NATIONAL WASTEWATER DRUG MONITORING PROGRAM

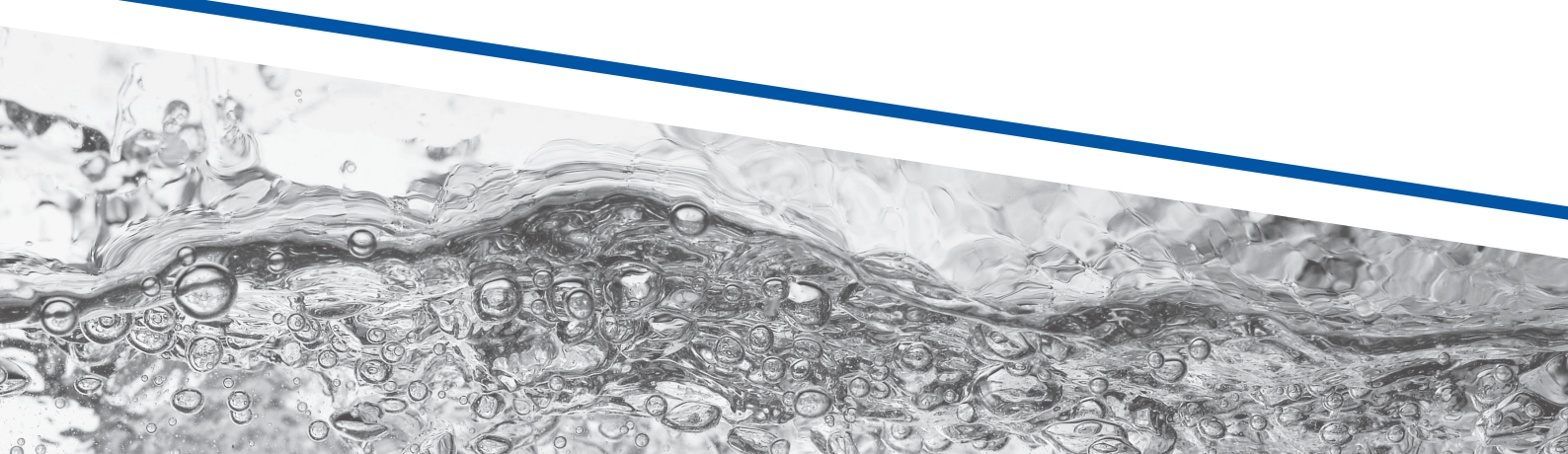
REPORT 18

AUSTRALIAN CRIMINAL INTELLIGENCE COMMISSION

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

University of South Australia

CONTENTS



CEO FOREWORD

I am pleased to present Report 18 of the National Wastewater Drug Monitoring Program (the Program) to interested stakeholders, including the Australian community. Wastewater analysis is one of the most costeffective, least intrusive methods of measuring drug use at a population level.

This report is based on data collected in August and October 2022. In August 2022 the Program covered 57% of the Australian population, rounding out year 6 (2021-22) of the Program. The findings are critical to the Australian Criminal Intelligence Commission's (ACIC) insights on serious and organised criminal involvement in illicit drug trafficking. Much of the harm Australians suffer at the hands of organised crime is due to illicit drugs.

Report 18 revealed that over 14 tonnes of methylamphetamine, cocaine, heroin and 3,4-methylenedioxymethylamphetamine (MDMA) was consumed between August 2021 and August 2022. This represents a 10% reduction in consumption from the previous year, as a result of reductions in consumption of cocaine (28%) and MDMA (41%). There is no evidence of a long-term reduction in demand for cocaine and MDMA, but consumption levels of these drugs are below levels seen previously in the Program, indicating that the dominant factor in these market changes is reduced supply. This is almost certainly the result of a number of law enforcement disruptions of attempted cocaine importations in the first half of 2022. In the case of MDMA, the major factor is a shift by overseas serious organised crime groups towards producing more methylamphetamine.

Nevertheless, increases in national methylamphetamine and heroin consumption are concerning. Moreover, at a time when discretionary expenditure by Australians is increasingly constrained, an estimated $10 billion was spent on methylamphetamine, cocaine, MDMA and heroin between August 2021 and August 2022. Methylamphetamine accounted for 83% of this expenditure.

Six years of longitudinal data enables monitoring of short and longer-term market trends, key events and law enforcement interventions, and the identification and monitoring of drug consumption in geographic locations that may benefit from focused responses. During this time:

- the ACIC has formed strong partnerships with academic institutions to develop detailed pictures of high-risk markets, particularly in regional settings
- some law enforcement investigations are now conducted with high intensity wastewater analysis so that the effectiveness of responses and the reaction of organised crime groups and drug consumers can be monitored.

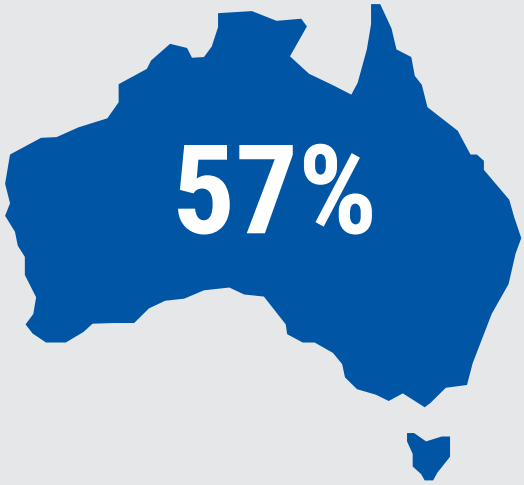
A multi-dimensional approach that targets supply, demand and harm reduction is critical to reducing drug use in Australia. Drug consumption estimates derived from wastewater data, when used in combination with other data—such as seizure, arrest, price, purity, health and availability data—provide the most comprehensive, empirically-based insight into Australian drug markets. In turn, these data reveal drug market resilience, but also points of vulnerability that present opportunities for coordinated supply, demand and harm reduction strategies that reduce harm to the Australian community. The ACIC remains committed to working with domestic and international law enforcement and intelligence partners to disrupt and dismantle serious organised criminal networks who continue to bring illicit drugs to Australia.

ACKNOWLEDGEMENTS

I would like to acknowledge the valuable support and expertise of The University of Queensland and the University of South Australia, which undertook the data collection and analysis underpinning this report, and the ACIC officers who contributed to the project.

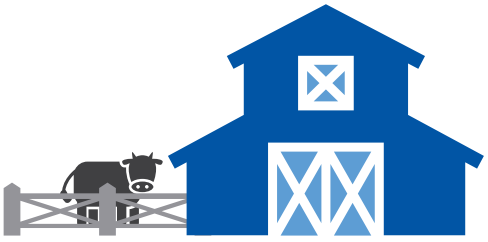
Matthew Rippon
Acting Chief Executive Officer
Australian Criminal Intelligence Commission

SNAPSHOT



The August 2022 collection covers around **57 per cent** of Australia's population—about **14.3 million Australians.**

Capital city **methylamphetamine, cocaine, MDMA, heroin** and **ketamine** average consumption exceeded regional consumption.



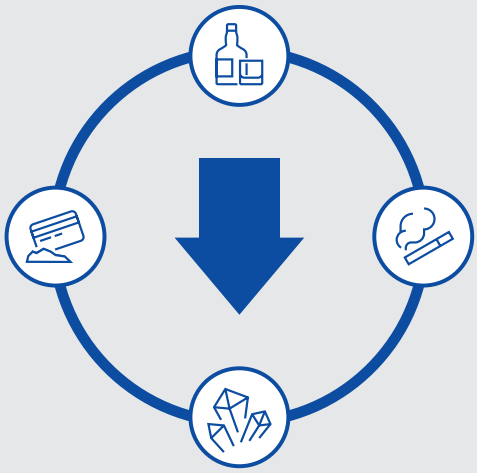
Regional **alcohol, nicotine, MDA, oxycodone, fentanyl** and **cannabis** average consumption exceeded capital city consumption.

August and October 2022 highlights

Record lows:

- **cocaine** capital and regional (August)
- **alcohol** capital and regional (August)

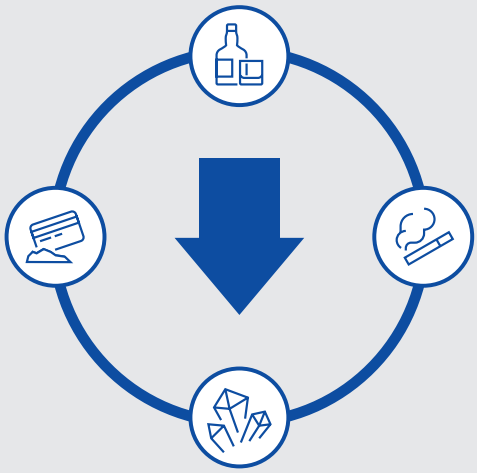
Between April and August 2022, the population-weighted average capital city consumption of:



alcohol, nicotine, methylamphetamine and cocaine **decreased**

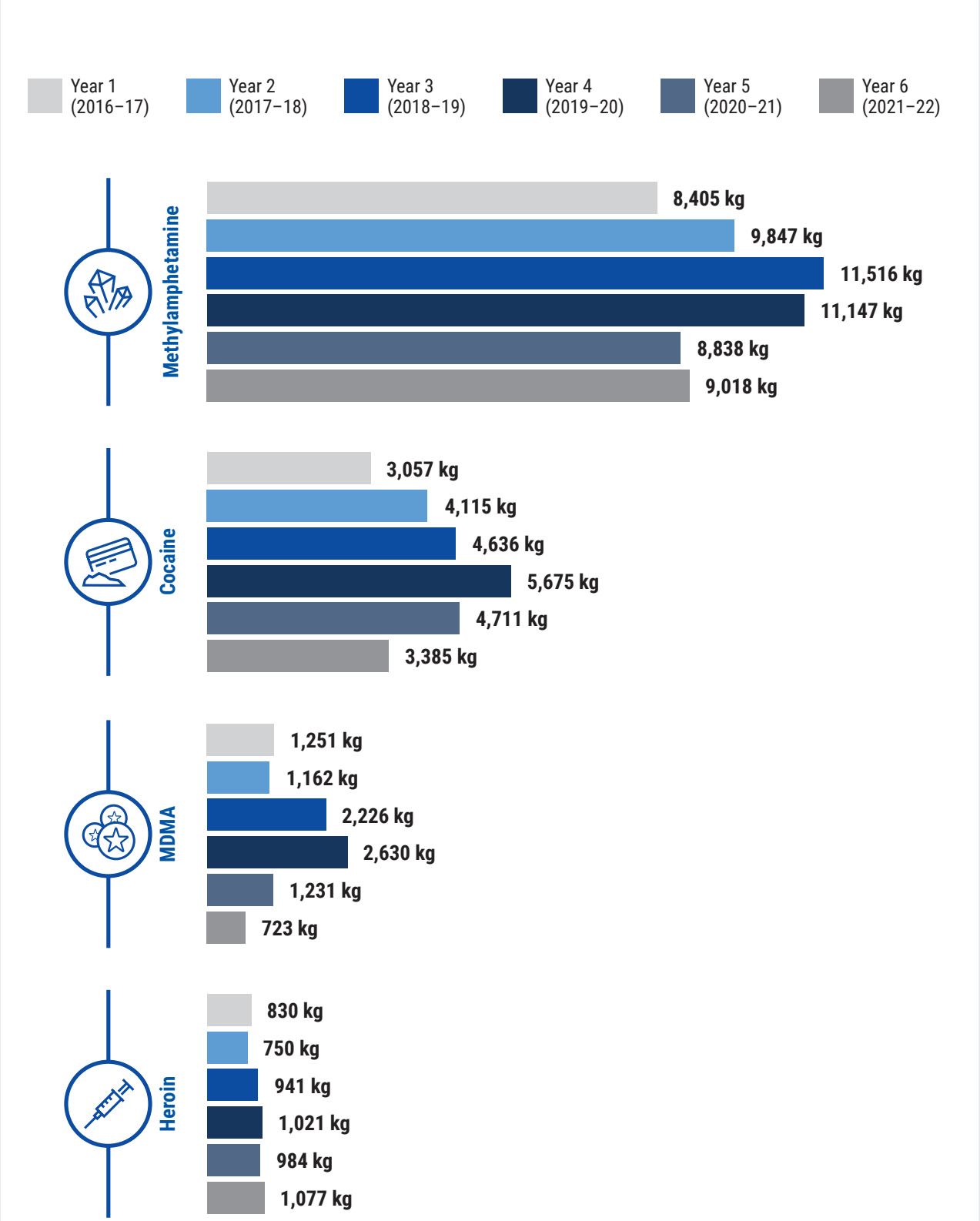
MDMA, MDA, heroin, oxycodone, fentanyl, cannabis and ketamine **increased**

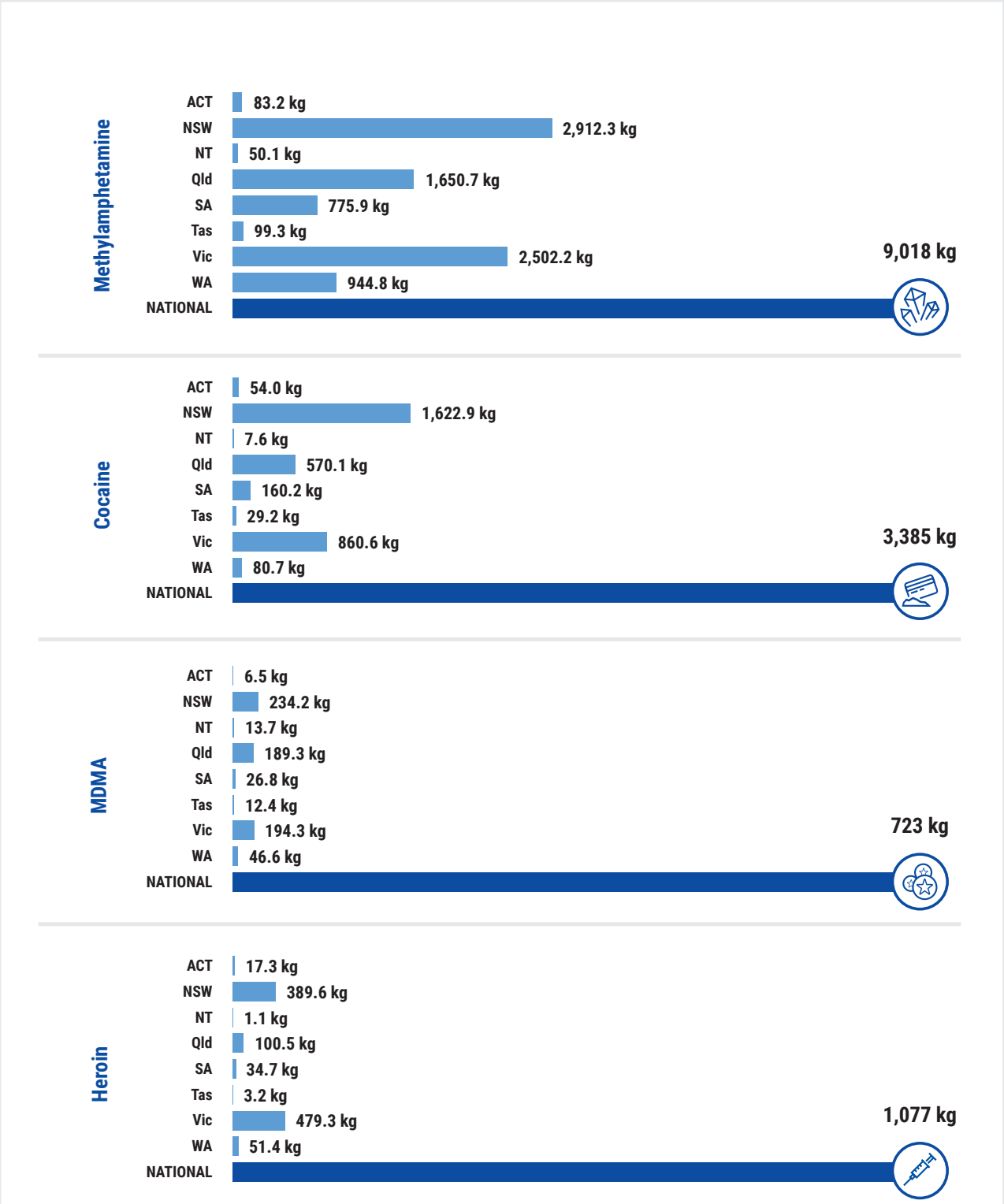
Between April and August 2022, the population-weighted average regional consumption of:



alcohol, nicotine, methylamphetamine and cocaine **decreased**

MDMA, MDA, heroin, oxycodone, fentanyl, cannabis and ketamine **increased**


Year 1 (2016–17)
Year 2 (2017–18)
Year 3 (2018–19)
Year 4 (2019–20)
Year 5 (2020–21)
Year 6 (2021–22)
Methylamphetamine
8,405 kg
9,847 kg
11,516 kg
11,147 kg
8,838 kg
9,018 kg
Cocaine
3,057 kg
4,115 kg
4,636 kg
5,675 kg
4,711 kg
3,385 kg
MDMA
1,251 kg
1,162 kg
2,226 kg
2,630 kg
1,231 kg
723 kg
Heroin
830 kg
750 kg
941 kg
1,021 kg
984 kg
1,077 kg

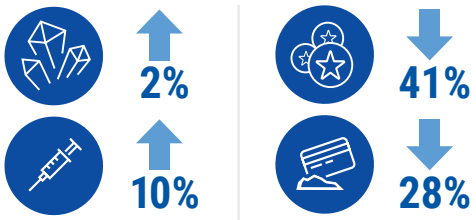


Estimated state and territory annual consumption of methylamphetamine, cocaine, MDMA and heroin for Year 6 of the Program.

Between Year 5 and Year 6 of the Program (August 2021 to August 2022) total estimated consumption of **methylamphetamine**, **cocaine**, **MDMA** and **heroin** decreased by 1.5 tonnes, or 10 per cent of the combined total weight.

Market impacts:

Consumption of **methylamphetamine** and **heroin** increased 2% and 10% respectively. There were much larger decreases in **MDMA** and **cocaine** consumption, by 41% and 28% respectively



Market values:

The estimated street value of the 4 drugs in Year 6 was **$10 billion**, down from $10.3 billion in Year 5.

INTRODUCTION

This is the 18th report of the National Wastewater Drug Monitoring Program (the Program) to be publicly released by the Australian Criminal Intelligence Commission (ACIC). Report 18 presents data on Australia's drug consumption for 12 substances and includes data for August (capital city and regional sites) and October 2022 (capital city sites).

The Program is an Australian Government-funded initiative that assists in understanding drug use within populations, providing a measure of one important aspect of national health—the demand for a range of drugs. Illicit drugs and licit drugs with abuse potential are inherently harmful. Reliable drug consumption data are a key indicator of the level of harm experienced by the community. This is because the level of community harm is directly related to the quantity of substances consumed.

Findings presented in ACIC wastewater reports provide law enforcement, policy, regulatory and health agencies with additional, objective data on drug use. These data create opportunities to shape responses to the demand and supply sides of illicit drug markets, particularly in high-use areas, and can inform harm reduction strategies. They inform priority-setting that is responsive to constantly evolving drug markets and broader world circumstances.

Longitudinal data captured by the Program increases our understanding of drug use nationally, in specific locations and over time. It provides valuable insight into trends and emerging issues in drug consumption across Australia and can identify new sources of risk.

IMPLEMENTATION

The ACIC has contracted The University of Queensland, and through it the University of South Australia, to deliver the Program. Relationships were built between the universities and the operators of wastewater facilities across Australia to permit the collection and analysis of samples.

In this report, Program wastewater analysis measured the presence[1] of the following substances:

- methylamphetamine
- amphetamine
- cocaine
- 3,4-methylenedioxymethylamphetamine (MDMA)
- 3,4-methylenedioxyamphetamine (MDA)
- heroin
- cannabis
- oxycodone
- fentanyl
- nicotine
- alcohol
- ketamine.

The ACIC continues to review the range of monitored substances with its partners, stakeholders and the universities.

1 The contract recognises that threshold levels are substance dependent and will vary accordingly. Refer to the research findings for further information on detection levels, and whether it was possible to measure all substances.

Both contracted universities monitored wastewater across Australia, covering all state and territory capital cities and a range of regional cities and towns. In August 2022, 58 wastewater treatment plants participated nationally (see Figure 1).[2] Sites were selected to permit the ACIC to provide data on major population areas, sites of actual or potential concern from a drug use perspective and sites where treatment plant operators have established relationships with the 2 universities.

Figure 1: The breakdown of sites by jurisdiction for August 2022.

Participation from all states and territories is vital to informing understanding of the national picture of drug use and demand. In the event that one or more states and territories choose(s) not to participate in the national program in the future, the ACIC, in consultation with the universities, will identify replacement sites from participating states and territories to ensure that the largest possible segment of the national population is sampled. Accordingly, the location of sites within and between states and territories may change over the life of the Program, although the intention is to ensure site continuity.

2 Sampling also occurred in October 2022 in capital city sites, with 20 participating wastewater sites nationally, covering approximately 48% of the Australian population.

REPORTING

Program reports are published 3 times a year. In accordance with current wastewater analysis conventions, the terms of the contract, and to protect the integrity of the Program, the exact locations of wastewater treatment plants sampled are not publicly released by the ACIC. Stakeholders in law enforcement, health and other relevant policy agencies are provided with classified information identifying actual sampling locations to inform appropriate responses.

Reported results reflect per capita use in all locations and, with the exception of MDA, cannabis and ketamine (for which reliable dose figures are unavailable), are expressed in terms of both the number of doses and the weight or volume consumed per capita of the respective substances, to facilitate comparison between substances.

EXPLOITATION OF PROGRAM DATA

The Program is based on a well-established, internationally recognised methodology. Program data provide an important basis for the development of empirically-informed government and private sector policy and decision making. The reports provide regular, timely, unambiguous and detailed measures of the level of demand for the listed substances in the Australian population, complementing other drug datasets published in Australia. Report 18 measures the drug use of approximately 57% of the Australian population. Population estimates were updated with Census 2021 population data and are reflected in the site data from April 2022.

Wastewater data are also particularly useful for identifying differences in levels of drug consumption in capital city and regional areas of Australia. The data reinforce different dynamics that apply to both capital city and regional markets and illustrate drug consumption variations that exist within and between states and territories. Understanding these preferences is important in the development and delivery of national responses and in tailoring responses to suit the specific needs of individual jurisdictions. Wastewater analysis also permits the ACIC to gain insight into the decision-making of serious and organised crime groups that supply illicit drug markets.

Regular wastewater reporting enables the ACIC and partners to detect and respond to increasing drug threats in a timely way. The number and diversity of regional sites that participate in the Program permit confident assessments to be made of drug trends outside of the capital cities that can be used to inform local responses. This is important because it allows wastewater data to complement a number of other Australian drug data collections that have limited regional coverage or are confined to capital cities. It also permits the ACIC and partners to speak with greater confidence about local drug threats. Wastewater data are used with other available data sources to develop a comprehensive and accurate understanding of drug markets nationally and in each state and territory.

Triangulated data show that domestic drug markets are complex and vary between jurisdictions, with external influences affecting markets in different ways at different time periods. Other Program data illustrated that consumption of the respective drugs also varied considerably at different sites within jurisdictions. Given that a relatively small proportion of the Australian population consumes illicit drugs, it is important that datasets that purport to measure drug consumption cover a significant proportion of the population on a regular and ongoing basis and a variety of local drug markets. It is also important that Australian drug datasets are interpreted holistically.

The ACIC engages with academic institutions, industry and public sector agencies to identify further data applications. Identified opportunities included informing responses in high risk areas; measuring drug use in specific local areas; estimating the size of discrete illicit markets; and exploring options for monitoring the effectiveness of existing demand, supply and harm reduction initiatives. The Program is sufficiently flexible to allow for focused collection activity in different geographic locations and at more regular intervals in response to identified need.

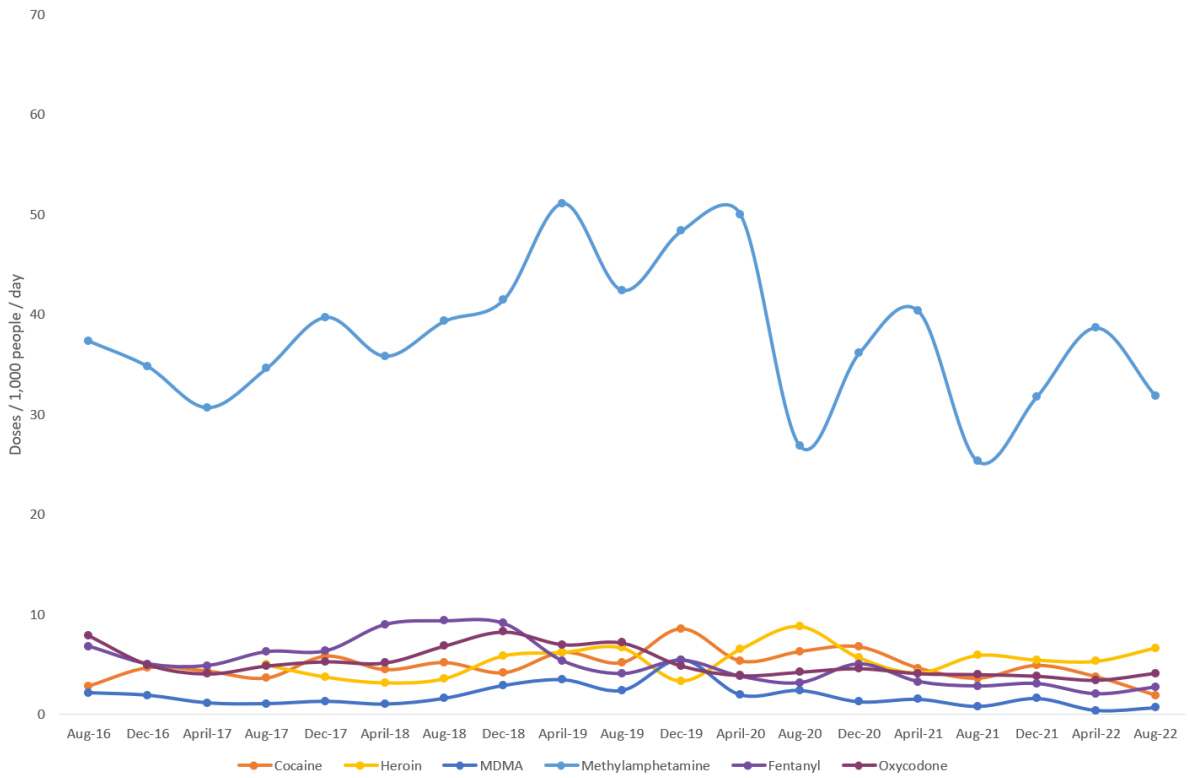
A 6 YEAR RETROSPECTIVE

With the passage of 6 years, sufficient data have now been collected by the Program to permit longitudinal analysis of consumption trends. Moreover, Program data have proven amenable to analysis from a variety of perspectives, including highlighting differences at the national versus regional levels, and differences in consumption between city and regional settings.

DRUG CONSUMPTION SNAPSHOT

The Program shows that of illicit drugs with available dose data, methylamphetamine remains the most consumed drug by a large margin, despite fluctuations across this market over time (Figure 2). Consumption of other drugs has also fluctuated throughout the life of the Program, albeit within a narrower range. There has been a considerable decrease in cocaine consumption since December 2021, culminating in August 2022 in cocaine consumption being at record low levels in capital city and regional areas. MDMA remains one of the lowest consumed drugs monitored by the Program. Since August 2021, heroin has been the second most consumed illicit drug after methylamphetamine. The consumption of fentanyl and oxycodone has remained relatively stable over the past 2 years.

Figure 2: National average drug consumption of methylamphetamine, cocaine, MDMA, oxycodone, fentanyl and heroin.



Throughout the life of the Program, national consumption of nicotine and alcohol far exceeded consumption of all other substances monitored. Dose data were unavailable for cannabis, but based on load data (mg of THC consumed/1,000 people/day) consumption of cannabis was higher in mid-2022 than it was at the commencement of monitoring in August 2018. Moreover, for 3 of the past 4 years, cannabis consumption has peaked in August in regional areas before decreasing, with a peak also recorded in August 2022. This trend has the appearance of being cyclical, which is perhaps surprising for the cannabis market. The reason for this is unknown.

The combined estimated national consumption of the 4 major illicit drugs of concern (methylamphetamine, cocaine, MDMA and heroin) increased annually in the first 4 years of the Program, followed by a marked reduction in total consumption in Year 5 (2020–21) of the Program and a further, smaller, decrease in Year 6 (2021–22). The most recent decrease amounts to 10%, or

1.5 tonnes, less consumption than in Year 5, chiefly driven by a decrease in MDMA and cocaine consumption (Table 1). In contrast, the consumption of methylamphetamine and heroin increased slightly in Year 6, with heroin consumption being the highest recorded by the Program. Methylamphetamine accounted for approximately 64% of the combined estimated consumption of these 4 drugs in Year 6 of the Program, compared with approximately 56% in Year 5.

Table 1. Estimated annual methylamphetamine, cocaine, MDMA and heroin consumption, as total weight consumed nationally, Year 1 to Year 6 of the Program.

Drug	Estimated consumption (kilograms per annum)						% Change	
	Year 1 2016–17	Year 2 2017–18	Year 3 2018–19	Year 4 2019–20	Year 5 2020–21	Year 6 2021–22		Year 5 to Year 6
Methylamphetamine	8,405	9,847	11,516	11,147	8,838	9,018	↑	2
Cocaine	3,057	4,115	4,636	5,675	4,711	3,385	↓	-28
MDMA	1,251	1,162	2,226	2,630	1,231	723	↓	-41
Heroin	830[a]	750	941	1,021	984	1,077	↑	10
TOTAL	**13,543**	**15,874**	**19,319**	**20,473**	**15,764**	**14,203**	↓	**-10**

[a] Heroin estimates for Year 1 are based on one collection period.

[b] This figure is not a summation of percentage change entries in this column, it represents the percentage difference in total consumption between Years 5 and 6 of the Program.

In Year 6 of the NWDMP (2021–22) total national consumption of all 4 drug types was 14.2 tonnes, worth an estimated $9.9 billion at the street level:

- methylamphetamine—9.0 tonnes
- cocaine—3.3 tonnes
- MDMA—0.7 tonne
- heroin—1.0 tonne.

Program data also show fluctuating consumption over time, including record high and low consumption of various drugs at different times during the 6-year period of the Program, emphasising that illicit drug markets do not operate in a consistent manner. At a national level, when both capital city and regional sites are considered, the Program is more likely to measure record highs in drug consumption during the month of December (41% of all record highs), while record low consumption is more likely to occur in April (50% of record lows). It is likely that these results reflect both opportunities for motivated users to consume drugs and decisions by organised crime groups to supply them in anticipation of higher demand. The Program recorded the highest number of record high consumption levels in 2019, which was a continuation of a period of increases in annual illicit drug consumption, while the highest number of record low consumption levels was recorded in 2022, which likely reflects a period of adjustment to the market shock during the time of the COVID-19 restrictions and a series of law enforcement successes.

VALUE OF DRUGS CONSUMED

Using Program consumption data and the most recent national median price data available to the ACIC it is possible to calculate the overall estimated street value of the 4 drugs. In Year 6 (2021–22) the total market value of the 4 major illicit drugs of concern remained relatively stable at $10 billion (Table 2). The methylamphetamine market, which is the most expensive of the four drug types and where consumption increased by 2%, accounted for the majority of that expenditure, amounting to $8.34 billion (83% of the total estimated expenditure). Analysis over a long period has indicated that in Australia street prices of the major drugs change little in response to external factors, including changes in wholesale prices or variations in supply. We judge that this is due in part to the large profit margin enjoyed by SOC groups and the fact that illicit drug users in Australia are ‘price-takers’. Also, the differences in prices between the 4 drugs do not appear to be a major factor in drug choice: the median national street price of a cocaine ‘deal’ is less than the price for a crystal methylamphetamine ‘deal’, so price does not appear to be a factor in the decreased consumption of cocaine.

Table 2. Estimated street value of annual methylamphetamine, cocaine, MDMA and heroin consumption for Year 1 to 6 of the Program.

Drug	Estimated street value					
	Year 1 (A$) 2016–17	Year 2 (A$) 2017–18	Year 3 (A$) 2018–19	Year 4 (A$) 2019–20	Year 5 (A$) 2020–21	Year 6 (A$) 2021–22
Methylamphetamine	7.24 billion	7.38 billion	8.63 billion	6.96 billion	7.95 billion	8.34 billion
Cocaine	1.06 billion	1.54 billion	2.08 billion	1.41 billion	1.88 billion	1.10 billion
MDMA	145.59 million	114.19 million	211.08 million	226.72 million	95.50 million	62.32 million
Heroin	207.50 million	375.00 million	423.45 million	382.87 million	418.20 million	538.50 million
TOTAL	**8.6 billion**	**9.4 billion**	**11.3 billion**	**8.9 billion**	**10.3 billion**	**10.0 billion**

ESTIMATED STATE AND TERRITORY CONSUMPTION

At the state and territory level methylamphetamine and heroin consumption trends were mixed, with cocaine and MDMA consumption decreasing in all jurisdictions in Year 6 (Tables 3 to 6). There were relatively minor changes in methylamphetamine consumption in jurisdictions. In contrast, cocaine consumption during Year 6 was marked by considerable decreases in major markets such as New South Wales (-32%), Victoria (-21%) and Queensland (-33%). There were notable decreases in MDMA consumption across most jurisdictions, including New South Wales (-48%) and Queensland (-37%). There were relatively modest changes to heroin consumption in jurisdictions, including increases in New South Wales and Victoria.

Table 3. Estimated methylamphetamine consumption per jurisdiction in Year 1 to Year 6 of the Program.

Jurisdiction	Estimated consumption (kilograms per annum)						% Change	
	Year 1 2016–17	Year 2 2017–18	Year 3 2018–19	Year 4 2019–20	Year 5 2020–21	Year 6 2021–22		Year 5 to Year 6
Australian Capital Territory	80.3	93.0	119.4	122.1	93.2	83.2	↓	-11
New South Wales	2,298.3	2,604.5	3,337.4	3,409.7	2,877.0	2,912.3	↑	1
Northern Territory	65.5	75.5	84.8	66.6	54.7	50.1	↓	-8
Queensland	1,277.5	1,893.3	2,247.7	2,246.8	1,608.8	1,650.7	↑	3
South Australia	1,005.3	1,159.5	943.2	980.5	838.5	775.9	↓	-8
Tasmania	92.0	127.1	177.1	155.0	88.5	99.3	↑	12
Victoria	2,039.2	2,477.7	3,124.6	2,980.2	2,307.9	2,502.2	↑	8
Western Australia	1,547.3	1,416.8	1,482.7	1,186.2	969.9	944.8	↓	-3

Table 4. Estimated cocaine consumption per jurisdiction in Year 1 to Year 6 of the Program.

Jurisdiction	Estimated consumption (kilograms per annum)						% Change	
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6		Year 5 to Year 6
Australian Capital Territory	67.8	81.2	83.4	113.9	91.9	54.0	↓	-41
New South Wales	1,812.3	2,397.8	2,548.0	2,988.2	2,374.5	1,622.9	↓	-32
Northern Territory	19.0	27.4	22.8	20.9	12.4	7.6	↓	-39
Queensland	319.4	576.6	714.1	918.5	845.3	570.1	↓	-33
South Australia	107.1	129.2	173.1	243.8	170.5	160.2	↓	-6
Tasmania	10.9	15.5	16.6	26.8	35.1	29.2	↓	-17
Victoria	676.5	819.9	968.0	1,216.0	1,083.9	860.6	↓	-21
Western Australia	43.9	67.9	110.0	147.0	98.3	80.7	↓	-18

Table 5. Estimated MDMA consumption per jurisdiction in Year 1 to Year 6 of the Program.

Jurisdiction	Estimated consumption (kilograms per annum)						% Change	
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6		Year 5 to Year 6
Australian Capital Territory	28.4	14.4	36.5	38.6	17.8	6.5	↓	-64
New South Wales	462.8	450.5	834.7	986.1	446.1	234.2	↓	-48
Northern Territory	37.8	24.1	32.4	46.4	32.1	13.7	↓	-57
Queensland	216.5	223.2	502.4	627.6	301.3	189.3	↓	-37
South Australia	56.5	66.6	70.8	127.8	79.6	26.8	↓	-66
Tasmania	30.6	16.7	54.9	54.1	31.0	12.4	↓	-60
Victoria	319.6	291.3	511.9	479.0	232.0	194.3	↓	-16
Western Australia	99.0	74.9	182.4	271.3	91.5	46.6	↓	-49

Table 6. Estimated heroin consumption per jurisdiction in Year 1 to Year 6 of the Program.

Jurisdiction	Estimated consumption (kilograms per annum)						% Change	
	Year 1[a]	Year 2	Year 3	Year 4	Year 5	Year 6		Year 5 to Year 6
Australian Capital Territory	14.7	15.3	10.3	16.9	15.3	17.3	↑	13
New South Wales	264.6	222.2	307.0	323.9	356.9	389.6	↑	9
Northern Territory	1.0	1.0	1.0	1.4	1.6	1.1	↓	-31
Queensland	65.5	66.2	66.4	77.7	84.8	100.5	↑	19
South Australia	47.8	34.8	30.5	41.8	37.5	34.7	↓	-8
Tasmania	3.3	4.5	2.8	4.3	5.4	3.2	↓	-41
Victoria	402.1	359.4	469.7	464.4	424.4	479.3	↑	13
Western Australia	31.1	46.8	53.8	91.4	58.7	51.4	↓	-12

[a] Annual heroin consumption estimates for Year 1 are informed by data from only one collection period.

CAPITAL CITY V REGIONAL COMPARISON

Over the life of the Program, consumption of most drugs was generally higher per capita in regional areas. The exceptions were cocaine and heroin, where consumption was generally higher in capital cities. Per capita consumption of methylamphetamine from December 2020 fluctuated between higher levels in the capital cities and regional areas. A similar situation was observed for MDMA since April 2021. In relation to fentanyl, the disparity between regional and capital city consumption has narrowed since August 2020.

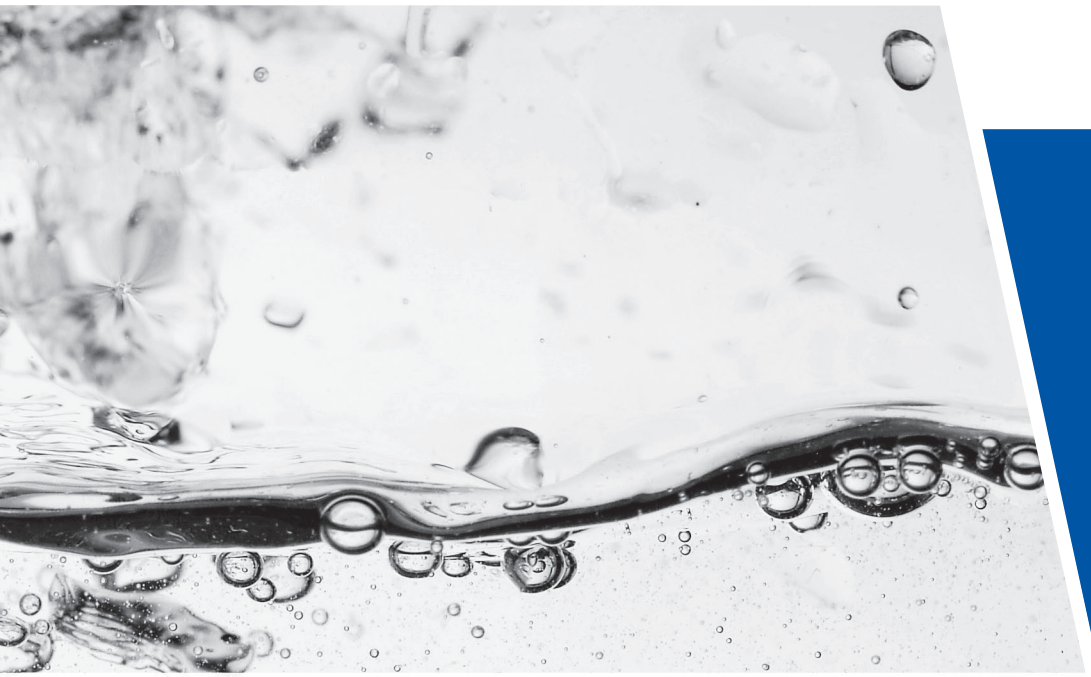
What these patterns show is that domestic drug markets are complex and vary between jurisdictions, with external influences affecting markets in different ways at different time periods. Other Program data illustrated that consumption of these drugs also varied considerably at different sites within jurisdictions.

We assess fluctuations in consumption that have occurred in the cocaine and MDMA market in Year 6 of the Program were largely driven by Australian law enforcement detections and seizures, among other supply side factors, because no other major environmental shifts have occurred globally in this period. More than 6 tonnes of cocaine was seized during 2022, which amounts to more than the estimated consumption of cocaine in Year 6 of the Program (to August 2022).

EVOLUTION OF THE PROGRAM

Wastewater data are an important part of the national suite of datasets that increase understanding of drug consumption, demand and supply in Australian cities and regional locations. Ensuring Program data are publicly available assists understanding and informs the national conversation on drug markets, including their supply, the harm they cause and appropriate policy responses. Report 18 builds on national drug consumption data contained in the 17 preceding reports to identify trends over at least 6 years in drug use across states, territories and the nation.

The ACIC's wastewater work extends far beyond the Program. We are exploiting new technology developed by our university partners to take sampling to an increasing variety of sites beyond wastewater treatment plants. Innovation in the range of chemicals that can be reliably detected and quantified in wastewater is also occurring, with these advances having application for law enforcement, health and broader community harm reduction purposes. Moreover, wastewater analysis now routinely extends to a broader range of drugs than is reported in the Program for research and development purposes, which aids future understanding of emerging drug market issues and responses.



RESEARCH FINDINGS

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LIST OF ABBREVIATIONS

ABS	Australian Bureau of Statistics
ACIC	Australian Criminal Intelligence Commission
ACT	Australian Capital Territory
DASSA	Drug and Alcohol Services South Australia
LC-MS/MS	Liquid chromatography tandem mass spectrometry
LOD	Limit of detection
LOQ	Limit of quantification
MDA	3,4-methylenedioxyamphetamine
MDMA	3,4-methylenedioxymethylamphetamine
NSW	New South Wales
NT	Northern Territory
NWDMP	National Wastewater Drug Monitoring Program
Qld	Queensland
SA	South Australia
SPE	Solid phase extraction
Tas	Tasmania
THC	Tetrahydrocannabinol
THC-COOH	11-nor-9-carboxy-tetrahydrocannabinol
Vic	Victoria
WA	Western Australia
WWTP	Wastewater treatment plant

TERMINOLOGY

Methylamphetamine is also commonly known as methamphetamine. In this report, consistent with the preferences of the Australian Criminal Intelligence Commission, methylamphetamine is used.

MDMA is commonly known as ecstasy.

Alcohol consumption in this report refers to ethanol consumption, but the more general term 'alcohol' is used throughout.

Nicotine consumption has replaced tobacco consumption in this report as the target metabolites may also be derived from nicotine replacement products such as gums and patches.

THC and THC-COOH: Tetrahydrocannabinol is the main psychoactive compound in cannabis and is referred to as THC throughout this report. Cannabis consumption levels have been calculated from the THC metabolite, 11-nor-9-carboxy-tetrahydrocannabinol (THC-COOH).

1: EXECUTIVE SUMMARY

The Australian Criminal Intelligence Commission (ACIC)'s National Wastewater Drug Monitoring Program (NWDMP) has reported on selected substances of concern in most populated regions of Australia since August 2016. The current version of the NWDMP focuses on 12 licit and illicit drugs including nicotine, alcohol, the stimulants methylamphetamine, amphetamine, cocaine, MDMA (ecstasy) and MDA, and the opioids oxycodone, fentanyl and heroin. Cannabis and ketamine make up the remaining number. Estimates of drug consumption in a population are determined from measured concentrations of drug metabolites (excreted into the sewer system after consumption) in wastewater samples and results are used to monitor trends in drug consumption over the life of the Program. Wastewater treatment plants (WWTPs) located across capital cities and regional Australia and covering all states and territories have been invited to participate in the Program. Each site has been allocated a unique code which is assigned to each WWTP throughout the course of the Program. Site names are not included in this report to maintain treatment plant confidentiality.

For Report 18, wastewater samples were collected for up to 7 consecutive days during weeks in August and October 2022. The August collection involved regional and capital city sites, while October included capital city sites only. A total of 58 sites participated in the Program for August 2022, consisting of 22 capital city WWTPs and a further 36 regional WWTPs, covering a population of 14.3 million Australians. Data from this report equates to coverage of approximately 57 per cent of Australia's population for August and 48 per cent for October 2022 (capital city sites only).

A total of 538 new samples have been added to the 8,537 collected previously, bringing the total number since the beginning of the Program to 9,075. The collected samples provide comprehensive, Australia-wide baseline data against which subsequent results can be compared to ascertain both spatial and temporal trends. The snapshot of the scale of drug consumption over a week in August 2022 was compared with historical data included in previous reports. The August 2022 dataset was used for the spatial comparison as it was more comprehensive, including both capital city and regional sites. The temporal comparison includes the latest capital city collection data for October 2022.

Expressed in terms of average dose amounts, alcohol and nicotine were consistently the highest consumed drugs in all states and territories in August 2022. This comparison did not include cannabis due to some uncertainties about the best estimate of a typical dose. The average consumption of nicotine was higher in regional areas in August 2022 compared to capital cities, except in Tasmania. Consumption was variable between sites, particularly in regional parts of the country. On a jurisdictional level, the Northern Territory had the highest average nicotine consumption in August 2022, as it generally has over the life of the Program.

Overall alcohol consumption in regional areas was higher than that in the capital cities in August 2022. Compared to nicotine, the spread in alcohol consumption over the August collection week tended to be wider. The Northern Territory had the highest overall per capita alcohol consumption. Nationally, average alcohol consumption in both capital city and regional sites in August 2022 decreased to the lowest levels recorded by the Program.

Average methylamphetamine consumption in August 2022 was similar in capital cities and regional areas. Several regional sites across the country recorded consumption levels that were well above the national average, with a regional site in Queensland and South Australia recording the highest per capita consumption of the drug. The population weighted-average consumption of methylamphetamine in capital cities exceeded that in regional areas in August 2022. Methylamphetamine consumption trends for this collection period varied nationally.

Average cocaine consumption in capital cities was higher than in regional areas in August 2022. New South Wales had the highest per capita cocaine consumption level, particularly in one of the capital city sites. Cocaine consumption has been decreasing relatively consistently over the past 2 years, with population-weighted average cocaine consumption in both capital city and regional areas decreasing to record low levels in August 2022.

MDMA consumption remains relatively low compared to levels reported earlier in the Program. In August 2022, average capital city consumption exceeded regional consumption. A capital city site in New South Wales had the highest per capita MDMA consumption nationally and was well above the capital city average. Increases in MDMA consumption were observed in most jurisdictions during this reporting period. MDA, being a stimulant in its own right as well as a metabolite of MDMA, was excreted at relatively low levels. MDA excretion in regional areas exceeded that in the capital cities in August 2022.

Oxycodone and fentanyl are prescription pharmaceutical opioids with abuse potential. The population-weighted average consumption of oxycodone and fentanyl was higher in regional parts of the country in August 2022 compared to capital city sites and in the case of oxycodone, consumption was almost double. Oxycodone and fentanyl consumption appears to have reached plateaus at historically low levels nationally, with small short-term variability at a jurisdictional level. The main difference between oxycodone and fentanyl consumption has been the diminishing gap between regional and capital city consumption of fentanyl since mid-2020.

The population-weighted average consumption of heroin in the capital cities was more than double that in regional areas in August 2022, with high consumption of the drug in New South Wales and Victoria. A regional site in Victoria had the highest per capita heroin consumption of any site nationally in August 2022, well above the national capital city and regional average. Trends in heroin consumption are variable.

The population-weighted average consumption of cannabis in regional areas was well above that of capital cities in August 2022. A regional site in Queensland had the highest per capita consumption nationally in August 2022 and was well above the regional average. Most regional sites across Australia had above average consumption in August 2022, particularly some sites in Queensland and South Australia. Cannabis consumption in this reporting period has been at some of the highest levels reported by the Program.

In addition to its use in pain management, ketamine is of growing concern due to its abuse potential. The population-weighted average excretion of ketamine in capital cities exceeded that of regional areas in August 2022. Sites with the highest per capita excretion levels were spread across New South Wales, the Northern Territory, Queensland, Tasmania and Victoria. A common feature at many of the sites with high ketamine excretion was the large range in excretion across the sampling week. Nevertheless, excreted amounts were relatively low.

2: INTRODUCTION

2.1 PREAMBLE

Wastewater analysis is a technique for monitoring the population-scale consumption of substances. The University of Queensland and University of South Australia were commissioned to provide drug consumption data to the ACIC for an initial 3-year program from 2016 to 2019 which included 9 public reports. The universities were then re-commissioned to provide data for an ongoing program. Wastewater treatment sites have been assessed, bimonthly in the case of capital city sites and every 4 months for regional sites. The aim has been to acquire data on the population-scale use of substances that cause potential harm, either through addiction, health risks or criminal and anti-social behaviour. The intention is to build on the baseline data of substance consumption across Australia to establish trends. The report presents patterns of substance consumption across Australia, showing differences in levels between capital cities and regional centres, within and between states and territories, and nationally.

Compounds of concern include nicotine from nicotine intake (cigarettes, gum, patches, e-cigarettes, etc.), ethanol from alcohol consumption, pharmaceutical substances with abuse potential such as oxycodone, fentanyl and ketamine, as well as illicit substances including methylamphetamine, MDMA, MDA, cocaine, cannabis and heroin.

Some drugs share a common clearance pathway from the body. Methylamphetamine is partially metabolised and excreted as amphetamine, while part of a MDMA dose is converted to MDA. The pharmacokinetics of these 4 compounds have been documented and have been accounted for in this report (Pizarro et al. 2002; Khan & Nicell 2011). MDA is a drug in its own right and a metabolite of MDMA. Since the proportion of MDA eliminated after MDMA consumption is known, the proportion of MDA attributable to MDMA metabolism was subtracted from the total measured amount of MDA for each site and expressed as mg excreted per 1,000 people per day (daily mass load). Due to the lack of information of MDA elimination following MDA ingestion, consumption estimates cannot be calculated.

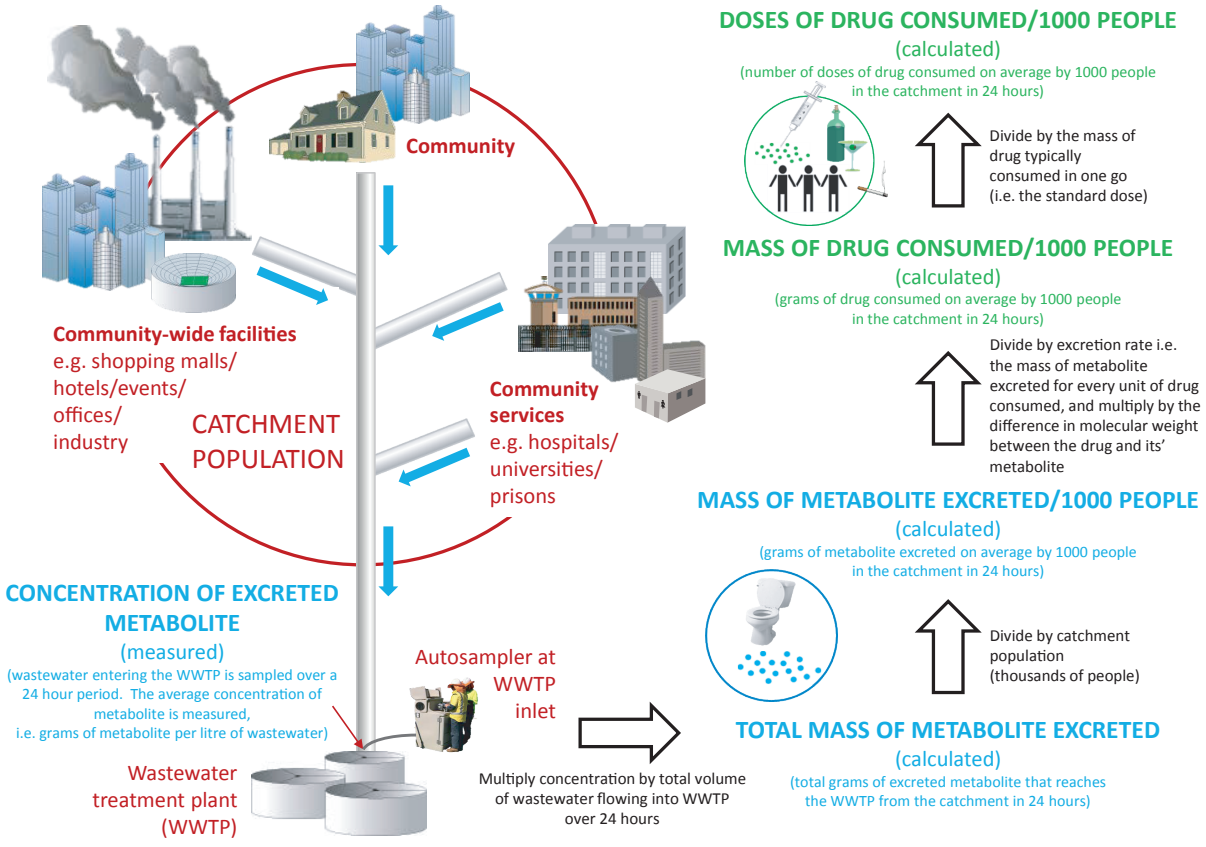
Cannabis results are expressed as amount consumed per day per 1,000 people, while MDA and ketamine results are reported as the amount (mg) of drug excreted per day per 1,000 people due to the absence of clear information in the scientific literature on suitable factors to estimate consumption of the substances through wastewater sampling.

3: METHODS

The method underlying wastewater-based monitoring of drug consumption in a given population is based on the principle that any given compound that is consumed (irrespective of whether it is swallowed, inhaled/smoked or injected) will subsequently be excreted. This may be either in the chemical form it was consumed and/or in a chemically modified form that is referred to as a metabolite. Once the excreted compound or metabolite is flushed, it will enter the sewer system, assuming the toilet forms part of a wastewater catchment.

The drugs and their metabolites of interest were included in the first NWDMP report (available at www.acic.gov.au), as well as an in-depth description of the methodologies involved.[1] Collectively, waste products in the sewer system arrive at a WWTP where wastewater samples are collected over a defined sampling period. Measuring the amount of a target compound in the wastewater stream allows for a back-calculation factor to be applied to determine the amount of drug that was used over the collection period (Figure 3). The method is non-invasive and is done on a population-scale level, so individuals are not targeted, and privacy is respected.

Figure 3: Schematic of the population catchment area and methodology employed to convert measured concentration of substances in wastewater to mass loads or doses consumed per day per normalised population.



1 Information in relation to heroin appears in Report 3.

To obtain an estimate of drug use, representative samples are collected over a given period (typically 24 hours) using autosamplers that collect time or flow proportional samples. Wastewater treatment plant operators aid with collecting the samples from the influent autosampler (where the wastewater enters the treatment plants). Details of the calculation methods are given in Report 1. Apart from a few sites in regional Western Australia, operators have been collecting a second daily influent sample with sodium metabisulphite (0.5% m/v) as preservative from August 2018 to allow for the detection of the cannabis metabolite.

Collected wastewater samples were analysed at the University of South Australia and The University of Queensland laboratories. The steps routinely performed in these laboratories are based on filtration of the samples followed by an enrichment/concentration step where the concentrated sample is injected, or (for chemicals with sufficiently high concentrations) direct injection of samples into the analytical instruments. The instrumental analysis consists of chromatographic separation and subsequent compound specific detection. A summary of the extraction and analytical methods is given in Report 1. An updated excretion table including THC-COOH and dose can be found in Appendix 1. Methods to extract and analyse the cannabis metabolite are outlined in Tscharke et al. (2016). Concentrations of drug metabolites were determined in the wastewater using liquid chromatography-tandem mass spectrometric (LC-MS/MS) analytical methods. Drug consumption estimates for each catchment population were calculated from these measured concentrations using flow volumes and estimates of the catchment population size by evaluating Census data vs. catchment maps, together with excretion and dose data obtained from the scientific literature.

3.1 PARTICIPATING WASTEWATER TREATMENT PLANTS (WWTPs)

Fifty-eight WWTPs across Australia participated in the NWDMP for the August 2022 collection period (Figure 4). Of these, 22 sites were located in capital cities and a further 36 in regional areas, covering a wide range of catchment population sizes. Sites were selected in consultation with the ACIC. The number of participating sites for this report and a complete list of participating sites, number of samples and relative catchment sizes are listed in Table 7 and Appendix 2. To maintain the confidentiality of the participating sites, all sites were allocated a unique code to de-identify their results for the course of the Program. Only site codes are presented in the results. From Report 17, the population estimates of each WWTP have been revised using Census 2021 data and the methodology has been refined (see Appendix 4 of Report 17 for the changes in population from 2016 Census estimates).

Figure 4: Participating WWTPs in August 2022 showing the number of capital city and regional WWTPs by state and territory. The colours in this figure are matched with others in the remainder of the report to identify results relating to individual states and territories.

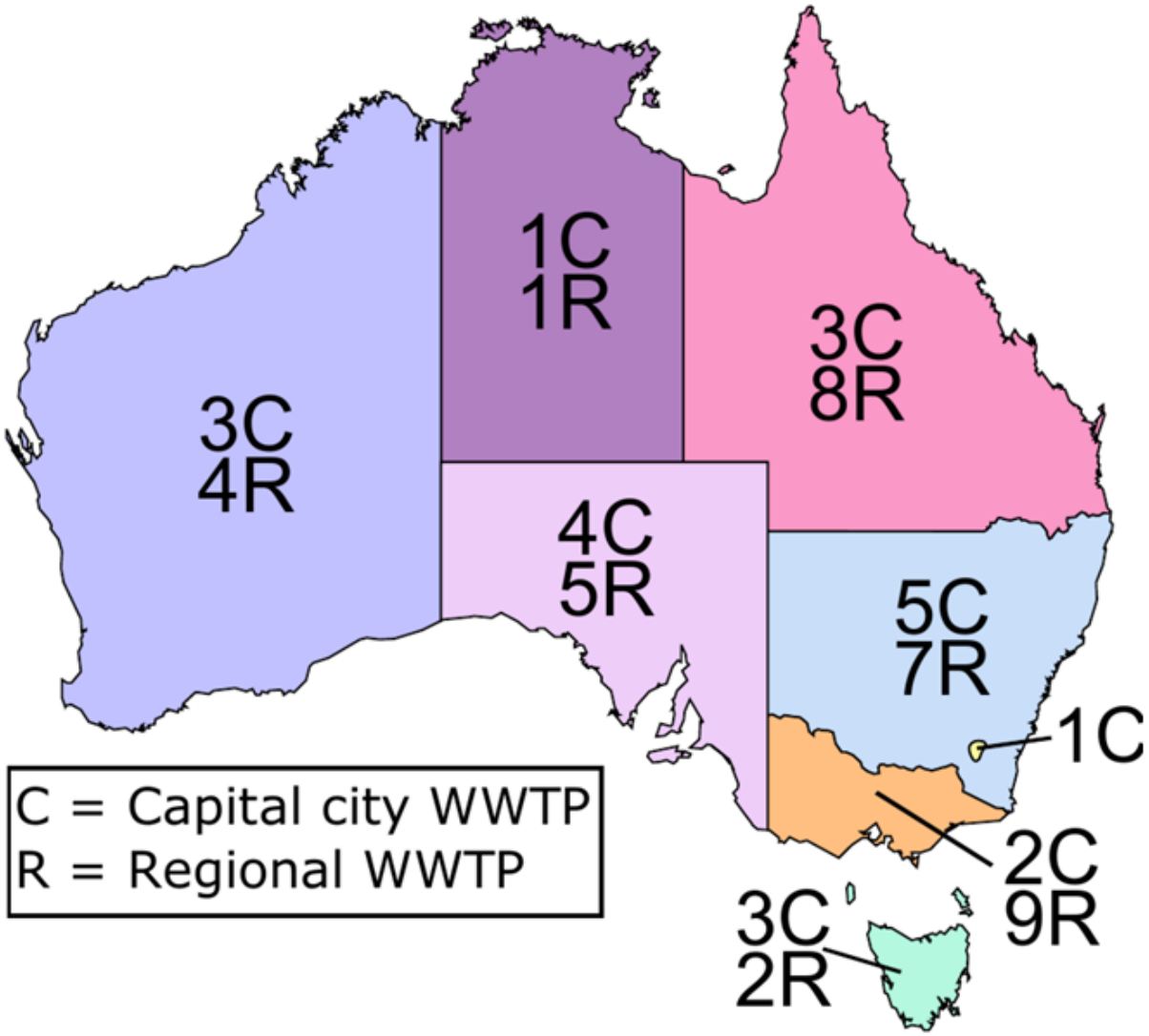


Table 7: Number of participating WWTPs for the periods covered in this report. One collection period aims to collect data from both capital city (C) and regional (R) sites, while the other collection period aims to collect data from capital city sites only.

State or territory	Aug 2022 Capital	Aug 2022 Regional	Oct 2022 Capital
ACT	1	0	1
NSW	5	7	3
NT	1	1	1
Qld	3	8	3
SA	4	5	4
Tas	3	2	3
Vic	2	9	2
WA	3	4	3
Sites	**22**	**36**	**20**
Population (millions) C & R	**12.4**	**2**	**12.1**
% of Australian population	**48.9**	**7.6**	**47.6**
Total population (millions)	**14.3**		**12.1**
% of Australian population	**56.5**		**47.6**

Estimates have been rounded to the nearest 0.1 million. Census 2021 population used (25,422,788) for population percentage estimates.

3.2 SAMPLE COLLECTION AND PREPARATION

Daily composite samples were collected by treatment plant staff on 7 consecutive days, or where 7 days was not feasible, across as many consecutive days as possible. Small revisions may be made to historical data when more accurate data become available, for example, when updated flow measurements supplied by wastewater treatment authorities or population estimates become available, such as the recently released Census 2021 figures. Samples were stored at 4°C or were frozen prior to transport to South Australia or Queensland. Further details of the sampling protocol and relevant quality controls are included in Irvine et al. (2011), Lai et al. (2011), Lai et al. (2015), Tscharke et al. (2016) and Bade et al. (2019). All other descriptions of calculations, extractions and analytical methods are outlined in Report 1 (available at www.acic.gov.au). Methods to detect and analyse THC-COOH are outlined in Tscharke et al. (2016).

3.3 PRESENTATION OF DATA AND INTERPRETATION OF GRAPHS

Reported averages: All averages for state/territory or Australia-wide drug consumption data are presented throughout this report as population weighted averages. The number of people in the catchment population is used as the weighting for the respective drug consumption data for that population. For example, to calculate the population weighted average of capital city methylamphetamine consumption, the methylamphetamine consumption data for each WWTP was multiplied by the respective population number, all data were then summed and divided by the total population across all capital city sites. Reported average values are therefore not skewed towards usage data from small, non-representative populations.

Per capita consumption: The per capita consumption estimates presented in this report are calculated using the total estimated catchment population (which includes children). For example, per capita alcohol consumption has previously been reported by the Australian Bureau of Statistics (ABS) based on population numbers for people aged 15 and over. The consumption values presented in the current report will be under-estimated compared to those determined for an adult-only population. For consistency, data from other studies included in this report were recalculated where necessary using the estimated total population.

Graphical presentation of data: An overview of how the data is presented in the graphs for the individual sites is given in Figure 5. This includes information on interpreting the consumption data presented on the vertical axes in all graphs in this report. To improve readability of graphs with much higher results in a single site, we have labelled the higher value on the respective bar. In some graphs, the values plotted in the graph can be read as either mass of drug consumed (left axis) or doses of drug consumed (right axis). For the specific case of MDA, the amount of MDA excreted following MDA consumption is not known, and therefore this drug can only be expressed as how much drug was excreted into the sewer network, e.g. the mg excreted per 1,000 people per day. This is also similar for ketamine. For cannabis, the approximate dosage is not well defined and results are expressed as mg consumed per 1,000 people per day.

Bubble charts are included to represent the relative extent of consumption in capital city and regional areas for each jurisdiction. See Figure 6 for a description of how to interpret the bubble charts.

Instrumental method limits of detection and limits of quantification: Since the wastewater samples contain very low quantities of particular drugs, the limit of detection (LOD) was determined analytically as the lowest concentration of that drug that could be determined in the sample (using the methods described in Report 1). A drug may be present at a concentration below the LOD. However, trace quantities may be present at undetectable levels. The limit of quantification (LOQ)[2] is a concentration (higher than the LOD), above which we have high confidence that the concentration measured on the analytical instrument is accurate. Above the LOD but below the LOQ there may be some uncertainty as to the actual concentration. To be conservative (a drug may be present but there is uncertainty as to its concentration) and in line with current practice, for back calculations to estimate per capita consumption, a concentration below the LOD was included as a value of LOD/√2. A concentration above the LOD but below LOQ, is included at the midpoint between the LOD and LOQ (i.e. (LOD + LOQ)/2). The frequency of detection of each analyte of interest is included in Appendix 3.

Weekly pattern of drug use: The pattern of drug consumption over the sampling week for the sites in this report cannot be elucidated from the data included in the current report. This is because the starting day of the collection week did not always correspond for every plant. We present the maximum, minimum and average (for individual sites as illustrated in Figure 5) and only population-weighted average values for all other graphs. Consistent patterns of drug consumption in Australia from previous wastewater-based epidemiology studies indicate that some substances such as cocaine, MDMA and alcohol have high variation in weekly consumption rates, with higher consumption on weekends. Other drugs such as methylamphetamine, oxycodone and fentanyl tend to have lower daily variation suggesting that their consumption is consistent throughout the week (Lai et al. 2015, Tscharke et al. 2016).

2 LOQ is the lowest level that can be accurately measured.

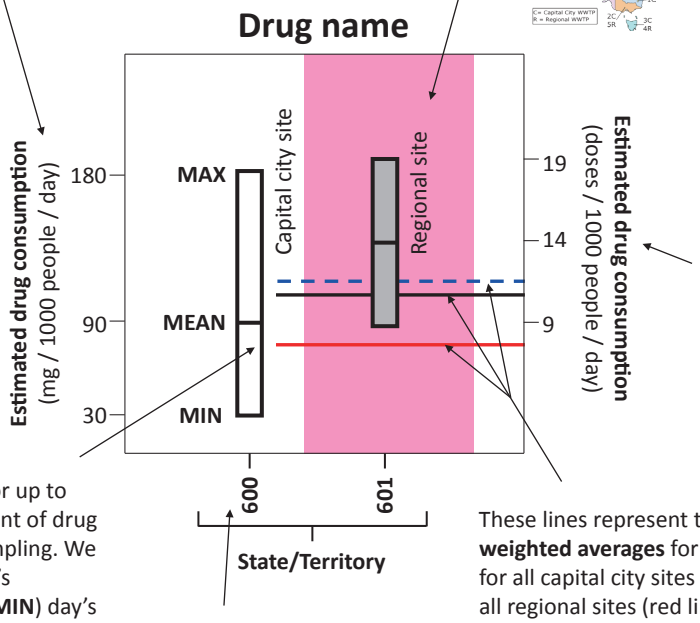
Figure 5: Explanation of the graphical representation of data for individual sites and bubble maps. General concepts relevant to all graphs in the report are also outlined (unique site codes, explanation of vertical axes, colour coding).

The **left hand axis** shows the estimated total mass consumed (in milligrams, mg) of a drug which is calculated by measuring the concentration of the drug's metabolite in a 24 hour wastewater composite sample, multiplying by the flow volume in the 24 hours, dividing by the population size and applying an excretion factor for the metabolite (see Equation 1, Report 1 for details).

To convert the mass consumed (left axis) to the estimated doses consumed (right axis), we divide the estimated mass consumed by the standard dose amount. Dose amount and excretion factors are given in Appendix 1 of Report 4. In this example, at Site 600, the minimum consumption was 30 mg in one day, the maximum was 180 mg and average was 90 mg per day over the sampling period (for every 1,000 people).

We collect wastewater data for up to 7 days and estimate the amount of drug consumed for each day of sampling. We plot the maximum (**MAX**) day's consumption, the minimum (**MIN**) day's consumption and the average (**MEAN**) across the 7 days. If the box is long, there is a large difference in consumption patterns over the week; for example, if drugs are used excessively at weekends but not often during the week. Alternatively, a short box suggests a similar drug usage every day of the week. See also main text.

Colours help identify the State or Territory that the data relates to (colours are consistent between Figures).



Unique number allocated to each WWTP to maintain confidentiality. WWTP names will not be disclosed publicly.

The **right hand axis** shows the estimated number of doses of a drug consumed by 1,000 people in the catchment in a 24 hour period; e.g., one dose would be 1 cigarette, 1 standard drink or 1 injected amount of drug. In this example, at Site 601, the minimum consumption was 9 doses in one day, the maximum was 19 and average was 14 per day over the sampling period (for every 1,000 people).

These lines represent the **population weighted averages** for drug consumption for all capital city sites (blue dotted line), all regional sites (red line) and for all sites combined (black line). The method to calculate weighted population averages is given in the main text. In this example, the average consumption for regional Site 601 (horizontal bar within red checked box) is above both the average for regional sites and all sites nationally. In contrast, the average consumption for capital city Site 600 is below the national average.

Figure 6: Explanation of the graphical representation of data for individual sites and bubble maps. General concepts relevant to all graphs in the report are also outlined (unique site codes, explanation of vertical axes, colour coding).

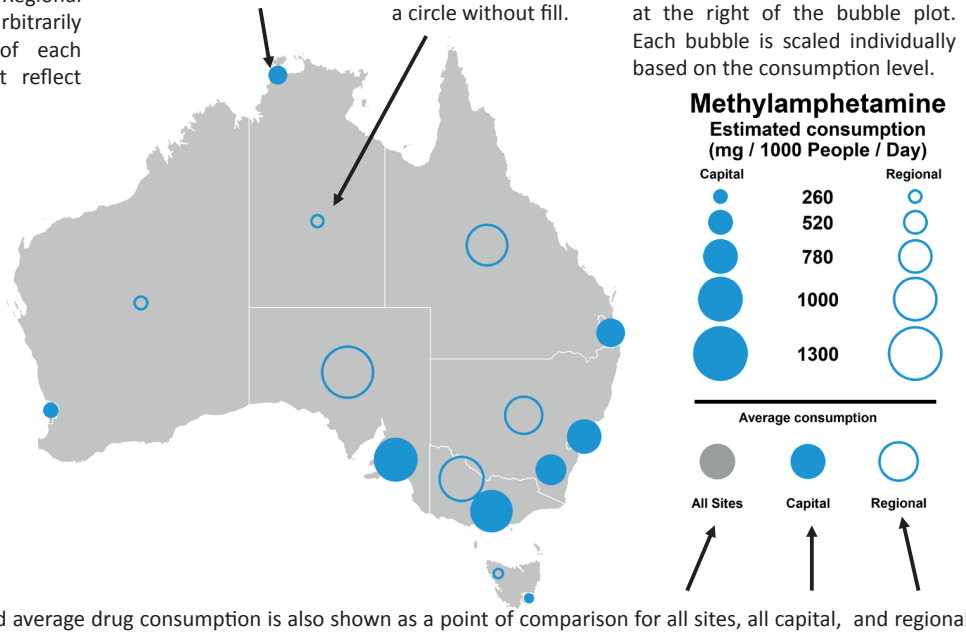
Bubbles:
Capital city site averages are drawn over the capital city of a jurisdiction and the regional site averages are drawn in the middle of the State or Territory. Regional bubbles are drawn arbitrarily close to the centre of each jurisdiction and do not reflect location of sites.

This type of plot gives a rough overview of drug consumption per jurisdiction. The other temporal and spatial comparison graphs give greater resolution to compare between locations and over time, and should be used for analysis.

Capital city average:
Population-weighted average of all capital sites tested per jurisdiction. Capital sites are indicated by a filled circle.

Regional city average:
Population-weighted average of all regional sites tested per jurisdiction. Regional sites are indicated by a circle without fill.

Legend:
The population-weighted average drug consumption for each jurisdiction is represented as a scaled circle. Representative consumption estimates are shown at the right of the bubble plot. Each bubble is scaled individually based on the consumption level.



Aggregated data:
The population-weighted average drug consumption is also shown as a point of comparison for all sites, all capital, and regional sites that were tested within the timepoint. This incorporates sites from **all jurisdictions** for the timepoint under investigation. These are also represented with sizes representing the scale of use categories used for the jurisdictional averages.

4: RESULTS

Estimated drug consumption data are presented in several different ways in the following sections to allow comparisons of drug consumption at the individual site level for August 2022 (section 4.1), temporal trends for states and territories for the past 2 years (section 4.2) and within each state and territory (section 4.3). August 2022 data were used for section 4.1, which compares the individual sites as it included the latest set of results for the full suite of sites included in the Program. We recommend exercising caution when comparing results between sites as some plants provided samples for fewer days than others. It is not always possible to coordinate collection of the same week of the month at all sites, so sampling weeks may not correspond in all instances. A list of the detection frequency for each drug can be found in Appendix 3. The population estimates introduced earlier in the Program were updated in Report 17 by integrating the specific wastewater catchment areas against the high-resolution population data released from the 2021 Census. The uncertainties in individual population estimates have less impact when data are averaged, for example when broader comparisons at the state/territory or international level are undertaken. The uncertainties in population numbers may be particularly evident in smaller regional communities or sites where short-term population changes occur due to employment opportunities, tourism or festival events.

4.1 INDIVIDUAL SITE COMPARISON OF DRUG USE IN AUGUST 2022

4.1.1 NICOTINE AND ALCOHOL

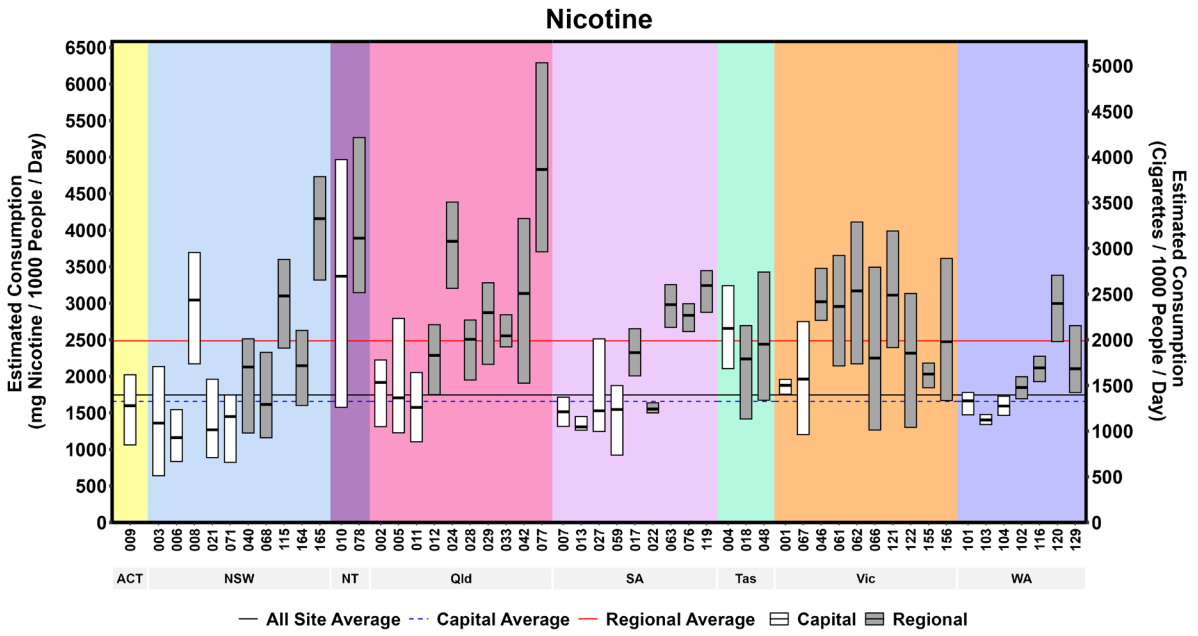
Nicotine is the main psychoactive substance present in tobacco products. Two nicotine metabolites, cotinine and hydroxycotinine, were used to estimate the consumption of tobacco. The estimate is expressed as nicotine in this report as the method cannot distinguish between nicotine intake from tobacco, electronic cigarettes and nicotine replacement therapies such as patches and gums.

The August 2022 results show that nicotine consumption varied widely between sites across the country, particularly regional areas (Figure 7). Average consumption in regional Australia was substantially higher than in the capital cities (red horizontal and dotted blue lines, respectively). A site in New South Wales and the Northern Territory had the highest capital city nicotine consumption in August 2022. Some regional sites in several jurisdictions had well above average nicotine consumption, particularly New South Wales, the Northern Territory and Queensland. Nicotine consumption showed large fluctuations over the sampling week at some sites, indicated by longer bars.

Alcohol consumption was measured using a specific metabolite of ethanol, ethyl sulphate. In August 2022 average alcohol consumption was higher in regional areas than in capital cities (Figure 8). All sites in South Australia and some in Western Australia had below average alcohol consumption. Large variations in consumption between days of the week were observed in many parts of the country.

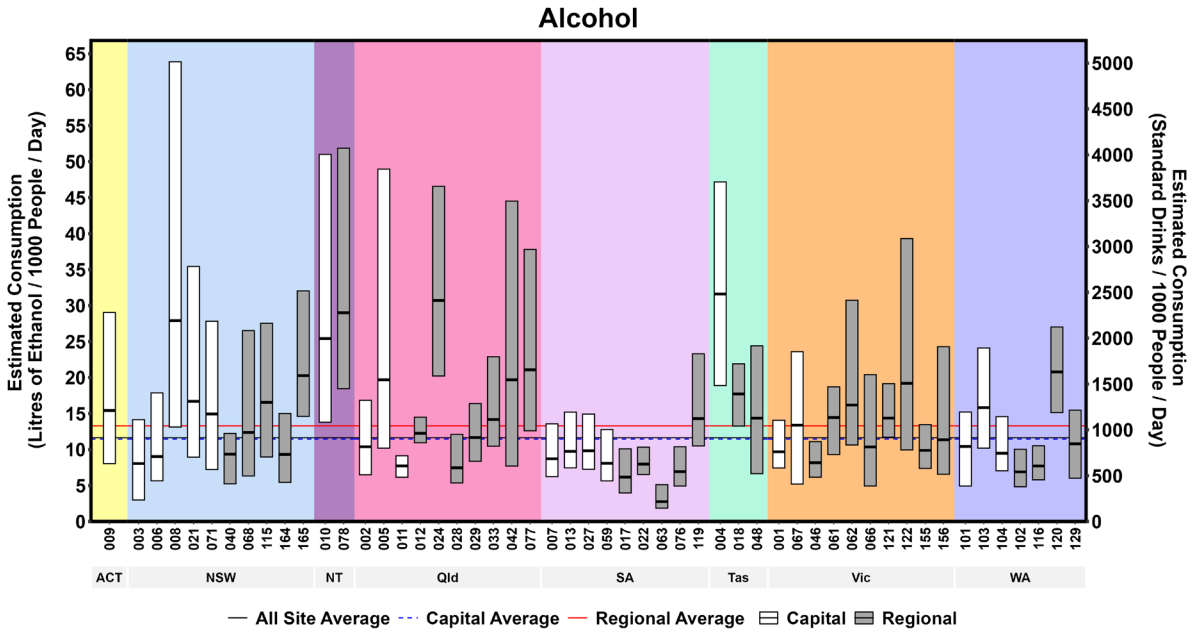
Relative consumption levels can be represented by showing the scale of consumption of nicotine (Figure 9) and alcohol (Figure 10) as capital city or regional ‘bubbles’ for each state and territory. The above average consumption of nicotine and alcohol in the Northern Territory is evident from the size of the respective bubbles. These findings need to be understood in the context that there is only one capital city site and one regional site included for this jurisdiction. However, approximately 25 per cent of the Northern Territory’s population is covered by those 2 sites.

Figure 7: Estimated nicotine consumption for August 2022 in mass of nicotine consumed per day (left axis) and number of cigarettes per day (right axis) per thousand people. The number of collection days varied from 5 to 7.



- Higher regional average
- Variable consumption nationally

Figure 8: Estimated alcohol consumption for August 2022 in litres consumed per day (left axis) and standard drinks per day (right axis) per thousand people. The number of collection days varied from 5 to 7.



- Higher regional average
- Wide weekly spread a common feature

Figure 9: Estimated average nicotine consumption per jurisdiction for August 2022 in number of cigarettes per day per thousand people. The number of collection days varied from 5 to 7.

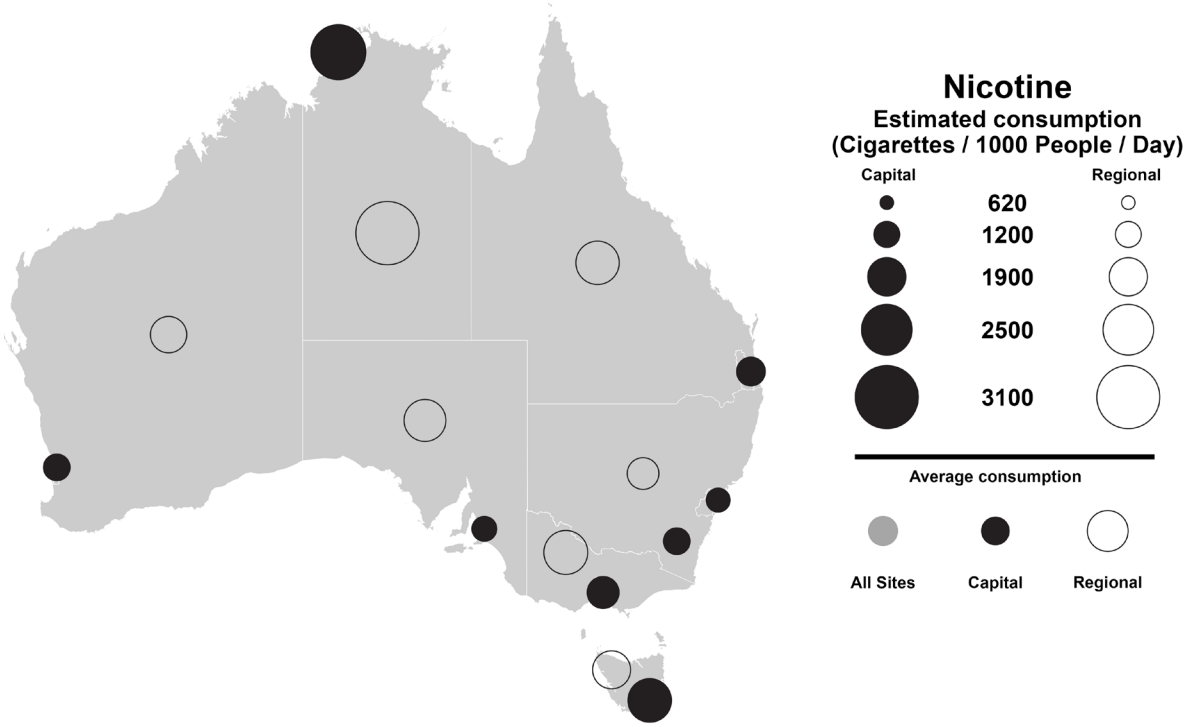
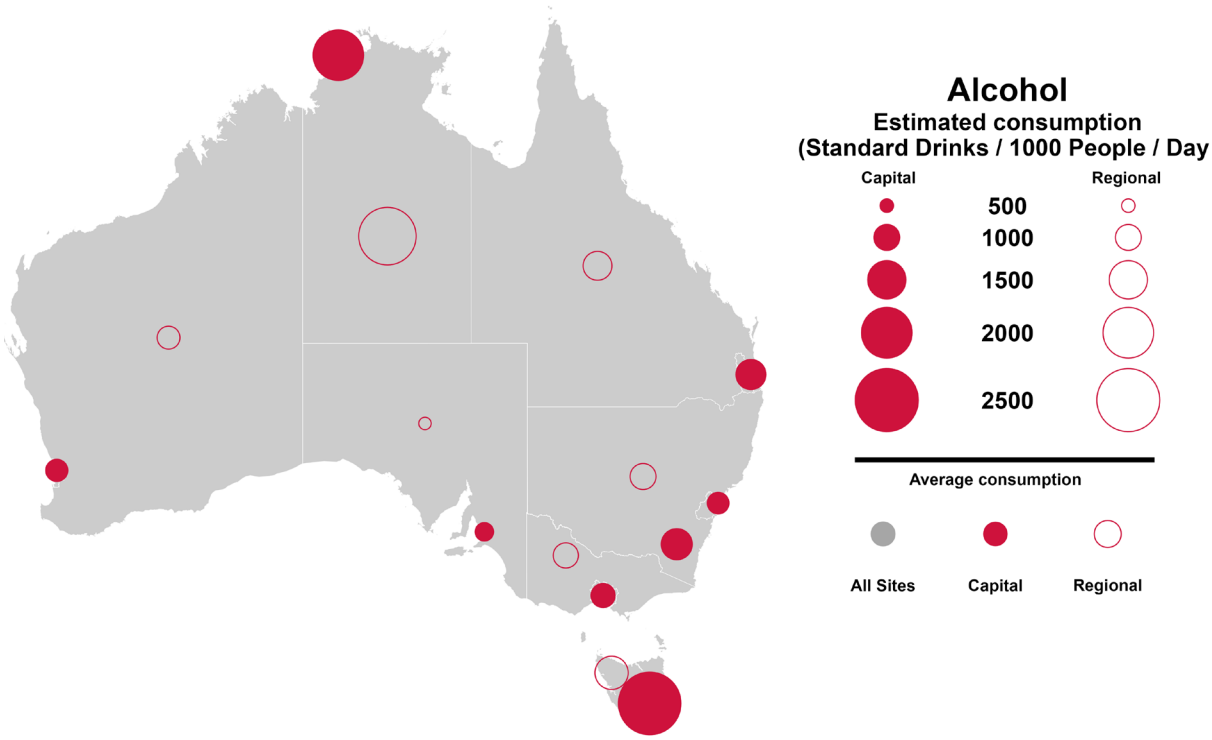


Figure 10: Estimated average alcohol consumption per jurisdiction for August 2022 in number of standard drinks per day per thousand people. The number of collection days varied from 5 to 7.



4.1.2 STIMULANTS

4.1.2.1 METHYLAMPHETAMINE

Average methylamphetamine consumption in capital city and regional Australia was almost identical in August 2022 (Figure 11). The difference in consumption between days of the week was generally smaller than for the other stimulants, which is consistent with the habitual use associated with methylamphetamine. This was more apparent in capital city catchments, although Site 3 in New South Wales had a very wide weekly spread, as did regional Site 29 in Queensland. A site in New South Wales and Tasmania had the lowest methylamphetamine consumption of the capital cities, while New South Wales and the Northern Territory had the lowest regional levels.

4.1.2.2 AMPHETAMINE

The measured concentration of amphetamine in the August 2022 samples mostly fell within a range which is consistent with the reported excretion rates following methylamphetamine consumption (Gracia-Lor et al. 2016). The results were largely in agreement with our previous findings (see Appendix 4 of Report 1). The levels of amphetamine in wastewater samples can be largely attributed to the metabolism of methylamphetamine. However, the drug is also prescribed for some behavioural disorders and the method cannot differentiate between medical and illicit use.

4.1.2.3 COCAINE

Benzoylecgonine, the specific metabolite of cocaine, was used to estimate the consumption of the stimulant. Per capita capital city cocaine consumption was more than double that of regional areas (Figure 12). The difference in cocaine consumption between days of the week was also generally more pronounced, as illustrated by the longer bars. Site 8 in New South Wales has been at the higher end of cocaine consumption over the life of the Program, with higher relative consumption in August 2022. Sites in capital city New South Wales generally had the highest overall consumption levels in the nation. Regional consumption was highest in New South Wales and Queensland. Cocaine consumption was generally low in most other regional parts of Australia, particularly in the Northern Territory, South Australia, Tasmania and Western Australia.

4.1.2.4 MDMA (3,4-METHYLENEDIOXYMETHYLAMPHETAMINE)

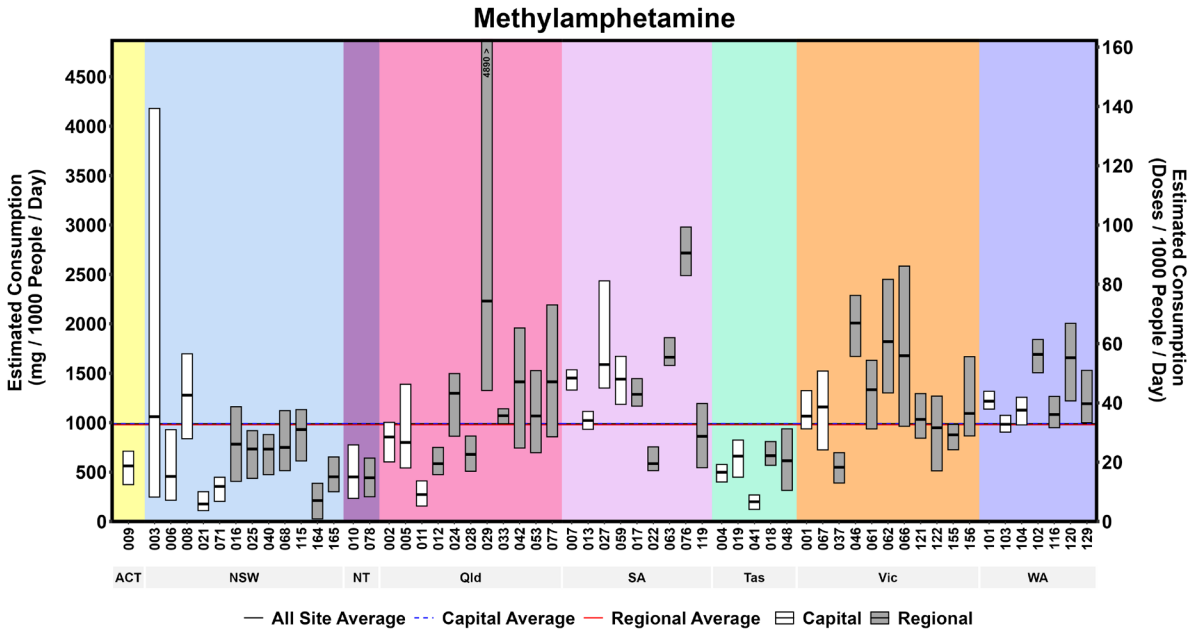
The average consumption of MDMA was lower than consumption of methylamphetamine and cocaine (Figure 13). Apart from a few exceptions, consumption of the drug was relatively consistent across the country. Site 8 in New South Wales had very high MDMA consumption levels. The same site also had relatively high cocaine consumption. Average regional MDMA consumption was lower than capital city consumption in August 2022.

4.1.2.5 MDA (3,4-METHYLENEDIOXYAMPHETAMINE)

Excretion levels of the drug were mostly low across Australia (Figure 14). Average capital city excretion was slightly lower than the average regional excretion in August 2022. A few sites had excretion levels substantially above the rest of the country, particularly Site 120 in Western Australia.

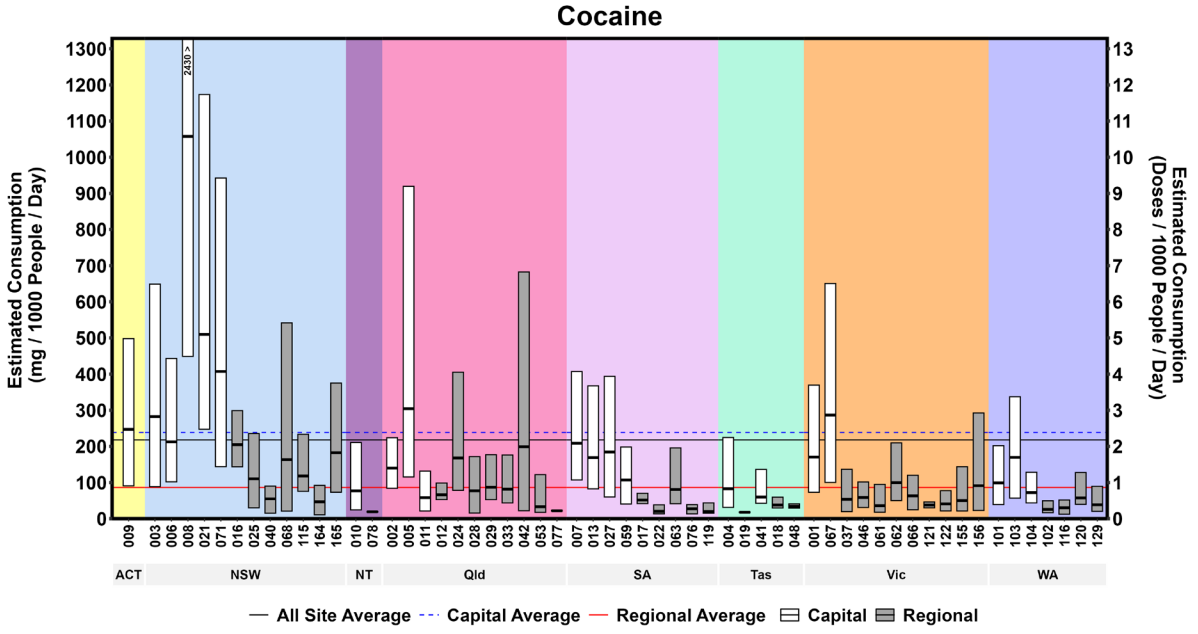
The scale of consumption is expressed as a bubble graph to compare regional and capital city consumption of methylamphetamine (Figure 15), cocaine (Figure 16), MDMA (Figure 17) and MDA (Figure 18) across the country. Higher consumption of methylamphetamine in southern parts of the mainland and cocaine on the south-eastern seaboard remains apparent.

Figure 11: Estimated methylamphetamine consumption for August 2022 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5 to 7.



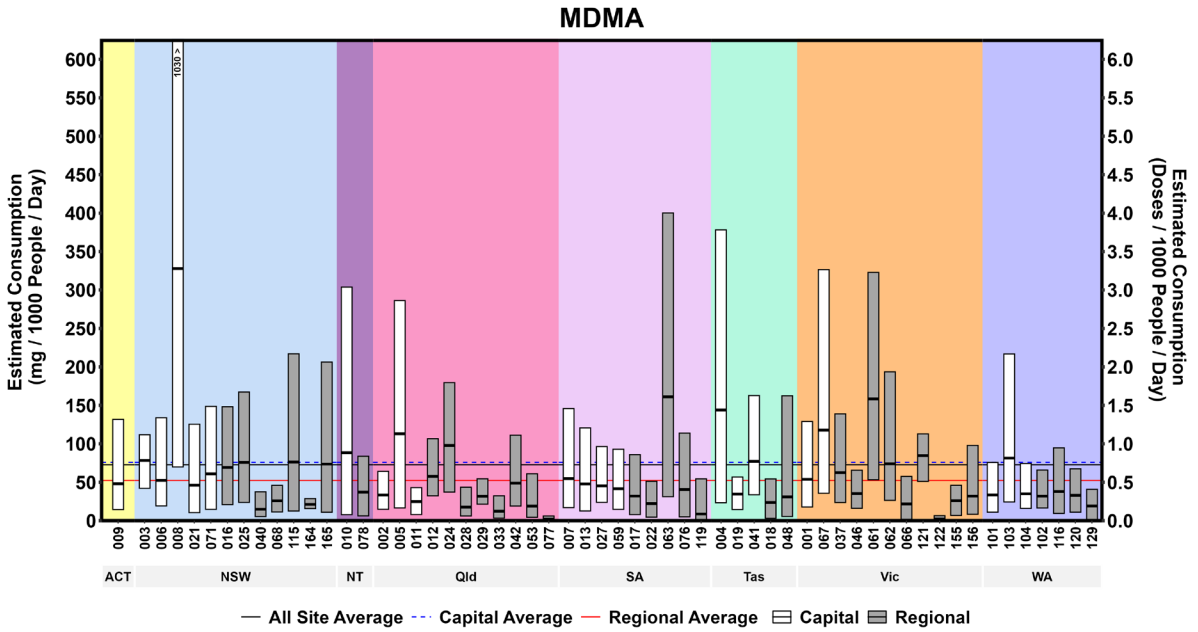
- Similar regional and capital city averages

Figure 12: Estimated cocaine consumption for August 2022 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5 to 7.



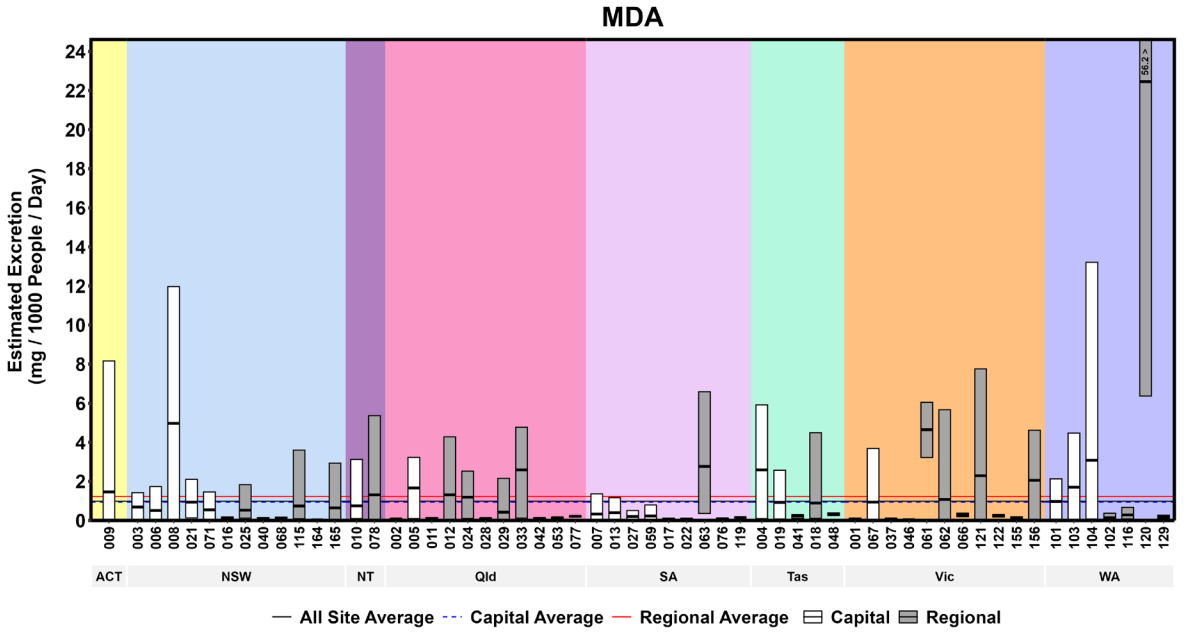
- Higher capital city consumption
- High overall consumption in New South Wales

Figure 13: Estimated MDMA consumption for August 2022 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5 to 7.



- Mostly low consumption nationally
- High relative consumption at specific sites

Figure 14: Estimated MDA excretion for August 2022 in mass excreted per day per thousand people. The number of collection days varied from 5 to 7.



- Relatively low excretion
- Some sites well above average

Figure 15: Estimated average methylamphetamine consumption per jurisdiction for August 2022 in mg consumed per day per thousand people. The number of collection days varied from 5 to 7.

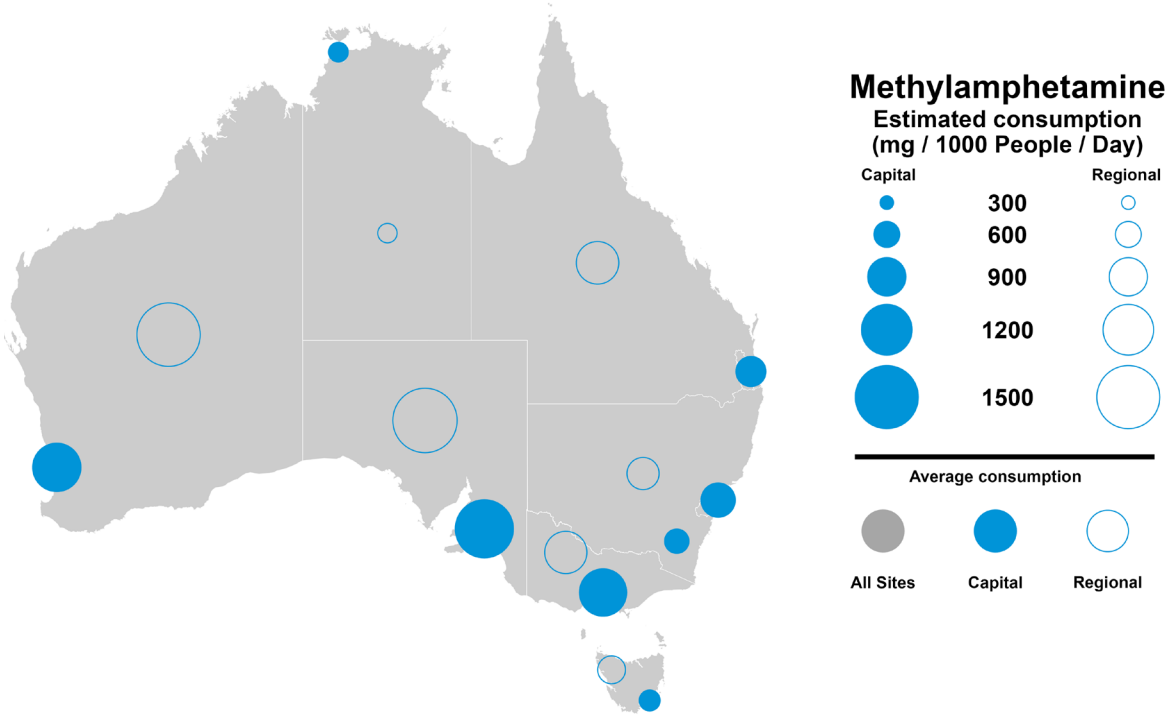


Figure 16: Estimated average cocaine consumption per jurisdiction for August 2022 in mg consumed per day per thousand people. The number of collection days varied from 5 to 7.

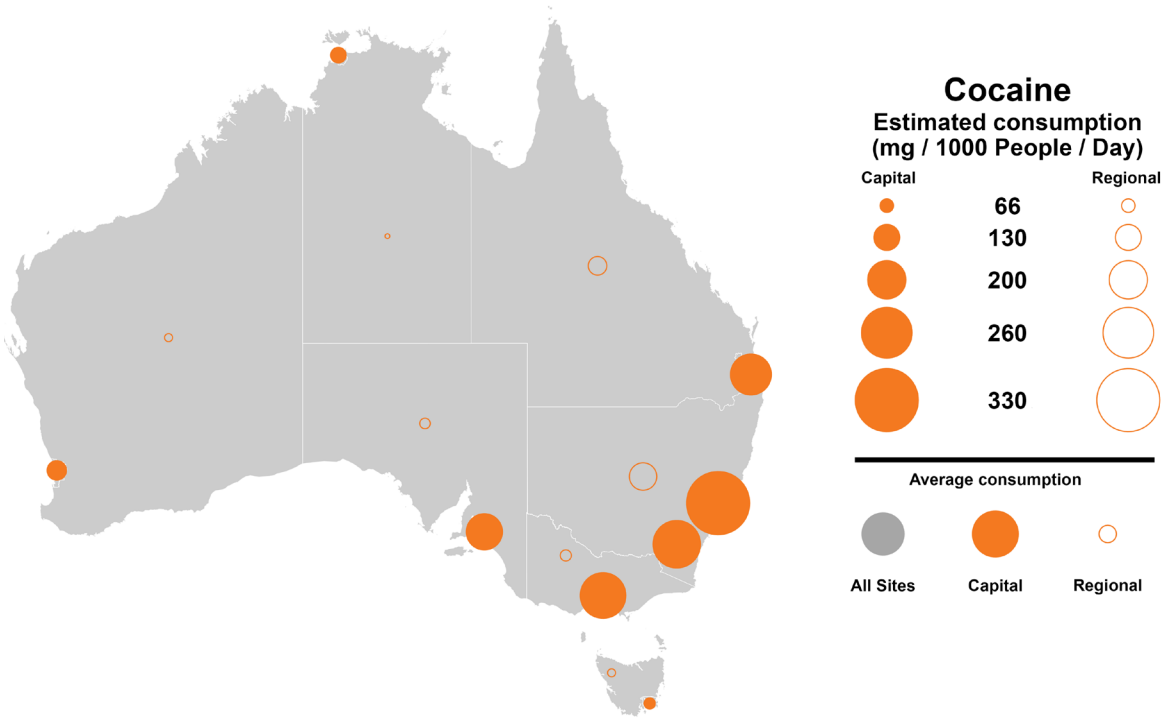


Figure 17: Estimated average MDMA consumption per jurisdiction for August 2022 in mg consumed per day per thousand people. The number of collection days varied from 5 to 7.

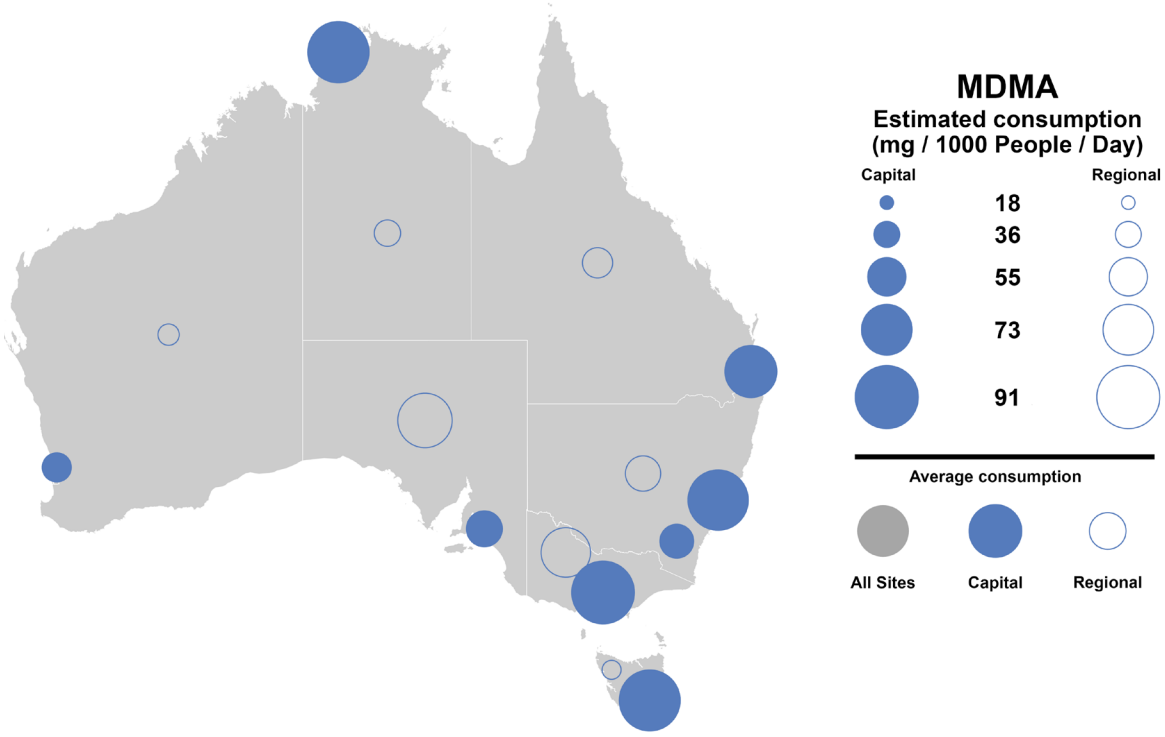
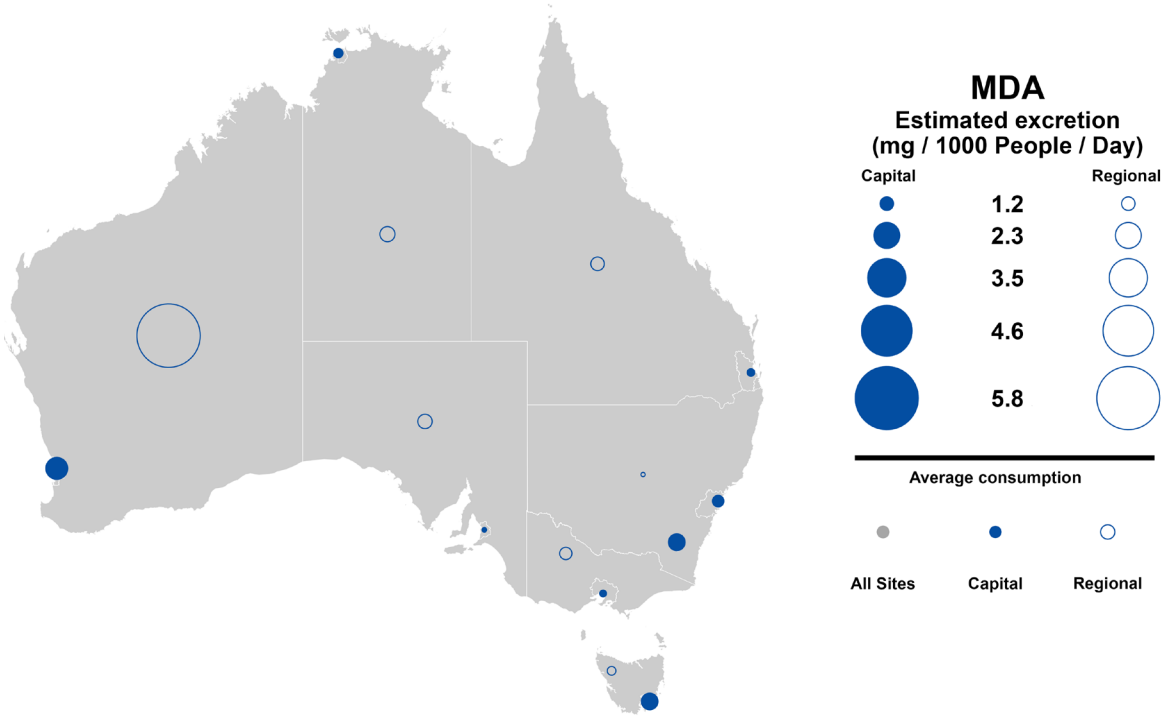


Figure 18: Estimated average MDA excretion per jurisdiction for August 2022 in mg excreted per day per thousand people. The number of collection days varied from 5 to 7.



4.1.3 OPIOIDS

Two prescription opioids were measured, as well as heroin, an illicit drug. Oxycodone and fentanyl are legally prescribed pharmaceuticals with abuse potential. Although wastewater analysis cannot differentiate between prescribed use and use for non-medical purposes, the relative scale of use of these substances remains of interest.

4.1.3.1 PHARMACEUTICAL OPIOIDS

The metabolism and excretion profiles of oxycodone and fentanyl are well established. The main metabolite of each compound was measured to estimate their consumption.

Oxycodone consumption across Australia in August 2022 was highly variable, with substantially higher average consumption occurring in regional areas compared with capital cities (Figure 19). Tasmania had the highest consumption of the capital cities. Above average regional consumption was spread across several states. Western Australia had relatively low oxycodone consumption compared to the national averages. The spread in consumption over the sampling week was generally small for most capital cities, with larger variations in consumption evident in regional sites.

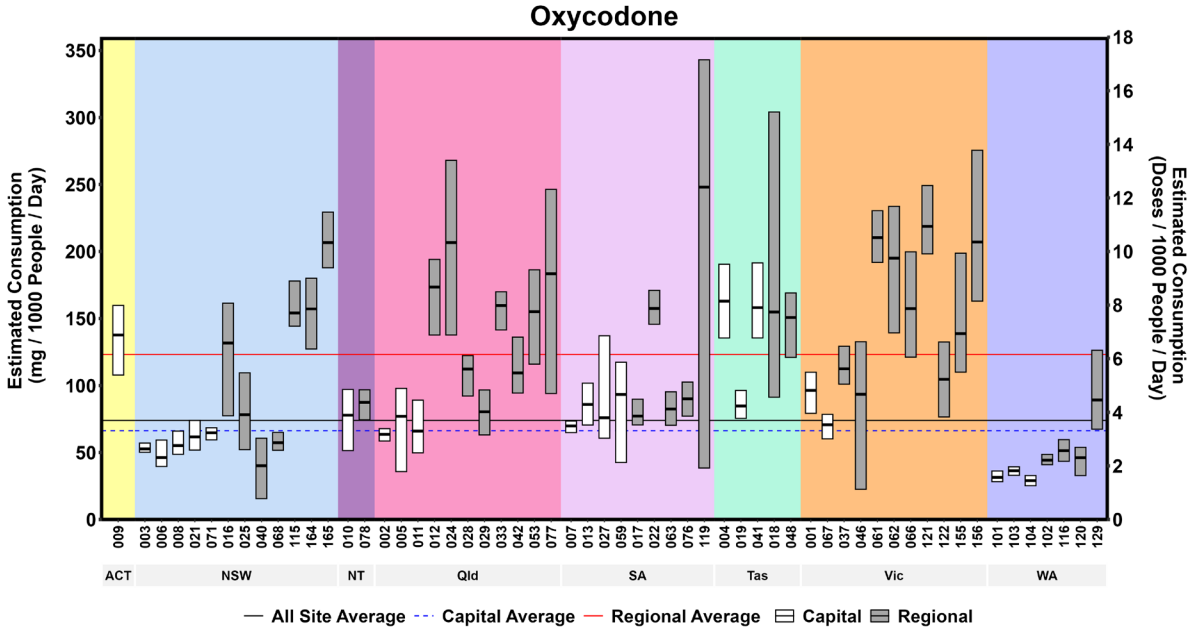
Fentanyl was also characterised by higher average regional than capital city consumption (Figure 20). The spread in consumption over the sampling week was generally greater in regional areas. Tasmania had sites with the highest capital city fentanyl consumption, with sites in regional South Australia and Victoria having the highest per capita consumption nationally in August 2022.

The relative scale of oxycodone and fentanyl consumption was apparent when results were aggregated by jurisdiction and capital city or regional area and presented in bubble graph form. Generally higher oxycodone consumption in regional areas and in capital city Tasmania were apparent (Figure 21). With the exception of Tasmania, average fentanyl consumption was relatively low in most capital cities compared to regional areas (Figure 22).

4.1.3.2 HEROIN

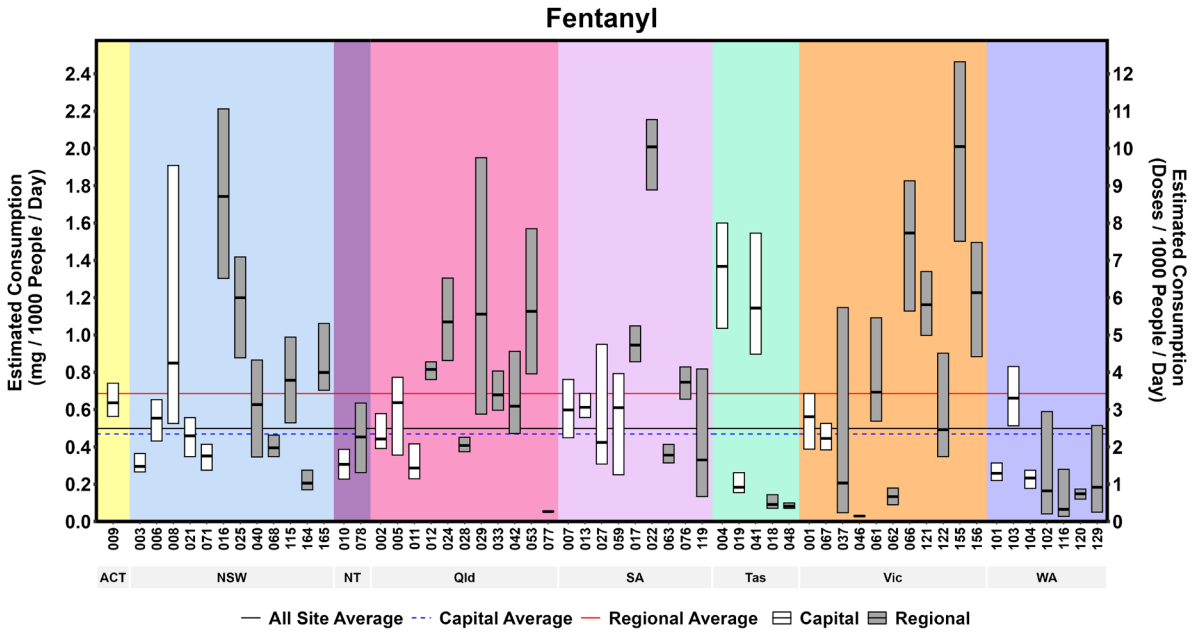
Heroin is metabolised in the body and excreted in low amounts as the unique metabolite, 6-monoacetylmorphine (6-MAM). Since the compound is characteristic of heroin metabolism, it can be used to distinguish heroin from other opioids such as morphine and codeine. Heroin consumption in regional areas was generally much lower than in the capital cities, the average being less than half (Figure 23). Two capital city sites in New South Wales and a site in Victoria had the highest consumption levels in August 2022, well above most other capital city sites. Regional sites in these 2 states also had high consumption levels, particularly Site 46 in Victoria. Levels of the drug tended to be low in many other parts of the country, with regional sites in several jurisdictions having levels at or below the quantification limits of the method. The elevated heroin consumption in New South Wales and Victoria is clearly evident from the bubble graph (Figure 24).

Figure 19: Estimated oxycodone consumption for August 2022 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. Collection days per week varied from 5 to 7.



- Higher regional average

Figure 20: Estimated fentanyl consumption for August 2022 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5 to 7.



- Higher regional average
- High relative consumption at specific sites in multiple jurisdictions

Figure 21: Estimated average oxycodone consumption per jurisdiction for August 2022 in mg consumed per day per thousand people. The number of collection days varied from 5 to 7.

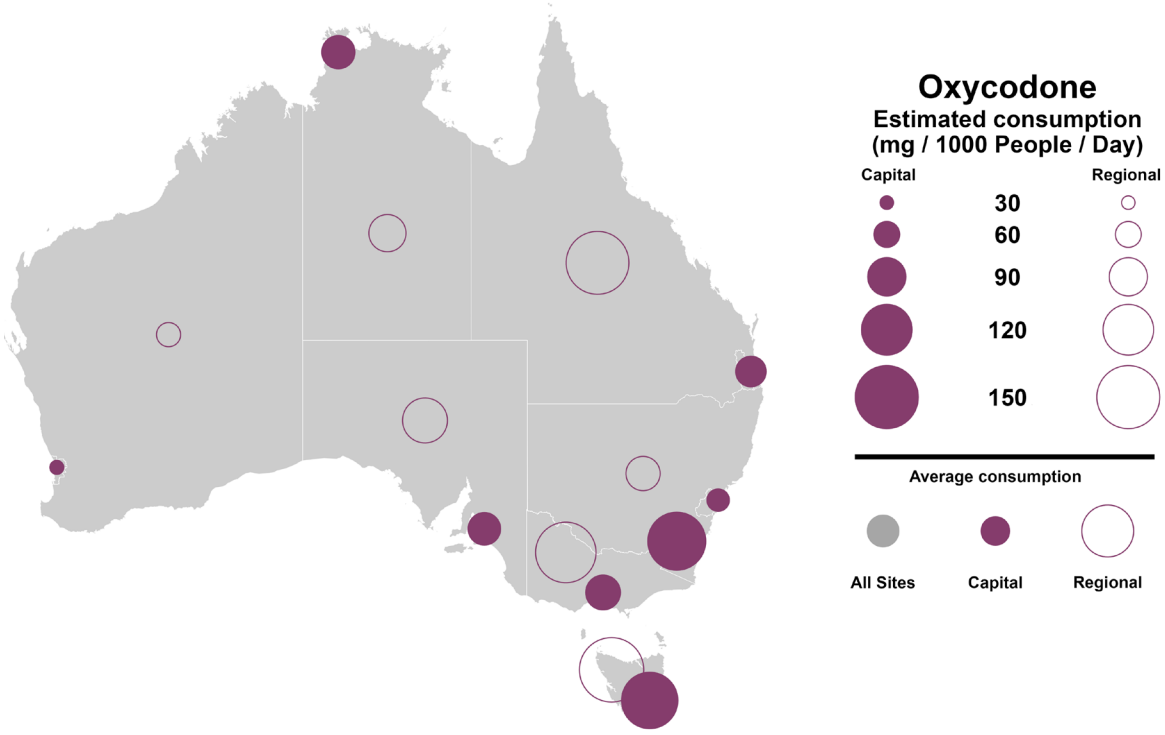


Figure 22: Estimated average fentanyl consumption per jurisdiction for August 2022 in mg consumed per day per thousand people. The number of collection days varied from 5 to 7.

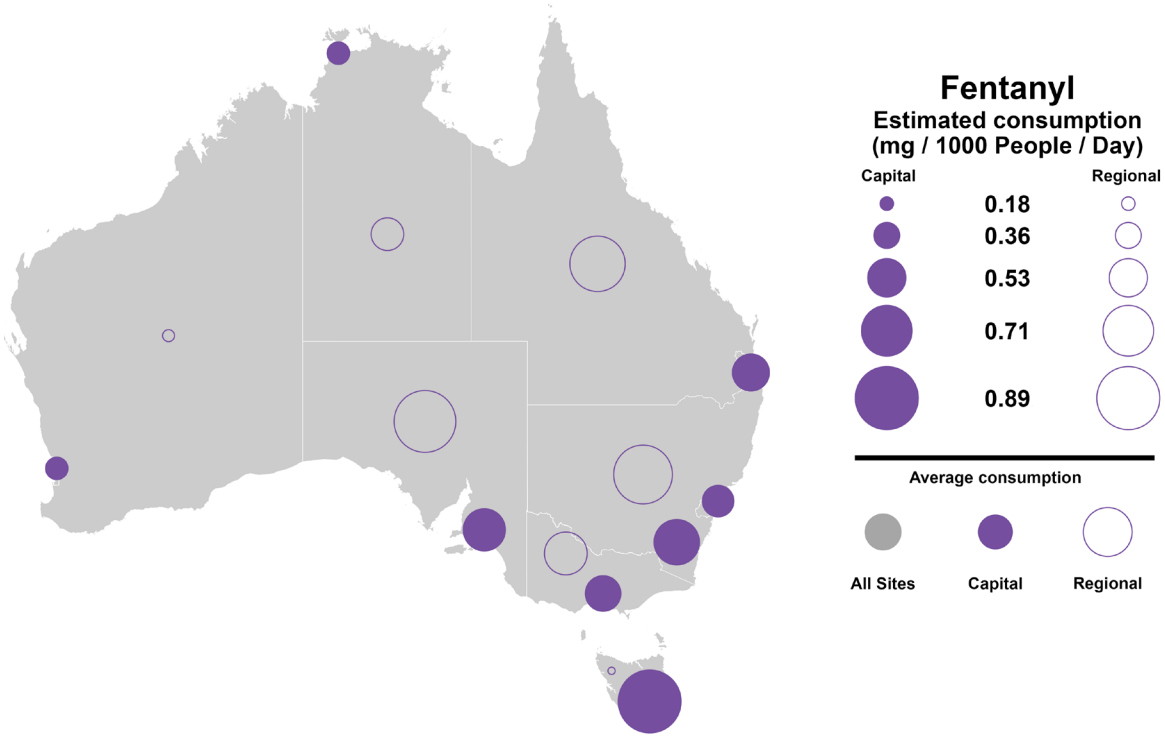
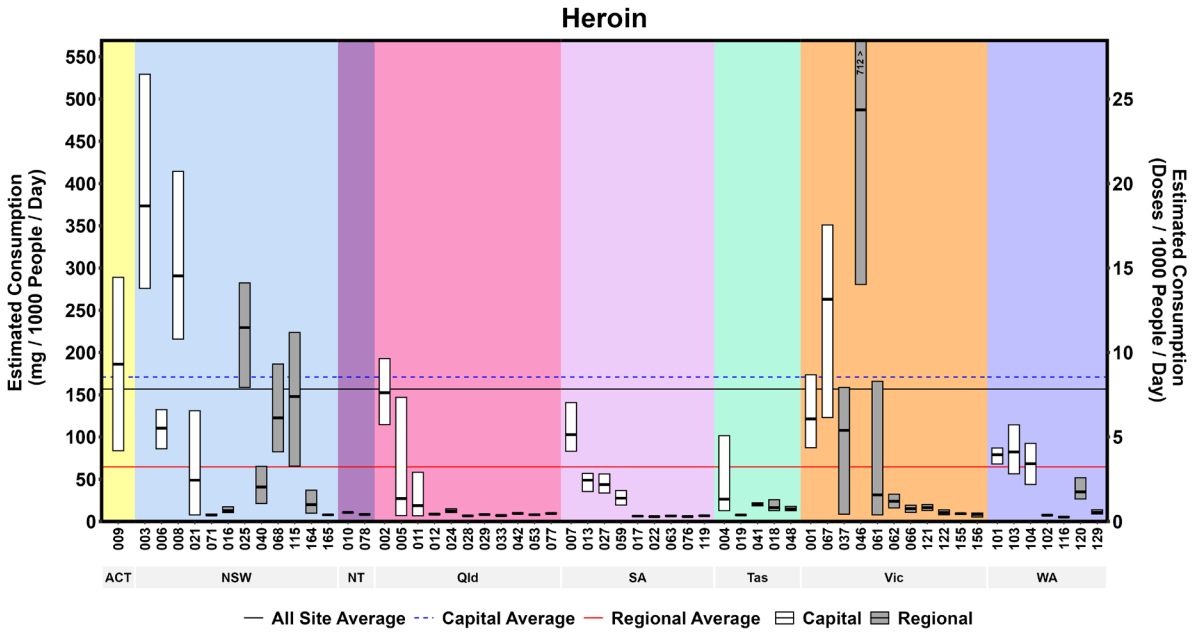
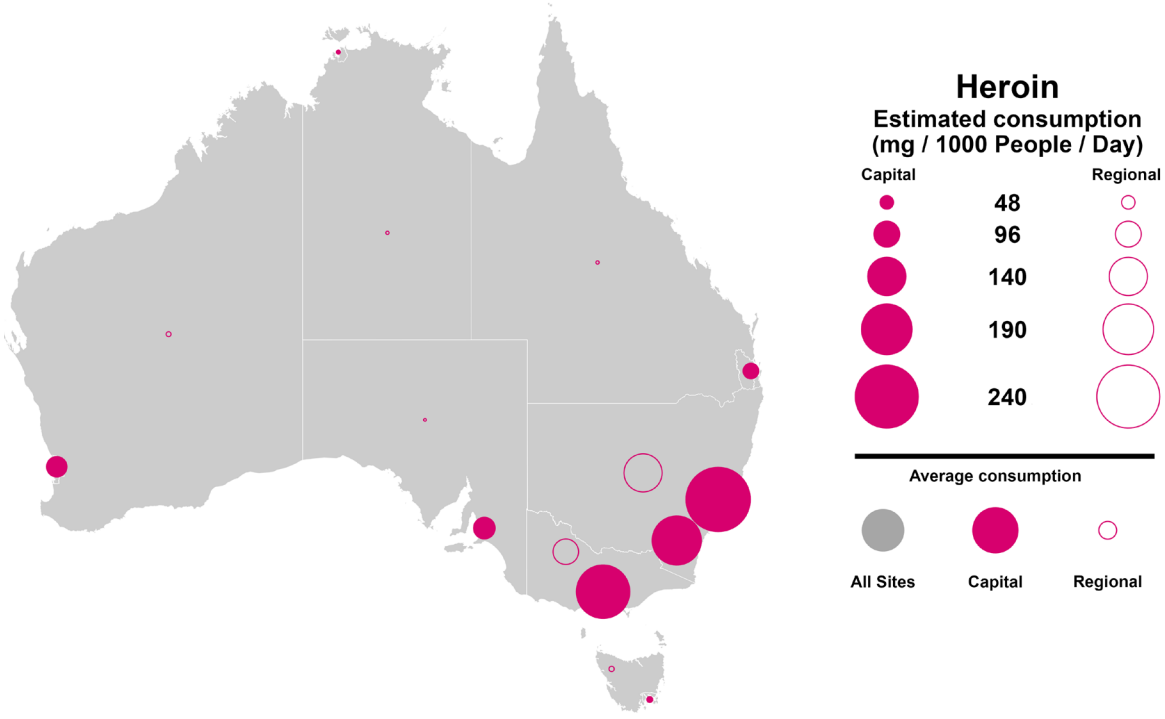


Figure 23: Estimated heroin consumption for August 2022 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5 to 7.



- Lower regional consumption, often not quantifiable
- Highest consumption generally in the south-east

Figure 24: Estimated average heroin consumption per jurisdiction for August 2022 in mg consumed per day per thousand people. The number of collection days varied from 5 to 7.



4.1.4 CANNABIS

Tetrahydrocannabinol (THC) is the main psychoactive compound found in cannabis. The compound is metabolised and largely cleared through the intestine. A small proportion (0.6 per cent) is excreted through the kidneys as 11-nor-9-carboxy-tetrahydrocannabinol (THC-COOH). The latter is known to adsorb to various surfaces, including sewer infrastructure. Therefore, in terms of wastewater analysis, the sewer design and collection method may play a part in the reportable levels of the target metabolite used for the purposes of the NWDMP. Upon collection, samples require preservation to avoid degradation of THC-COOH, without using acidification (McCall et al. 2016). This is one reason why cannabis consumption is not reported on a regular basis in other countries where wastewater analysis is routinely conducted, as acidification is a common preservation technique. For the NWDMP, separate samples are collected each day and preserved specifically for THC-COOH analysis, except in some sites in regional Western Australia where this is not possible.

Cannabis consumption was expressed as the daily mass load (mg) of consumed active ingredient (THC) consumed per 1,000 people. An average dose was not defined as for other drugs in the report. The dose of cannabis depends on several factors, such as the part of the plant, the strain, or whether an extract was used. This will be included in graphical representations of the data when an appropriate dose becomes available.

Large spatial differences were evident across Australia, with regional cannabis consumption generally much higher than in the capital cities (Figure 25). Site 77, a regional site in Queensland, had the highest per capita consumption. In contrast, capital city sites in New South Wales had relatively low cannabis consumption levels. The bubble plot (Figure 26) and Figure 25 show the generally higher consumption in regional areas.

Figure 25: Estimated cannabis consumption for August 2022 in mass consumed per day (left axis). The number of collection days varied from 5 to 7.

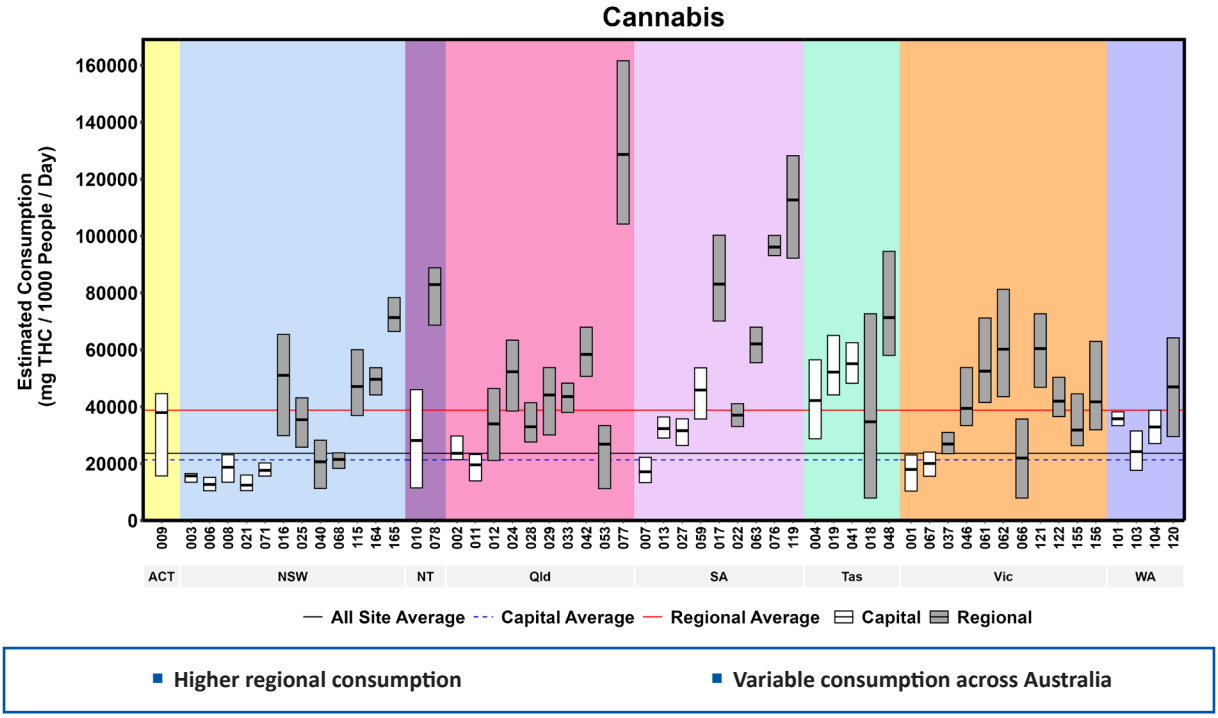
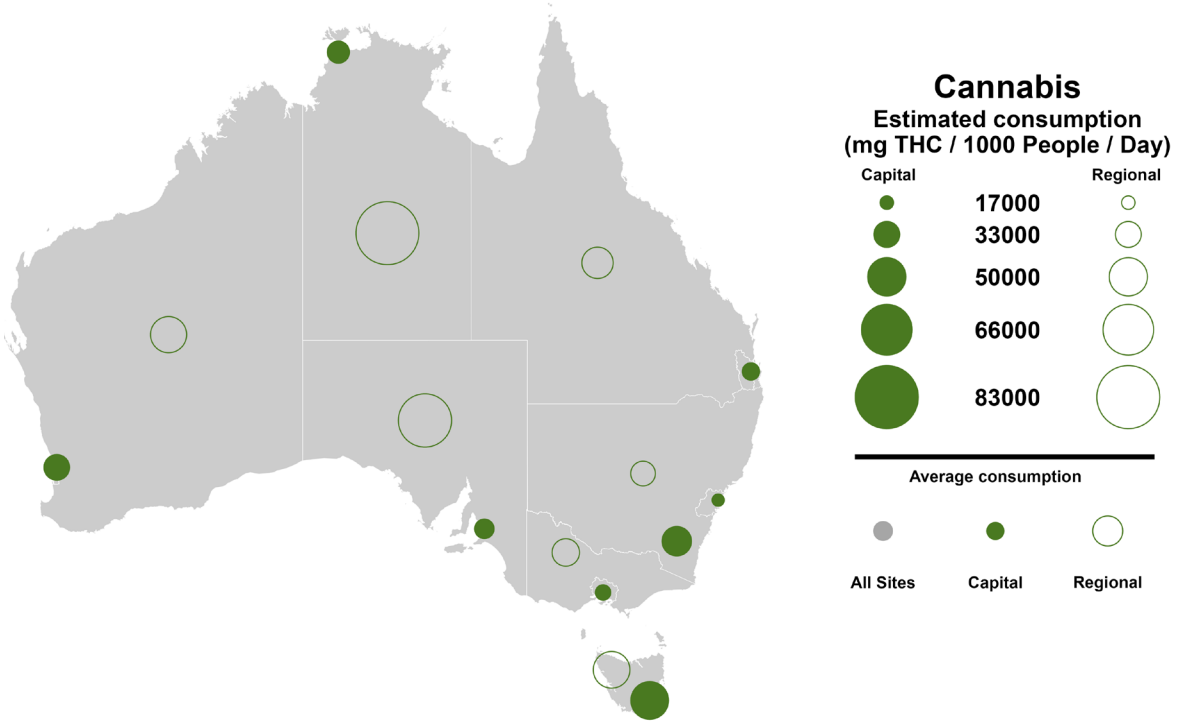


Figure 26: Estimated average cannabis consumption per jurisdiction for August 2022 in mg consumed per day per thousand people. The number of collection days varied from 5 to 7.

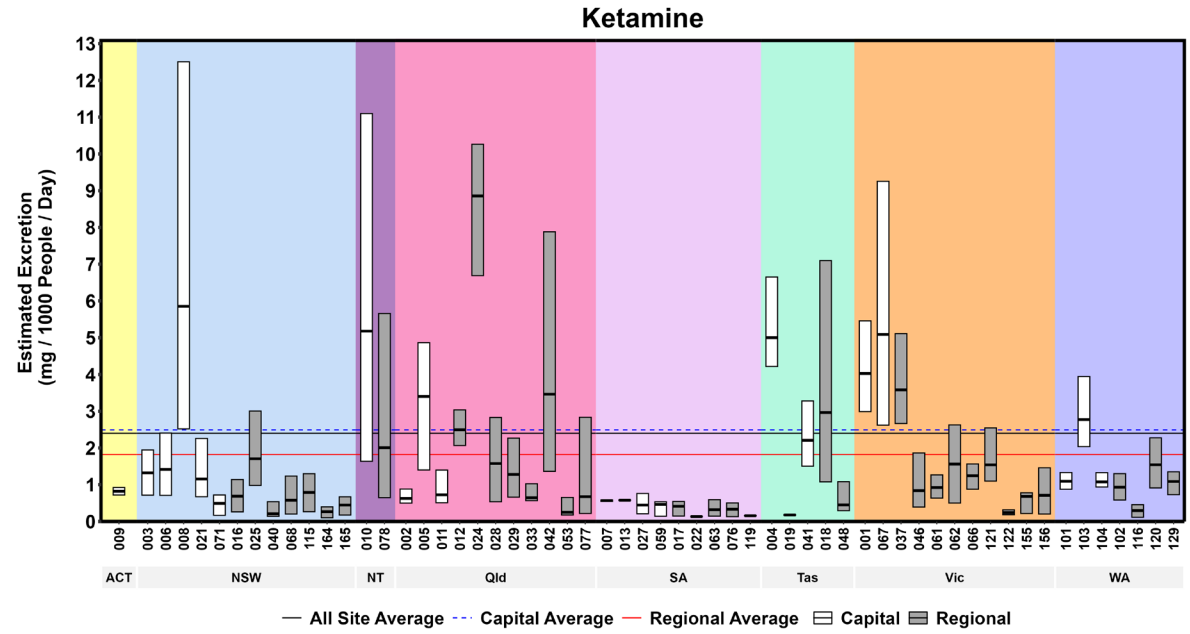


4.1.5 KETAMINE

Ketamine, measured as its metabolite norketamine, is used medically for the management of acute pain often associated with surgery or trauma. It has veterinary applications as well, although this may have less relevance in terms of wastewater monitoring due to the separation of stormwater and agricultural run-off from the sewer network in most Australian catchments. Due to its sedative and hallucinogenic effects, the drug has been associated with illicit substance abuse and is listed as a new psychoactive substance by the United Nations Office on Drugs and Crime (UNODC). The reported proportions of ketamine and its metabolites in wastewater leave some doubt as to an appropriate factor to convert excreted amounts to consumed amounts. Therefore, measured levels are being shown here as excreted daily mass loads, similar to the case of the stimulant MDA.

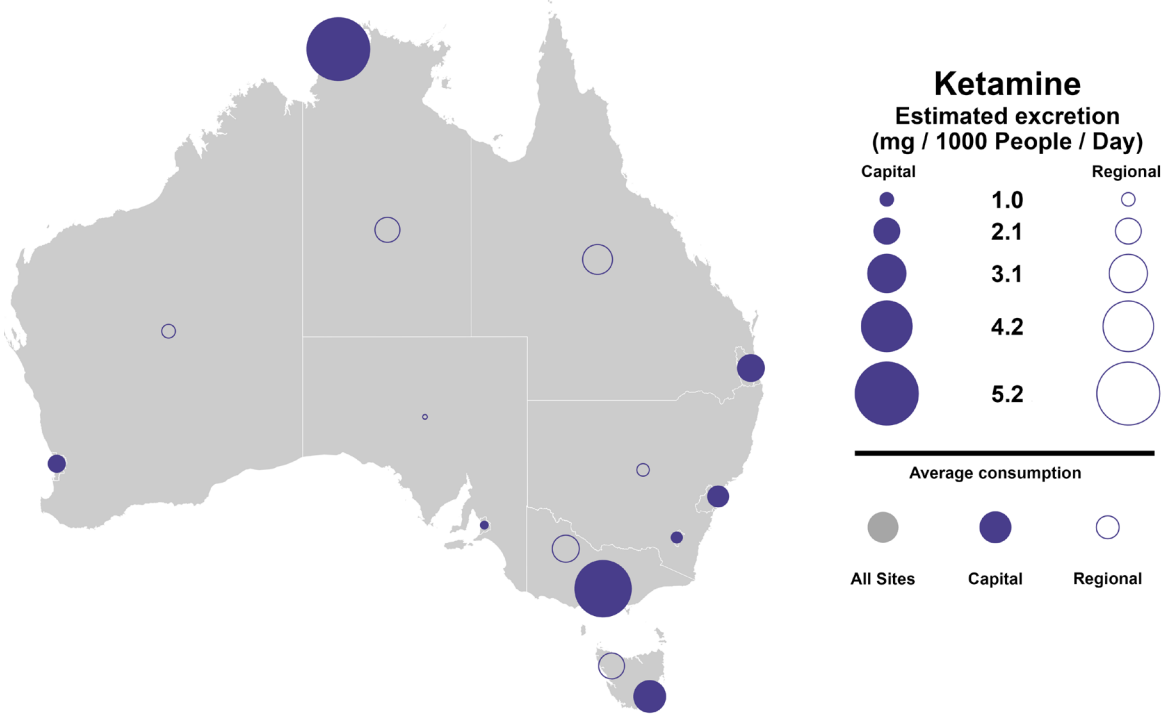
The regional average was lower than the capital cities (Figure 27). Capital city sites in New South Wales, the Northern Territory, Tasmania and Victoria had comparatively high excretion levels, while Site 24 in regional Queensland had the highest average per capita excretion levels nationally. A bubble plot shows the relative scale of ketamine excretion across Australia, with the Northern Territory and Victoria being the most prominent (Figure 28).

Figure 27: Estimated ketamine excretion for August 2022 in mass excreted per day (left axis) per thousand people. The number of collection days varied from 5 to 7.



- Higher capital city consumption
- High excretion in multiple sites

Figure 28: Estimated average ketamine consumption per jurisdiction for August 2022 in mg excreted per day per thousand people. The number of collection days varied from 5 to 7.



4.2 TEMPORAL CHANGES IN DRUG CONSUMPTION ESTIMATES BY JURISDICTION

The per capita consumption of each drug outlined in the following figures compares data acquired in this report to previous collection periods on a state or territory basis. The data relating to capital cities in this section have been updated to include both the August and October 2022 collections, while regional areas were updated for August 2022. This needs to be considered when comparing results between sections 4.1 and 4.2. Ketamine was included in the Program for the first time in Report 13 and so has fewer data points than the other substances.

Although every effort has been made to assess the same sites for each period, the individual sites and the number of sites used to generate the population-weighted averages may have changed between periods. Comparing between time points should be done with caution. This would be most evident for the regional averages, which had more variation in participation between each period (see Appendix 2 and Appendix 3, Report 6 and Appendix 2 in this report). Due to the larger number of data points collected by the Program, the current Report presents the last 2 years of data. Prior data dating back to 2016 for each substance of interest is available on the ACIC website by jurisdiction.

Note: The horizontal red, blue and black lines on each temporal graph which represent the averages are the cumulative average across all sampling time points and all samples analysed for each substance. Updated changes to the graphs relating to this report are the 2 most recent bars consisting of capital cities (August and October 2022) and the single most recent bar for regional areas (August 2022). Some temporal changes reflected in these bars may be a consequence of updated populations used in the calculations, see Appendix 4 of Report 17 for the difference in populations for the 2016 and 2021 Census for each catchment.

4.2.1 NICOTINE AND ALCOHOL

Trends in nicotine consumption reflect the historical elevated consumption in regional Australia (red line) over the life of the Program (Figure 29). Nicotine consumption in August and October 2022 in some states has narrowed between the capital city and regional areas. Nicotine consumption in the Northern Territory is the highest in the country. Capital city consumption of nicotine in South Australia and Western Australia has consistently been at levels below the national average, but the same observation is now starting to apply across other jurisdictions such as the Australian Capital Territory, New South Wales and Queensland.

Alcohol consumption in this collection period reflects localised changes (Figure 30). The Northern Territory experienced a general decline in alcohol consumption over the past year, whereas the trend has been variable in most other parts of the country. The Northern Territory continues to have the highest per capita consumption of alcohol, while several jurisdictions continue to have consumption levels below the long-term average, particularly South Australia. The difference in alcohol consumption in regional areas compared to the cities is less pronounced than for nicotine, but consumption of both substances has been higher in regional areas since the start of the Program.

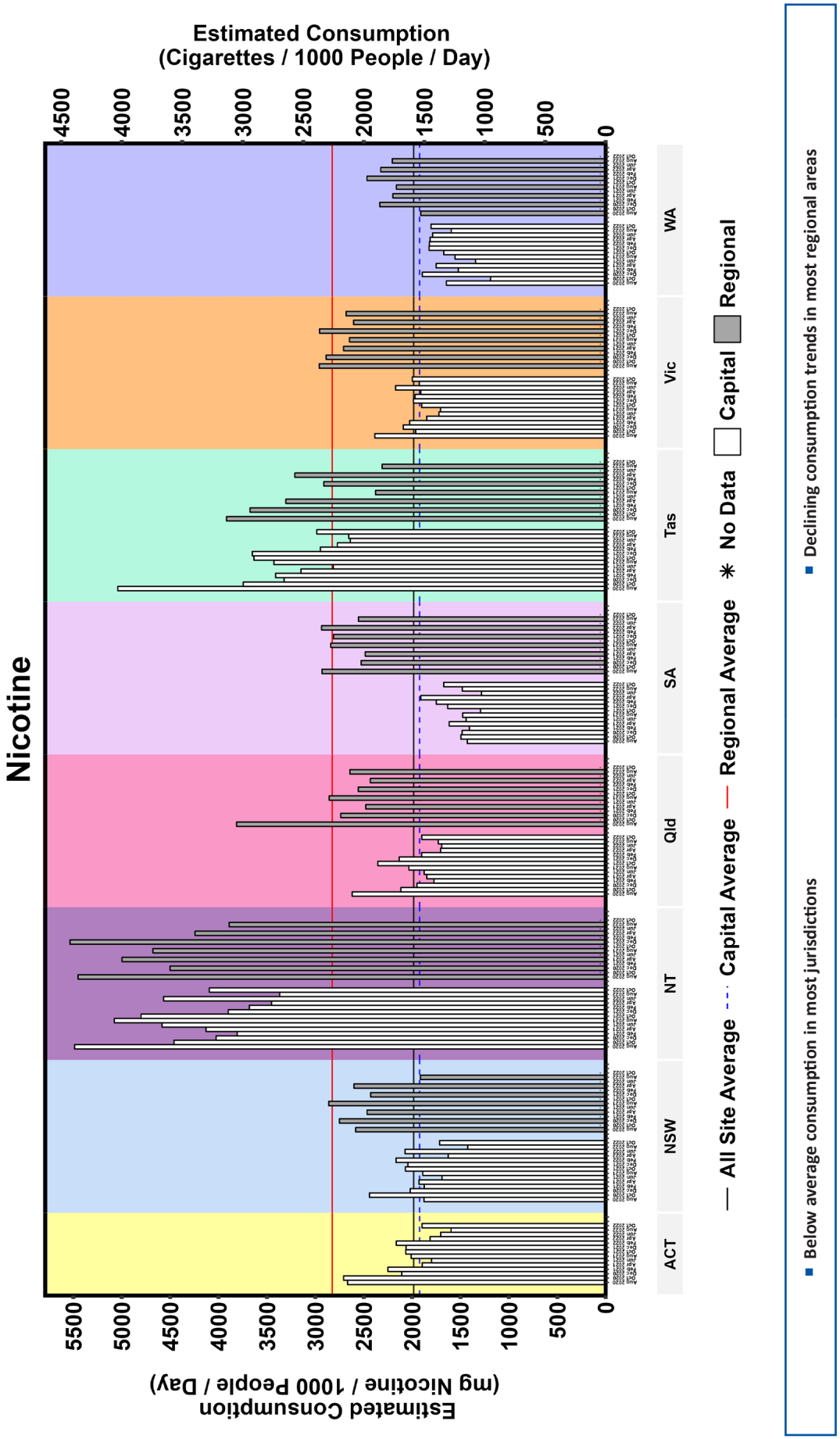


Figure 29: Estimated average consumption of nicotine by state/territory, August 2020 to October 2022, where 1 cigarette provides 1.25 mg of nicotine.

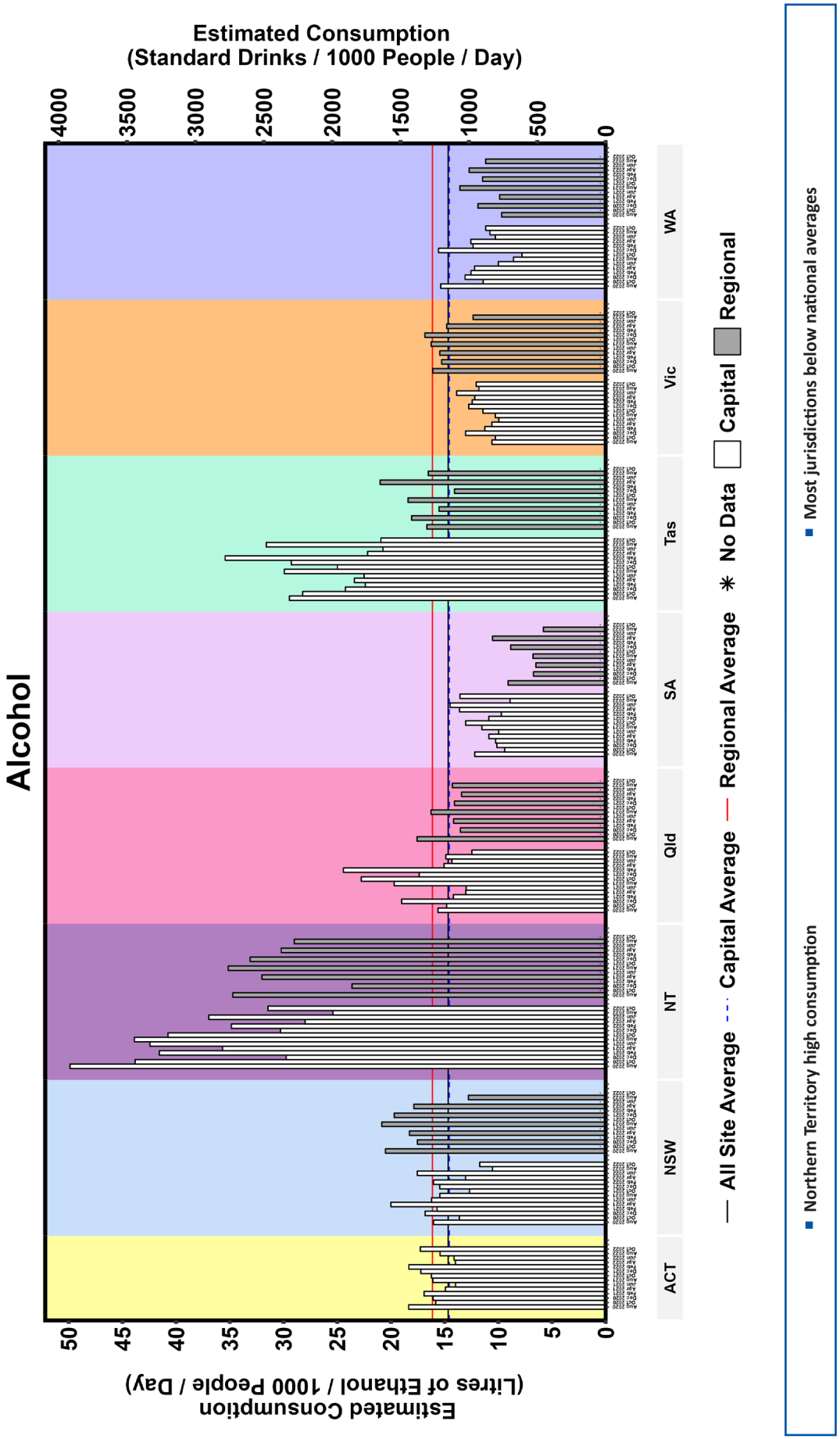


Figure 30: Estimated average consumption of alcohol by state/territory, August 2020 to October 2022. A standard drink is 10.0 g, or 12.6 mL.

4.2.2 STIMULANTS

Trends in methylamphetamine consumption over the past 2 years have been variable, with short term changes a prominent feature (Figure 31). Many jurisdictions observed 2 peaks in methylamphetamine consumption over the past 2 years separated by 2 low points, with the first in August 2020 and another in mid-2021. Troughs in August 2021 were less evident for capital city Queensland and regional New South Wales. The recent changes in consumption tend to be short-term when viewed over the life of the Program. For the most part, methylamphetamine is being consumed at the same levels as at the start of the Program. In August 2022 methylamphetamine consumption was highest in South Australia. Sites where data have been available from before the start of the NWDMP show that patterns of methylamphetamine consumption differ between states (Figure 32 and Figure 33).

There have been large declines in cocaine consumption in almost all jurisdictions over the past 2 years (Figure 34). New South Wales continues to have the highest cocaine consumption nationally, in both capital city and regional areas. Cocaine consumption in the Northern Territory was the lowest in the nation.

MDMA consumption across Australia has also been declining over the past 2 years (Figure 35). Declines in consumption have been evident from 2020, generally reaching their lowest levels in April 2022. Several jurisdictions had increased MDMA consumption this reporting period. The Northern Territory and Tasmania capital cities have historically had the highest MDMA consumption in the nation, but consumption in 2022 is now more evenly spread across the country. Regional MDMA consumption continues to exceed capital city consumption.

There have been sporadic spikes observed in MDA excretion in several jurisdictions over the last 2 years (Figure 36). Excretion of the drug this reporting period increased in several jurisdictions, albeit at low levels.

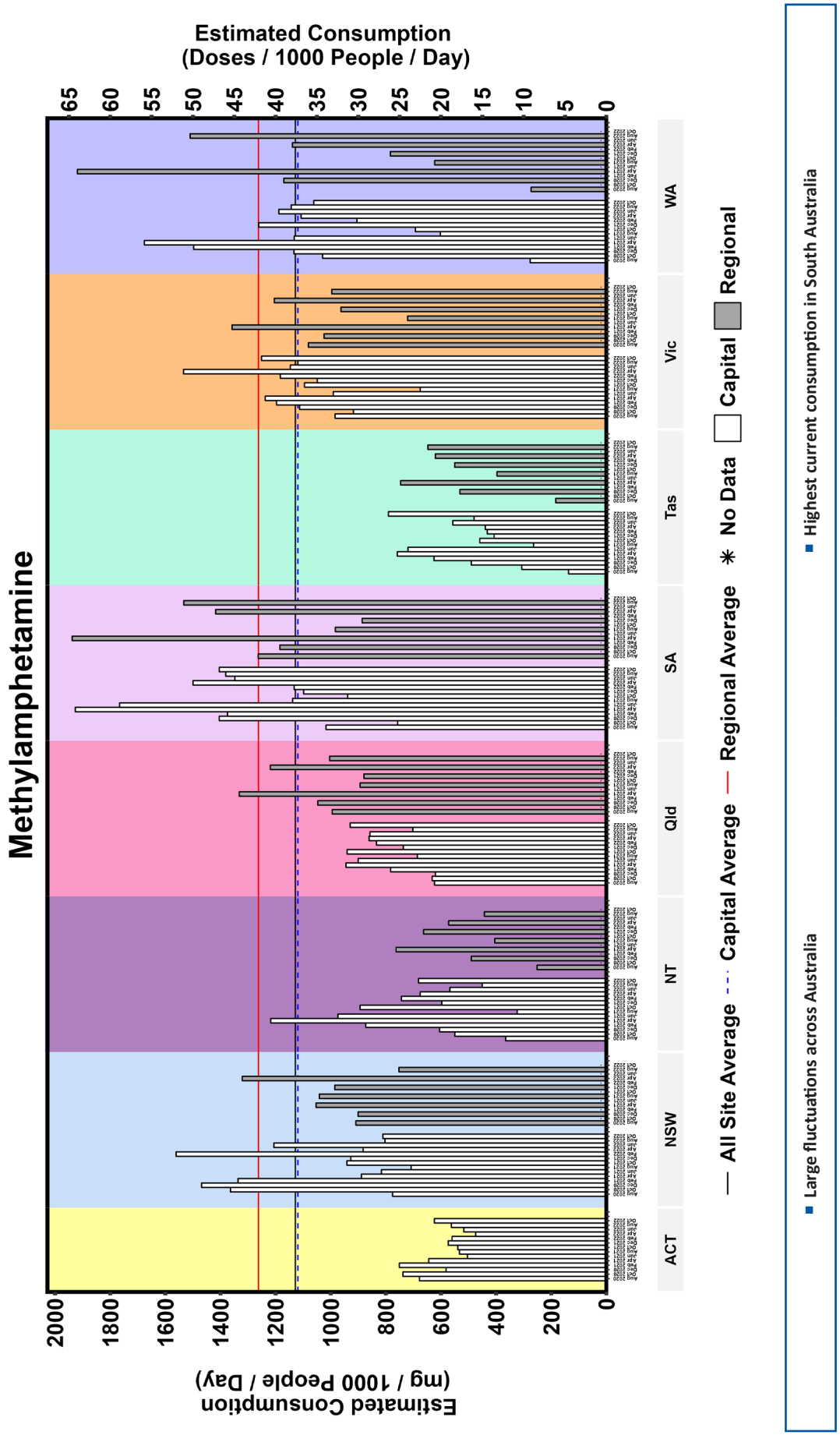


Figure 31: Estimated average consumption of methylamphetamine by state/territory, August 2020 to October 2022.

Figure 32: Change in methylamphetamine consumption for sites in Queensland and South Australia with historical data.

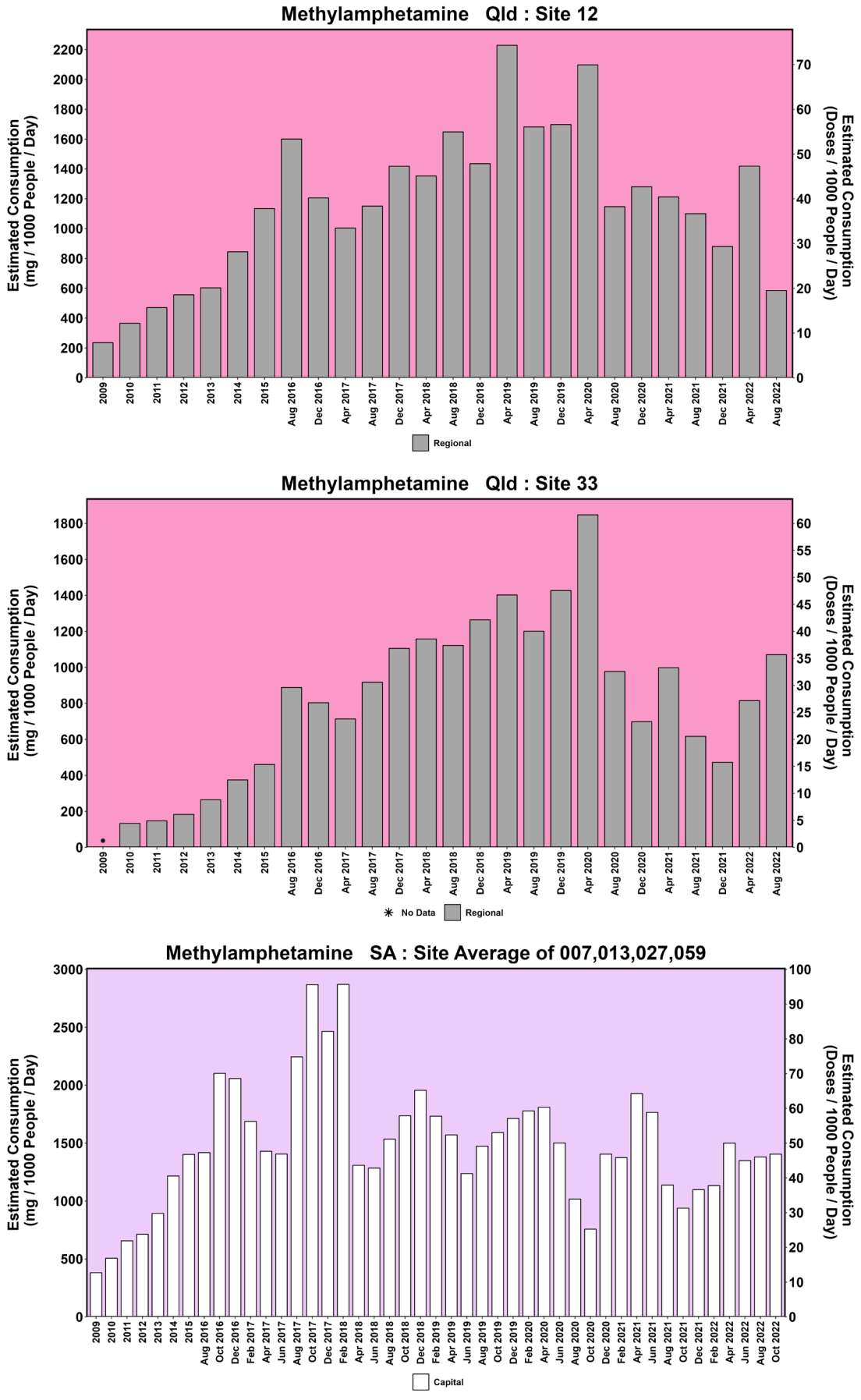
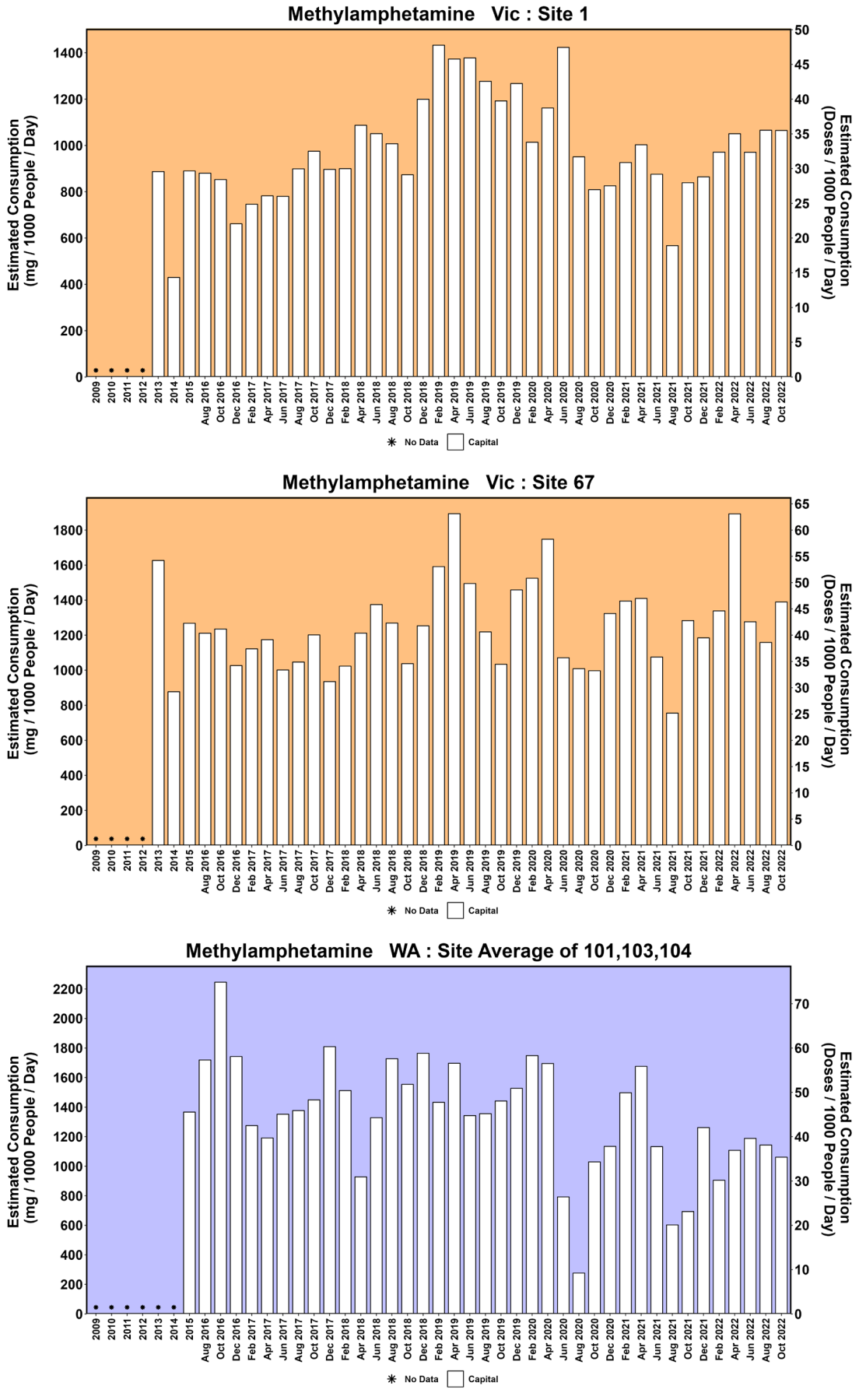


Figure 33: Change in methylamphetamine consumption for sites in Victoria and Western Australia with historical data. Victorian sites were the average of one week per year in 2013, 2014 and 2015.



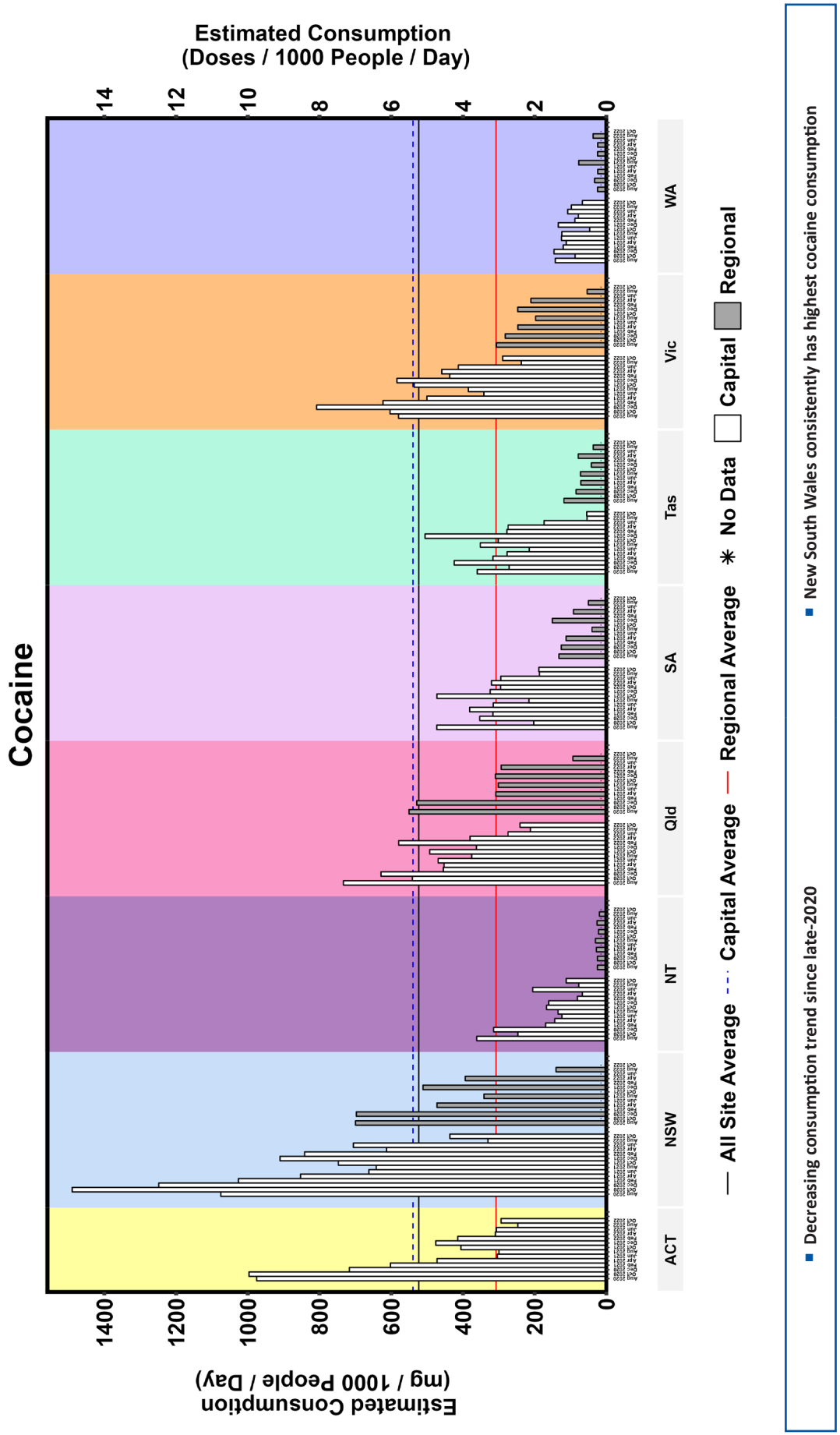


Figure 34: Estimated average consumption of cocaine by state/territory, August 2020 to October 2022.

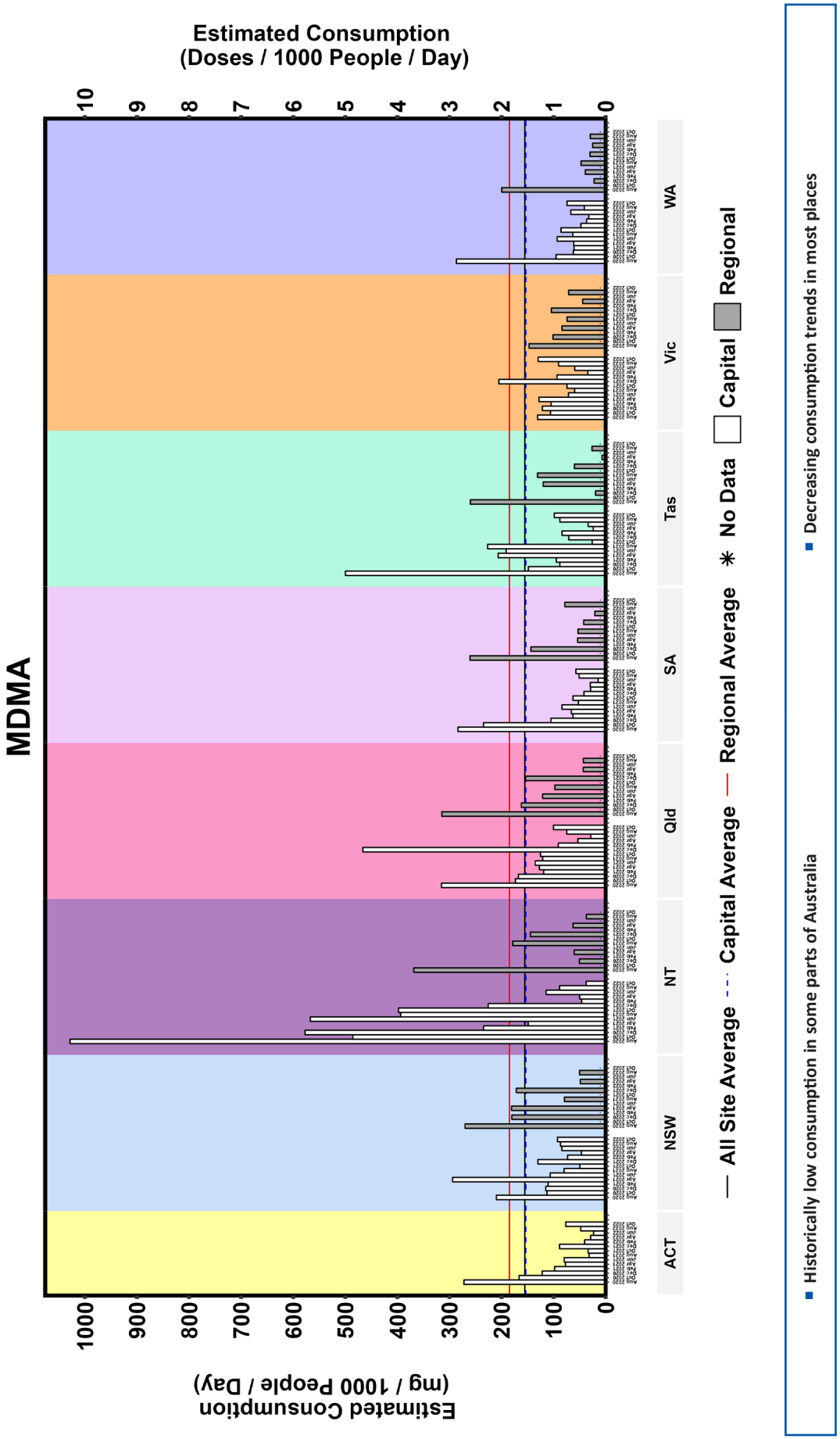


Figure 35: Estimated average consumption of MDMA by state/territory, August 2020 to October 2022.

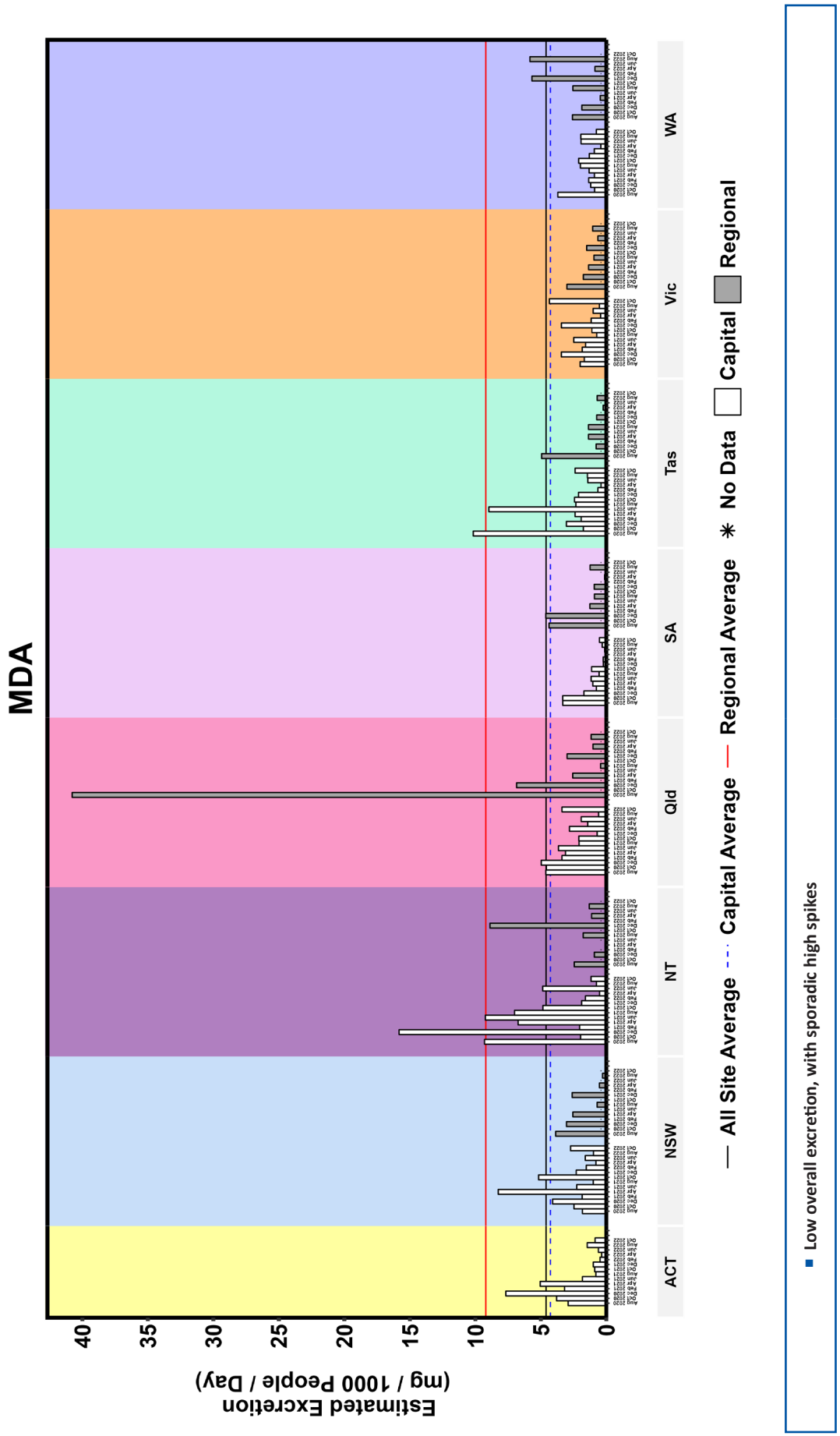


Figure 36: Estimated average excretion of MDA by state/territory, August 2020 to October 2022.

4.2.3 OPIOIDS

Oxycodone consumption in Australia has been declining over the past 2 years in many parts of the country (Figure 37). This reporting period showed some variability between jurisdictions. Average per capita regional oxycodone consumption is nearly double that of capital cities. The Australian Capital Territory and Tasmania had the highest per capita consumption of oxycodone nationally in August 2022.

No overall trend relating to fentanyl consumption has been apparent over the past 2 years (Figure 38). Regional per capita fentanyl consumption remains higher than in the capital cities.

In contrast to the pharmaceutical opioids, heroin is mostly consumed in the capital cities, with the rolling capital city average consumption nearly triple that of the regional average (Figure 39). Outside of New South Wales and Victoria, regional consumption of heroin is very low.

Heroin consumption has been measured in capital city South Australia since 2013 (Figure 40). A gradual long-term decrease in heroin consumption was evident from 2013 to early 2019, followed by an increase towards the end of that year, before a period of fluctuation to October 2021, since when consumption has stabilised at relatively low levels.

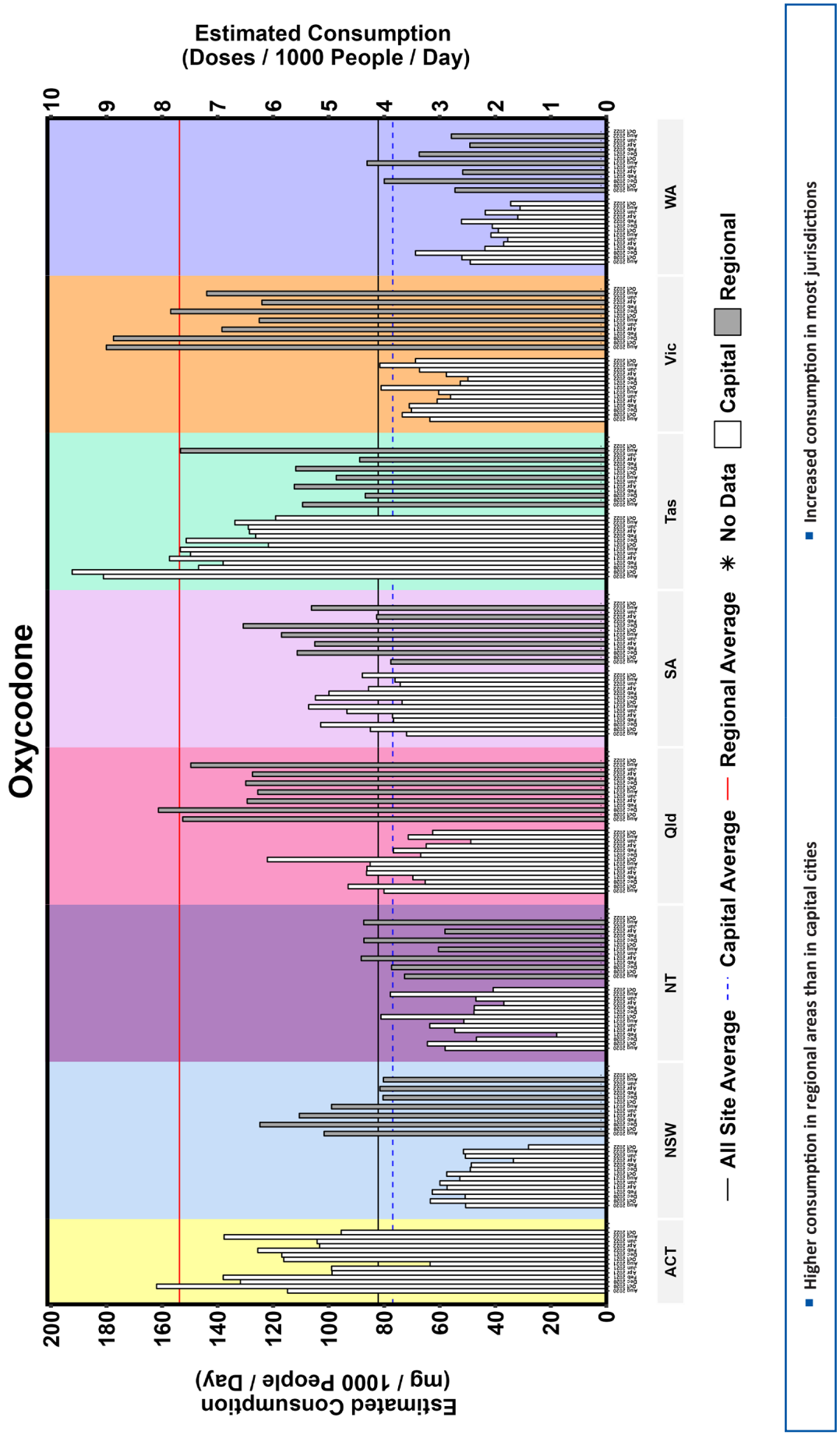


Figure 37: Estimated average consumption of oxycodone by state/territory, August 2020 to October 2022.

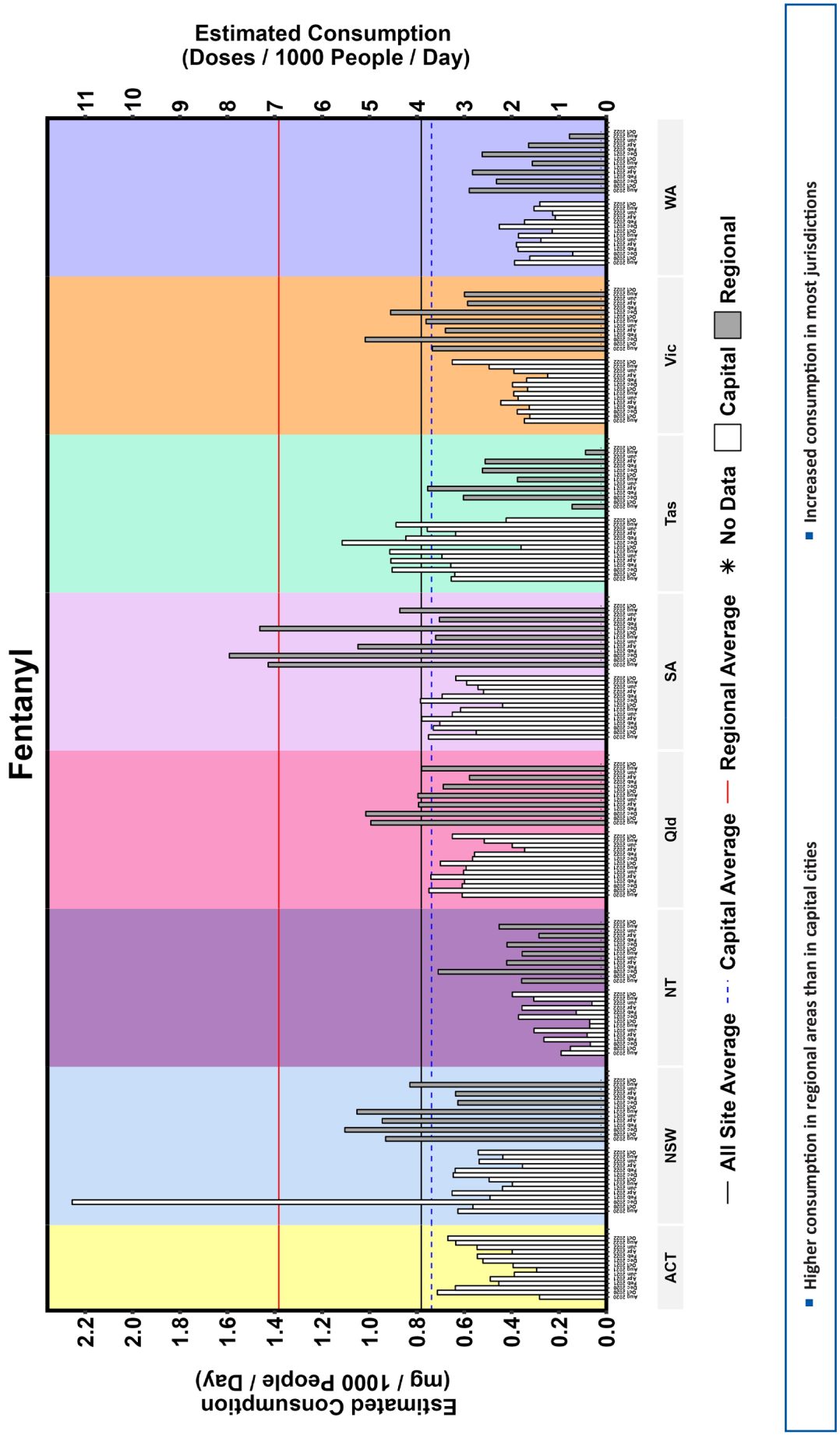


Figure 38: Estimated average consumption of fentanyl by state/territory, August 2020 to October 2022.

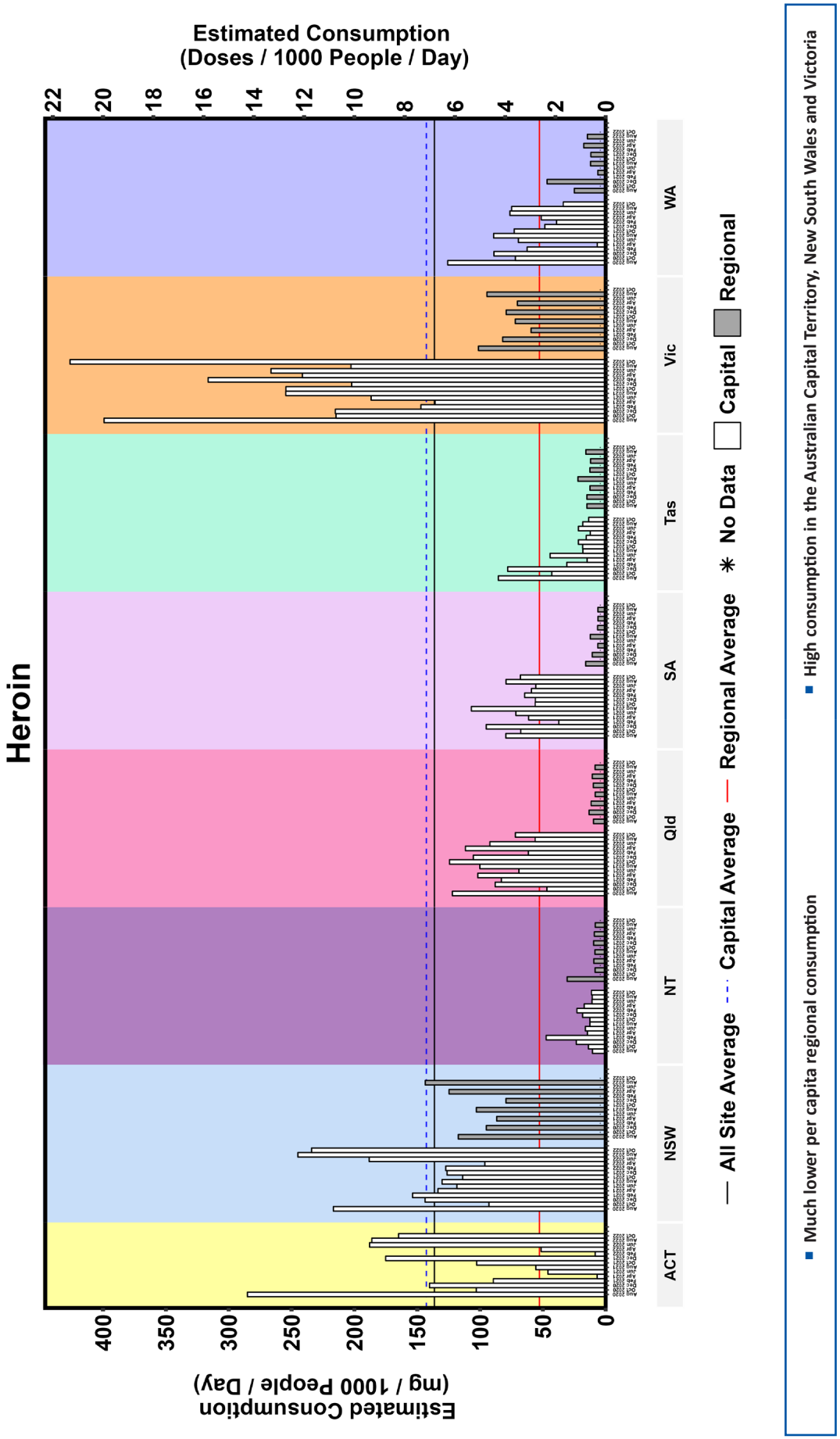
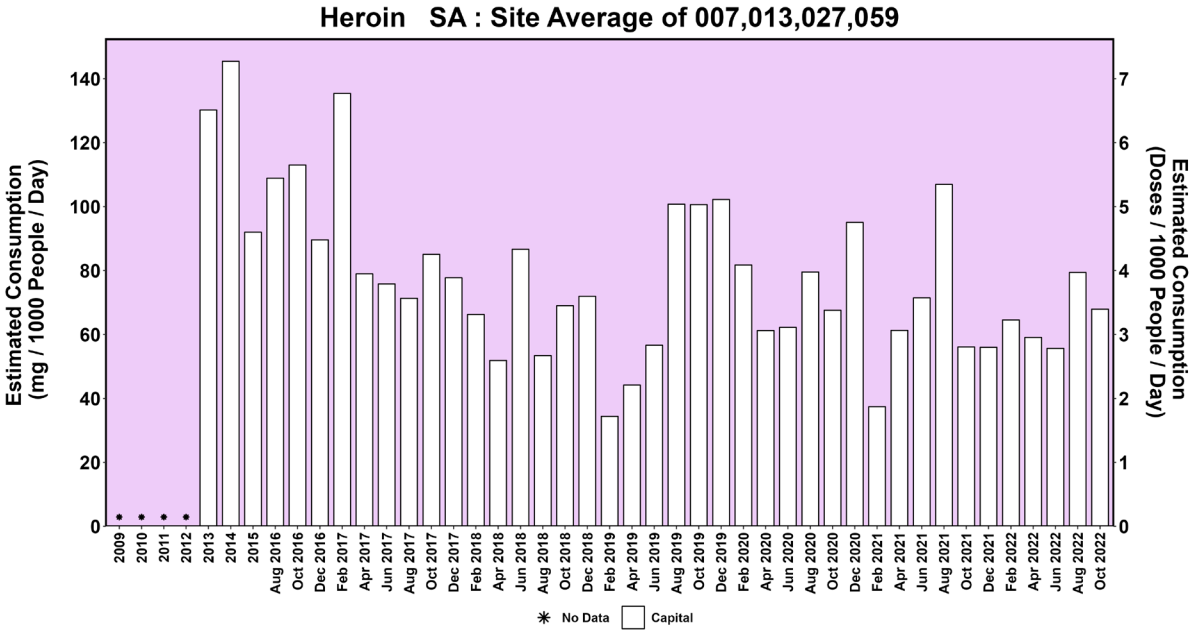


Figure 39: Estimated average consumption of heroin by state/territory, August 2020 to October 2022.

Figure 40: Change in heroin consumption for capital city sites in South Australia with historical data.



4.2.4 CANNABIS

Cannabis consumption is variable (Figure 41). Regional consumption is substantially higher than capital city consumption. Cannabis consumption in capital cities in the larger population centres of New South Wales and Victoria is consistently lower than in the smaller capital cities. Cannabis consumption in August 2022 was highest in the Northern Territory (regional) and Tasmania (capital city).

Cannabis consumption has been monitored in capital city South Australia since 2011. An overall increasing trend in consumption was observed until early 2019, followed by a period of fluctuations to the present (Figure 42).

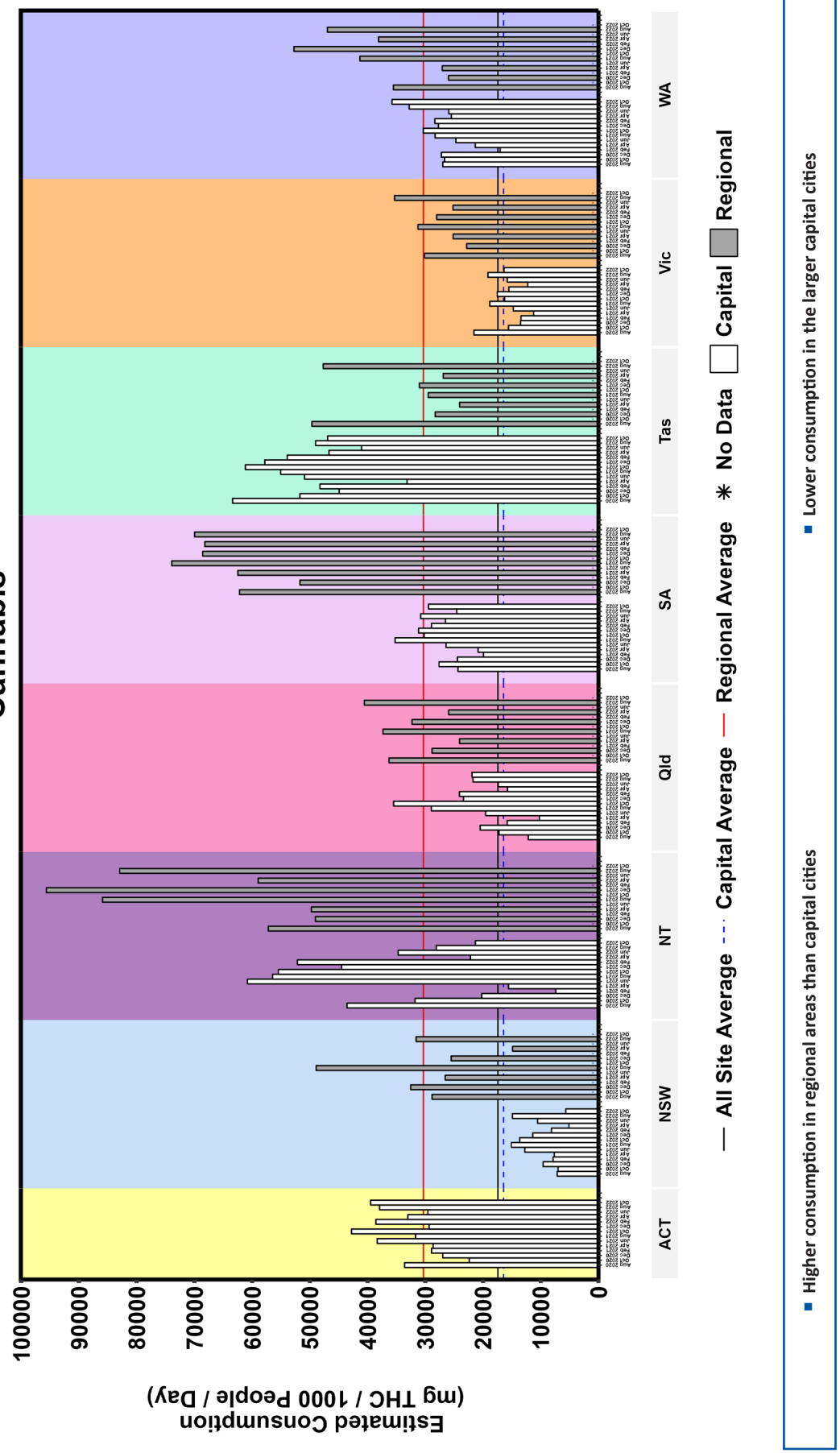
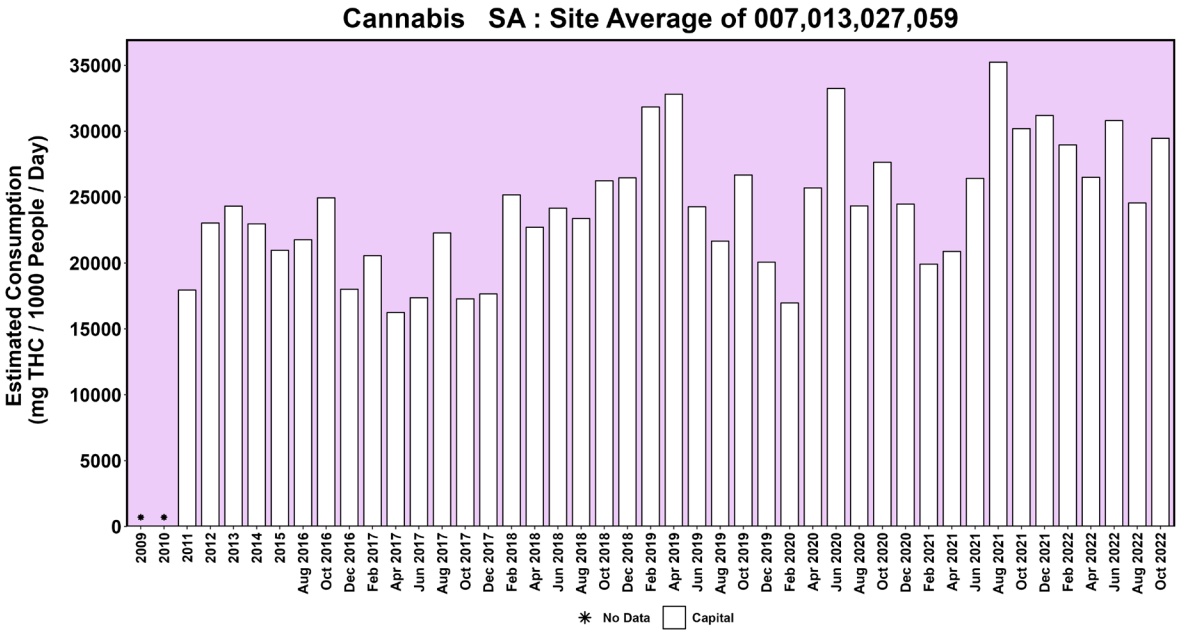


Figure 41: Estimated average consumption of cannabis by state/territory, August 2020 to October 2022.

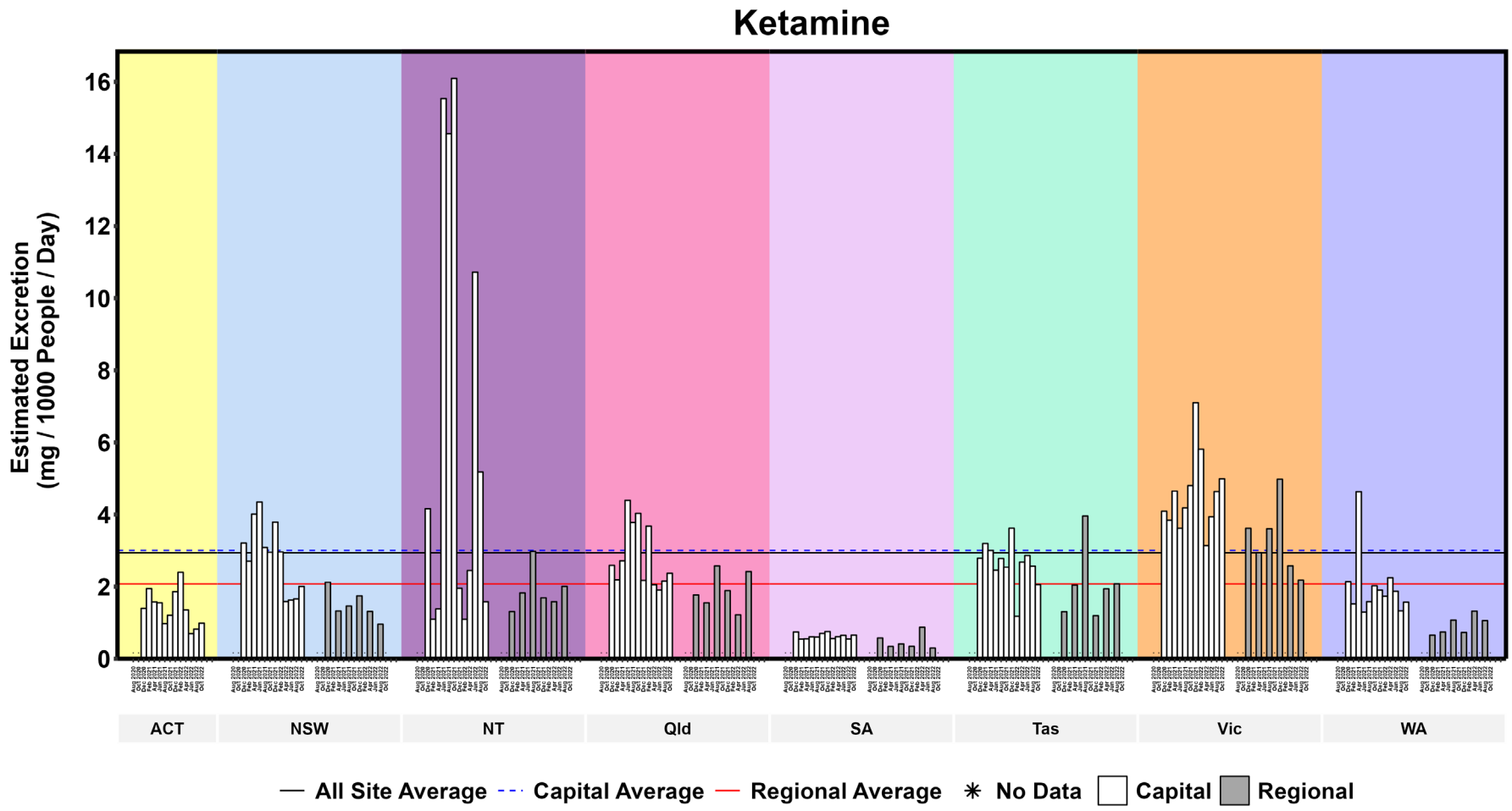
Figure 42: Change in cannabis consumption for capital city sites in South Australia with historical data. Cannabis is detected via the THC metabolite, THC-COOH.



4.2.5 KETAMINE

Ketamine has been part of the Program for the past 2 years and is reported as amounts excreted until an appropriate urinary elimination rate is selected to calculate back to consumption. Average capital city excretion exceeds regional excretion (Figure 43). The Northern Territory capital city site shows large variability between collection periods compared to other jurisdictions. South Australia has had the lowest ketamine excretion over the past 2 years at relatively constant levels.

Figure 43: Estimated average excretion of ketamine by state/territory, August 2020 to October 2022.



- A level of volatility in consumption in several jurisdictions
- Generally higher excretion in capital cities

4.3 NATIONAL CAPITAL CITY AND REGIONAL AVERAGES

In order to show the national trends of the individual substances, all capital city and regional sites were combined for each substance (Figure 44 to Figure 49). Fewer sites were able to be sampled in October 2016 and this is highlighted as such in the respective figures.

In terms of legal substances, nicotine consumption has remained relatively unchanged from the start of the Program (Figure 44). Fluctuations appear to be cyclical to some extent, with a downward trend in consumption apparent in 2022 in regional areas. Average nicotine consumption in regional areas has consistently been higher than in the capital cities. Alcohol consumption has been relatively steady over time, with some short-term peaks and troughs. Alcohol consumption peaked in the capital cities in early 2018, with consumption levels declining to historical low levels in August 2022. Regional alcohol consumption reached a peak in late 2019 but has similarly declined to its lowest level in August 2022.

Average regional methylamphetamine consumption increased more than in the capital cities from early 2017 to the introduction of COVID restrictions in early 2020 (Figure 45). From that point, methylamphetamine consumption decreased substantially to August 2020. The trend since mid-2020 has been a tangible decrease in methylamphetamine consumption in capital cities and regional areas between April and August, followed by increased consumption over the next 2 reporting periods. From 2017 to April 2020, average regional methylamphetamine consumption was much higher than average capital city consumption. However, since April 2020, this pattern has changed and average consumption levels are more similar.

MDMA consumption declined over the first year of the Program, followed by a gradual increase until the end of 2019 (Figure 45). The rate of change in consumption was more pronounced in regional areas. MDMA consumption reached a peak in both capital city and regional areas in late 2019, but has since declined to much lower levels, although consumption has increased slightly since April 2022. While MDMA was consumed at a higher rate in regional areas prior to the pandemic, the pattern has now changed.

Cocaine consumption steadily increased until mid-2020. The trend has reversed in both capital city and regional areas since then (Figure 46). Over the course of 2022 cocaine consumption across Australia has declined, reaching historical low levels in August 2022. Long-term trends show much higher average cocaine consumption in capital cities compared to regional areas.

MDA excretion has shown sporadic spikes, particularly in regional parts of the country (Figure 46). The initial pattern for MDA tended to show a preference for the drug in regional areas, although this trend has been less evident since late 2020. MDA excretion has been declining since 2016.

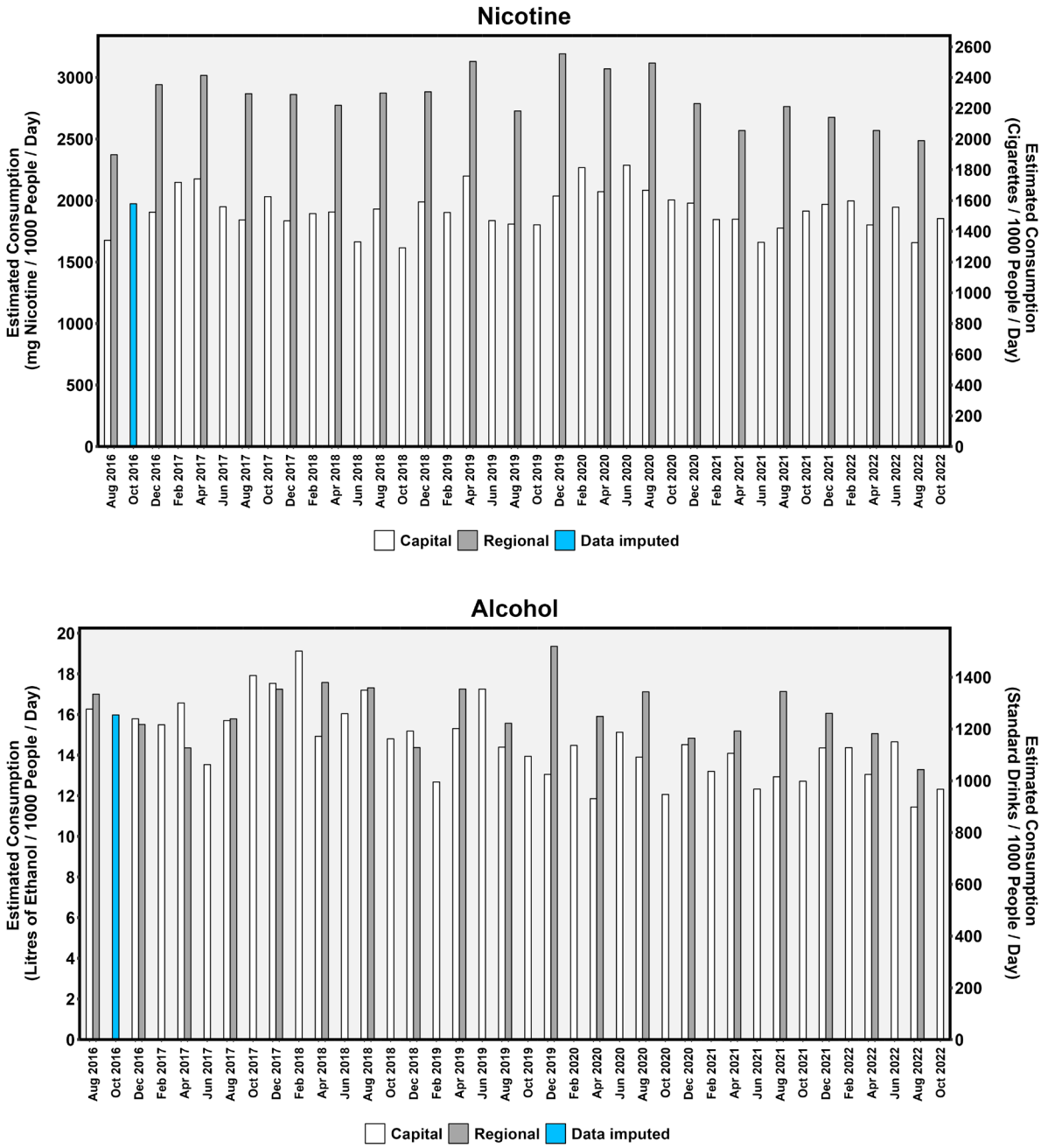
Large differences between average capital city and regional consumption are evident for the 2 pharmaceutical opioids, oxycodone and fentanyl, for almost all the sampling periods (Figure 47). Average capital city consumption of both drugs is substantially lower than average regional consumption, although the gap in fentanyl consumption has narrowed. Oxycodone consumption increased steadily after early 2017 to a peak in December 2018, followed by a decline until 2022. Average consumption of the drug has subsequently remained relatively stable, although it increased between April and August 2022. Fentanyl consumption has largely followed a similar trend.

The remaining substances, heroin, ketamine and cannabis had mixed consumption patterns (Figure 48 and Figure 49, respectively). Heroin consumption trended upward between 2017 and mid 2020, then declined over the next year. Since then, heroin consumption remained relatively stable at levels close to the long-term average in the capital cities before increasing in both capital cities and regional areas between April and August 2022. Average capital city heroin consumption remains considerably higher than regional consumption.

Analysis of ketamine commenced in December 2020. Excretion of the pharmaceutical compound has been consistently lower in regional Australia than in the capital cities. The changes in ketamine excretion to date have occurred within a relatively narrow band.

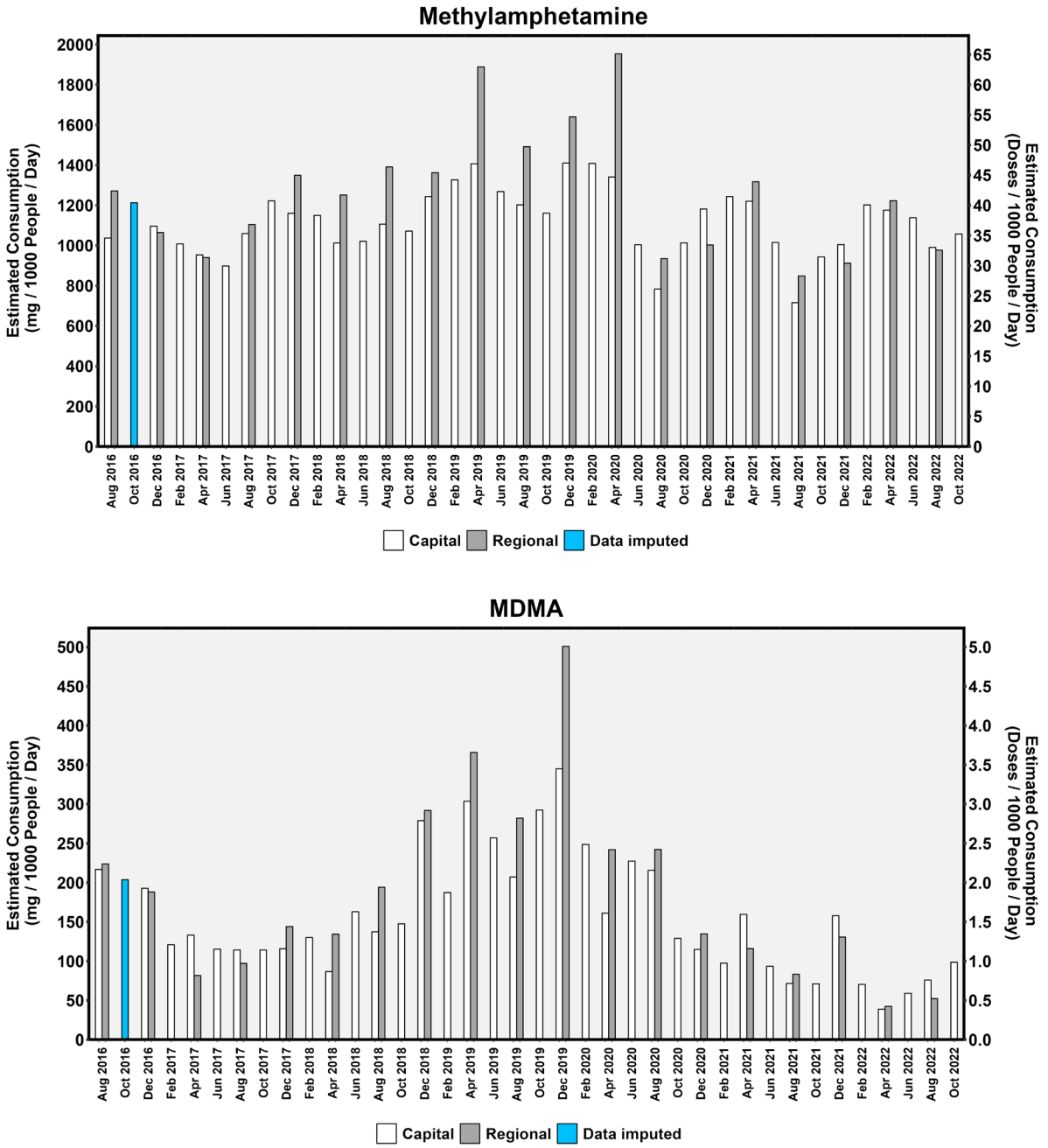
Average capital city cannabis consumption is lower than regional consumption (Figure 49). Current consumption of the drug is at levels towards the higher end of historical values, but varies throughout the year in both capital cities and regional areas.

Figure 44: The population-weighted average of all sites for nicotine and alcohol.



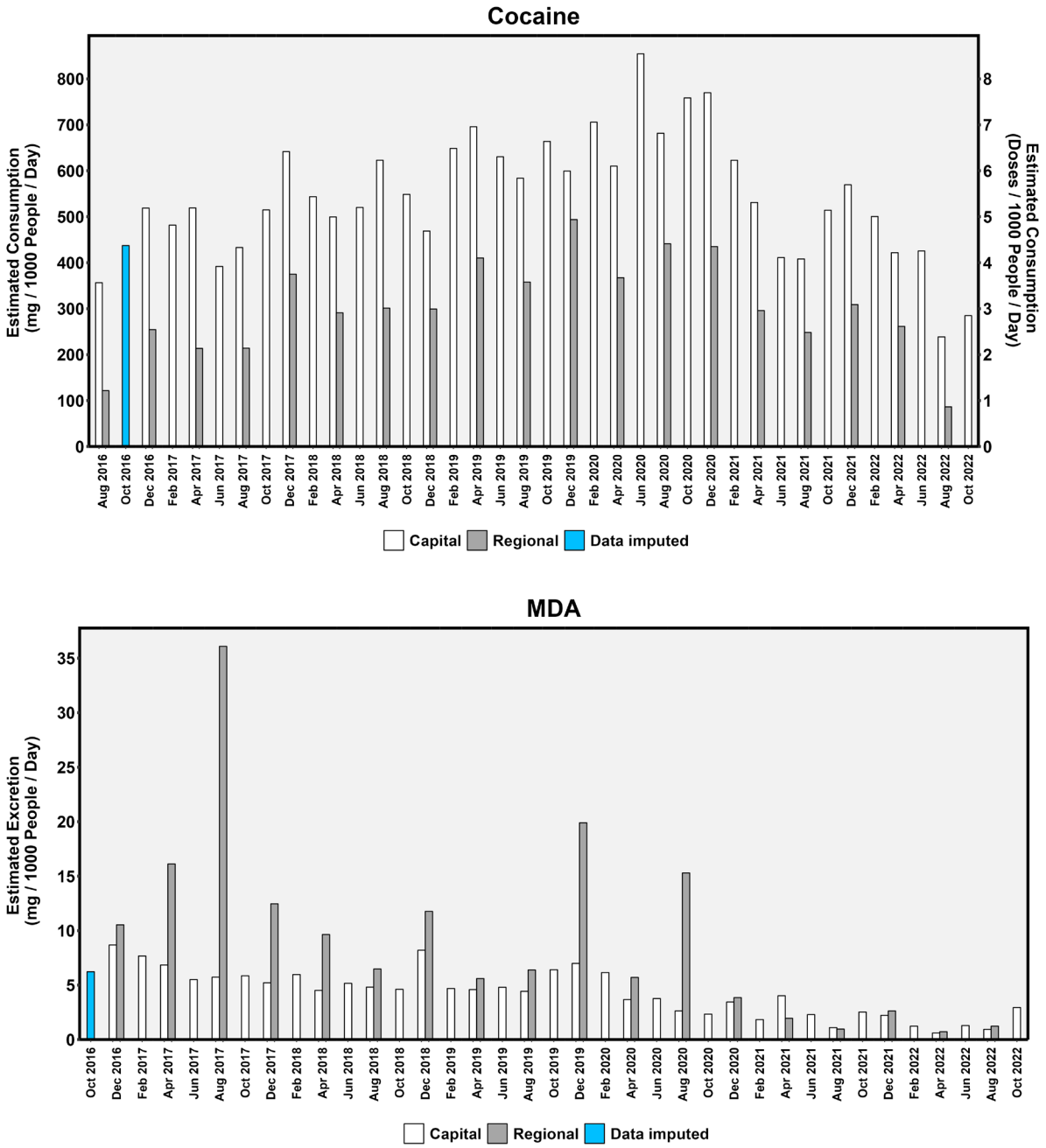
As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and December 2016 was used to provide the overall October estimate.

Figure 45: The population-weighted average of all sites for methylamphetamine and MDMA.



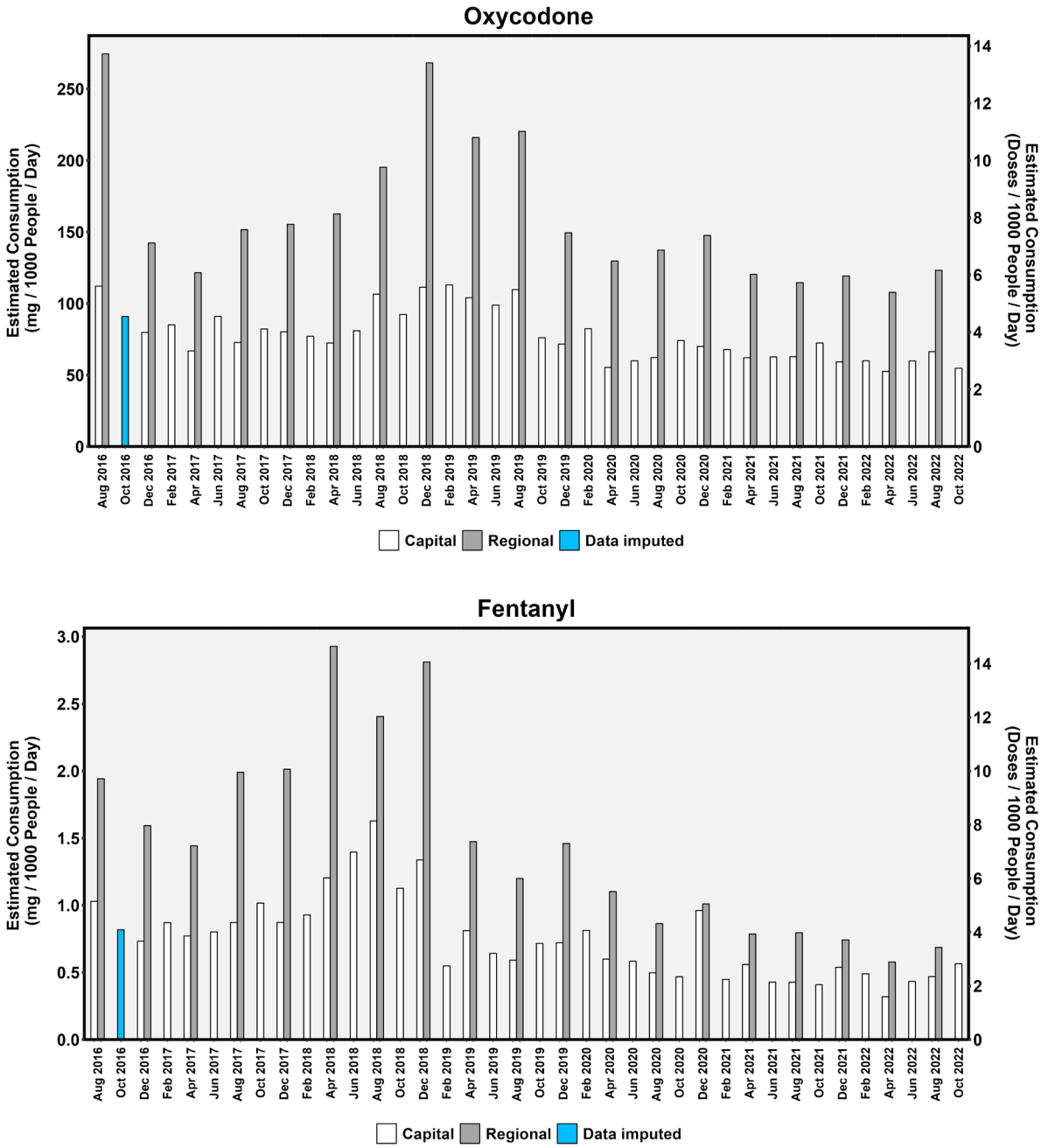
As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and December 2016 was used to provide the overall October estimate.

Figure 46: The population-weighted average of all sites for cocaine and MDA.



As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and December 2016 was used to provide the overall October estimate.

Figure 47: The population-weighted average of all sites for oxycodone and fentanyl.



As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and December 2016 was used to provide the overall October estimate.

Figure 48: The population-weighted average of all sites for heroin and ketamine.

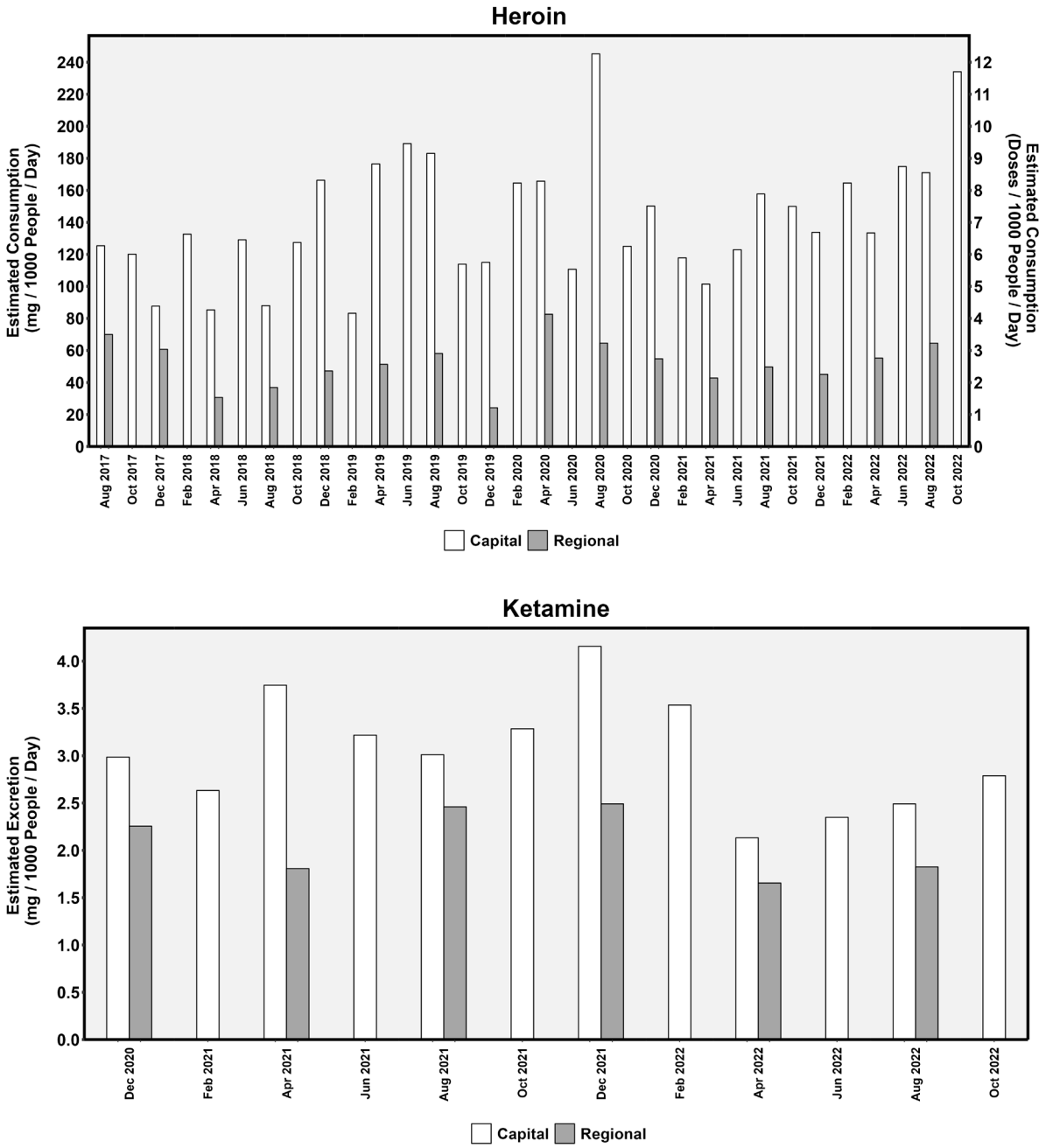
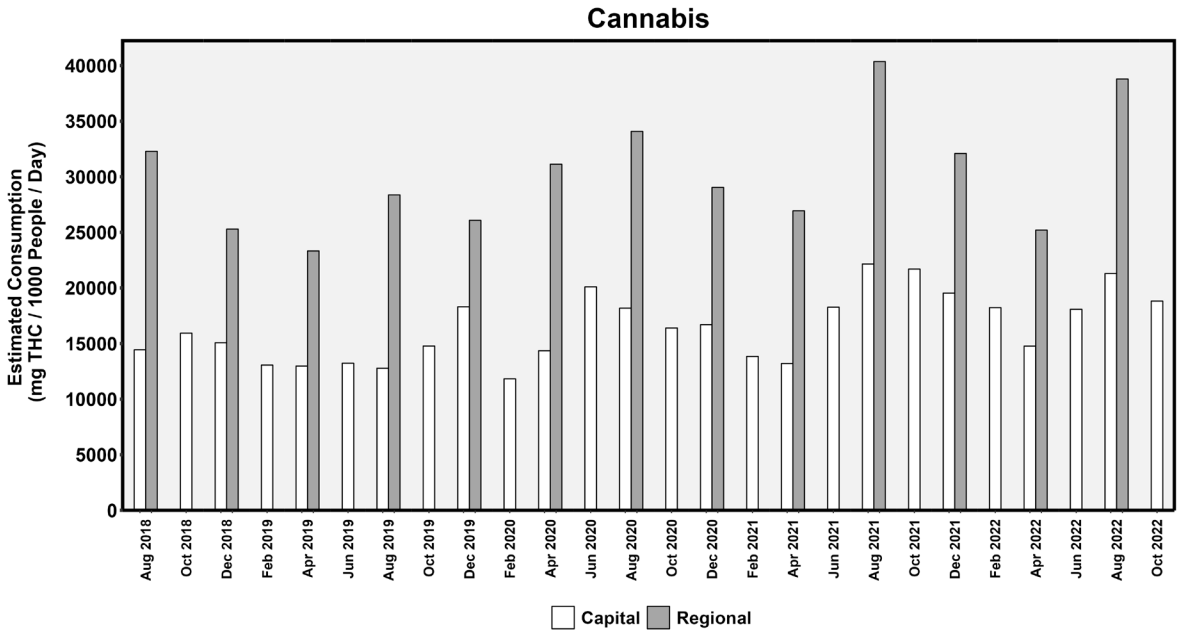


Figure 49: The population-weighted average of all sites for cannabis.



4.4 DRUG PROFILE FOR EACH STATE AND TERRITORY

To compare the scale of use of different types of drugs within the same region (for example, within a state or territory), drug consumption was reported as the number of doses consumed and plotted on the same figure. Cannabis has been omitted from this section in this and previous reports since the definition of a typical dose of cannabis is not well defined. This will be included in comparisons when an appropriate dose for cannabis becomes available. In the absence of clear pharmacokinetic excretion data for MDA and ketamine, these compounds were also excluded from the section.

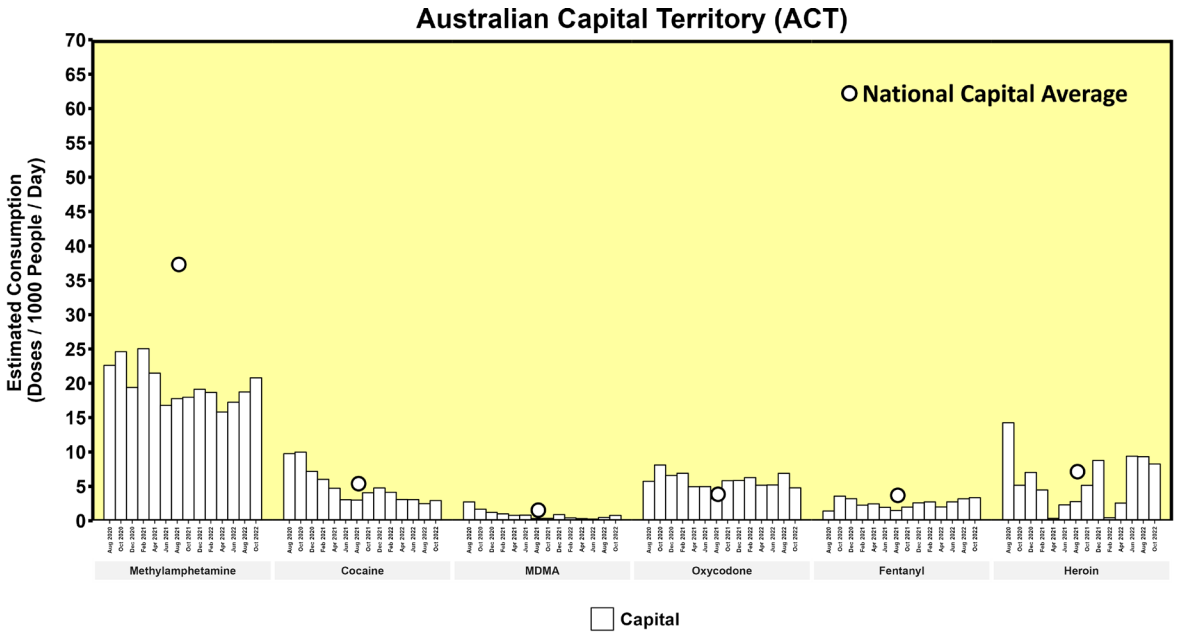
When the amount of drug measured in wastewater was normalised for population size and average dose consumed (excretion factors listed in Appendix 1), alcohol and nicotine remained consistently the highest consumed drugs in all states and territories.

In terms of the substances with available dose information, methylamphetamine consumption remained the highest (Figure 50 to Figure 53). This was the case across all regions of Australia, with the scale of methylamphetamine consumption consistently high for both capital cities and regional areas. Even with the dramatic decrease in methylamphetamine consumption in some jurisdictions such as Western Australia during the periods of COVID-19 restrictions, the drug was still present at higher levels than any other illicit substance included in the graphs (Figure 53). Over the past 2 years, regional and capital city consumption of methylamphetamine has narrowed compared to earlier in the Program, where the regional average was much higher than the capital city average. However, temporal changes in the consumption of methylamphetamine tend to differ by jurisdiction, as outlined in section 4.2.

The temporal profiles of other illicit drugs monitored by the NWDMP were remarkably similar. Cocaine consumption in most regions has been declining for some time, with some variability within the overall period. MDMA consumption has similarly been on the decline in most jurisdictions until the current reporting period, when there was a modest increase.

The opioids, both prescribed and illicit, tended to follow different patterns, depending on the jurisdiction. Current heroin consumption exceeds oxycodone and fentanyl consumption in several states and territories (Figure 53).

Figure 50: Profile of average drug consumption by state or territory, August 2020 to October 2022 for capital sites and to August 2022 for regional sites. Consumption is shown as the number of doses per 1,000 people per day to allow comparison of drugs of different types within the same region (state or territory). The circles represent the cumulative national average of all time points for respective drugs.



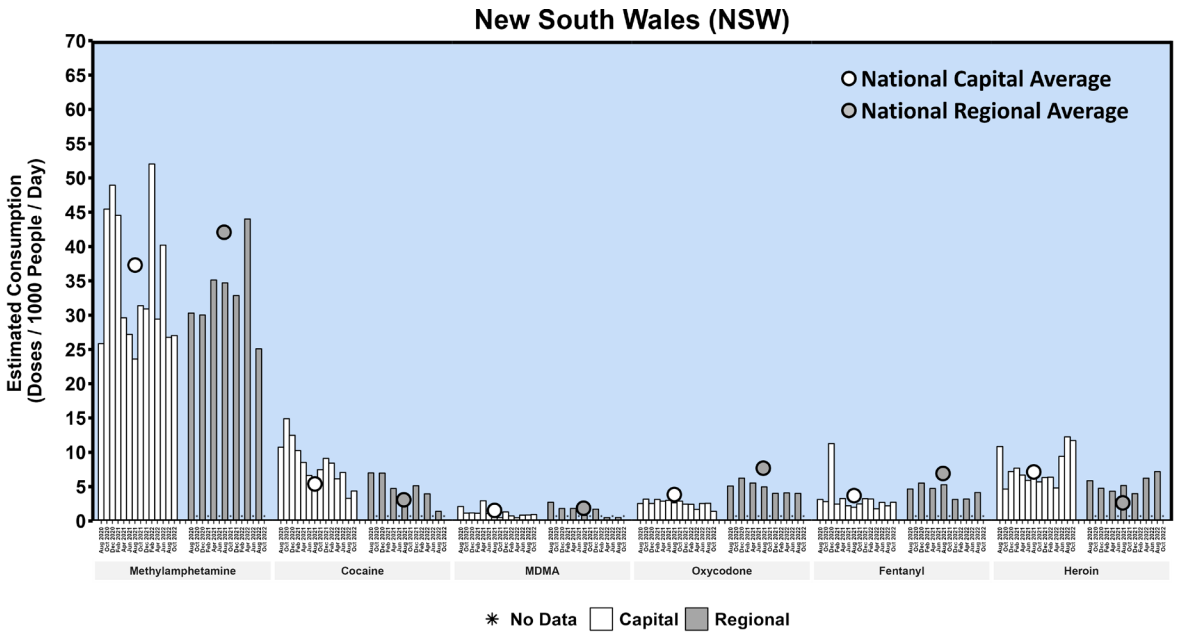


Figure 51: Profile of average drug consumption by state or territory, August 2020 to October 2022 for capital sites and to August 2022 for regional sites.

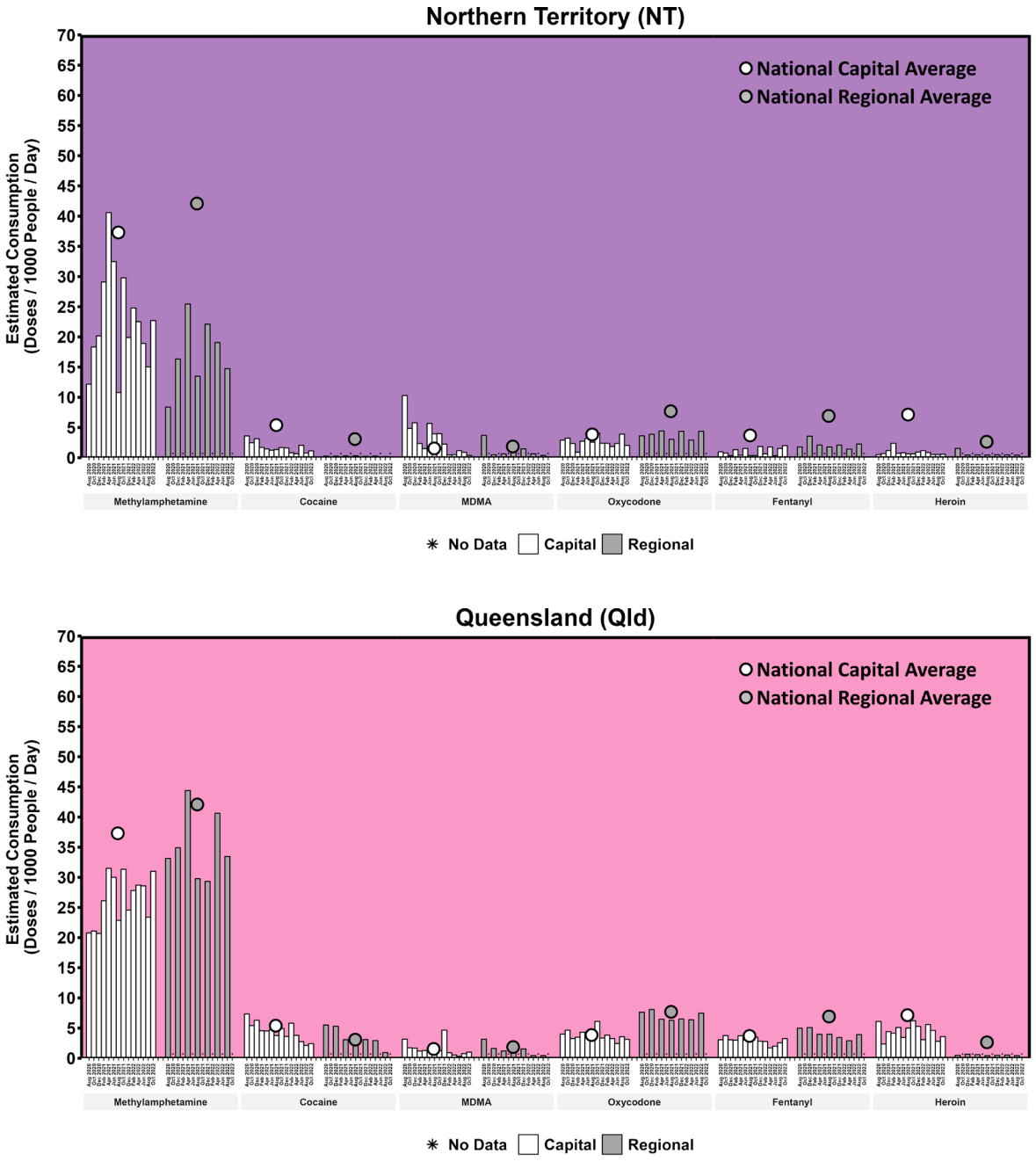


Figure 52: Profile of average drug consumption by state or territory, August 2020 to October 2022 for capital sites and to August 2022 for regional sites.

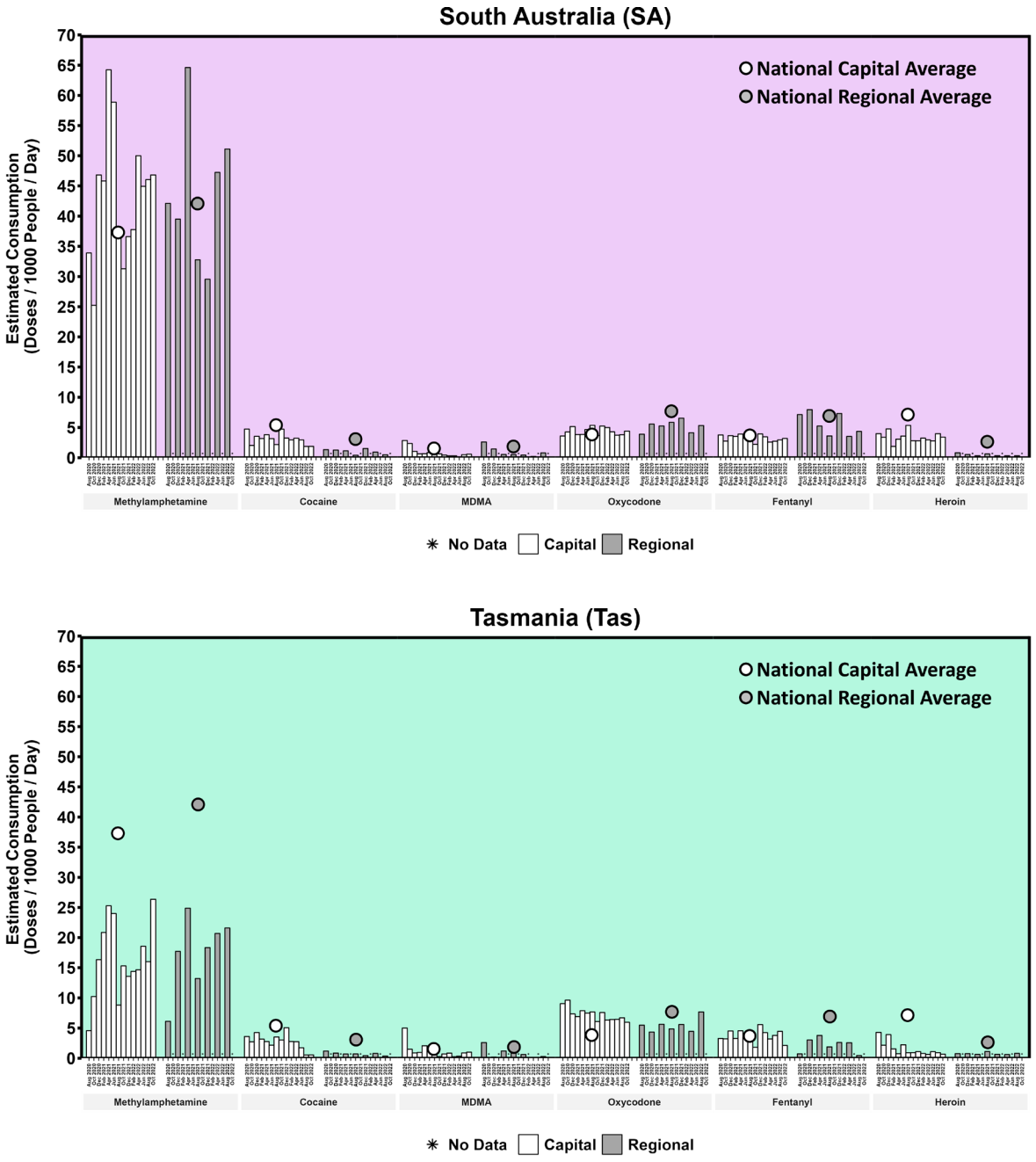
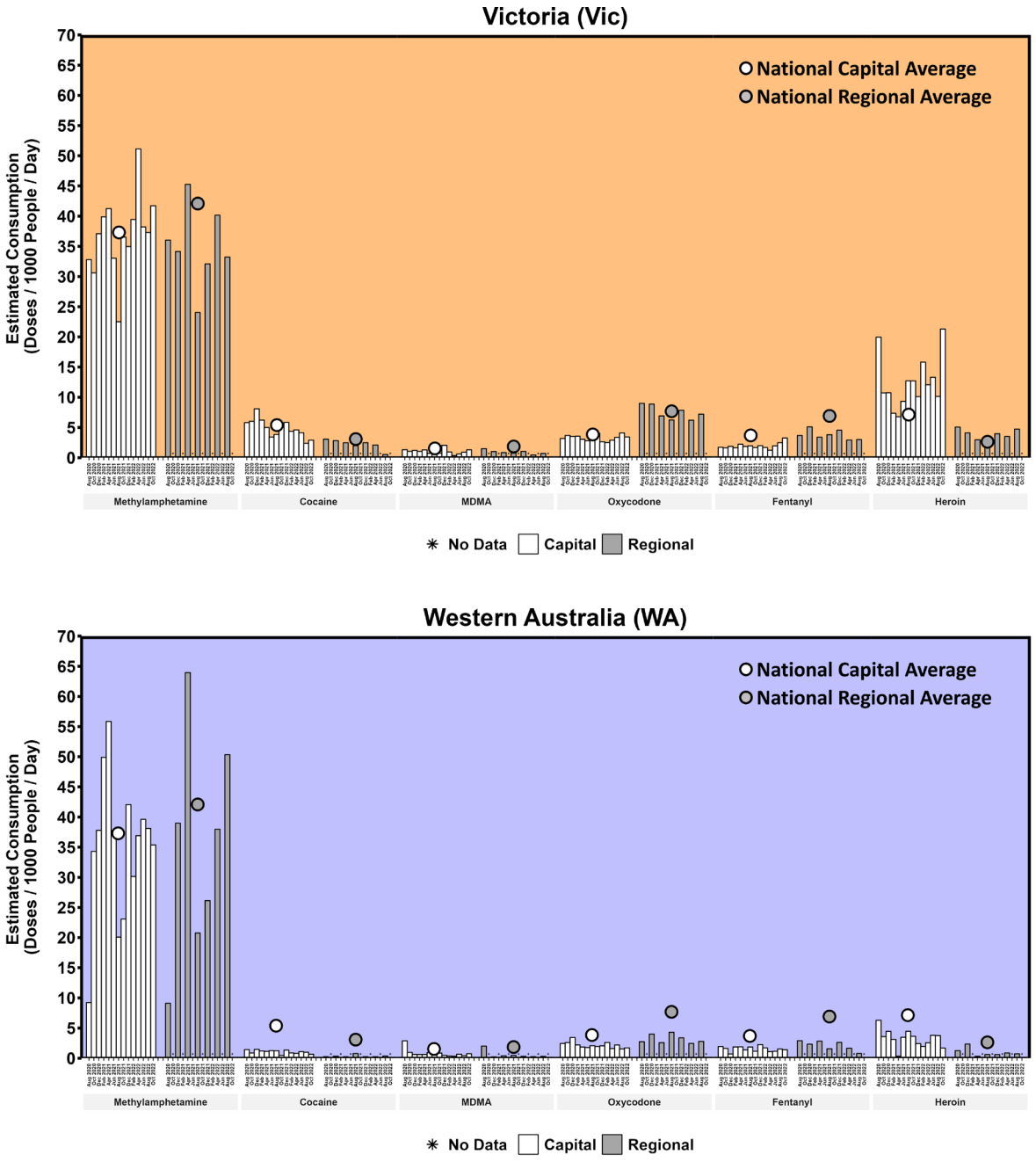


Figure 53: Profile of average drug consumption by state or territory, August 2020 to October 2022 for capital sites and to August 2022 for regional sites.



5: ACKNOWLEDGEMENTS

The project team sincerely thanks the numerous WWTP operators involved in sample collection and WWTP management agencies for providing flow volumes and site information. The cooperation of the plants and management agencies is critical to the ongoing success of this project.

The University of South Australia would like to thank our funding partners, the Drug and Alcohol Services South Australia (DASSA), for their permission to use historical and current data from South Australia. The University of Queensland thanks the research staff and PhD students at QAEHS for their assistance for sample processing. We also thank the members of the Emerging Environmental Health Risks research group at QAEHS (incorporating the former Entox) for assistance with preparing and shipping sampling bottles to the various plants, and those members, past and present, who helped establish this field at the university.

We also would like to acknowledge the wider wastewater-based epidemiology field which includes addiction specialists, analytical chemists, environmental engineers, forensic scientists, pharmacologists, policy advisors and sewer engineers for their ongoing contributions to knowledge, willingness to share both methodology and data, critical review and for advancing wastewater analysis research.

The symbols/images used in Figure 3 in the report were provided courtesy of the Integration and Application Network, University of Maryland, Center for Environmental Science (ian.umces.edu/symbols/).

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7: APPENDICES

APPENDIX 1: DRUG-SPECIFIC PARAMETERS FOR ANALYTICAL REPORTING AND USAGE CALCULATIONS

Analyte levels of detection, levels of reporting, highest detection, excretion factors and standard doses from the literature.

Analyte/metabolite	Drug	Limit of detection (LOD) [ng/L]	Limit of quantification (LOQ) [ng/L]	Excretion factor	Standard dose pure drug (mg)
Amphetamine	Amphetamine	12	16	0.394[a]	30[b]
Cocaine	Cocaine	17	50	0.075[b]	100[b]
Cotinine	Nicotine	33	100	0.3[c]	1.25[c]
Norfentanyl	Fentanyl	0.1	0.1	0.3[d]	0.2[d]
MDA *	MDA	1	4	n.a.	n.a.[#]
MDMA	MDMA	1.5	2	0.225[b]	100[b]
Methylamphetamine	Methylamphetamine	33	100	0.39[g]	30[b]
Hydroxycotinine	Nicotine	17	50	0.44[c]	1.25[c]
Noroxycodone	Oxycodone	0.1	1	0.22[f]	20[d]
Ethyl Sulphate	Alcohol (ethanol)	167	500	0.00012[e]	10g[e]
Benzoylecgonine	Cocaine	33	100	0.35[g]	100[b]
6-Monoacetylmorphine	Heroin	0.5	1.0	0.013[h]	20[i]
THC-COOH	THC (cannabis)	30	180	0.006[b]	n.a.
Norketamine	Ketamine	1	2	n.a.[^]	n.a.

n.a. = data not available; a = (Khan and Nicell 2012); b = (Zuccato et al. 2008); c = (Castiglioni et al. 2015); d = (Rossi 2016); e = (Ryu et al. 2016); f = (Lalovic et al. 2006); g = (Lai et al. 2011); h = (Boerner et al. 1975); i = (Sullivan et al. 2006).

*Data is not available in the scientific literature for the proportion of MDA that is eliminated after MDA consumption. However, data is available detailing the proportion of MDA eliminated after MDMA consumption. Therefore, our MDA estimate of mg excreted per day per 1,000 people is the amount of MDA excreted from the population after considering the metabolic fraction excreted from MDMA.

[#]It is likely that the dose for MDA is similar to that of MDMA, or 100 mg.

^Ketamine is excreted as norketamine and several conjugated metabolites. As the level of conjugation is not well known and conjugated metabolites (e.g., glucuronides) are likely to deconjugate in the sewer, a ketamine excretion rate has not been assigned at this time. Once the impact of in-sewer deconjugation is known, this will be revised.

APPENDIX 2: SAMPLING DETAILS FOR THIS REPORT

Site	Capital or regional	August 2022	October 2022	Population
ACT: 009	Capital	7	7	> 150,000
NSW: 003	Capital	7	7	> 150,000
NSW: 006	Capital	7	7	> 150,000
NSW: 008	Capital	7	7	> 150,000
NSW: 021	Capital	7	–	30,000 to 150,000
NSW: 071	Capital	7	–	> 150,000
NSW: 016	Regional	7	–	30,000 to 150,000
NSW: 025	Regional	7	–	30,000 to 150,000
NSW: 040	Regional	7	–	< 30,000
NSW: 068	Regional	7	–	> 150,000
NSW: 115	Regional	7	–	30,000 to 150,000
NSW: 164	Regional	7	–	< 30,000
NSW: 165	Regional	7	–	< 30,000
NT: 010	Capital	7	7	30,000 to 150,000
NT: 078	Regional	7	–	< 30,000
Qld: 002	Capital	7	7	> 150,000
Qld: 005	Capital	7	7	> 150,000
Qld: 011	Capital	7	7	> 150,000
Qld: 012	Regional	7	–	> 150,000
Qld: 024	Regional	7	–	30,000 to 150,000
Qld: 028	Regional	7	–	30,000 to 150,000
Qld: 029	Regional	7	–	30,000 to 150,000
Qld: 033	Regional	7	–	30,000 to 150,000
Qld: 042	Regional	7	–	30,000 to 150,000
Qld: 053	Regional	7	–	< 30,000
Qld: 077	Regional	7	–	< 30,000
SA: 007	Capital	7	7	> 150,000
SA: 013	Capital	7	7	> 150,000
SA: 027	Capital	7	7	30,000 to 150,000
SA: 059	Capital	7	7	> 150,000
SA: 017	Regional	7	–	< 30,000
SA: 022	Regional	7	–	< 30,000
SA: 063	Regional	7	–	< 30,000
SA: 076	Regional	7	–	< 30,000
SA: 119	Regional	7	–	< 30,000
Tas: 004	Capital	7	5	< 30,000
Tas: 019	Capital	5	5	< 30,000
Tas: 041	Capital	7	5	< 30,000
Tas: 018	Regional	7	–	< 30,000
Tas: 048	Regional	7	–	< 30,000

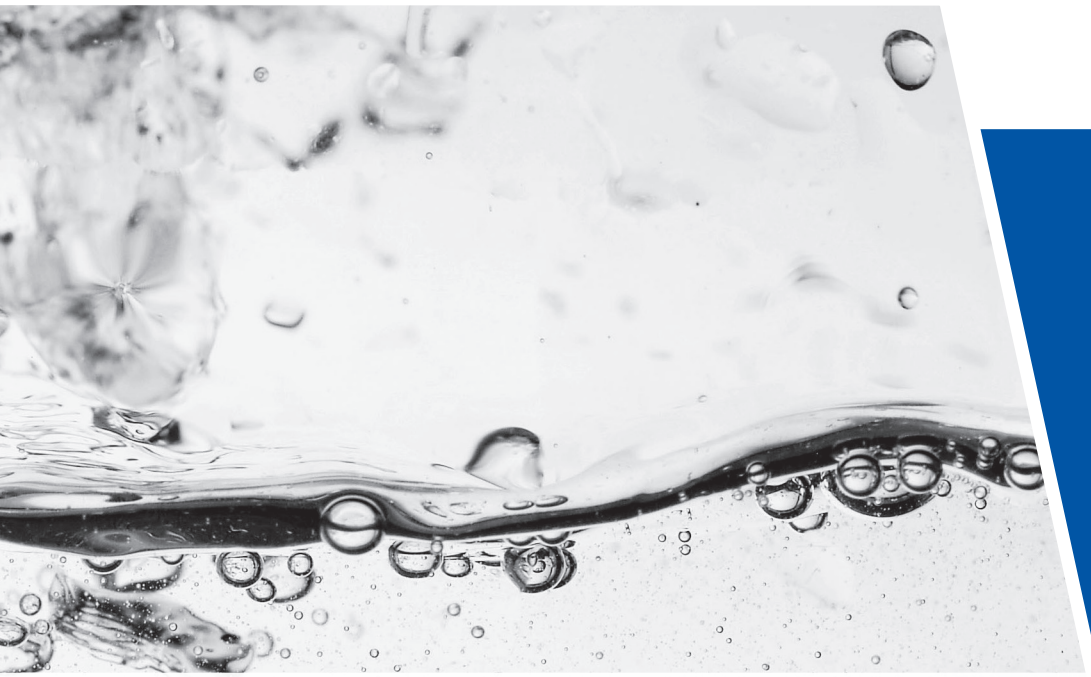
APPENDIX 2 (CONTINUED)

Site	Capital or regional	August 2022	October 2022	Population
Vic: 001	Capital	7	7	> 150,000
Vic: 067	Capital	7	7	> 150,000
Vic: 037	Regional	7	–	> 150,000
Vic: 046	Regional	7	–	30,000 to 150,000
Vic: 061	Regional	7	–	30,000 to 150,000
Vic: 062	Regional	7	–	< 30,000
Vic: 066	Regional	7	–	30,000 to 150,000
Vic: 121	Regional	7	–	< 30,000
Vic: 122	Regional	7	–	< 30,000
Vic: 155	Regional	7	–	30,000 to 150,000
Vic: 156	Regional	7	–	< 30,000
WA: 101	Capital	7	7	> 150,000
WA: 103	Capital	7	7	> 150,000
WA: 104	Capital	7	7	> 150,000
WA: 102	Regional	7	–	30,000 to 150,000
WA: 116	Regional	7	–	< 30,000
WA: 120	Regional	7	–	30,000 to 150,000
WA: 129	Regional	7	–	< 30,000
Regional Sites	36	–		
Capital Sites	22	20		
Total Sites	**58**	**20**		
Regional Samples	252	–		
Capital Samples	152	134		
Total Samples	404	134		
Cumulative Samples	**8,941**	**9,075**		

APPENDIX 3: PROPORTION OF SAMPLES ABOVE LOD (%) FOR EACH DRUG AND PERIOD ASSESSED[3]

Drug	Capital or regional	August 2022	October 2022
Alcohol	Capital	100	100
Alcohol	Regional	100	–
Cannabis	Capital	100	99
Cannabis	Regional	100	–
Cocaine	Capital	88	92
Cocaine	Regional	60	–
Fentanyl	Capital	100	89
Fentanyl	Regional	77	–
Heroin	Capital	69	69
Heroin	Regional	22	–
Ketamine	Capital	92	93
Ketamine	Regional	70	–
MDA	Capital	26	38
MDA	Regional	19	–
MDMA	Capital	100	99
MDMA	Regional	91	–
Methylamphetamine	Capital	100	100
Methylamphetamine	Regional	100	–
Nicotine	Capital	100	100
Nicotine	Regional	100	–
Oxycodone	Capital	100	100
Oxycodone	Regional	100	–

3 Percentage detections for previous collection periods are available in Appendix 4 of Report 6 and Appendix 3 of Reports 7 to 17.



CONCLUSIONS

CONCLUSIONS

For the 18th report of the National Wastewater Drug Monitoring Program, wastewater analysis was conducted in August (capital city and regional sites) and October 2022 (capital city sites only). The Program identified variations in drug consumption over time and within and between jurisdictions. Consistent with previous reports, findings show that of the substances monitored with known doses, nicotine and alcohol are the most consumed drugs in Australia, while methylamphetamine remains the most consumed illicit drug.[4]

METHYLAMPHETAMINE

When comparing data for April and August 2022, the population-weighted average consumption of methylamphetamine decreased in both capital city and regional sites. Average capital city methylamphetamine consumption then increased from August to October 2022. In August 2022, capital city methylamphetamine consumption exceeded regional consumption. In August 2022, South Australia had the highest estimated average capital city and regional consumption of methylamphetamine.

COCAINE

When comparing data for April and August 2022, the population-weighted average consumption of cocaine decreased in both capital city and regional sites, both to record low levels. Average capital city cocaine consumption then increased from August to October 2022. Average capital city cocaine consumption continued to exceed average regional consumption. In August 2022, New South Wales had the highest estimated average capital city and regional consumption of cocaine.

3,4-METHYLENEDIOXYMETHYLAMPHETAMINE (MDMA)

When comparing data for April and August 2022, the population-weighted average consumption of MDMA increased in both capital city and regional sites. Average capital city MDMA consumption then increased from August to October 2022. In August 2022, average capital city MDMA consumption exceeded regional consumption. In August 2022, Victoria had the highest estimated average capital city MDMA consumption, while South Australia had the highest regional consumption.

3,4-METHYLENEDIOXYAMPHETAMINE (MDA)

MDA is a metabolite of MDMA, but also an illicit drug in its own right. When comparing data for April and August 2022, MDA excretion increased in both capital city and regional sites. Average capital city MDA excretion then increased from August to October 2022. In August 2022, average regional MDA excretion exceeded average capital city excretion. In August 2022, Western Australia had the highest estimated average capital city and regional excretion of MDA.

4 Throughout this report, unless otherwise stated, all comparisons on the consumption of different drugs are based on doses consumed rather than drug mass.

HEROIN

When comparing data for April and August 2022, the population-weighted average consumption of heroin increased in both capital city and regional sites. Average capital city heroin consumption then increased from August to October 2022. Average capital city heroin consumption continued to exceed average regional consumption. In August 2022, New South Wales had the highest estimated average capital city and regional consumption of heroin.

CANNABIS

When comparing data for April and August 2022, the population-weighted average consumption of cannabis increased in both capital city and regional sites. Average capital city cannabis consumption then decreased from August to October 2022. Average regional cannabis consumption continued to exceed average capital city consumption. In August 2022, Tasmania had the highest estimated average capital city consumption of cannabis, while Northern Territory[5] had the highest average regional consumption.

KETAMINE

When comparing data for April and August 2022, the population-weighted average excretion of ketamine increased in both capital city and regional sites. Average ketamine excretion then increased from August to October 2022. Average capital city ketamine excretion exceeded regional ketamine excretion. In August 2022, Northern Territory[6] had the highest estimated average capital city and Queensland had the highest regional ketamine excretion.

OXYCODONE

When comparing data for April and August 2022, the population-weighted average consumption of oxycodone increased in both capital city and regional sites. Average capital city oxycodone consumption then decreased from August to October 2022. Average regional oxycodone consumption continued to exceed average capital city consumption. In August 2022, the Australian Capital Territory had the highest estimated average capital city consumption of oxycodone, while Tasmania had the highest average regional consumption.

FENTANYL

When comparing data for April and August 2022, the population-weighted average consumption of fentanyl increased in both capital city and regional sites. Average capital city fentanyl consumption then increased from August to October 2022. Average regional fentanyl consumption continued to exceed average capital city consumption. In August 2022, Tasmania had the highest estimated average capital city consumption of fentanyl, while South Australia had the highest average regional consumption.

5 As the Northern Territory only had 2 participating sites, results may not be representative of the Territory as a whole, however the 2 sites cover approximately 25% of the population of the Northern Territory.

6 Ibid.

NICOTINE

When comparing data for April and August 2022, the population-weighted average consumption of nicotine decreased in both capital city and regional sites. Average capital city nicotine consumption then increased from August to October 2022. Average regional nicotine consumption continued to exceed average capital city consumption. In August 2022, the Northern Territory[7] had the highest estimated average capital city and regional consumption of nicotine.

ALCOHOL

When comparing data for April and August 2022, the population-weighted average consumption of alcohol decreased in both capital city and regional sites, both to record low levels. Average capital city alcohol consumption then increased from August to October 2022. Average regional alcohol consumption exceeded average capital city consumption. In August 2022, Tasmania had the highest estimated average capital city consumption and the Northern Territory[8] had the highest regional consumption of alcohol.

NEXT REPORT

The 19th report of the National Wastewater Drug Monitoring Program is scheduled for public release in June 2023.

7 Ibid.

8 Ibid.