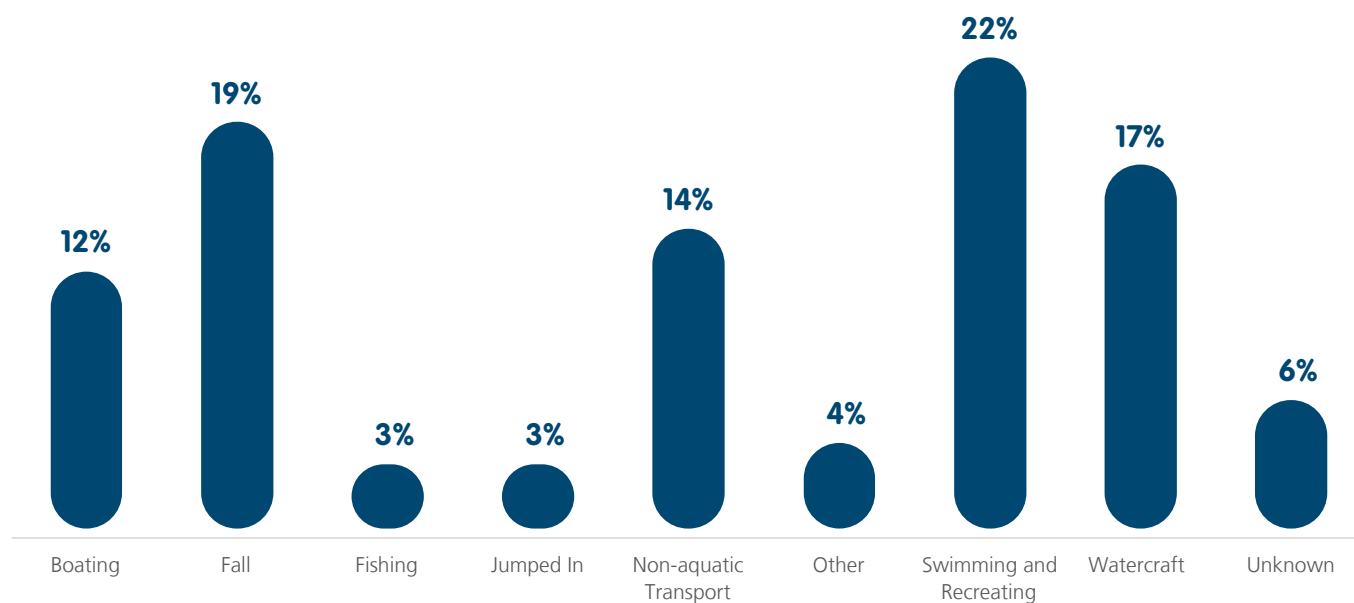


#### What do they do?

Swimming / Jogging / Cycling / Fishing

## > ACTIVITY BEING UNDERTAKEN

Activity being undertaken at inland waterways prior to drowning



No differences were found when analysed by activity and location, however differences in drowning location and activity were found by age group.

| Age Group     | Location                                                                                          | Leading activity prior to drowning                                                                         |
|---------------|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| 0 - 4 years   |  Lake / Dam    |  Fall                  |
| 5 - 9 years   |  Lake / Dam    |  Swimming & Recreating |
| 10 - 17 years |  River / Creek |  Swimming & Recreating |
| 18 - 24 years |  River / Creek |  Swimming & Recreating |
| 25 - 34 years |  River / Creek |  Swimming & Recreating |
| 35 - 44 years |  River / Creek |  Swimming & Recreating |
| 45 - 54 years |  River / Creek |  Swimming & Recreating |
| 55 - 64 years |  River / Creek |  Fall                  |
| 65 - 74 years |  River / Creek |  Non-aquatic Transport |
| 75+ years     |  River / Creek |  Fall                  |



1 Johnston Street  
In an emergency dial 000  
& quote the address above

## Wagga Beach

Cabarita Reserve

Swimming in the river can be dangerous.  
Please take responsibility for your safety.



### WARNING

تحذير onyo babala  
警告 သတိပေး nyiin



Shallow  
water



Deep  
water



Drop  
off



Strong  
currents



Submerged  
objects



No lifeguard  
service

In accordance with Section 632 of Local Government Act (NSW), 1993.



Offenders may be prosecuted and fined



RIVERSIDE  
MURRUMBIDGEE RIVER

By order of the General Manager

#### Alcohol



**26%**

recorded a BAC  $\geq 0.05\%$  alcohol

People aged 45 – 54 years and 55 – 64 years recorded the highest proportion of deaths with a BAC  $\geq 0.05\%$  alcohol (30% each)

#### Pre-existing medical condition



**40%**

recorded a pre-existing medical condition

The majority of people who recorded a pre-existing medical condition were aged 65 years and over.

The most common medical conditions recorded were cardiac-related.

#### Drugs



**37%**

recorded drugs

**27%**

medication

**15%**

illegal substances

#### Multiple Fatality Event



**7%**

drowned in a multiple fatality incident

**37%** non-aquatic transport

**21%** boating

**21%** swimming and recreating

#### Flood-related



**8%**

were flood-related

**64%** occurred when using non-aquatic transport (e.g., car driving through floodwater)

**17%** occurred as a result of being swept away by flood-water

#### Lifejackets



**61**

people who drowned while boating and watercraft, of which

**16%** were recorded as wearing a lifejacket, with the majority being inflatable types that did not inflate

#### Swimming ability



**18%**

swimming ability was recorded, of which people were thought to be

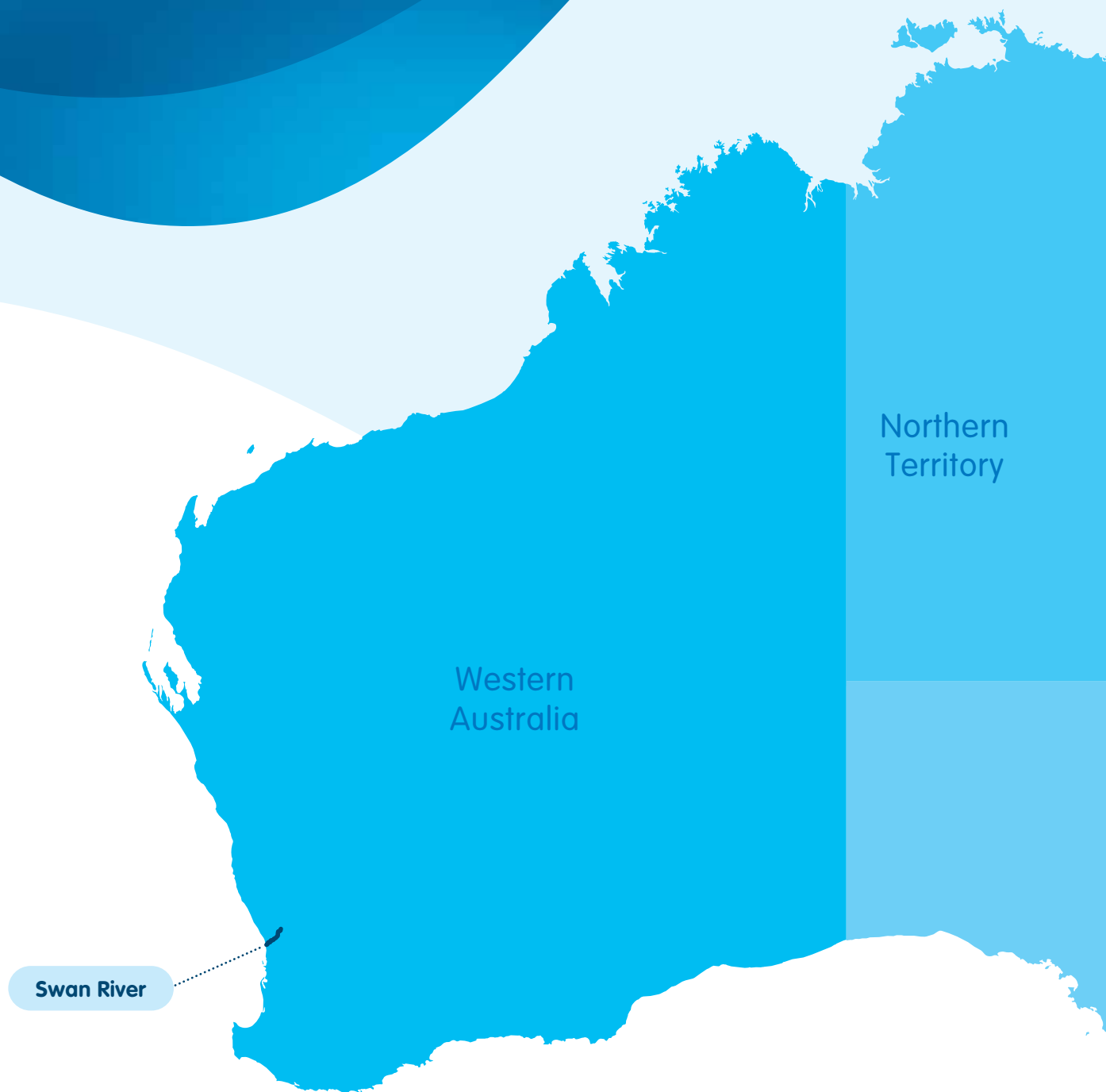
**31%** non-swimmer

**34%** competent swimmer

**28%** poor swimmer

**8%** strong swimmer

## > TOP RIVER AND LAKE/DAM BLACKPOTS FOR DROWNING



| Rank | Name of River      | State        | Total |
|------|--------------------|--------------|-------|
| 1    | Murray River       | NSW, VIC, SA | 49    |
| 2    | Yarra River        | VIC          | 27    |
| 3=   | Hawkesbury River   | NSW          | 21    |
| 3=   | Murrumbidgee River | NSW, ACT     | 21    |
| 4    | Swan River         | WA           | 19    |
| 5    | Brisbane River     | QLD          | 17    |
| 6    | Parramatta River   | NSW          | 12    |
| 7=   | Nepean River       | NSW          | 10    |
| 7=   | Ross River         | QLD          | 10    |
| 8=   | Clarence River     | NSW          | 8     |
| 8=   | Georges River      | NSW          | 8     |
| 8 =  | Goulburn River     | NSW          | 8     |

| Name of Lake / Dam | N | State |
|--------------------|---|-------|
| Lake Eildon        | 7 | VIC   |
| Lake Macquarie     | 5 | NSW   |
| St Georges Basin   | 5 | NSW   |



## MURRAY RIVER: NUMBER ONE RIVER DROWNING BLACKSPOT IN AUSTRALIA

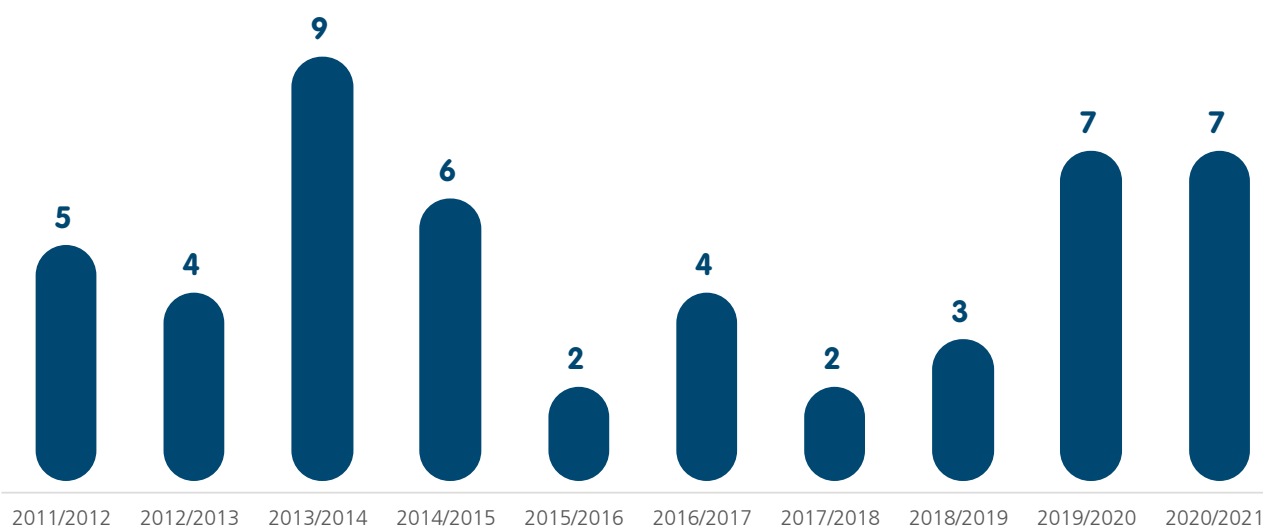
### Murray River Drowning Deaths Over 10 Years (2011/12 To 2021/22)

49

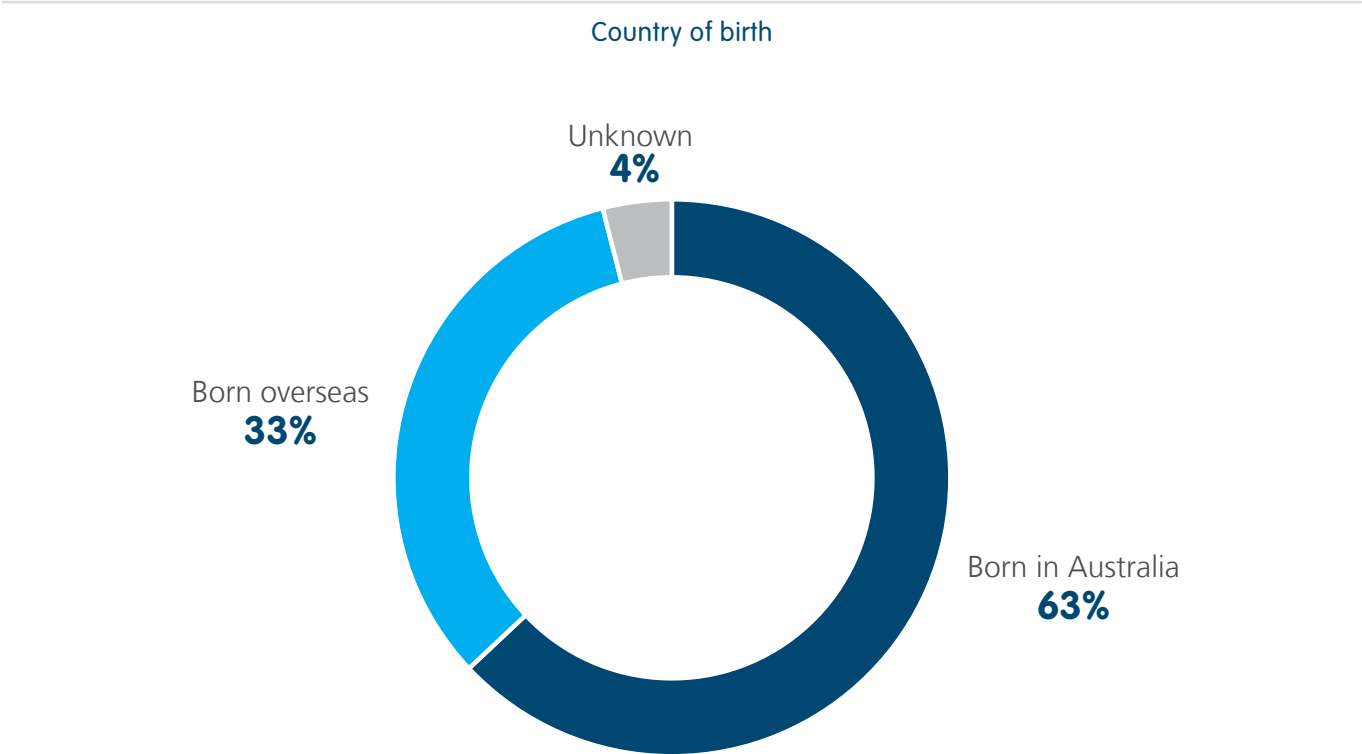
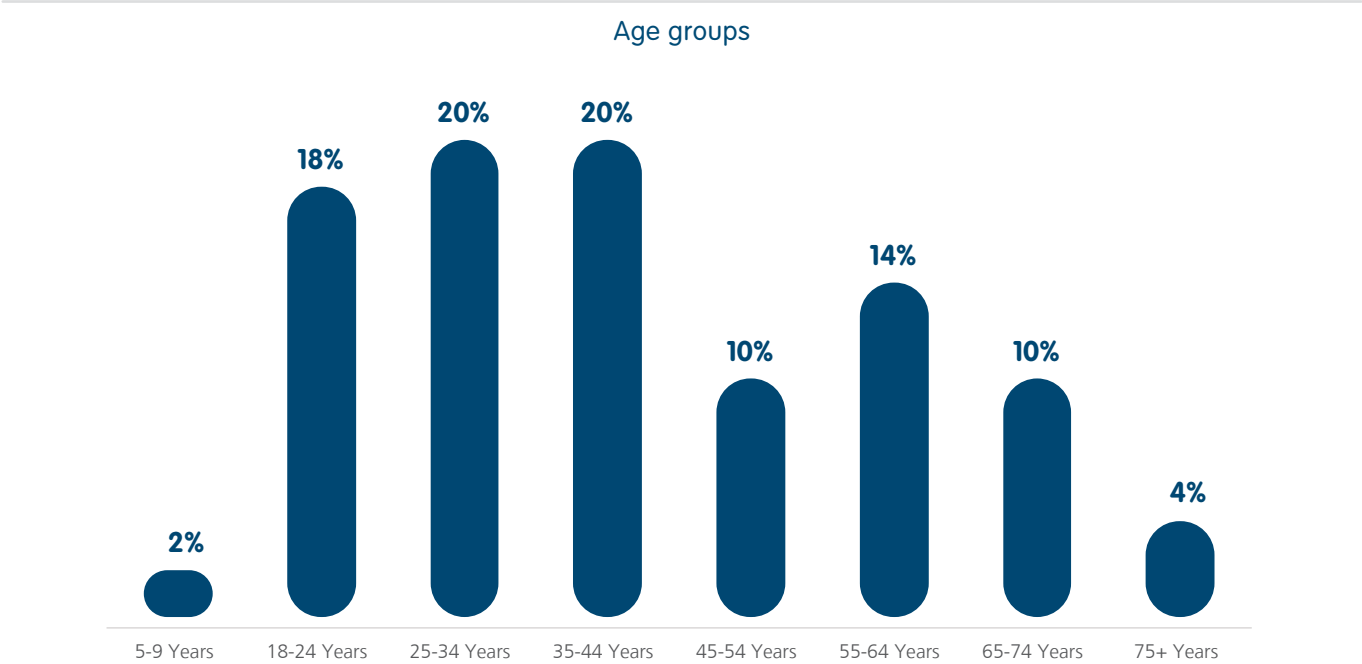
people have drowned  
in the Murray River over the  
past decade

- > The highest number of drowning deaths in the Murray River occurred in 2013/14, followed by a decreasing number in the following five years
- > The highest numbers of drowning deaths in five years were recorded in 2019/20 and 2020/21
- > The impact of COVID-19 and travel restrictions may have contributed to this increase
- > The 'Respect the River' national campaign was launched on the bank of the Murray River in Albury in October 2015 to increase public awareness of river safety.

Drowning deaths that have occurred in the Murray River 2011/12 to 2020/21



Who is drowning in the Murray River?





## When



51%

in the summer

## Activity



39%

when swimming  
and recreating



51%

in the afternoon  
(12:01pm to 6pm)



24%

occurred when using  
boats or watercraft

Of which, 50% involved a fall from a houseboat



20%

on a Saturday, followed  
by a Friday (18%)



43%

occurred during the  
school holidays

## Risk Factors



**59%**

involved alcohol

Of which, half recorded  
a BAC of  $\geq 0.05\%$



43%

on a public holiday  
or public holiday long  
weekend



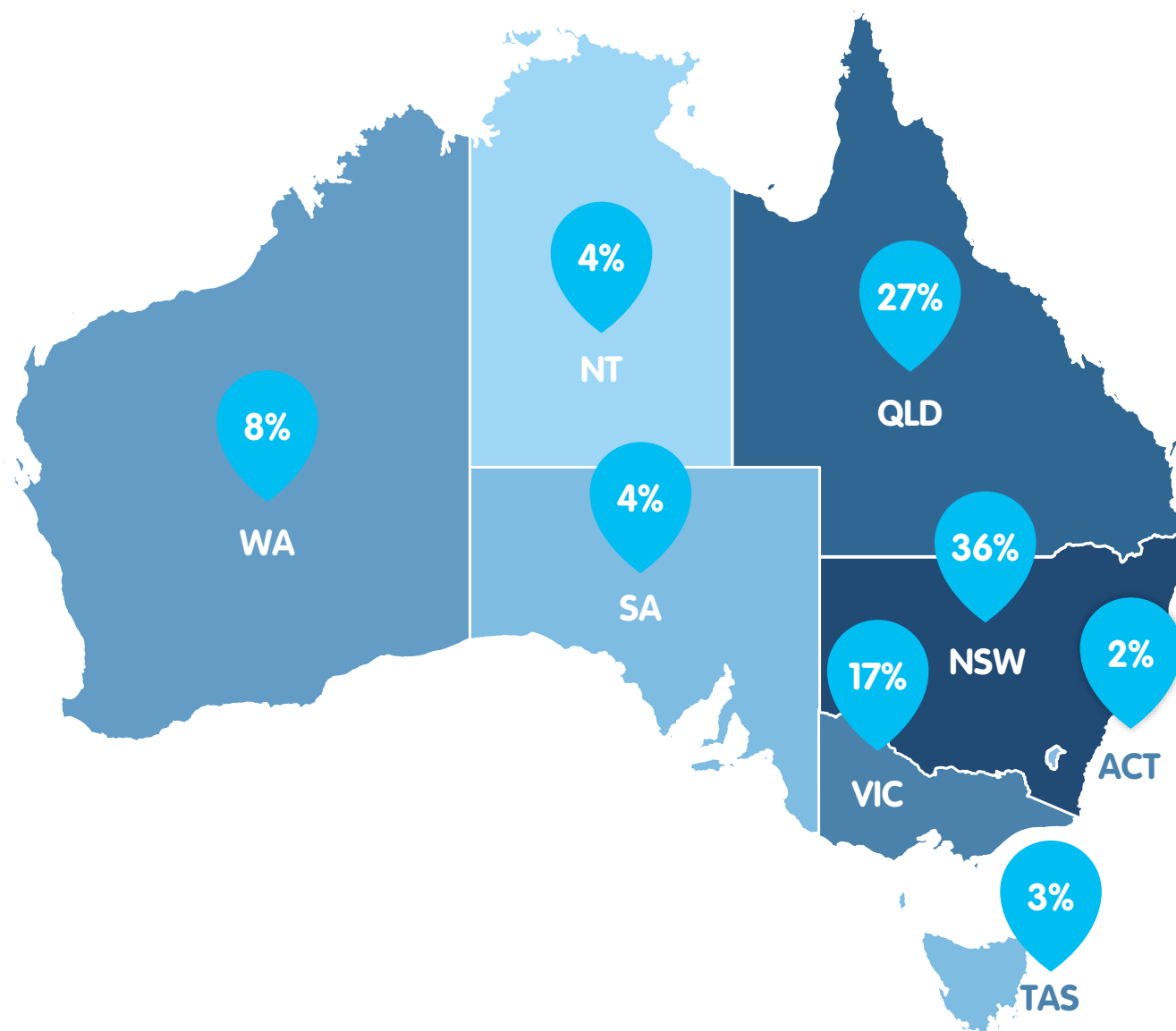
29%

recorded drugs present

Of which 50% recorded  
illicit drugs

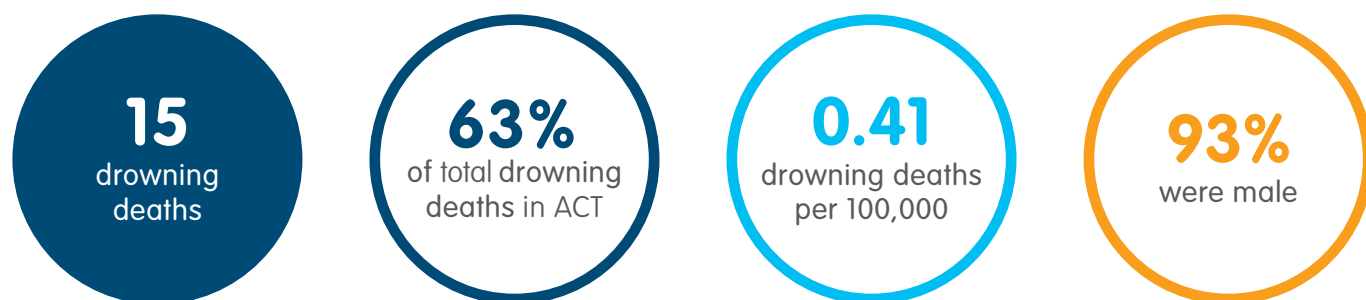


Murray River

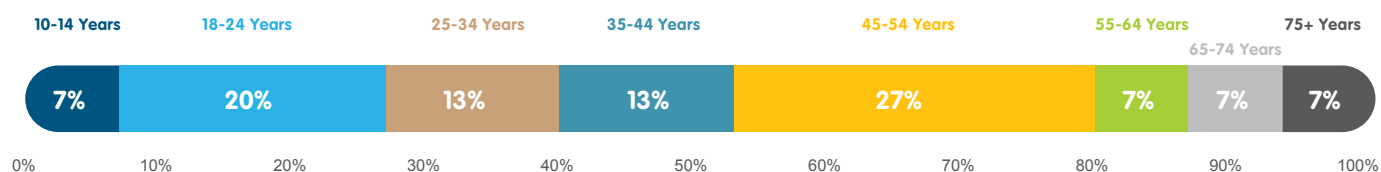




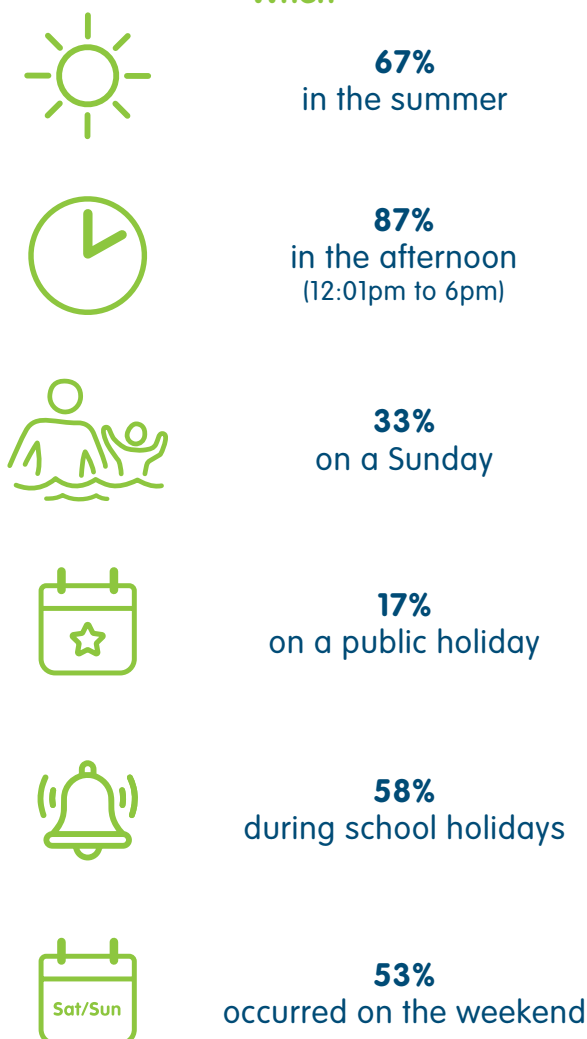
Deep Creek Reserve, Narrabeen, New South Wales



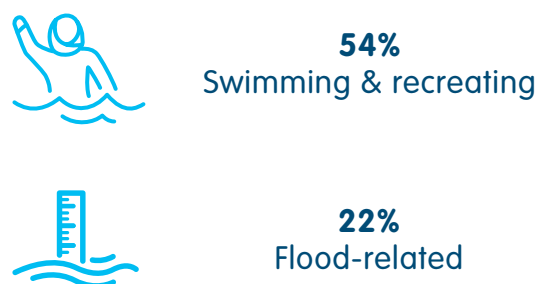
### Inland waterway drowning deaths in the ACT



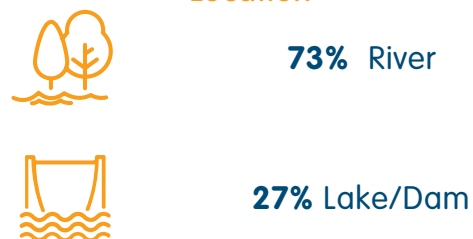
### When



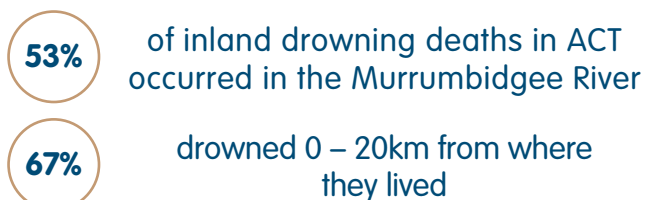
### Activity

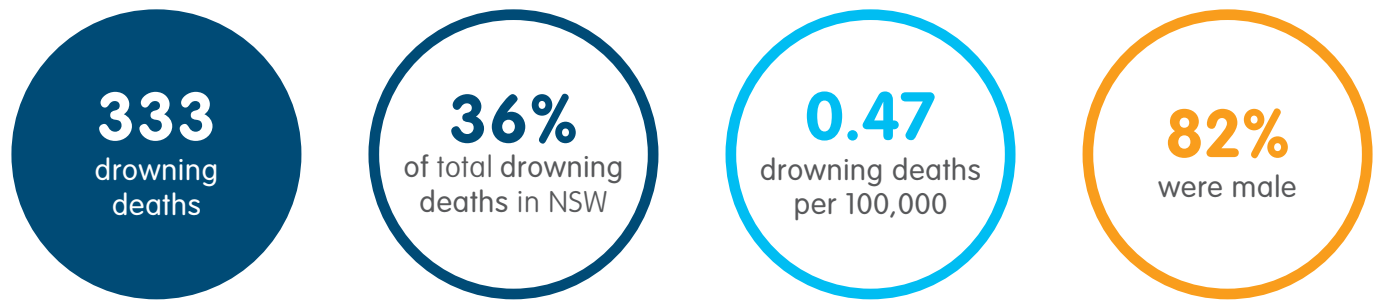


### Location

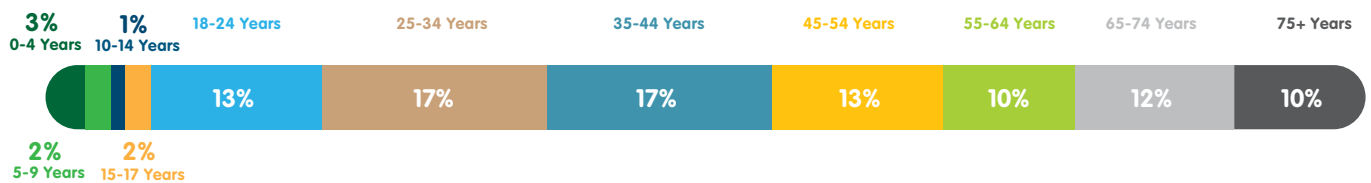


### Key locations





### Inland waterway drowning deaths in NSW



### When



**38%**  
in the summer



**43%**  
in the afternoon  
(12:01pm to 6pm)



**18%**  
on a Sunday



**5%**  
on a public holiday



**30%**  
during school holidays



**33%**  
occurred on the weekend

### Activity



**21%**  
Swimming & recreating



**17%**  
Fall into water

### Location



**77%** River  
4% were children aged 0-14 years



**23%** Lake/Dam  
10% were children aged 0-14 years

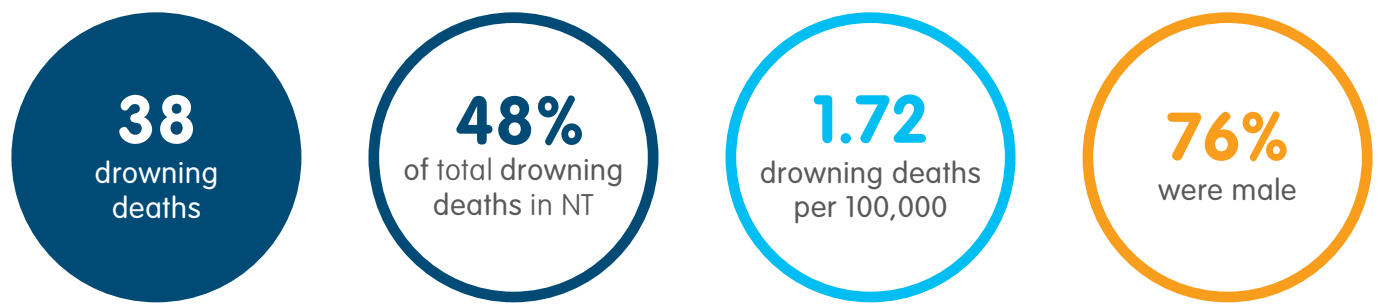
### Key locations

**25%**

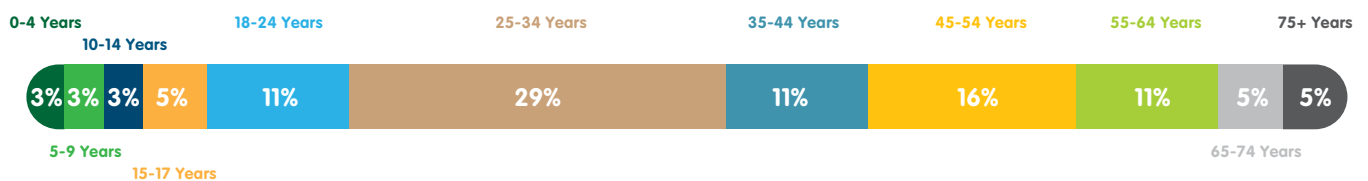
had travelled 100km or further to where they drowned

**51%**

drowned 0 – 20km from where they lived



### Inland waterway drowning deaths in the NT



#### When



**55%**  
in the dry season  
(November – April)



**50%**  
in the afternoon  
(12:01pm to 6pm)



**29%**  
on a Friday



**8%**  
on a public holiday



**34%**  
during school holidays



**34%**  
occurred on the weekend

#### Activity



**40%**  
Swimming & recreating



**30%**  
Flood-related

#### Location



**82%** River  
10% were children aged 0-14 years



**24%**  
occurred in a national park

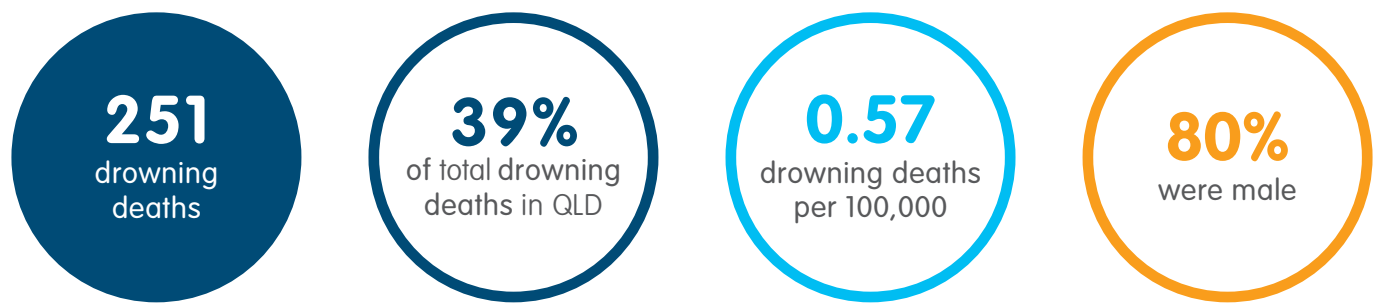
#### Key locations

**36%**

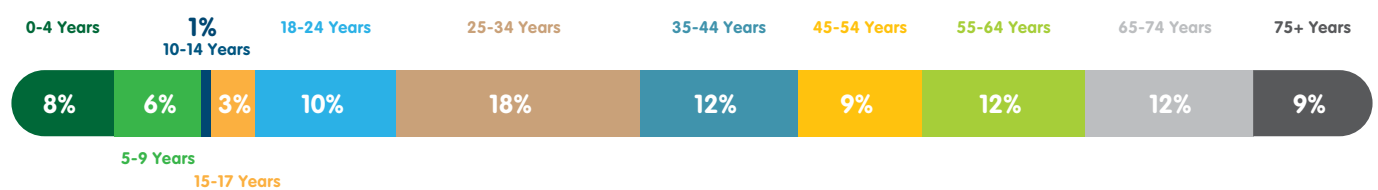
had travelled 100km or further to the location where they drowned

**32%**

drowned 0 – 20km from where they lived



### Inland waterway drowning deaths in QLD



#### When



**39%**  
in the summer



**50%**  
in the afternoon  
(12:01pm to 6pm)



**12%**  
on a Sunday



**8%**  
on a public holiday



**29%**  
during school holidays



**39%**  
occurred on the weekend

#### Activity



**24%**  
Swimming & recreating



**24%**  
Fall into water

#### Location



**77%** River



**23%** Lake/Dam

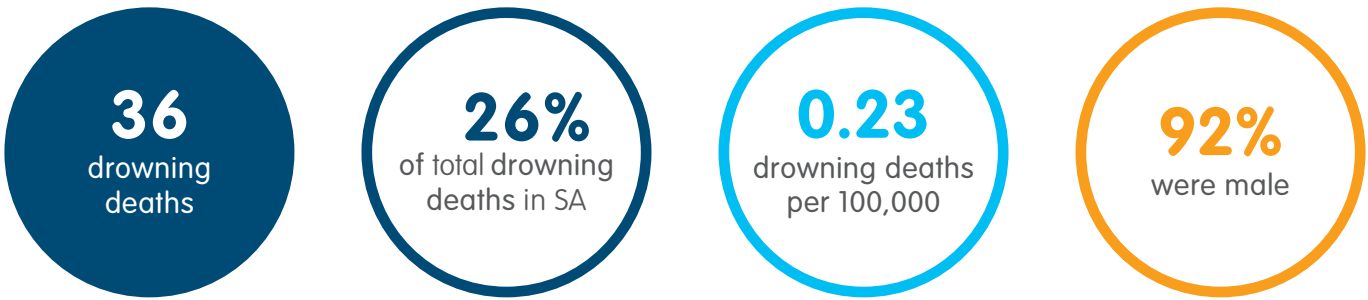
#### Key locations

**18%**

had travelled 100km or further to where they drowned

**44%**

drowned 0 – 20km from where they lived



Inland waterway drowning deaths in SA



When



31% in the winter



58% in the afternoon (12:01pm to 6pm)



25% on a Friday



6% on a public holiday



31% during school holidays



42% occurred on the weekend

Activity



22% Fall into water



17% Swimming & recreating

Location



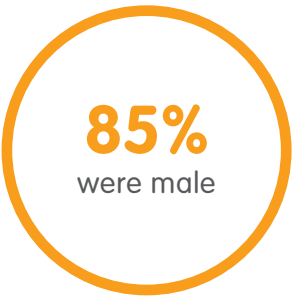
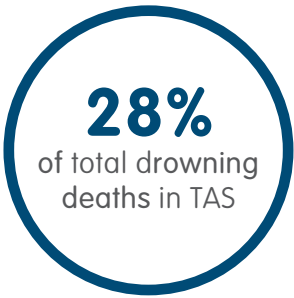
67% River



33% Lake/Dam

Key locations

- 48% drowned within 5km from where they lived
- #1 Murray River - Murray Bridge & River Torrens - Adelaide



Inland waterway drowning deaths in TAS



When



**42%**  
in the winter



**50%**  
in the afternoon  
(12:01pm to 6pm)



**23%**  
on a Monday  
followed by 19% on a Friday



**4%**  
on a public holiday



**19%**  
during school holidays

Activity



**35%**  
Boating & watercraft



**23%**  
Fall into water

Location



**77%** River



**23%** Lake/Dam

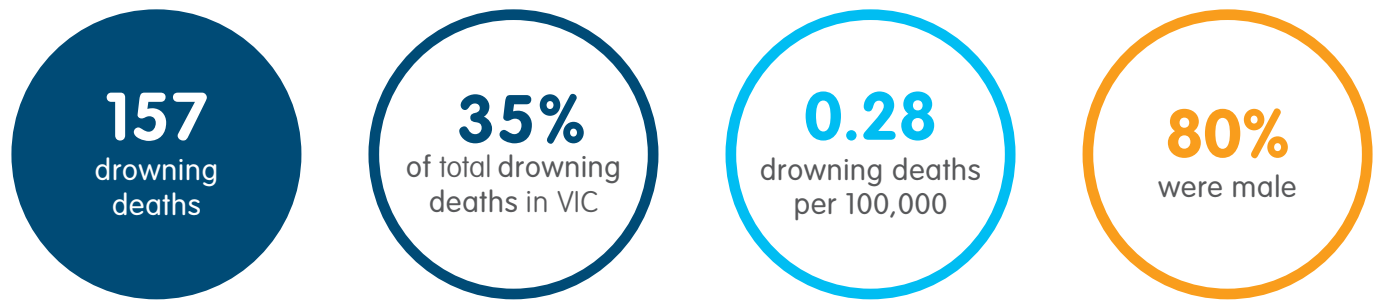
Key locations



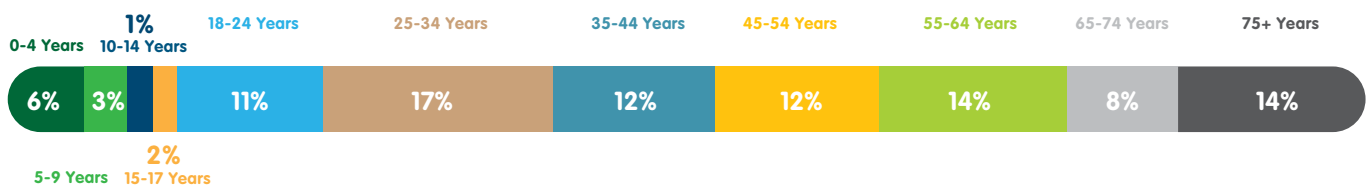
drowned with 5km from where they lived



Derwent River & Tamar River



### Inland waterway drowning deaths in VIC



#### When



**36%**  
in the summer



**34%**  
in the afternoon  
(12:01pm to 6pm)



**21%**  
on a Sunday



**8%**  
on a public holiday



**33%**  
during school holidays



**37%**  
occurred on the weekend

#### Activity



**21%**  
Fall into water



**18%**  
Swimming & recreating

#### Location



**60%** River



**40%** Lake/Dam

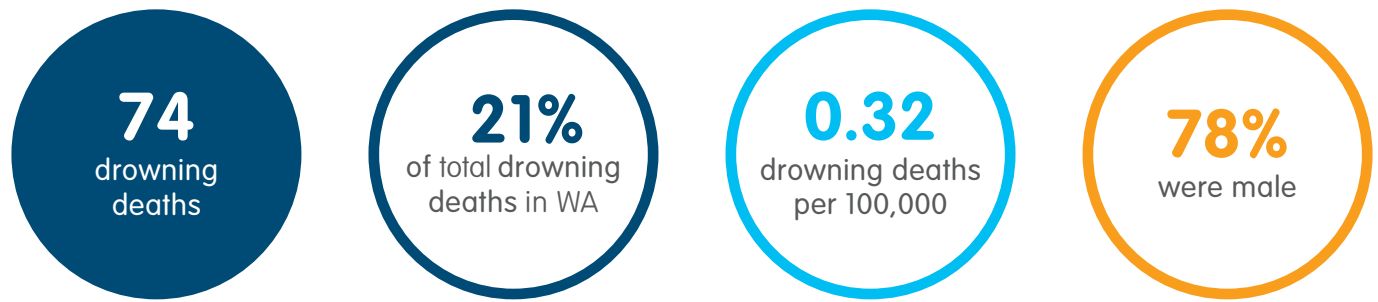
#### Key locations

**59%**

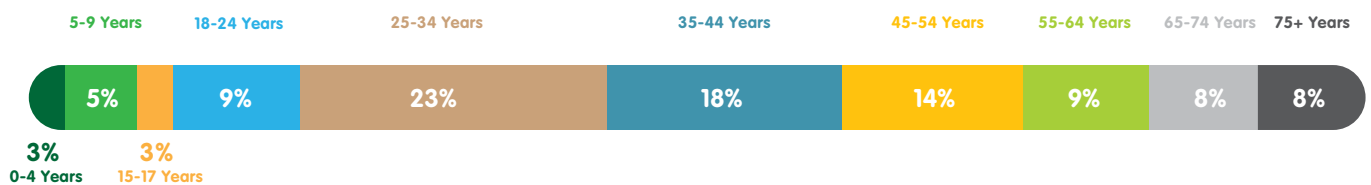
drowned within 0-20km from where they lived

**#1**

Yarra River, Melbourne



### Inland waterway drowning deaths in WA



#### When



**54%**  
in the summer



**47%**  
in the afternoon  
(12:01pm to 6pm)



**28%**  
on a Sunday  
followed by 19% on a Wednesday



**5%**  
on a public holiday



**43%**  
during school holidays

#### Activity



**24%**  
Swimming & recreating



**21%**  
Fall into water

#### Location



**68%** River



**32%** Lake/Dam

#### Key locations

**51%**

drowned with 0 - 20km from where they lived

**#1**

Swan River  
Perth, Blackwall Reach & Maylands

This report provides an overview of current drowning trends at rivers, creeks, lakes and dams across Australia.

Inland waterways remain a leading location for drowning. Many people are unaware that inland waterways are a leading location for drowning deaths in Australia. Extensive research and improved data collection over the past decade has helped increase our understanding of the burden of drowning at inland waterways, risk factors and exposure. This has helped to inform targeted prevention strategies, focused on men (high risk population), alcohol (key risk factor) and key locations based on the highest drowning numbers at certain waterways. More recently, studies on visitation trends [13, 14] have filled gaps on exposure information, for example who is visiting inland waterways, for how long and what they do when at inland waterways.

## Overall

Inland waterways account for more than one third of total drowning deaths in Australia, with rivers the single leading location for drowning compared to other locations. The rate of drowning is 0.4 / 100,000 population, this equates to about 92 people each year drowning in an inland waterway. While rates have not increased, the rates have not substantially decreased either. Prevention efforts should continue in an effort to reduce these rates to achieve the Australian Water Safety Strategy goal of reducing drowning by half by 2030.

The impact of COVID-19 should be acknowledged. The 12 months between 01 June 2020 and 30 July 2021 showed an increase in drowning deaths (consistent with overall national drowning deaths for 2020/21) [15], particularly in rivers. This may be an impact of travel restrictions, meaning that more people were staying close to home and going to more isolated and remote locations away from crowds; swimming pools were closed, leading people to swim and recreate in other environments without supervision.

In contrast, the year prior, 2019/20, recorded the lowest number of drowning deaths in rivers (n=48) with the highest number of drowning in lakes and dams recorded (n=31), likely to be due to the high number of children drowning in dams. This reinforces the need for prevention efforts focusing on water safety on farms and rural properties to continue.



Dove Lake, Cradle Mountain, Tasmania

## Demographics

Men continue to account for more than 80% of drowning deaths, consistent with general drowning trends, with those aged 25 to 44 years the most likely to drown at an inland waterway. However, key trends differed when analysed by age, sex and location.

Children and older people shared similar trends for drowning, although the contributing factors are likely to be different. Overall, children aged 0 - 4 years and people aged 75+ years were more likely to drown as a result of an unintentional fall into water, whereas most other age groups drowned when swimming or recreating.

Children aged 0 – 9 years were more likely to drown in a lake or dam than in a river, with a higher proportion of girls drowning compared to other locations and age groups. All other ages groups most commonly drowned in a river/creek.

Contributing factors for children drowning including lack of adequate supervision and unsupervised access to water, whereas older people were more likely to have a medical condition present, medication and/or alcohol, and be alone, reinforcing the need for tailored strategies targeting different demographics.

More than a quarter (27%) of people who drowned in an inland locations were adults who were born overseas and 8% identified as Aboriginal and Torres Strait Islander background. In the summer, people born overseas accounted for one-third of total deaths in the summer months.

A greater awareness of water safety and practical tips for swimming and recreating in and around rivers and lakes in Australia, with a specific focus before and during the summer for all communities should be considered.

## Where and when people drowned

Collectively, more than half of all drowning deaths at inland ways occurred at regional locations and a further 12% drowned at remote or very remote locations. Previous research has found that the rate of drowning increases in regional and remote locations [2, 4]. With more isolated locations which may have limited mobile phone reception, take longer to alert emergency services and may have limited accessibility.

Five per cent of drowning occurred within a National Park or State Conservation area, which are often in more isolated and remote locations, that can pose problems for raising the alarm (e.g., lack of mobile reception) and access for rescue personnel. A further 5% drowned in and around waterfalls and swimming holes, many are popular tourist destinations across Australia (of which some are situated in National Parks). Partnerships with water safety agencies, National Parks and Wildlife (or other land management agencies) and tourism boards may be needed to combat the issue of drowning at popular locations, in and around national parks such as waterfalls and swimming holes, particularly as both domestic and international visitors start to travel again post COVID-19.

One-fifth (21%) drowned 100km or further from where they lived or had travelled more than an hour to get to an inland waterway, indicating that people may be visiting areas that are unfamiliar or unknown to them. This applies particularly in summer when the most common visitors were those who had travelled 100km or more. This highlights an opportunity for water safety agencies, holiday accommodation providers and visitor centres to work together to raise awareness of inland waterway safety during peak times.

This analysis reported that people most commonly drowned within 20km of where they lived (51%), suggesting that some people may be relying on their experience, skills and familiarity of the environment to keep them safe around water.

The Murray River remains the leading river location for drowning, spanning the NSW and Victorian border, through to South Australia. An even higher proportion of males drowned in the Murray River (92%), with half occurring in the summer months and in the afternoon, and over 40% during the school holidays. This supports the need for targeted drowning prevention strategies at key locations along the Murray River and at key times. Alcohol and drugs (both medication and illegal substances) were found to be contributing factors for among people who drowned on the Murray River.

This report identified key drowning blackspots within each State and Territory that include both rivers and lakes that can help to better target drowning prevention and water safety strategies at the local level.

## Summer drowning trends

Summer is the peak time for drowning at inland waterways, consistent with general drowning trends. Young people aged 25 – 34 years accounted for the highest proportion of drowning deaths in the summer, predominately males.

More than fifty percent of drowning in the summer months occurred in the school holidays and 10% on public holidays. Previous research has reported that drowning risk increases on public holidays when there are more people off work and school, and likely to have increased access and exposure to water bodies [16]. Surprisingly, alcohol presence did not differ in summer when compared to other times of the year. Water safety campaigns and programs should be delivered before and during the summer and other school holidays periods with public holidays, e.g., autumn school holidays when Easter and ANZAC school often fall.

## Visitation to inland waterways

This report included information about the types of people attending key inland waterways around Australia, how far they are travelling, how long they are staying and what types of activities they are doing. Unsurprisingly, locals are most commonly attending these locations, however this does change in the summer months with more people travelling from over 100km away to attend these locations.

The average time spent at an inland location is two hours, most frequently in the afternoon, reflecting the most common time for drowning to occur. A number of drowning deaths occurred due to an unintentional fall into water. While people may not intend to go in the water at these locations, people always need to be vigilant around water, especially as young children can wander off unnoticed, or alcohol consumption may lead to risk-taking behaviour around water.

## Risk factors

Some risk factors for drowning at inland waterways have stayed consistent, including alcohol consumption and not wearing a lifejacket, however new risk factors were identified including locations and activities. While some of these things accounted for a small proportion during this period, it is important to ensure that these issues do not become more common into the future.

- Drowning deaths due to flooding and climate change are likely to become more common into the future. With eight percent of drowning deaths during the study period being flood-related, often due to driving through floodwater or being swept away, more can be done to work with local emergency services to promote flood safety messages in and around inland waterways.
- For older people, a pre-existing medical condition and medications were found to be key risk factors for drowning, particularly for those with cardiac conditions.
- 26% of drowning deaths at inland waterways recorded a BAC  $\geq 0.05\%$  alcohol, the highest proportion was recorded among people aged between 45 and 64 years. This indicates that older men may be undertaking more risky behaviour around water.
- Multiple fatality events occurred when boating, swimming and driving non-aquatic transport, and included people of all ages from young children through to older adults.
- The majority of people who drowned when boating and using watercraft at inland waterways were not wearing a life jacket.
- National Parks, waterfalls and swimming holes were identified as locations for drowning risk, especially in regional and remote locations.





### Research

- > Evaluate the effectiveness of relevant campaigns, programs and services focused on drowning prevention at inland waterways
- > Conduct observational studies at inland waterways to increase exposure information and gain a better understanding of the number of people who attend popular locations
- > Pilot and evaluate the use of technology for drowning prevention at inland waterways, including but not limited to social media, locational QR codes, apps, push notifications, geo-fencing / geo-mapping
- > Pilot and evaluate the use of public-access rescue equipment at inland waterways
- > Evaluate the feasibility, effectiveness and sustainability of lifeguard based responses at high use or high risk inland waterways locations



### Policy

- > Land and waterway owners and operators should work with water safety agencies, government at all levels and their agencies, as well as community stakeholders, to develop and implement strategies to reduce drowning and water-related injury, e.g. local water safety plans.
- > Adopt and implement inland water safety guidelines into current and future local government, land and waterway owners and operators (e.g. water and park authorities), water boards community safety plans, including emergency management plans
- > Implement and enforce of alcohol-free zones to prevent drowning around inland waterways
- > Enforce safe boating regulations at inland waterways e.g. consistent lifejacket wear, limiting alcohol consumption of skippers
- > Collaborate with local aquatic facilities (council and privately run) to offer reduced rates for pool entry during summer and public holidays



### Advocacy

- > Work with local stakeholders and emergency services to promote flooding preparedness and safety messages
- > Advocate for increased funding for classroom and practical inland water safety education programs
- > Encourage the tourism sector and organisations who operate in, on or around inland waterways and organisations to promote and raise awareness of water safety messaging
- > Identify community champions for drowning prevention and water safety around inland waterways
- > Advocate for solutions for improved telecommunication in regional and remote locations with limited mobile phone coverage
- > Advocate for safe swimming locations at inland waterways that are supported by rescue equipment, lifesaving patrols, and/or professional supervision



## Practice

- Active promotion of 'child-safe' play areas in rural and remote locations that have access to inland waterways
- Continue to promote and enhance existing river and inland waterway drowning prevention initiatives and awareness campaigns, specifically targeting young men and multicultural communities
- Increase availability of swimming and inland water safety education programs for all ages year-round
- Increase awareness of the dangers of mixing alcohol around water, and enforcement of alcohol restrictions to prevent drowning, especially among young males
- Increase awareness of the role of medical conditions and medications in drowning, especially among older people
- Continue to promote active supervision messages for parents and carers of young children, focusing on all locations, including inland waterways
- Deliver public awareness and community engagement activities focusing on or at inland waterway locations during weekends and key holiday times
- Campaign messaging focusing on inland waterways to be launched prior to school holidays with micro reminders around all public holidays
- Ensure rescuers, lifesavers and professional lifeguards have appropriate competency for inland waterways, including swift water and/or flood rescue where applicable



## Partnerships

- Partner with water safety agencies, state and local government, National Parks and other land and water management agencies to: manage popular inland waterway locations including waterfronts, shorelines, waterfalls and swimming holes where fatal and non-fatal incidents have occurred to enhance safety at these locations, including but not limited to engineering solutions
- Continue working with partners such as FarmSafe and KidSafe to promote water safety on farms and rural properties, focusing on both young children and adults who may work alone
- Explore partnerships with tourism boards and media (traditional and social media) agencies to raise awareness of water safety and promote drowning prevention messages at key inland waterway locations

## > CONCLUSION

This report provides a snapshot of drowning deaths that have occurred in inland waterway locations over a 10-year period. While the number of drowning deaths across all inland waterways have decreased over time, the rates of drowning per 100,000 population have remained steady indicating that more needs to be done to reduce drowning across all inland waterway environments by 2030. This study provided new insights into: who is drowning at inland waterways; how, where and when they are drowning; and key risk factors. Differences in people drowning at rivers/creeks and lakes/dams, and visitor trends were identified, providing new information for drowning prevention.

There is an opportunity to enhance existing strategies and develop new and innovative strategies focusing on key populations, activities and risk factors tailored to rivers and lakes/dams.

While this study focused on fatal drowning deaths, we must acknowledge that non-fatal drowning has a significant impact on families and communities, and any future drowning prevention strategies should take a multi-pronged approach with a range of partners in order to effectively address drowning in all forms at inland waterway locations.

## > METHODS

Drowning data for this analysis is sourced from the Royal Life Saving National Fatal Drowning Database. Data in the Royal Life Saving National Fatal Drowning Database have been collated from the National Coronial Information System (NCIS), State and Territory Coronial offices and year-round media monitoring. Information contained within the NCIS is made available by the Victorian Department of Justice and Community Safety.

Drowning deaths as a result of suicide or homicide, deaths from natural causes, shark and crocodile attacks, or hypothermia have been excluded from this report. All information presented in this report relates to drowning deaths or deaths where drowning was a contributory cause of death.

This report contains information correct as of 01 October 2022. As of this date, 85% of cases were closed (i.e. no longer under coronial investigation). Note that figures may change depending on ongoing coronial investigations and findings.

The time period for this report is the 10-years between 2011/12 and 2020/21, due to the most current drowning data being 90% open at the time of writing (2021/22 financial year) and 18% of inland waterway drowning deaths in 2021/22 financial year were due to a significant flooding event in Northern NSW and South-Eastern Queensland in late February and early March 2022 which may have skewed the data if it was included.

### Definitions

Location and activity being undertaken prior to drowning are coded as per the Royal Life Saving National Fatal Drowning Database (Table 1). For this report, inland waterways refer to: river, creek, lake, or dam, and includes inland billabongs, canals, culverts, estuary, inlets, lagoons, reservoir, swimming holes, reservoir, waterfalls, weirs (Table 1).

For drowning deaths that occurred in the Murray River, all drowning deaths are recorded as being in NSW, regardless of which side of the river the person entered (NSW or Victoria) due to the waters of the Murray River belonging to NSW [17].

Variables analysed in this study included: financial year, age groups, sex, country of birth, state/territory of drowning, location of drowning, residential location, distance from residential location and drowning location, remoteness classification of drowning location, season, time of day, holiday periods, activity being undertaken prior to drowning, and presence of alcohol, drugs and a pre-existing medical condition(s).

Table 1: Definitions of drowning location and activity being undertaken immediately prior to drowning, based on the Royal Life Saving Drowning Database and Coding Definitions Manual [18]

| Variable                | Definition                                                                                                                                                                                                                                                                         |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Location                | Based on where the drowning incident occurred                                                                                                                                                                                                                                      |
| Lake/Dam (lakes)        | Lake, dam, lagoon, swimming holes, gorges, billabong, reservoir                                                                                                                                                                                                                    |
| River/Creek             | A natural waterway fed by other bodies of water. Can vary in water flow, length, width and depth. Includes: river, creek, stream, canal, channel, culvert, estuary, flood plain, inlet, stream, weir, waterfall.                                                                   |
| Activity                | Activity being undertaken immediately prior to drowning, where known.                                                                                                                                                                                                              |
| Boating                 | Is defined as using motor or wind powered vessels of all sizes, and includes yachts. Personal watercraft (8), also known as jet skis, are included in this category as these are motor powered.                                                                                    |
| Diving                  | The sport or activity of exploring or swimming under water. This category includes activities related to diving where the person was already in and or submerged by water prior to drowning e.g. spear fishing                                                                     |
| Fall                    | Unintentional entry into the water from land.<br><br>Note intention may be unknown – particularly in cases of children where intention may have been to be in the water. For example: fall while walking near water, fall whilst playing near water, fall whilst cleaning the pool |
| Rock Fishing            | Fishing from rocks, rocky outcrops, cliffs. Includes where people were conducting this activity and fell or were swept into the water subsequently.                                                                                                                                |
| Swimming and recreating | Already in the water either partially or fully submerged while performing recreational or swimming activities. Includes people who were in the water prior to drowning and includes activities such as swimming, wading, playing and floating.                                     |
| Other                   | Includes activities where small counts were presented <5 cases and includes diving (free diving, scuba and snorkelling), swept away e.g. in floodwater and attempting a rescue.                                                                                                    |
| Unknown                 | Activity was unknown and has been removed for data analysis purposes                                                                                                                                                                                                               |

## Seasons

Seasons are as follows: summer (December to February); autumn (March to May); winter (June to August); spring (September to November). Time of drowning was coded into morning (6:01 am to 12 pm), afternoon (12:01 pm to 6 pm), evening, (6:01 pm to 12 am) and early morning (12:01 am to 6 am). Information relating to alcohol and drugs involvement were sourced from toxicology and autopsy reports in the NCIS. A blood alcohol concentration (BAC) greater than or equal to 5 grams of alcohol per 100 millilitres of blood ( $BAC \geq 0.05\%$ ), was considered contributory to the drowning (the upper legal limit in Australia for operating a motor vehicle). Drugs were classified as legal (medication) and illegal (illicit). Information regarding swimming ability was sourced from coroners and police reports.

Where recorded, swimming ability was classified as: competent swimmer, poor swimmer, and non-swimmer. These definitions may not be reflective of actual skills of the person.

## Remoteness classification

Remoteness classification of drowning location was determined by the Australian Standard Geographical Classification – Remoteness Area (ASGC-RA) system and categorised into: Major cities, Inner regional, Outer regional, Remote and Very remote locations, determined according to population and distance to services [19].

Geographical information for the Murray River was sourced from Geoscience Australia [11] Crude drowning rates per 100,000 population were calculated using the latest 2021 census population data from the Australian Bureau of Statistics between 1 July 2012 and 30 June 2021 released 2022 [20] .

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