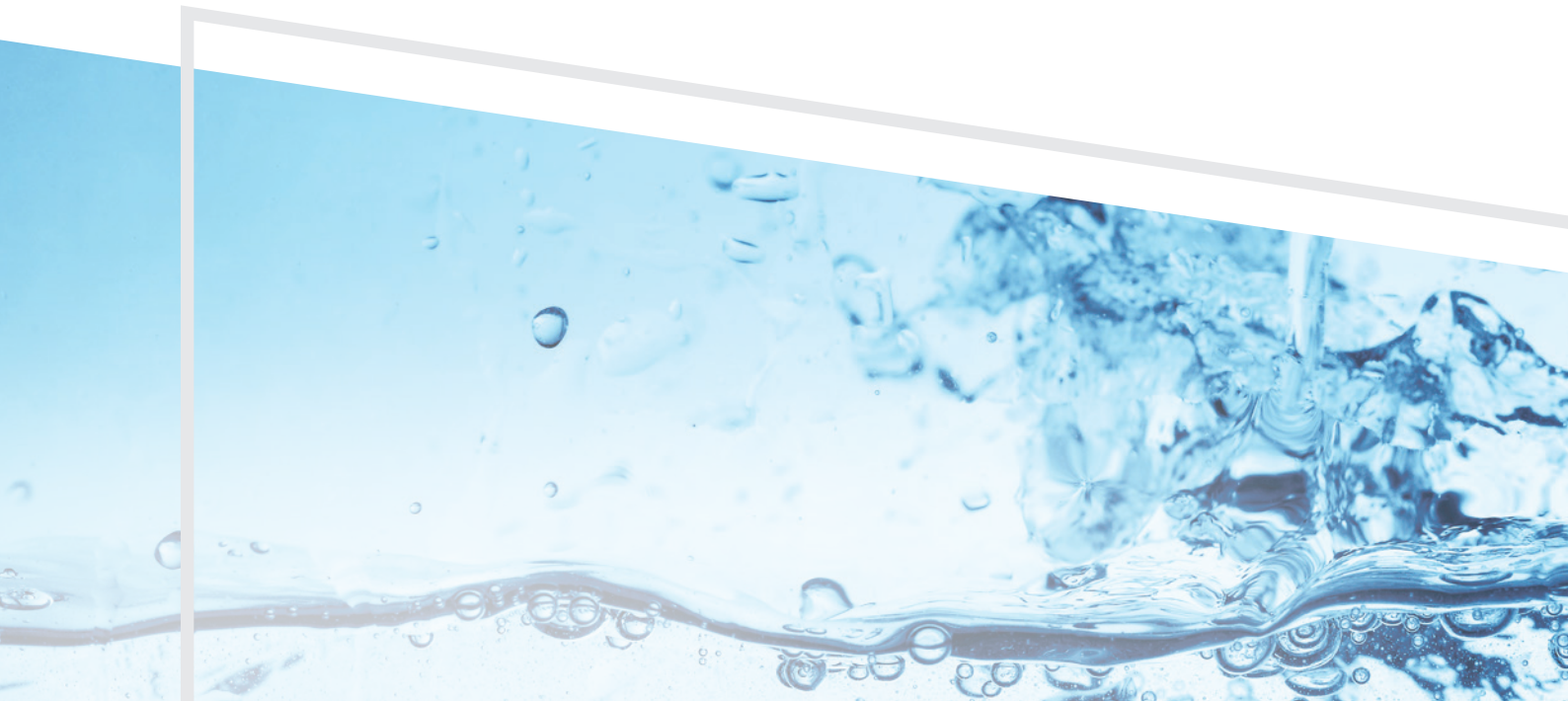
NATIONAL WASTEWATER DRUG MONITORING PROGRAM

REPORT 8, AUGUST 2019

AUSTRALIAN CRIMINAL INTELLIGENCE COMMISSION

THE UNIVERSITY OF QUEENSLAND AUSTRALIA

University of South Australia



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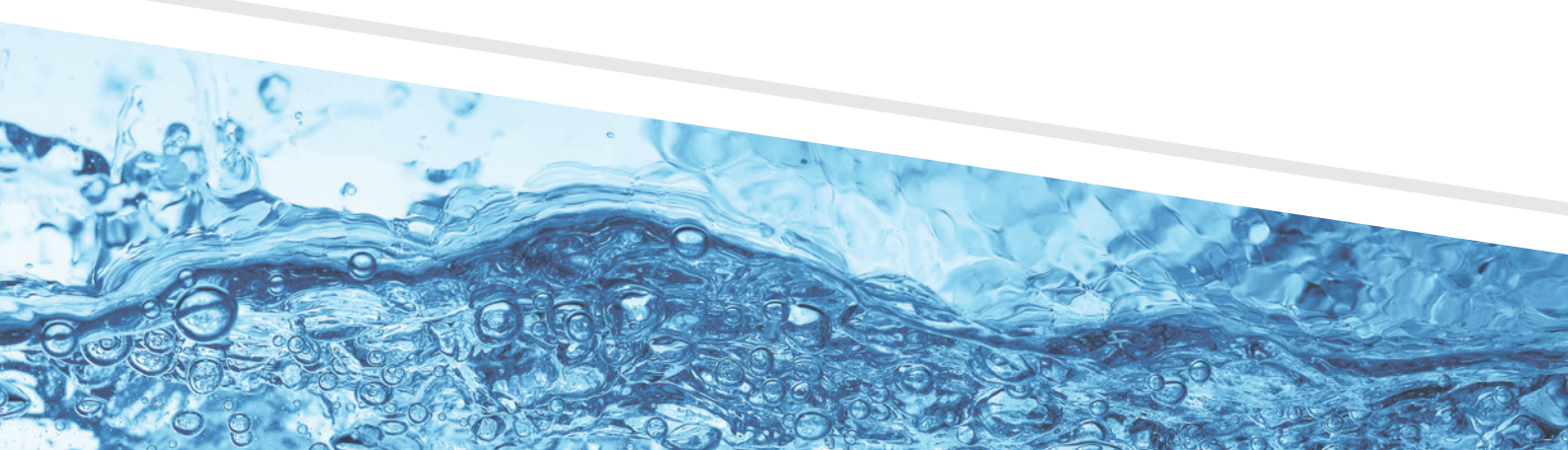


CEO FOREWORD

The Australian Criminal Intelligence Commission has a responsibility to provide information and intelligence on criminal activity to support the Government in creating a safer Australia. Much of the harm that Australians suffer at the hands of organised crime is due to the illicit drug trade. Serious and organised crime groups profit from the importation, manufacture, trafficking and sale of drugs which cause harm to the community.

The National Wastewater Drug Monitoring Program represents world best practice in its field. Wastewater analysis is a tool to measure and interpret drug use within populations, providing a measure of one important aspect of national health—the demand for a range of licit and illicit drugs. Scheduled illicit drugs and licit drugs with abuse potential are inherently harmful. Reliable drug consumption data is a useful indicator of the level of harm experienced by community. Understanding drug use behaviour supports the effective direction of resources to priority areas. It also allows monitoring of the progress of demand, supply and harm reduction strategies.

The National Wastewater Drug Monitoring Program is an Australian Government initiative. The Australian Criminal Intelligence Commission will receive an additional $4.8 million as part of its annual appropriation to continue delivery of this important program for a further four years. This will allow the Australian Criminal Intelligence Commission to not only continue to provide an objective evidence base of illicit and licit drug use, but also build on the program to support Government service provision. By incorporating additional Government, state and territory, industry and academic datasets into the analysis over the next four years we will continue to enhance Australian Government responses to reduce community harm.

TRENDS IDENTIFIED DURING THIS REPORTING PERIOD

This National Wastewater Drug Monitoring Program report is the eighth in a series of public reports that detail program findings. The program provides statistically valid datasets of drug use and distribution patterns across a large number of sites in capital cities and regional Australia. The data are used to build a detailed picture of national drug consumption.

All states and territories participate in the National Wastewater Drug Monitoring Program, providing a timely national picture of consumption. In April 2019, 52 wastewater sites were monitored nationally. Based on 2016 Census data, these sites covered approximately 55 per cent of the Australian population—around 12.9 million people.

With the exception of cocaine and heroin, regional average drug consumption exceeded capital city consumption. Of the drugs measured by the program with available dose data, alcohol and nicotine continue to be the most consumed, and methylamphetamine the most consumed illicit drug.

Of note in this report are the decreases in cannabis, fentanyl and oxycodone consumption between December 2018 and April 2019, and the record methylamphetamine, cocaine, MDMA and heroin consumption levels reported in April 2019.

Data collected by the program continue to illustrate distinct drug consumption characteristics, which can vary both within and between states and territories, and over time. The continued monitoring of drug consumption in Australia will build longitudinal data and assist in identifying and understanding variations in use to inform the development of timely and appropriate local, regional and national responses.

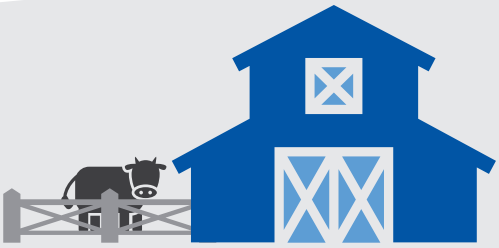
I would like to acknowledge the valuable support and specialist expertise of the University of Queensland and the University of South Australia, which undertook the data collection and analysis which underpins this report, and the Australian Criminal Intelligence Commission officers who contributed to the project.

Michael Phelan APM
Chief Executive Officer
Australian Criminal Intelligence Commission

SNAPSHOT

The April 2019 collection covers around **55 per cent** of Australia's population—about **12.9 million Australians.**

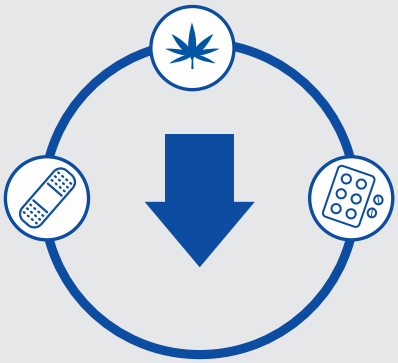
Capital city **cocaine** and **heroin** average consumption exceeded regional consumption.



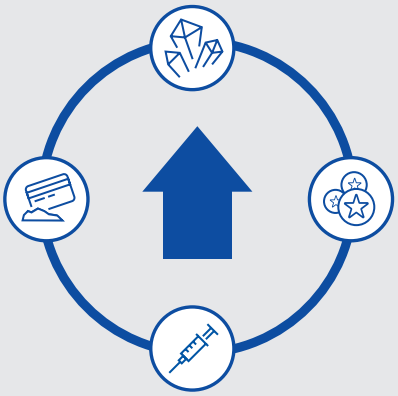
Regional **nicotine, alcohol, methylamphetamine, MDMA, MDA, oxycodone**, **fentanyl** and **cannabis** average consumption exceeded capital city consumption.

Of the drugs measured with available dose data, **alcohol** and **nicotine** remain the most consumed, with **methylamphetamine** the most consumed illicit drug.

Between December 2018 and April 2019, the population-weighted average consumption of:



cannabis, fentanyl and oxycodone **decreased**



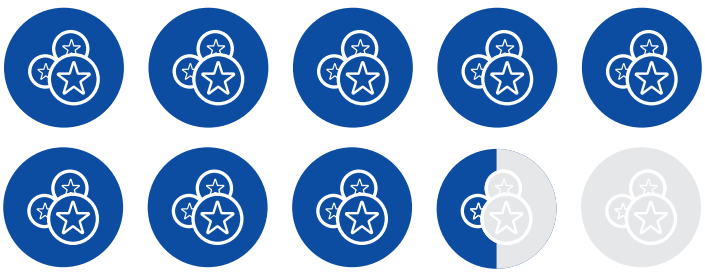
methylamphetamine, cocaine, MDMA and heroin **increased**

Based on wastewater consumption estimates, in 2017–18 Australian law enforcement seized:

Almost a third of the **heroin** needed to meet national demand

Almost half of the **cocaine** needed to meet national demand

Around half of the **methylamphetamine** needed to meet national demand



Almost double the **MDMA** needed to meet national demand

INTRODUCTION

This is the eighth in a series of National Wastewater Drug Monitoring Program reports to be publicly released by the Australian Criminal Intelligence Commission. The program provides a measure, rather than an estimate, of the use of a number of illicit drugs, as well as licit drugs including nicotine, alcohol and some pharmaceuticals. It gives us valuable insight into the trends and emerging issues of drug consumption across Australia and can identify new sources of threat.

The program aims to deliver on the recommendations of the *Final Report of the National Ice Taskforce*. In 2016 the Australian Criminal Intelligence Commission received funding under the *Proceeds of Crime Act 2002* to deliver the National Wastewater Drug Monitoring Program over three years. Since then, additional funding in the Australian Criminal Intelligence Commission's annual budgetary appropriation has allowed for the extension of the program until 30 June 2023. Longitudinal data captured by the program will increase our understanding of drug use in Australia nationally, in specific regions and over time.

Findings presented in the reports provide law enforcement, policy, regulatory and health agencies with additional, objective data on the use of methylamphetamine and other drugs. These data create opportunities to shape the response to the demand and supply sides of the illicit drug market, particularly in high-use areas, and inform harm reduction strategies.

IMPLEMENTATION

The Australian Criminal Intelligence Commission has contracted the University of Queensland, and through it the University of South Australia, to deliver the program. Relationships have been built between the universities and the operators of wastewater facilities across Australia to permit the collection and analysis of samples.

In this report, wastewater analysis from the National Wastewater Drug Monitoring Program measured the presence[1] of the following substances:

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

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.

The Australian Criminal Intelligence Commission continues to review the appropriateness of monitored substances with its partners, stakeholders and the universities.

Both contracted universities monitor wastewater across Australia, covering all state and territory capital cities and a range of regional cities and towns. In April 2019, 52 wastewater treatment plants participated nationally. Sites were selected to permit the Australian Criminal Intelligence Commission to provide data on major population areas, sites of actual or potential concern from a drug use perspective, and sites where the local authorities have established relationships with the two universities.

The breakdown of sites by jurisdiction for April 2019 is as follows:

Participation from all states and territories is vital to informing our understanding of the national picture of drug use and demand. In the event that one or more states and territories decide not to participate in the national program in the future, the Australian Criminal Intelligence Commission 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.

REPORTING

National Wastewater Drug Monitoring Program reports are published as public reports three 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 Australian Criminal Intelligence Commission. Stakeholders in law enforcement, health and other relevant policy agencies may be 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 and cannabis (for which reliable dose figures are not available), are expressed in terms of both the number of doses and the weight or volume per capita of the respective substances, to facilitate comparison between substances.

EXPLOITATION OF THE NATIONAL WASTEWATER DRUG MONITORING PROGRAM DATA

The National Wastewater Drug Monitoring Program is based on a well-established and internationally recognised methodology. The Australian Criminal Intelligence Commission considers that National Wastewater Drug Monitoring Program data provide an important basis for the development of empirically informed government 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. The eighth National Wastewater Drug Monitoring Program report measures the drug use of 55 per cent of the Australian population.[2]

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 the different dynamics that apply to both capital city and regional markets and also illustrate drug preference variation that exists both 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 data are used with other available data sources to develop a comprehensive and accurate understanding of drug markets nationally and in the states and territories. The Australian Criminal Intelligence Commission engages with academic institutions, industry and public sector agencies to identify further data applications. Opportunities identified include 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. Advantages of the National Wastewater Drug Monitoring Program are that the data are collected on an ongoing basis, are reported regularly, and the program is sufficiently flexible to allow for focusing collection activity in different geographic locations and at more regular intervals in response to identified need.

2 The April 2019 population estimate is based on the Australian Bureau of Statistics 2016 Census data and catchment data supplied by the operators of the wastewater facilities and service providers.

ESTIMATED NATIONAL CONSUMPTION

The Australian Criminal Intelligence Commission used wastewater data collected between August 2017 and August 2018 (Year 2 of the program) to estimate the annual weight of methylamphetamine, MDMA, cocaine and heroin consumed nationally. While these estimates are conservative, they enable comparisons with seizure data, in addition to providing drug to drug comparisons (see table below).

Comparison of the weight of methylamphetamine, cocaine, MDMA and heroin seized nationally in 2017–18 and estimated consumption.

Drug	Estimated consumption[a] (kilograms per annum)	2017–18 national seizures (gross kilograms)	Percentage of total estimated consumption seized (%)
Methylamphetamine	9,847	5,064[b]	51
Cocaine	4,115	1,970	48
MDMA	1,162	2,033	175
Heroin	750	229	31

a Consumption estimates are based on data derived from Year 2 of the National Wastewater Drug Monitoring Program.

b At this time it is not possible at a national level to provide a further breakdown of drugs within the amphetamines category. As such national seizure figures reflect the weight of amphetamines seized. Amphetamines include amphetamine, methylamphetamine, dexamphetamine and amphetamines not elsewhere classified. Based on available data, methylamphetamine accounts for the majority of amphetamines seized.

On comparing the estimated weight of methylamphetamine, cocaine, MDMA and heroin consumed annually in Year 2 of the program with the gross weight of related drug seizures reported in the *Illicit Drug Data Report 2017–18*:

- the weight of amphetamines seized equated to 51 per cent of the total estimated weight of methylamphetamine needed to meet national demand (an increase from 46 per cent)
- the weight of cocaine seized equated to 48 per cent of the total estimated weight of cocaine needed to meet national demand (a decrease from 150 per cent)
- the weight of MDMA seized exceeded the total estimated weight of MDMA needed to meet national demand (175 per cent; an increase from 111 per cent)
- the weight of heroin seized equated to 31 per cent of the total estimated weight of heroin needed to meet national demand (an increase from 29 per cent).

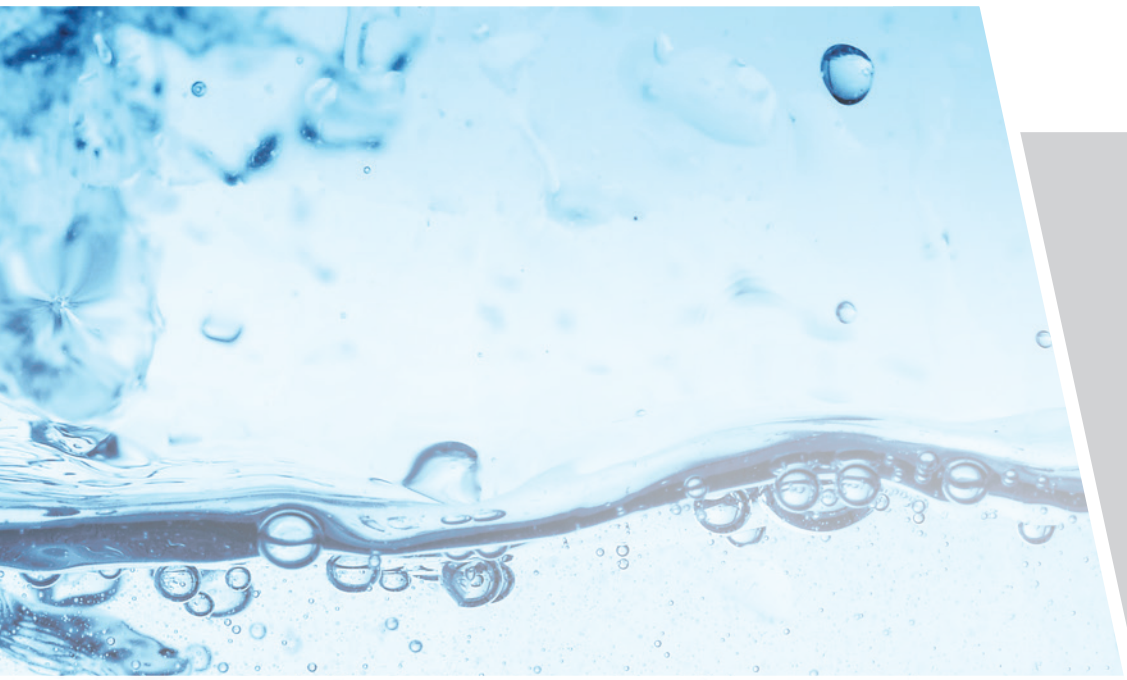
On comparing these figures to the estimated weight of methylamphetamine, cocaine, MDMA and heroin consumed annually in Year 1 of the program and the weight of related drug seizures reported in the *Illicit Drug Data Report 2016–17*, the proportion of methylamphetamine, MDMA and heroin seized nationally has increased when compared with estimated consumption, while the proportion of cocaine seized decreased.[3]

3 For previous comparisons see Report 5, available at <https://www.acic.gov.au/publications/reports/national-wastewater-drug-monitoring-program-reports>.

From the above data it is evident that a multi-dimensional approach that targets supply, demand and harm reduction is critical to addressing 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 insight into related markets and the potential impact of supply, demand and harm reduction strategies.

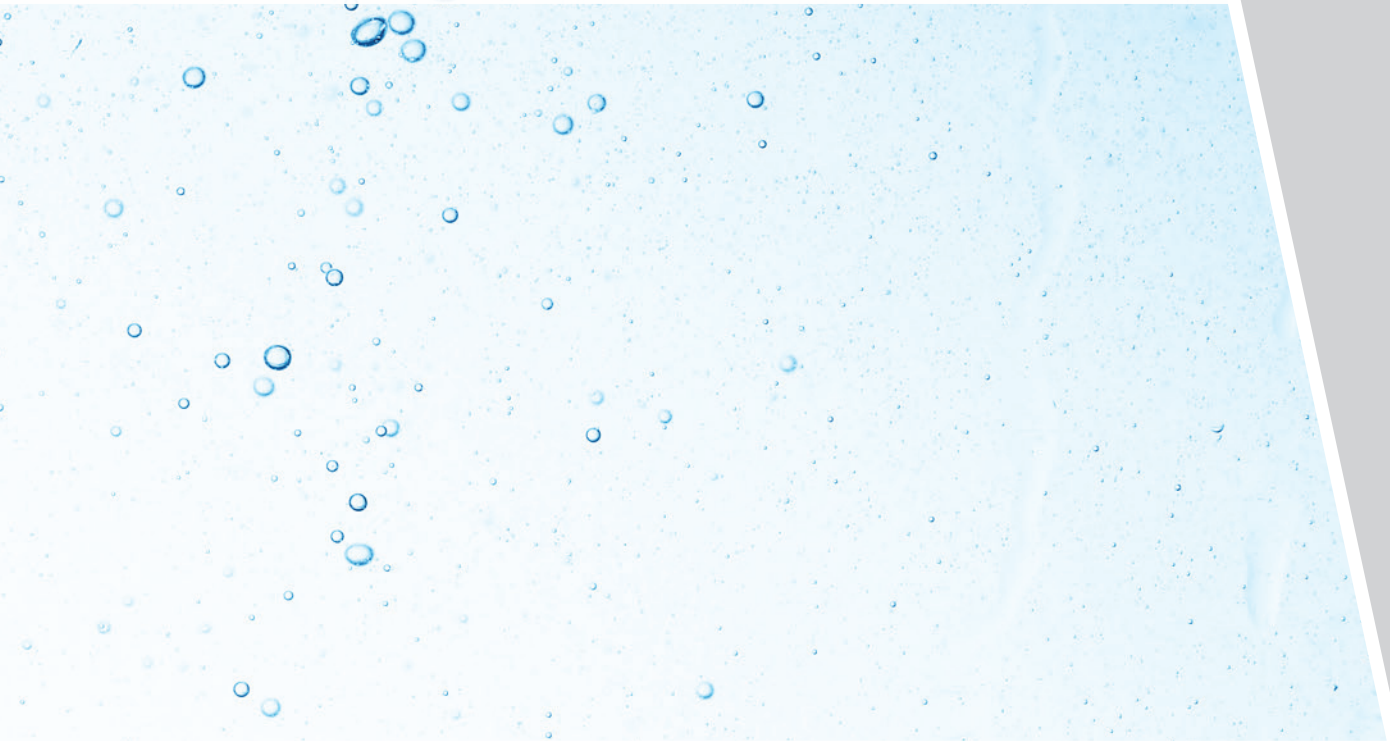
RESULTS FROM THE COLLECTION

Wastewater data are an important part of the suite of datasets available to increase our understanding of drug consumption, demand and supply in Australia. Making data from the program publicly available assists to enrich understanding and inform the national conversation on drug trends and related demand. This eighth report of the National Wastewater Drug Monitoring Program builds on national drug consumption data contained in the preceding seven reports to identify drug use temporal trends across states, territories and the nation. It provides data on capital city and regional drug use and, where possible, comparisons with previous levels of use in sites across Australia and internationally. This, and future reports, continue to build and shape understanding on trends and changes in patterns of use, creating an increasingly detailed picture of drug consumption in Australia.



RESEARCH FINDINGS

Prepared by the University of Queensland (B Tscharke, J O'Brien, T Reeks, G Elisei, S Grant, J Mueller, K Thomas) and University of South Australia (M Ghetia, R Bade, L Nguyen, C Gerber, J White)



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
NPS	New psychoactive substances
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 (THC-COOH), metabolite of THC
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-Δ9-tetrahydrocannabinol (THC-COOH).

1: EXECUTIVE SUMMARY

The National Wastewater Drug Monitoring Program (NWDMP) for the Australian Criminal Intelligence Commission (ACIC) monitors selected substances of concern in most populated regions of Australia. Estimates of drug usage in a population were back-calculated from measured concentrations of drug metabolites (excreted into the sewer system after consumption) in wastewater samples. The current version of the NWDMP focuses on thirteen licit and illicit drugs, including nicotine, alcohol, methylamphetamine, cocaine and MDMA (ecstasy), with cannabis included from Report 6. Trends in estimated drug consumption are being established over the life of the program. Wastewater treatment plants (WWTPs) located across capital cities and regional Australia, covering all states and territories, have been invited to participate in this program.

For this eighth report, wastewater samples were collected during weeks of February and April 2019. Twenty-four-hour composite influent wastewater samples were collected using time or flow-proportional autosamplers at each WWTP by plant operators. Samples were collected for up to seven consecutive days. 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.

A total of 20 WWTPs in capital cities and a further 32 regional sites participated in the program for the April 2019 period, covering a population of 12.9 million Australians. Two additional regional sites, 42 and 116, agreed to participate in the program for the first time. To maintain treatment plant confidentiality, each site was allocated a unique code and site names are not included in this report. Site codes stay assigned to each WWTP throughout the course of the program. Data from this report equates to coverage of approximately 48 per cent and 55 per cent of Australia's population for February and April, respectively. A total of 3,741 individual daily samples have been collected and analysed since the beginning of the program, with new results from 481 additional samples added in this report. The collected samples provide comprehensive, Australia-wide baseline data against which subsequent results can continue to be compared to ascertain both spatial and temporal trends.

The estimation of drug use across the 52 sites provided a snapshot of the scale of use over a week in April 2019, which was compared with historical data included in previous reports. After normalising the amount of drug measured in wastewater for population size and average dose consumed, alcohol and nicotine remained consistently the highest consumed drugs in all states and territories. Cannabis will be included in the comparison once better estimates of a typical dose are available. The consumption of nicotine was substantially higher in regional areas compared to capital cities whereas, in the case of alcohol, there was a relatively small difference between regional and capital city use. The Northern Territory had the highest consumption of nicotine and alcohol, followed by Tasmania. In other parts of Australia, alcohol consumption was similar for the most part, except in regional South Australia, where it remained relatively low.

Methylamphetamine had the highest dose levels of the illicit stimulants included in the report, both in capital cities and regional sites. Use in capital city South Australia in April 2019 was below that in the Northern Territory, Victoria and Western Australia for the first time. An increased number of doses was evident in many parts of the country. Regional dose levels were on average higher than in the capital cities. The scale of use in regional parts of the Northern Territory, South Australia and Tasmania was below the national averages.

Amphetamine is a metabolite of methylamphetamine. Measured amphetamine concentrations across the sites were mostly consistent with the observed levels being related to methylamphetamine metabolism rather than a consequence of direct amphetamine consumption.

Compared to methylamphetamine, estimated usage of other stimulants was generally much lower, and no consistent pattern was apparent between states and territories. Cocaine consumption in Australia remains mostly centred in New South Wales, particularly the capital city. Use of the drug in capital city Victoria and Queensland increased sharply and rose above the national average in the current reporting period. Consumption of cocaine was lowest in regional South Australia, Tasmania and Western Australia. Regional use of the drug was generally less than in capital cities. MDMA usage was relatively low across most sites, but a rise at many sites nationwide was apparent in this reporting period, with capital city Northern Territory and Queensland being the highest users.

Oxycodone and fentanyl, both of which are prescription pharmaceutical drugs with abuse potential, had elevated consumption levels at several sites, noticeably across Tasmania and regional Victoria. Regional areas had average oxycodone use well above capital city. The Northern Territory and Western Australia had the lowest national levels of oxycodone.

Fentanyl consumption declined in most regions in this sampling period. Consumption of heroin varied widely, with minimal amounts detected in the Northern Territory and many regional areas of other states. The highest levels were recorded in capital city sites in Victoria.

The cannabis metabolite, 11-nor-9-carboxy-tetrahydrocannabinol (THC-COOH), a specific marker for cannabis consumption, is excreted in extremely small amounts. This may be a cause of variability in back-calculated results, so caution has to be exercised when making comparisons. Nevertheless, cannabis consumption in Tasmania, regional South Australia and the Northern Territory were highest in the nation. Use was relatively low in capital city New South Wales and Victoria compared to other parts of the country. A feature of national cannabis consumption was the elevated regional average compared to capital cities. No obvious temporal trends were apparent over the relative short period of cannabis reporting.

For the other drugs included in the NWDMP, methylone and mephedrone concentrations were generally at or below detection levels at most participating sites. The detection frequency of mephedrone has been on the rise.

The collection of wastewater samples at regular intervals allowed for the temporal comparison of consumption data. While small incremental overall changes are evident at both a site and a state or territory level when comparing reporting periods, the growing set of measurements is showing longer term trends. Some of these include the consistently higher prevalence of nicotine, methylamphetamine, fentanyl and oxycodone in regional Australia. In contrast, heroin and cocaine consumption tends to be associated with capital cities. In terms of temporal trends, methylamphetamine use has been rising steadily in the past year, a noticeable exception being South Australia. MDMA is on the rise from a low base. Oxycodone levels have been increasing, particularly in regional Australia, while fentanyl is showing a decline in the current year.

2: INTRODUCTION

2.1 PREAMBLE

Wastewater analysis is a technique for delivering population-scale consumption of substances. The University of Queensland and University of South Australia have been commissioned to provide drug consumption data to the ACIC for a period of three years, beginning in August 2016. Wastewater treatment sites have been assessed, bimonthly in the case of capital city sites and every four 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 establish baseline data of substance use across Australia. This NWDMP report compares consumption data from the first seven reports with results obtained subsequently from February and April 2019.

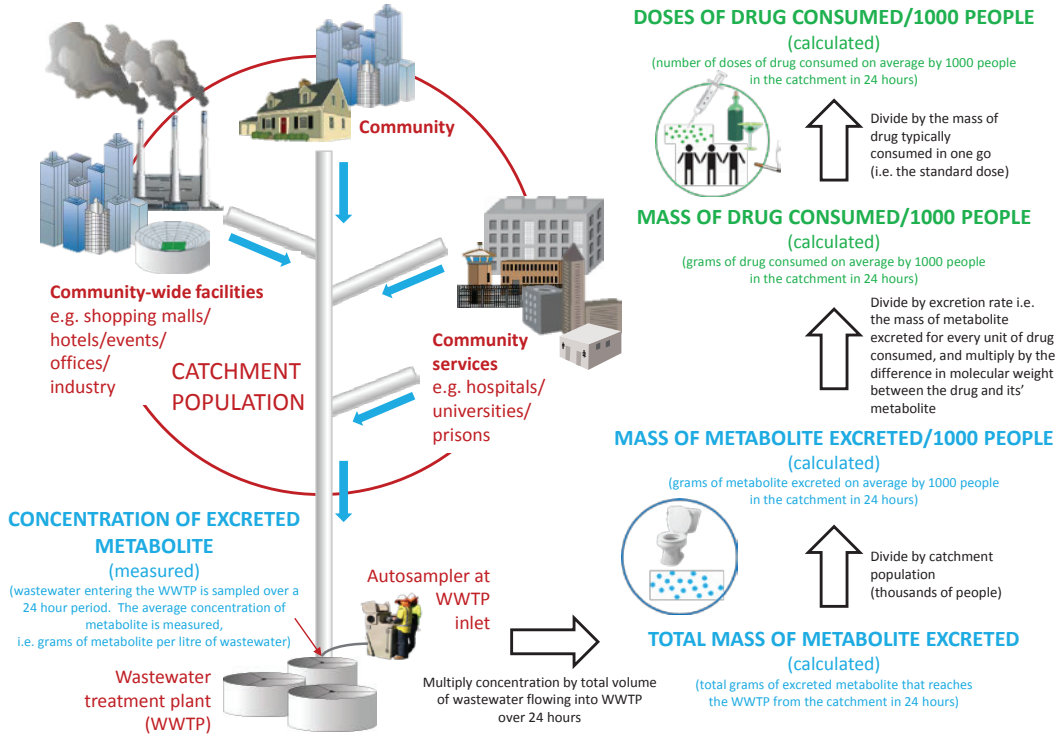
Compounds of concern include nicotine from nicotine intake (cigarettes, gum, patches, e-cigarettes, etc.), ethanol from alcohol intake, pharmaceutical opioids with abuse potential, illicit substances such as methylamphetamine, MDMA, cocaine and heroin, as well as a number of new psychoactive substances (NPS). Initially, amphetamine and MDA were measured but not included in the earlier reports. Amphetamine is a by-product of methylamphetamine pyrolysis and is also one of its metabolites. We found the levels of amphetamine to correspond largely with the expected values from the excretion of methylamphetamine. MDA is a metabolite of MDMA, but since the proportion of MDA derived from MDMA is known, the difference between measured MDA and MDMA metabolite is included in the report. The amount of MDA was calculated by subtracting 1.65 mg of MDA for every 100 mg of MDMA consumed (Pizarro et al. 2002; Khan & Nicell 2011). Cannabis was measured by its urinary metabolite, THC-COOH. The report presents patterns of substance use across Australia, showing differences in levels between capital cities and regional centres, within and between states and territories, and nationally.

3: METHODS

The method underlying wastewater-based monitoring of drug use 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 (either in the chemical form it is consumed and/or in a chemically modified form that is referred to as a metabolite). The excreted compound or metabolite will eventually arrive in the sewer system. The drugs and their metabolites of interest in this study are given in the first NWDMP report (available at www.acic.gov.au), as well as an in-depth description of the methodologies involved.[4] 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 1). The method is non-invasive and is done on a population-scale level, so individuals are not targeted, and privacy is respected.

4 Information in relation to heroin appears in Report 3.

Figure 1: 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.



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. From the August 2018 collection period, operators collected a second daily influent sample with sodium metabisulphite (0.5% m/v) as preservative 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 our 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 and dose table including THC-COOH can be found in Appendix 1. Methods to extract and analyse the cannabis metabolite are outlined in Tscharke et al. (2016).

3.1 PARTICIPATING WASTEWATER TREATMENT PLANTS (WWTPS)

Fifty-two WWTPs across Australia participated in the NWDMP for the April 2019 collection (Figure 2). Of these, 20 sites were located in capital cities and a further 32 were regional sites, covering a wide range of catchment population sizes. Sites were selected by the Australian Criminal Intelligence Commission. The number of participating sites for February and April 2019 and a complete list of participating sites, number of samples and relative catchment sizes are listed in Table 1 and Appendix 2. To maintain the confidentiality of the participating sites, all sites were allocated a unique code to de-identify their results. Only site codes are presented in the results sections.

Figure 2: Participating WWTPs in April 2019 showing the number of capital city and regional plants 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.

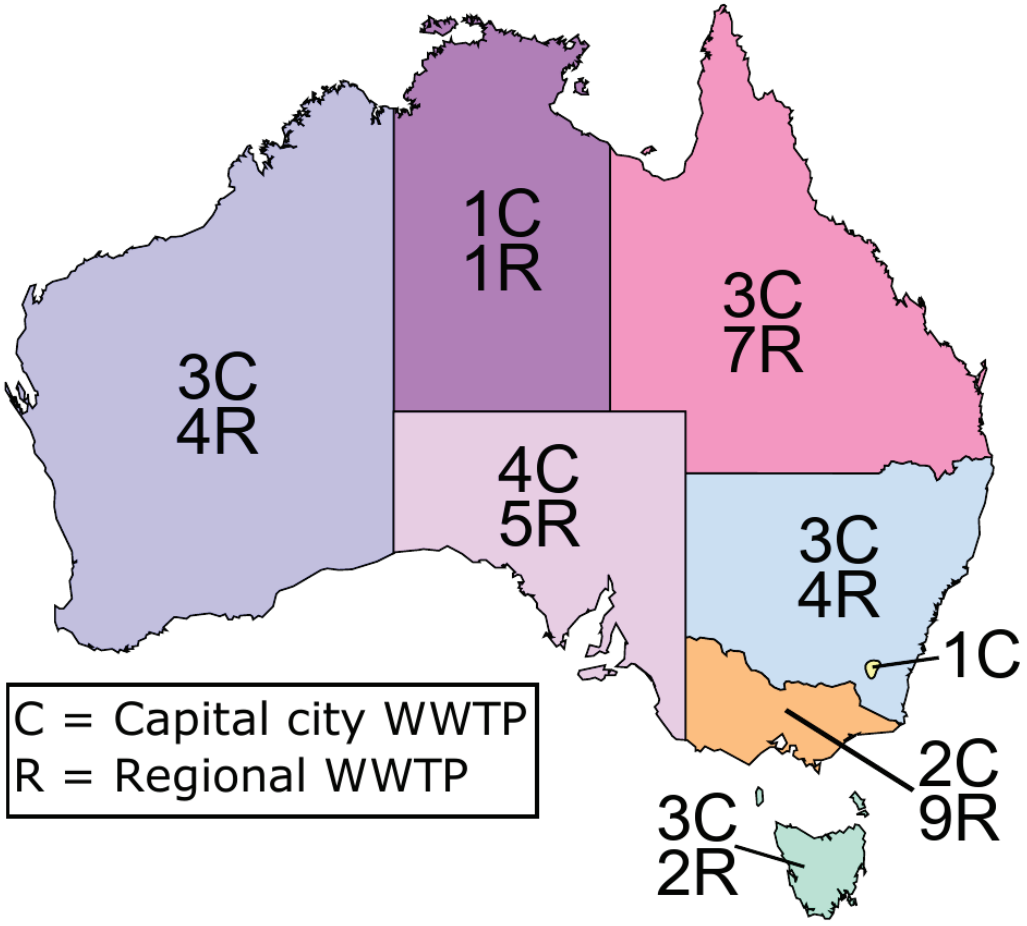


Table 1: Number of participating WWTPs for the periods covered in this report. Every second collection period aims to collect data from both regional (R) and capital city (C) sites, while the in-between collection period aims to collect data from capital city sites only.

	Feb 2019		Apr 2019	
State/territory	C	R	C	R
ACT	1	–	1	–
NSW	3	–	3	4
NT	1	–	1	1
Qld	3	–	3	7
SA	4	–	4	5
Tas	3	–	3	2
Vic	2	–	2	9
WA	3	–	3	4
Sites	**20**	**–**	**20**	**32**
Population (millions) C & R	**11.2**	**–**	**11.2**	**1.7**
Total population (millions)	**11.2**		**12.9**	
% of Australian population	**47.9**		**55.2**	

Estimates have been rounded to the nearest 0.1 million. Census 2016 population used (23,401,892) for population percentage estimates.

3.2 SAMPLE COLLECTION AND PREPARATION

Daily composite samples were collected by treatment plant staff on seven consecutive days, or where seven days was not feasible, across as many consecutive days as possible. Regional sites in South Australia have been providing weekend samples over the past year, which should be considered when interpreting historical results where number of sampling days was five—see Appendix 3, Report 6. Small revisions may be made to historical data when more accurate data become available. Samples were stored at 4°C or were frozen prior to transport to Adelaide or Brisbane. 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) and Tscharke et al. (2016). 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).

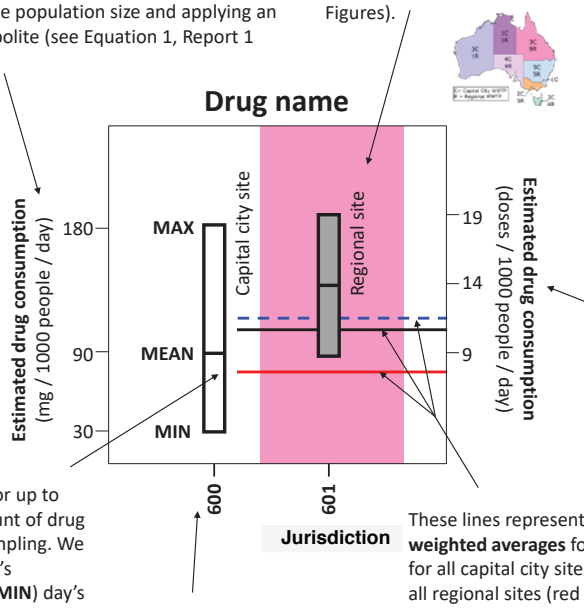
3.3 PRESENTATION OF DATA AND INTERPRETATION OF GRAPHS

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 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 3. This includes information on interpreting the consumption data presented on the vertical axes in all graphs in this report. 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. For cannabis, the approximate dosage is not well defined, and results are expressed as mg consumed per 1,000 people per day.

Figure 3: 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. 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 grey 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 3 (continued): 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).

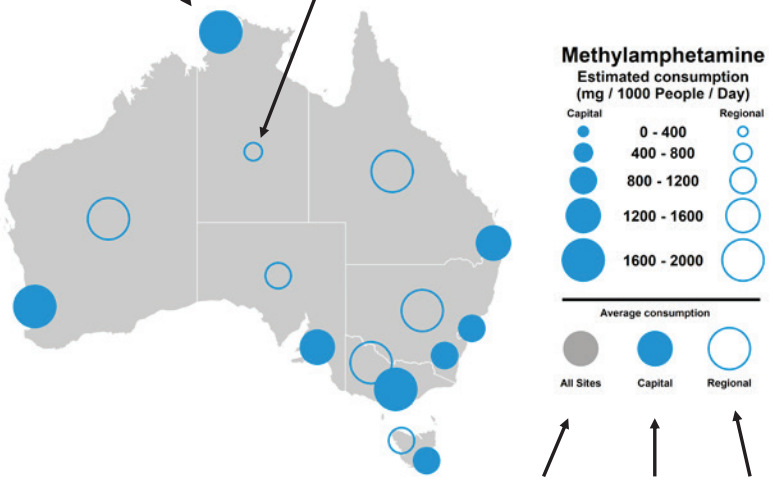
Bubbles:
Capital city site averages are drawn over the capital city of a jurisdiction and the regional site averages are drawn close to the middle of the State or Territory. Regional bubbles are drawn arbitrarily close to the centre of each jurisdiction and do not reflect location of sites.

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 next to the bubble plot.



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.

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)[5] 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. 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 use over the sampling week for the sites in this report cannot be elucidated from the data included in the current report since the start of collection weeks did not always correspond for every plant. We present only maximum, minimum and average (for the individual sites) (Figure 3) and only average (or population weighted average, see above) values for all other graphs. Consistent patterns of drug use in Australia from previous wastewater-based epidemiology studies indicate that some illicit drugs such as cocaine, MDMA, mephedrone and methylone have high variation in weekly consumption rates, with higher consumption on weekends. Other drugs such as methylamphetamine, oxycodone and fentanyl appear to have lower daily variation suggesting that their consumption is consistent throughout the week (Lai et al. 2015; Tscharke et al. 2016).

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

4: RESULTS

Estimated drug consumption data are presented in several different ways in the following sections to allow comparisons of drug use at the individual site level for April 2019 (section 4.1), temporal trends for states and territories since August 2016 (section 4.2) and within each state and territory (section 4.3). We recommend exercising caution when comparing results between sites as some plants provided samples for fewer days than others and the collection week did not correspond in all instances. A list of the detection frequency for each drug can be found in Appendix 3. This report retained the current population estimates introduced in Report 4 by integrating the specific wastewater catchment areas against the high-resolution population data released from the 2016 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 are 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 APRIL 2019

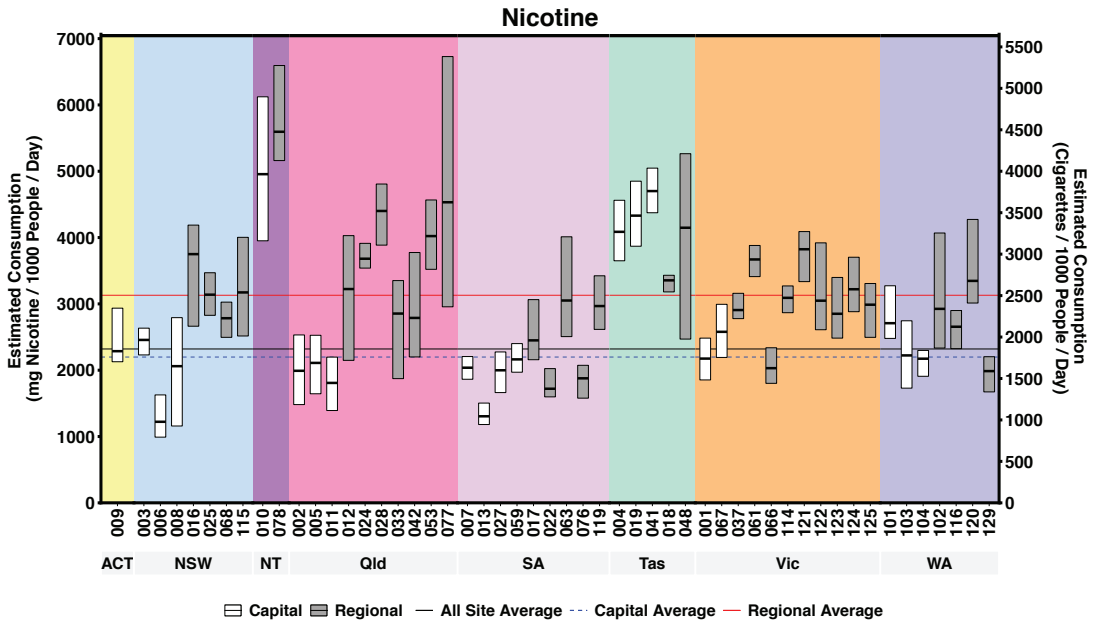
4.1.1 NICOTINE AND ALCOHOL

Two nicotine metabolites were used to estimate the consumption of tobacco. The method cannot distinguish between nicotine intake from tobacco, electronic cigarettes and nicotine replacement therapies such as patches and gums. Therefore, the estimate is reported as nicotine in this report. The results show that in April 2019 the consumption of nicotine was highly variable between sites across the country (Figure 4). The regional average was well above that of the capital cities (red horizontal and dotted blue lines). The Northern Territory had the highest overall use, while capital city sites in Tasmania were high compared to the national average.

Alcohol was measured using a specific metabolite of ethanol. The difference between the average consumption of alcohol in regional and capital city sites was much less compared to nicotine (Figure 5). No discernible pattern was evident in terms of use between states and territories, except in the case of Tasmania where all capital city sites had consumption rates above the national average and South Australia where use was generally below the national mean. The spread of use over the collection week was wide, in agreement with studies showing a spike in alcohol use over weekends (Tscharke et al. 2016).

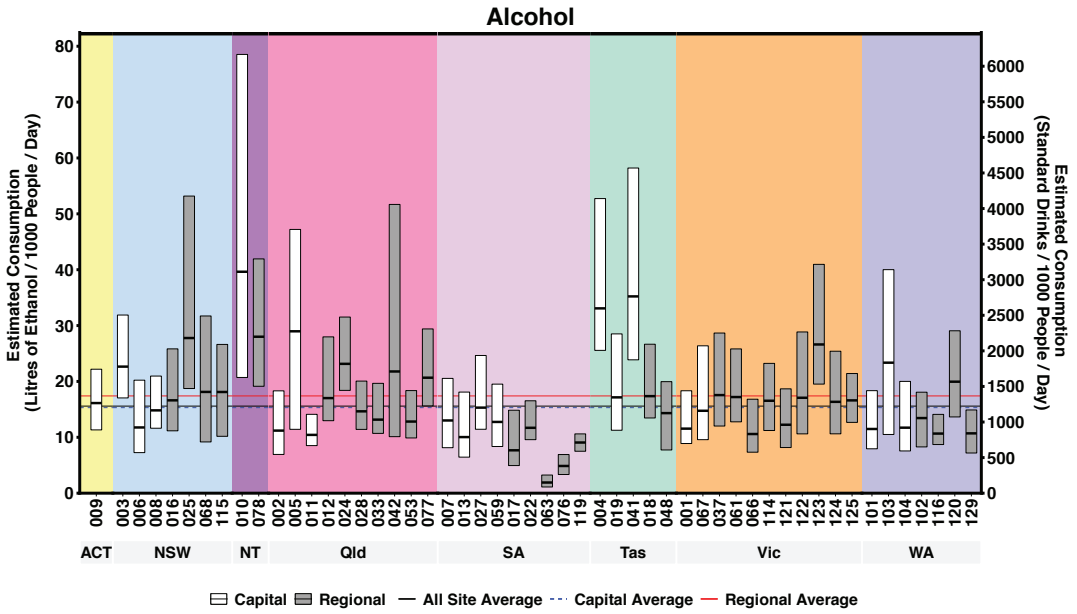
The relative consumption levels can be represented in a pictorial way by showing the relative scale of use of nicotine (Figure 6) and alcohol (Figure 7) as capital city or regional ‘bubbles’ for each state and territory.

Figure 4: Estimated nicotine consumption for April 2019 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 5–7.



- High regional average
- Wide weekly spread

Figure 5: Estimated alcohol consumption for April 2019 in volume consumed per day (left axis) and standard drinks per day (right axis) per thousand people. The number of collection days varied from 5–7.



- Wide weekly spread
- Regional average slightly higher

Figure 6: Estimated average nicotine consumption per jurisdiction for April 2019 in number of cigarettes per day per thousand people. The number of collection days varied from 5–7.

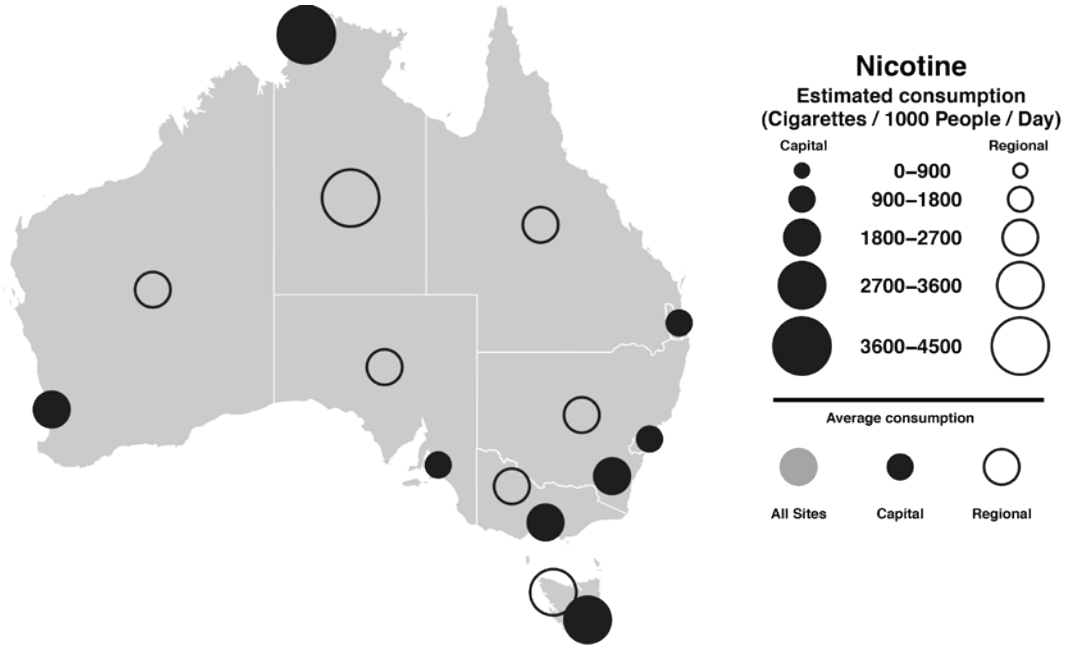
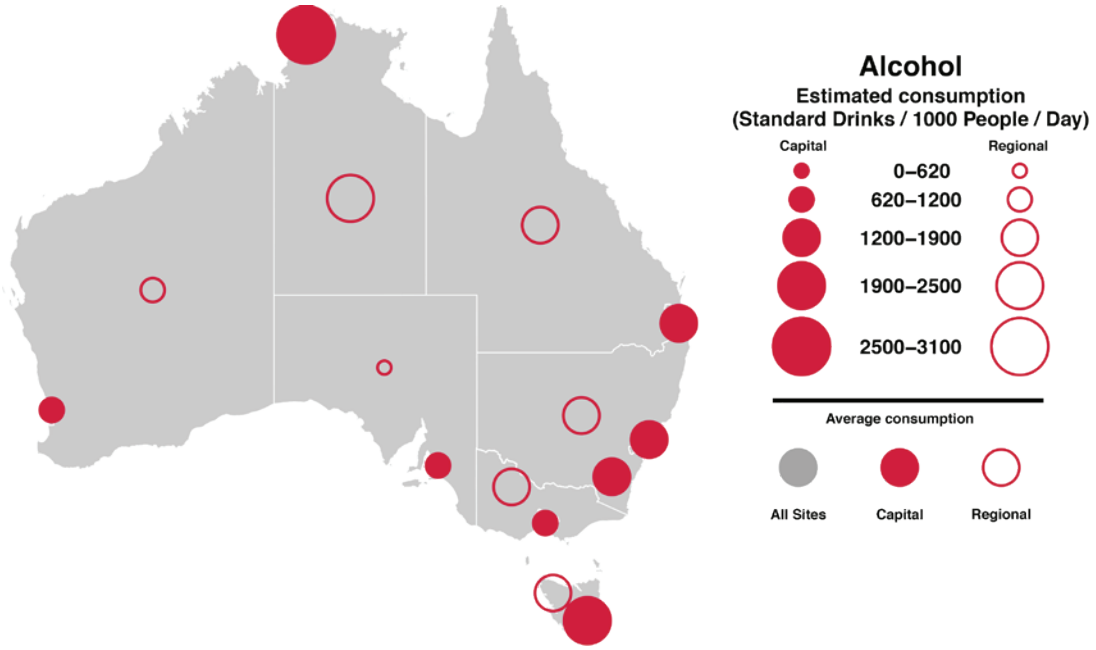


Figure 7: Estimated average alcohol consumption per jurisdiction for April 2019 in number of standard drinks per day per thousand people. The number of collection days varied from 5–7.



4.1.2 STIMULANTS

The relative estimated consumption levels across the participating sites for four stimulants—methylamphetamine, cocaine, MDMA and MDA—are described in more detail below.

4.1.2.1 METHYLAMPHETAMINE

The average regional use of methylamphetamine remained well above that of capital city sites (Figure 8). Site 25 in regional New South Wales had the highest mean weekly use, while site 59 in South Australia had the highest mean of the capital cities. South Australia historically had high values across the board. However, in this reporting period, use in the state was generally on par with other capital cities, with regional use below the national average.

4.1.2.2 AMPHETAMINE

The measured concentration of amphetamine in the April 2019 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 in agreement with our previous findings (see Appendix 4 of Report 1). Therefore, we assumed that the levels of amphetamine in wastewater samples were predominantly due to the metabolite of methylamphetamine. It is possible that some of the measured amphetamine could be the result of ingestion of the drug, but the high levels of methylamphetamine means a firm conclusion is not possible.

4.1.2.3 COCAINE

Benzoylecgonine, the specific metabolite of cocaine, was used to estimate the consumption of the stimulant. In contrast to methylamphetamine, capital city areas on average had higher cocaine use than regional centres (Figure 9). New South Wales tended to have higher consumption than other regions, although some sites in Queensland and Victoria had relatively high use as well. Cocaine consumption was generally low in most other parts of Australia, especially Tasmania and Western Australia.

4.1.2.4 MDMA (3,4-METHYLENEDIOXYMETHYLAMPHETAMINE)

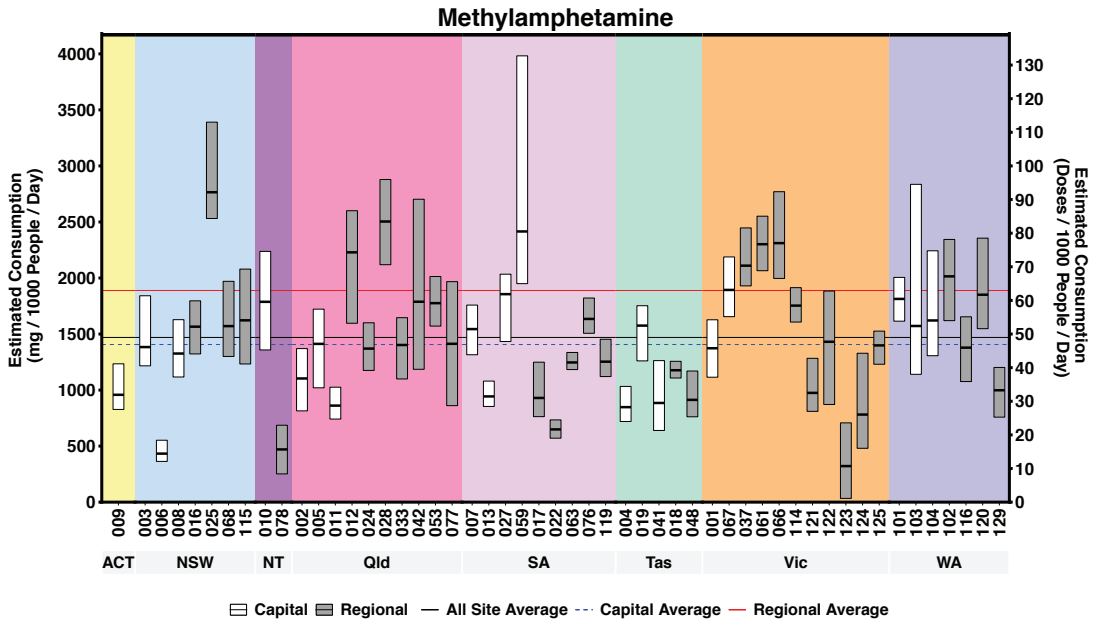
The average consumption of MDMA was similar between capital city and regional catchments compared to the other stimulants (Figure 10). The large spread in values over the sampling week was consistent with the weekend use of the drug. News South Wales and the Northern Territory, as well as a few sites in Queensland showed high use compared to the national averages. A direct comparison of regional and capital city sites in some regions (e.g. Tasmania) may be inappropriate as a few regional sites did not sample on weekends when MDMA consumption is typically higher.

4.1.2.5 MDA (3,4-METHYLENEDIOXYAMPHETAMINE)

MDA is both a drug in its own right and a metabolite of MDMA. Since the proportion of MDA eliminated after MDMA consumption is known, this proportion of MDA attributable to MDMA metabolism was subtracted from the total measured amount of MDA for each site. Results for MDA were expressed as mg excreted per 1,000 people per day and not as consumption due to the lack of metabolic information of MDA elimination following MDA consumption. The daily mass loads for regional sites were on average slightly higher than capital cities. Large variations were evident over the collection week (Figure 11). South Australia and Victoria appeared to be the lowest consumers of MDA.

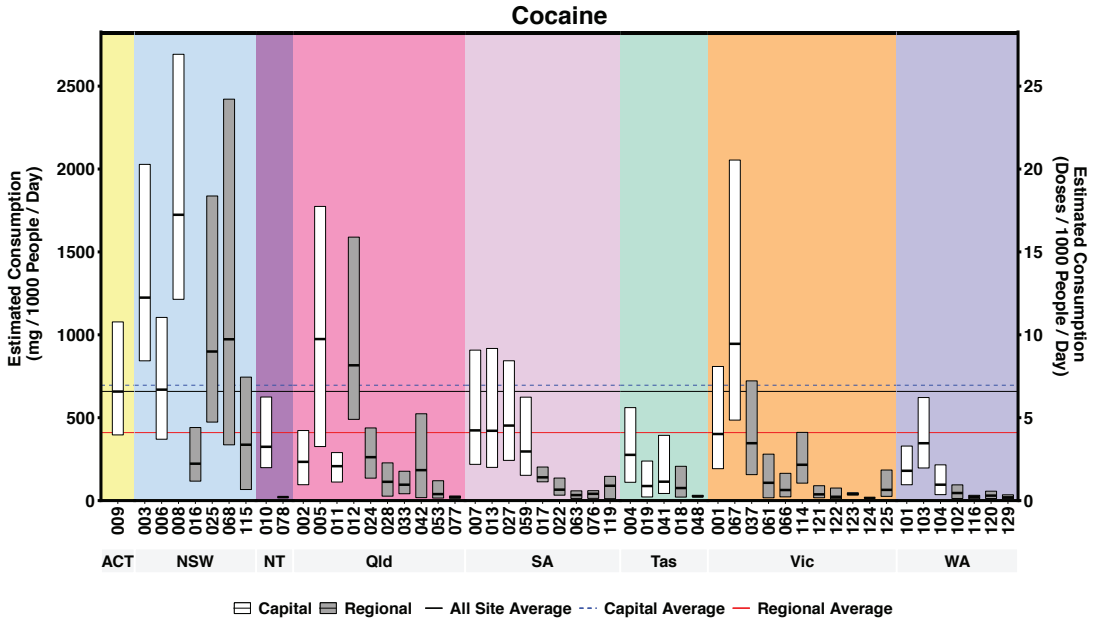
The scale of use of each stimulant is showed as bubble graphs. Regional and capital city use of methamphetamine (Figure 12), cocaine (Figure 13), MDMA (Figure 14) and MDA (Figure 15) are all represented to reflect the proportion of drug use across the country. The popularity of cocaine on the south-eastern seaboard remains apparent, while stimulant use in South Australia is low, with the obvious exception of methylamphetamine.

Figure 8: Estimated methylamphetamine consumption for April 2019 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5–7.



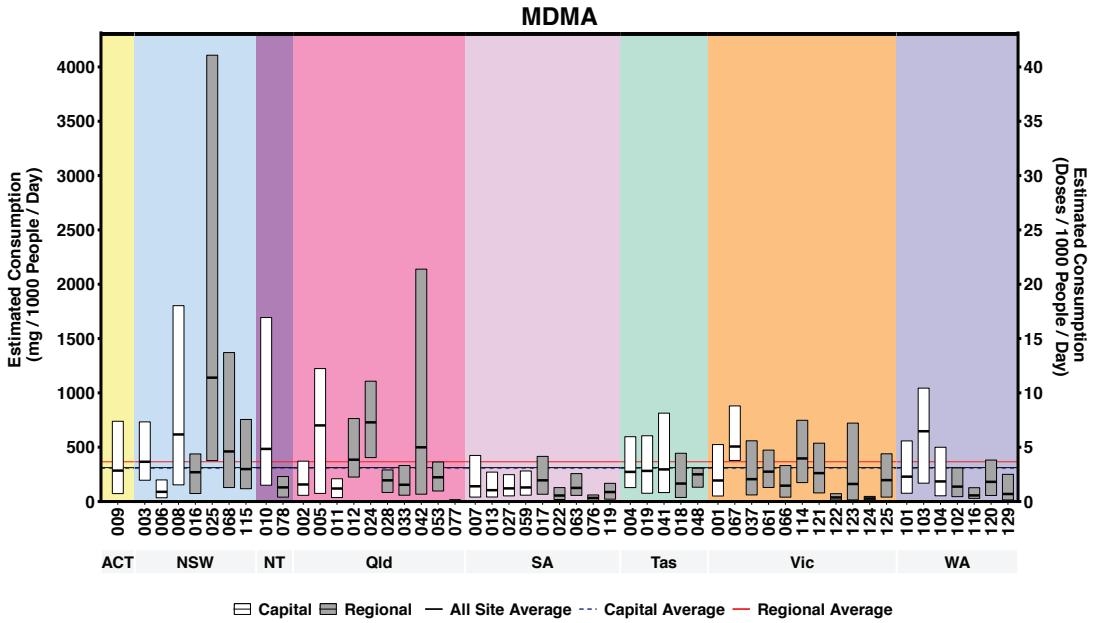
- Variable across Australia
- Higher regional consumption

Figure 9: Estimated cocaine consumption for April 2019 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5–7.



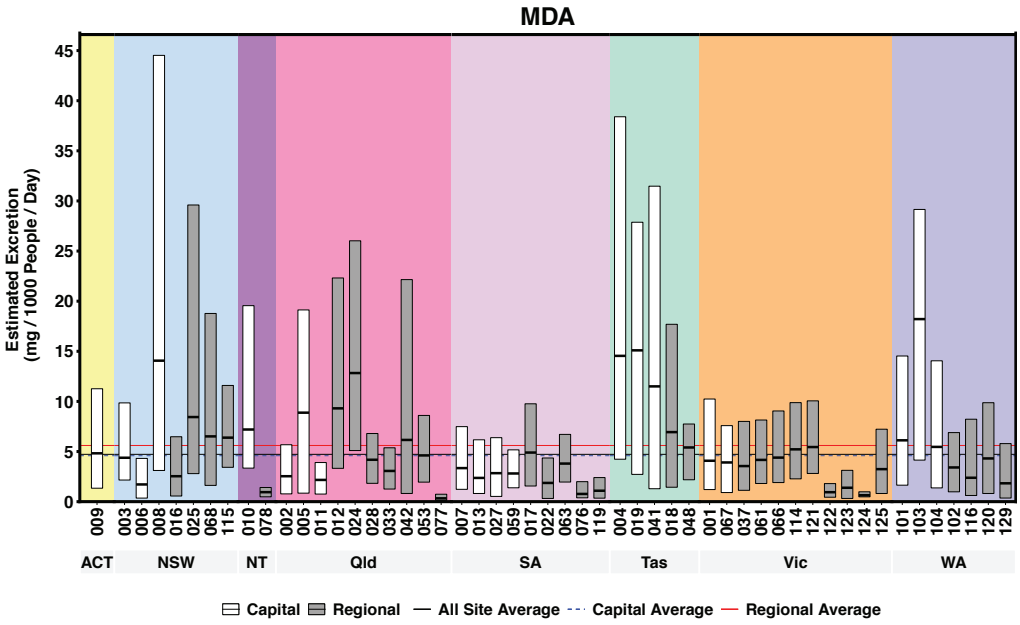
- Variable across Australia
- Higher capital consumption

Figure 10: Estimated MDMA consumption for April 2019 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5–7.



- High consumption at some sites, but low overall nationally
- Wide weekly spread indicates higher weekend consumption

Figure 11: Estimated MDA excretion for April 2019 in mass excreted per day per thousand people. The number of collection days varied from 5–7.



- Wide weekly spread
- Regional averages slightly higher

Figure 12: Estimated average methylamphetamine consumption per jurisdiction for April 2019 in mg consumed per day per thousand people. The number of collection days varied from 5–7.

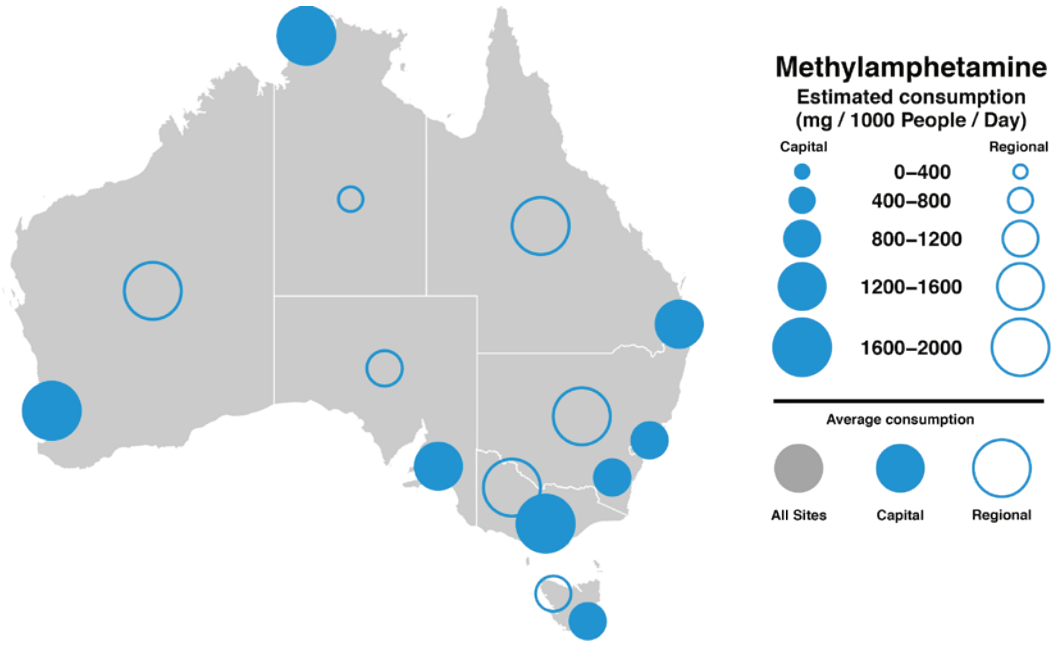


Figure 13: Estimated average cocaine consumption per jurisdiction for April 2019 in mg consumed per day per thousand people. The number of collection days varied from 5–7.

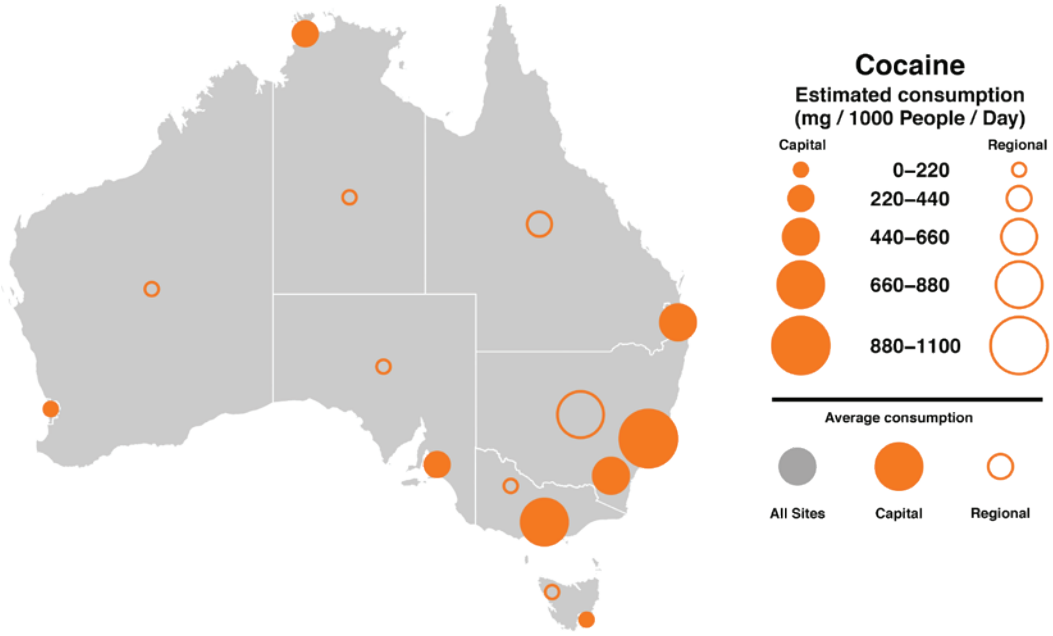


Figure 14: Estimated average MDMA consumption per jurisdiction for April 2019 in mg consumed per day per thousand people. The number of collection days varied from 5–7.

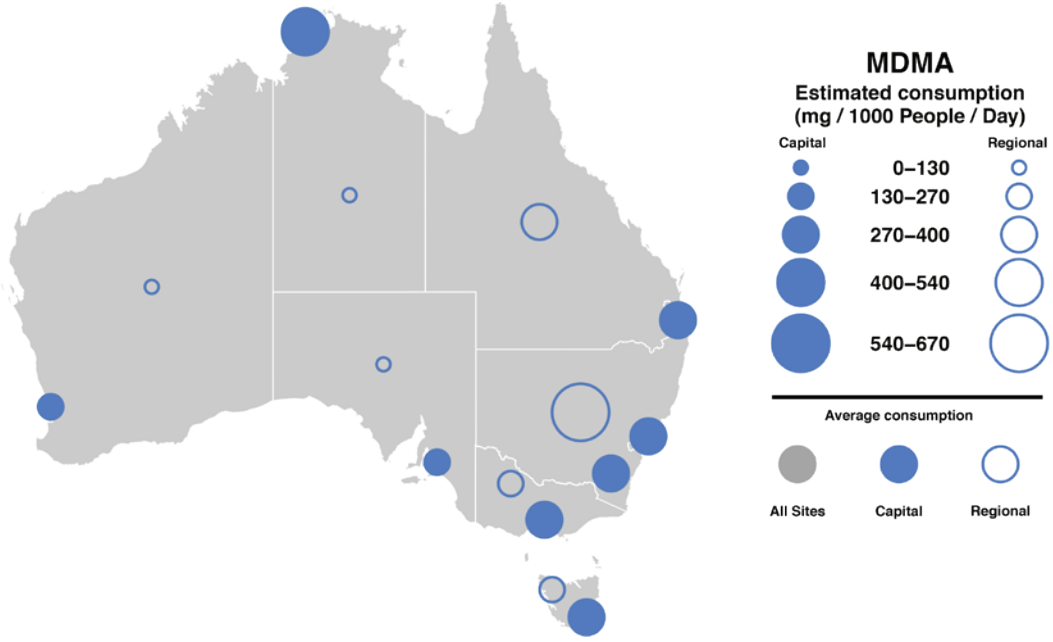
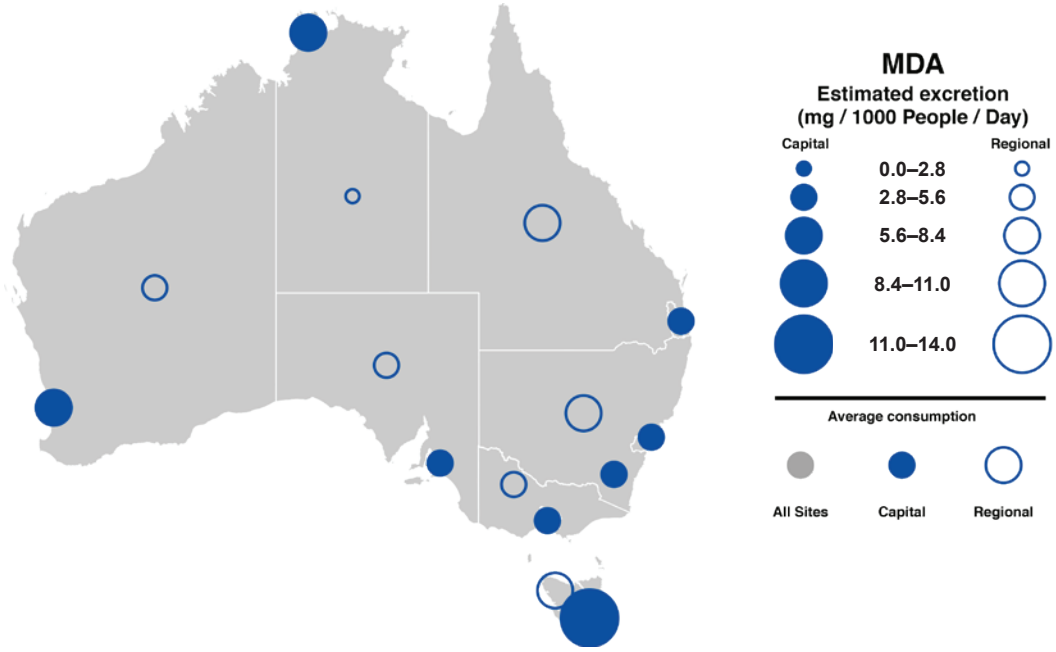


Figure 15: Estimated average MDA excretion per jurisdiction for April 2019 in mg excreted per day per thousand people. The number of collection days varied from 5–7.



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 be used to differentiate between prescribed and illicit use, the relative scale of use of these substances remain of interest.

4.1.3.1 PHARMACEUTICAL OPIOIDS

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

A striking feature of oxycodone consumption across the nation was the very high levels in regional areas, the average being almost double that of the capital cities. Tasmania had the highest use, both in regional and capital city catchments (Figure 16). The regional average has been steadily on the rise since previous reporting periods, with regional Victoria having the highest rates in the country. Western Australia had relatively low consumption levels compared to the national averages.

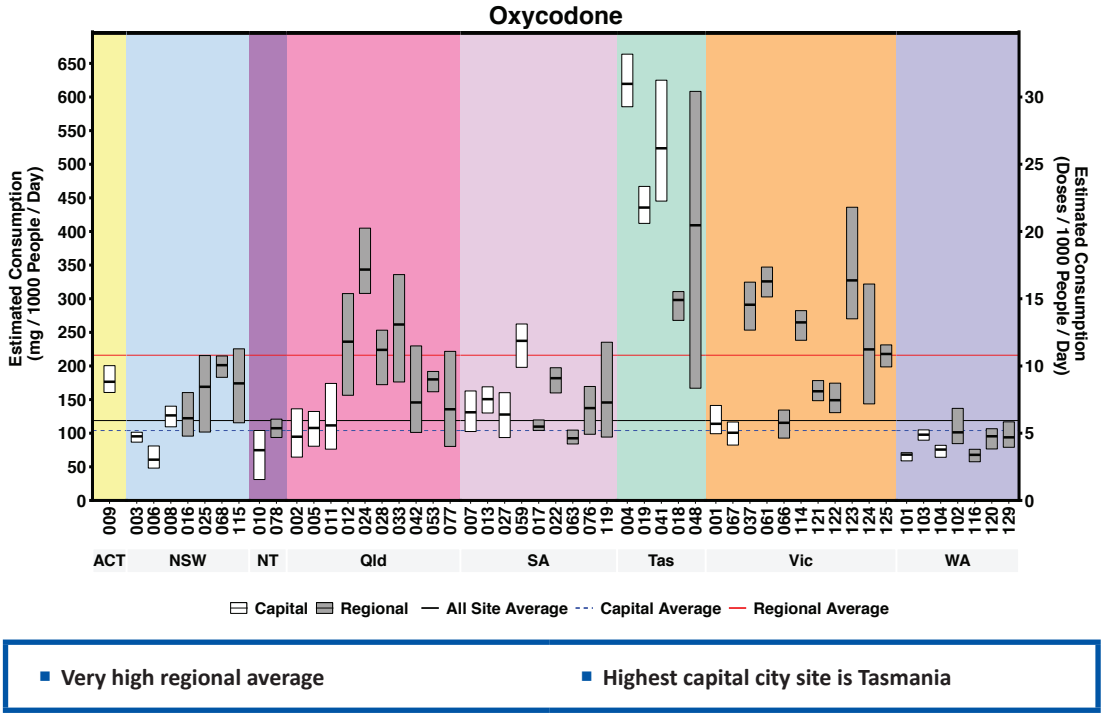
Fentanyl use was very variable across Australia (Figure 17). Similar to oxycodone, regional use far exceeded the capital city average. Tasmania had the highest consumption of the capital cities, while regional sites in many states were well above the average as well. The one participating capital city site in the Northern Territory had very low use. Some sites in Tasmania and Victoria had levels below the quantification limits of the method.

The relative scale of oxycodone and fentanyl use is apparent when results are presented in bubble graph form. Oxycodone consumption in south eastern Australia was very apparent (Figure 18). The use of both pharmaceuticals in regional centres was high compared to capital cities (Figure 19).

4.1.3.2 HEROIN

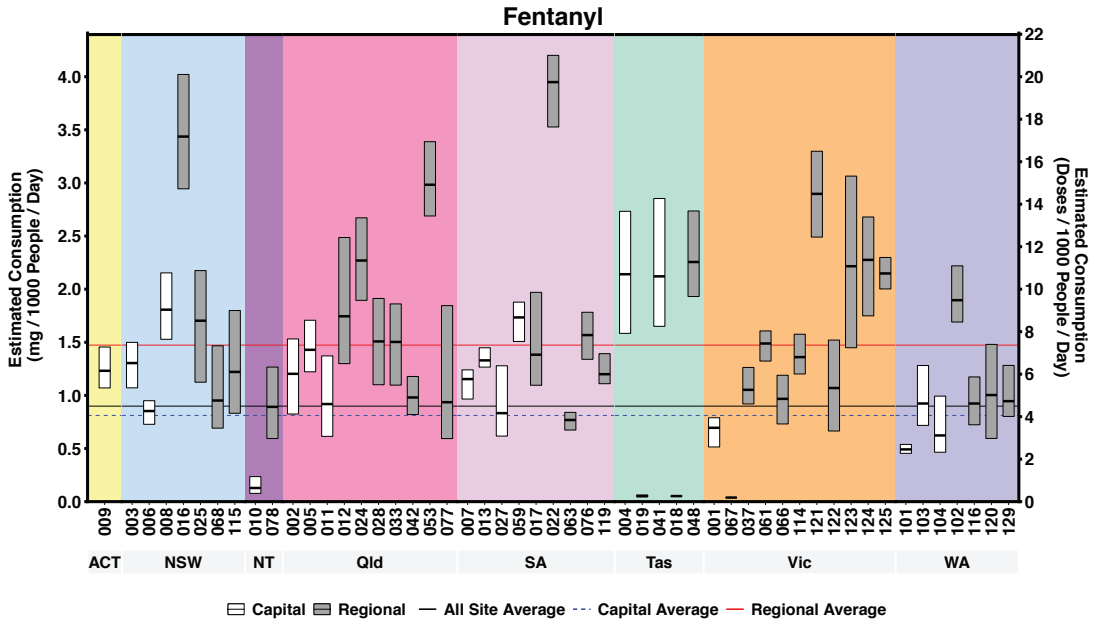
Heroin is metabolised in the body and excreted in low amounts as the unique metabolite, 6-monoacetylmorphine (6-MAM). Since the metabolite is characteristic of heroin use, it can be used to distinguish heroin from other opioids such as morphine and codeine. Unlike the two pharmaceutical opioids, heroin consumption in regional areas was much less than in the capital cities (Figure 20). Victoria site 67 had very high consumption rates across the sampling week, well above any other catchment. Many regional sites had levels at or below limits of quantification. The elevated heroin consumption in the south eastern parts of the country is clearly evident from the bubble graph (Figure 21).

Figure 16: Estimated oxycodone consumption for April 2019 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5–7.



- Very high regional average
- Highest capital city site is Tasmania

Figure 17: Estimated fentanyl consumption for April 2019 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5–7.



- Higher and variable regional average
- Some sites had non-detects for fentanyl

Figure 18: Estimated average oxycodone consumption per jurisdiction for April 2019 in mg consumed per day per thousand people. The number of collection days varied from 5–7.

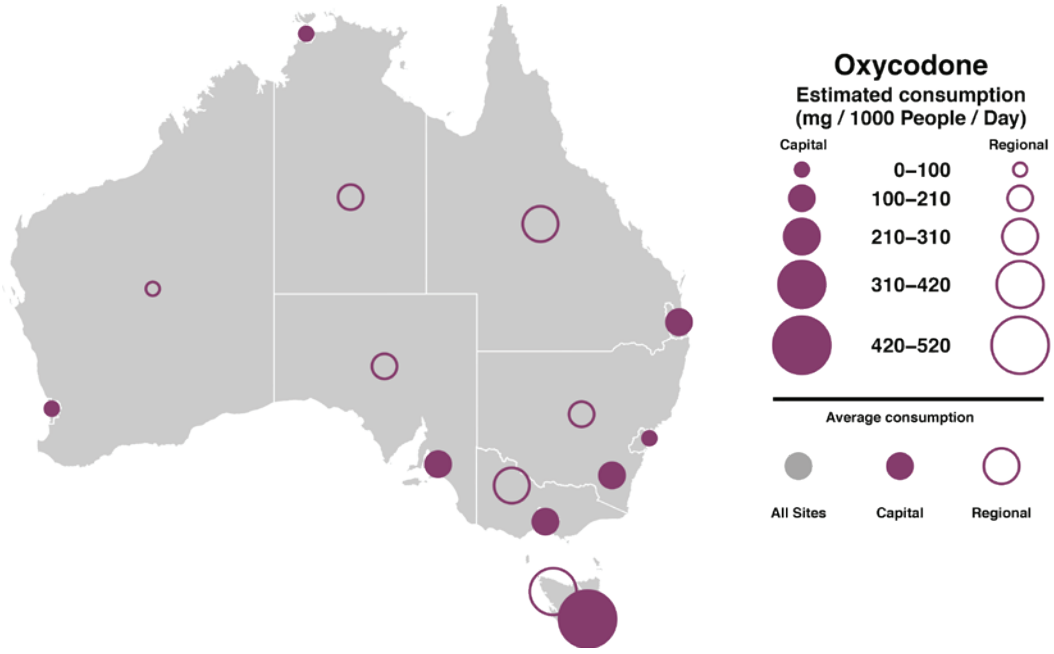


Figure 19: Estimated average fentanyl consumption per jurisdiction for April 2019 in mg consumed per day per thousand people. The number of collection days varied from 5–7.

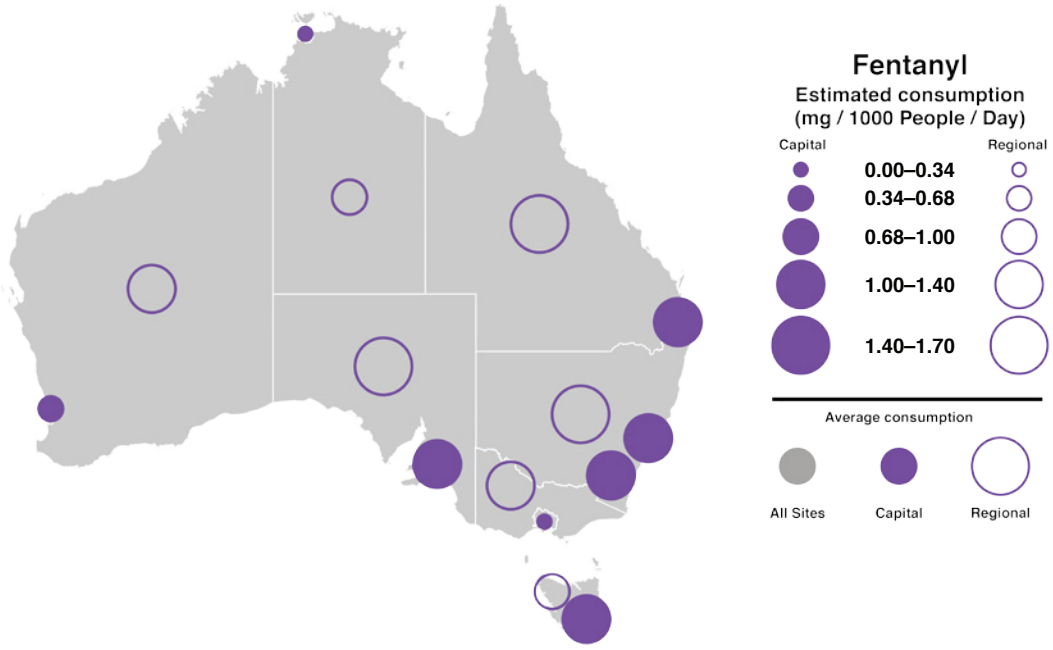
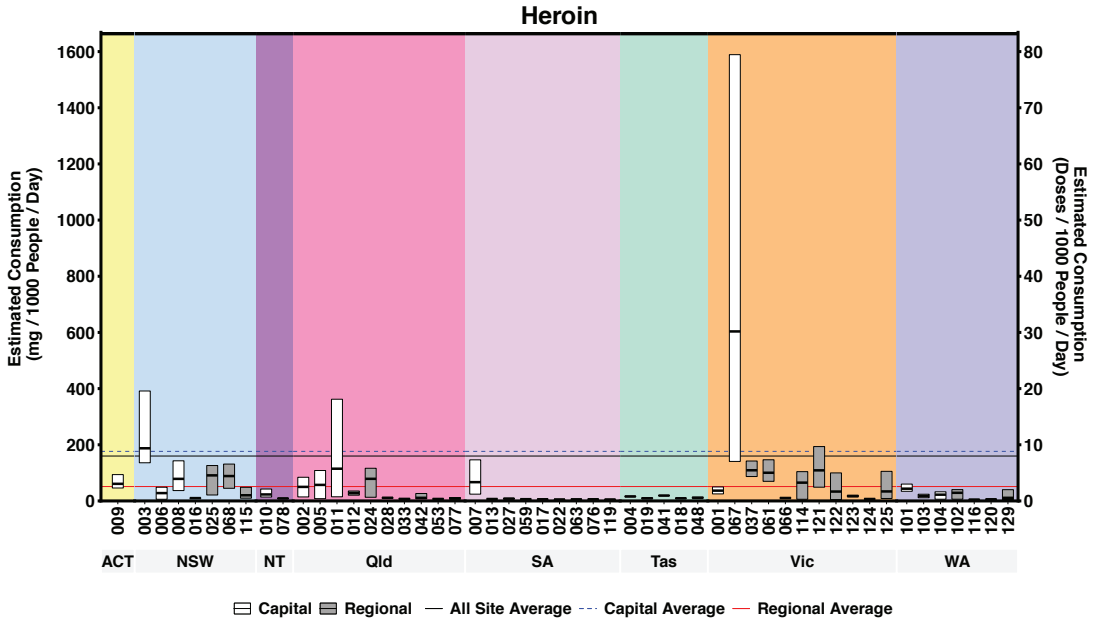
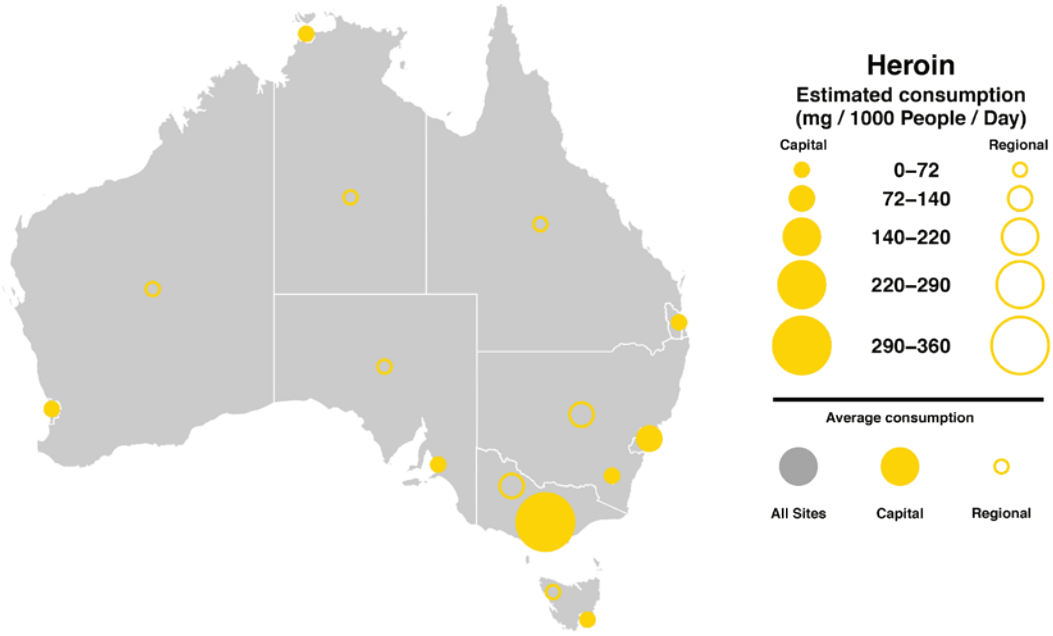


Figure 20: Estimated heroin consumption for April 2019 in mass consumed per day (left axis) and doses per day (right axis) per thousand people. The number of collection days varied from 5–7.



- Lower regional consumption
- Highest consumption in Victoria and New South Wales

Figure 21: Estimated average heroin consumption per jurisdiction for April 2019 in mg consumed per day per thousand people. The number of collection days varied from 5–7.



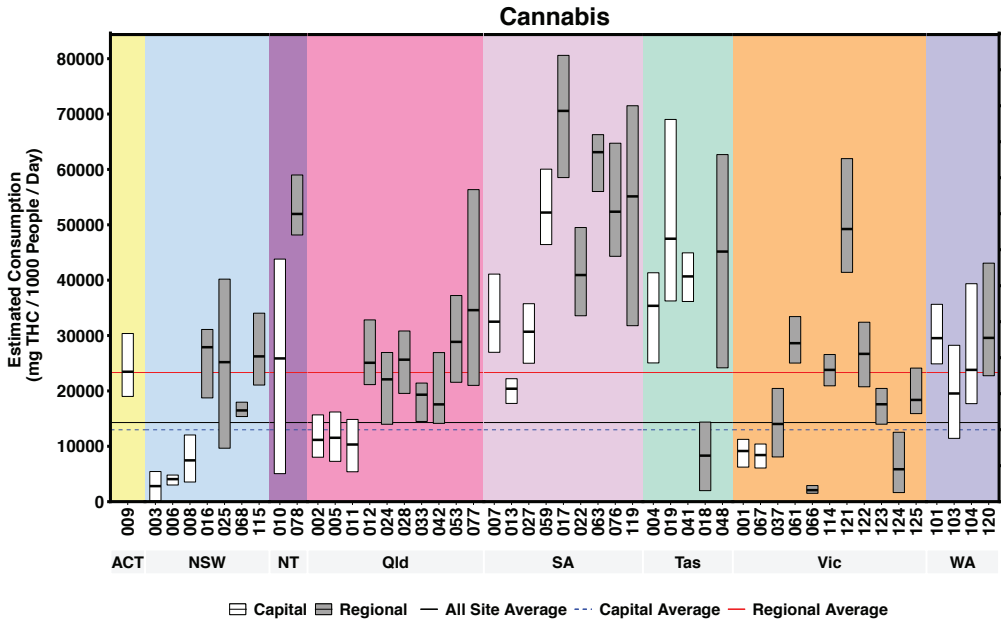
4.1.4 CANNABIS

Tetrahydrocannabinol (THC) is the main psychoactive compound found in cannabis. The compound is metabolised and largely cleared through the gut. A small proportion (0.06 per cent) is excreted through the kidneys as 11-nor-9-carboxy-THC (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 have to be preserved to avoid degradation of THC-COOH (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.

Cannabis consumption was expressed as the daily mass load (mg) of 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, strain, or whether an extract was used.

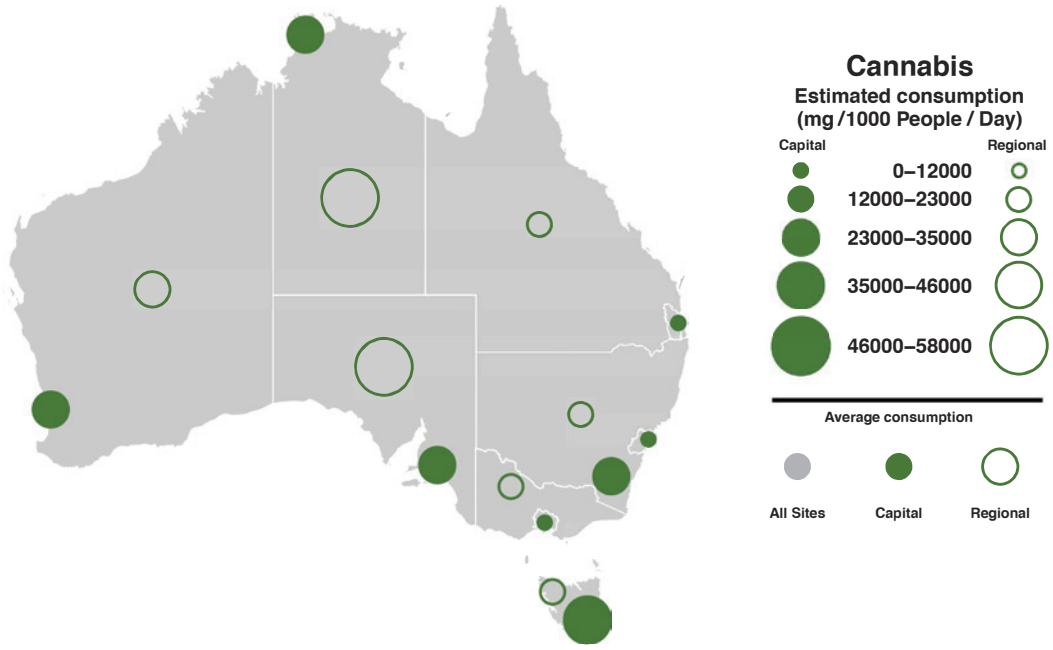
Clear spatial differences were evident across Australia (Figure 22). The regional average use exceeded capital city consumption. Parts of South Australia, particularly regional sites, and Tasmania were very high consumers of the drug. Almost every state and territory had some catchments with use well above the averages. Except for site 120, regional treatment plants in Western Australia were unable to provide a suitable composite sample for cannabis analysis. The bubble plot and jurisdictional differences of cannabis use across Australia show the generally higher consumption in regional areas (Figure 23).

Figure 22: Estimated cannabis consumption for April 2019 in mass consumed per day (left axis). The number of collection days varied from 5–7.



- High regional consumption
- Variable use

Figure 23: Estimated average cannabis consumption per jurisdiction for April 2019 in mg consumed per day per thousand people. The number of collection days varied from 5–7.



4.1.5 NEW PSYCHOACTIVE SUBSTANCES

Two compounds are included under the NPS class in the NWDMP; methylone and mephedrone. Limited information is available on the human metabolism and excretion of these drugs. Therefore, the parent compound was measured and reported as detection frequency. Sites that showed the presence of the two compounds are qualitatively listed in Table 2 for April 2019. The number of mephedrone detections were most frequent in New South Wales. Queensland had fewer detections, while in South Australia mephedrone was only present in one capital city sample. Methylone was more regularly detected in Queensland, followed by New South Wales and Victoria.

The temporal changes in detections per state and territory (number of samples above LOD) are shown in Figure 24. Mephedrone detections have remained relatively low, although the detection frequency has been on the increase. The number of detections of methylone has dropped since a peak in late 2017. However, since April 2018, the number of detections have remained between 3–10 per cent in all samples tested.

Table 2: The number and code of sites per state and territory where mephedrone and methylone were detected. The total number of daily samples that was assessed was 350.

	Number of detections Apr 2019		Sites detected Apr 2019	
State/territory	**Mephedrone**	**Methylone**	**Mephedrone**	**Methylone**
ACT	0	0		
NSW	16	12	006, 008, 016, 025, 068	003, 006, 008, 068
NT	0	0		
Qld	7	19	005, 012	012, 028, 033, 042, 077
SA	1	0	007	
Tas	0	0		
Vic	0	9		114, 124
WA	0	0		
Total	**24**	**40**	**8 sites**	**11 sites**

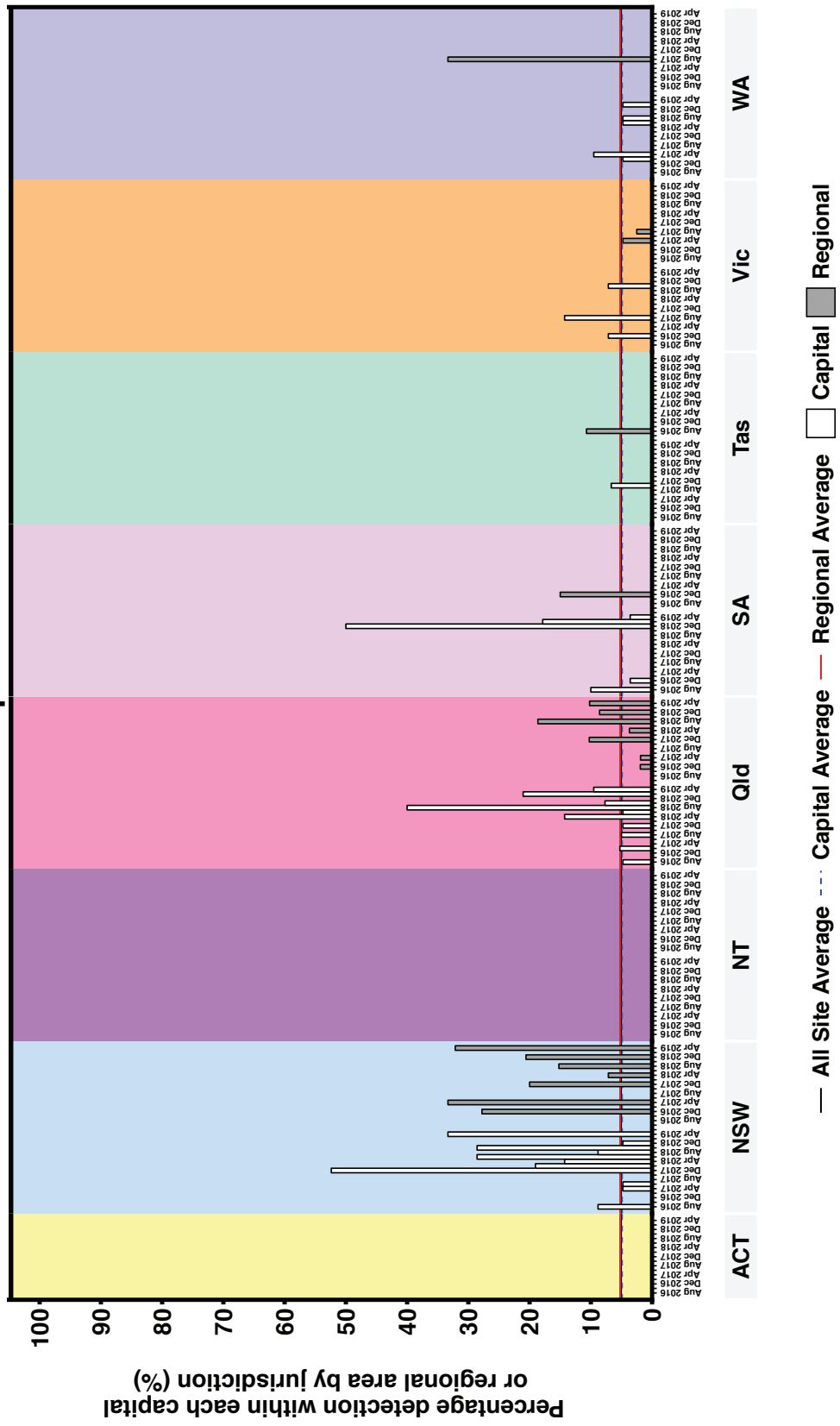


Figure 24: Estimated percentage positive detections per jurisdiction for mephedrone and methylone for April 2019. This is the number of detections as a percentage of the total number of samples analysed per jurisdiction. The number of collection days varied from 5–7.

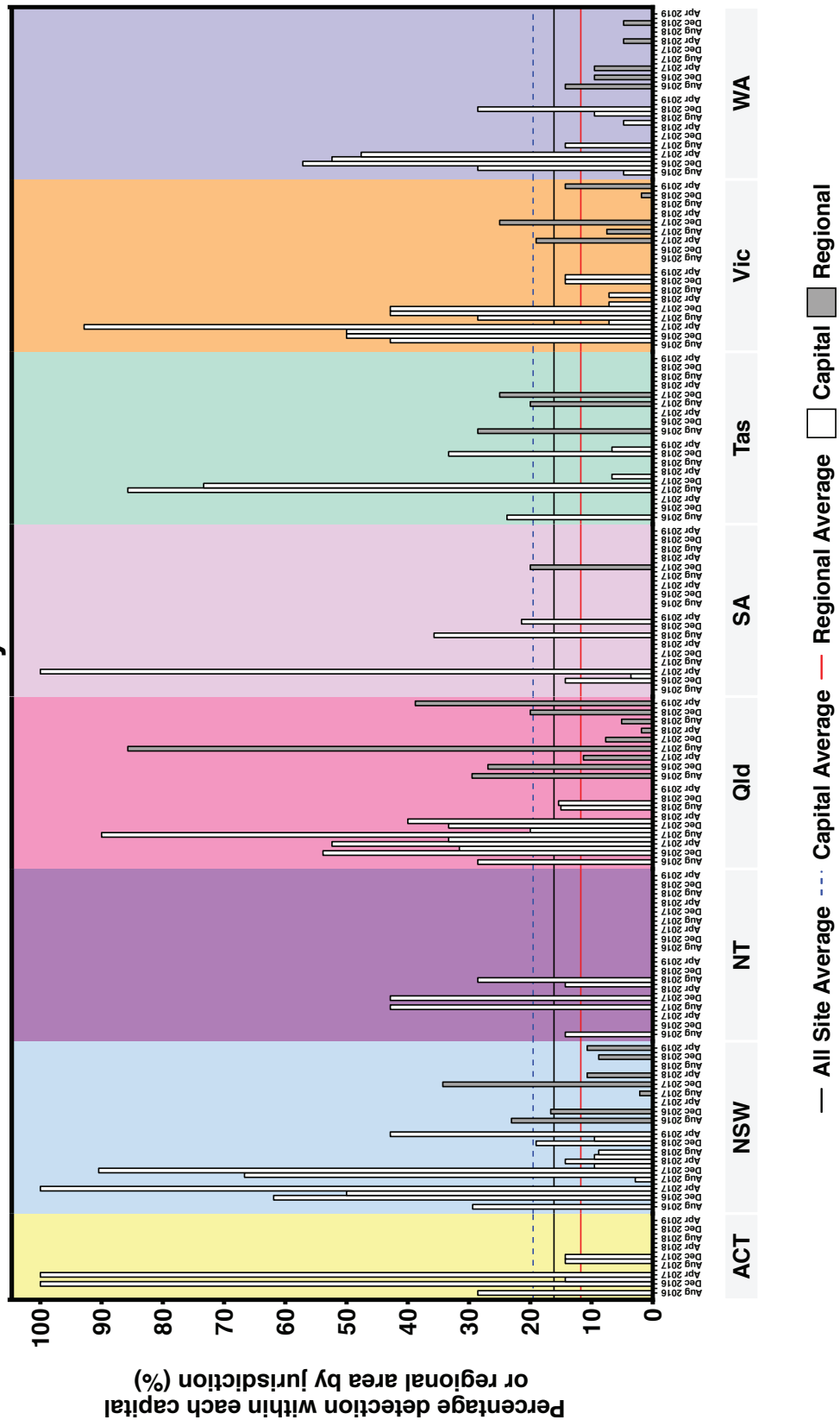
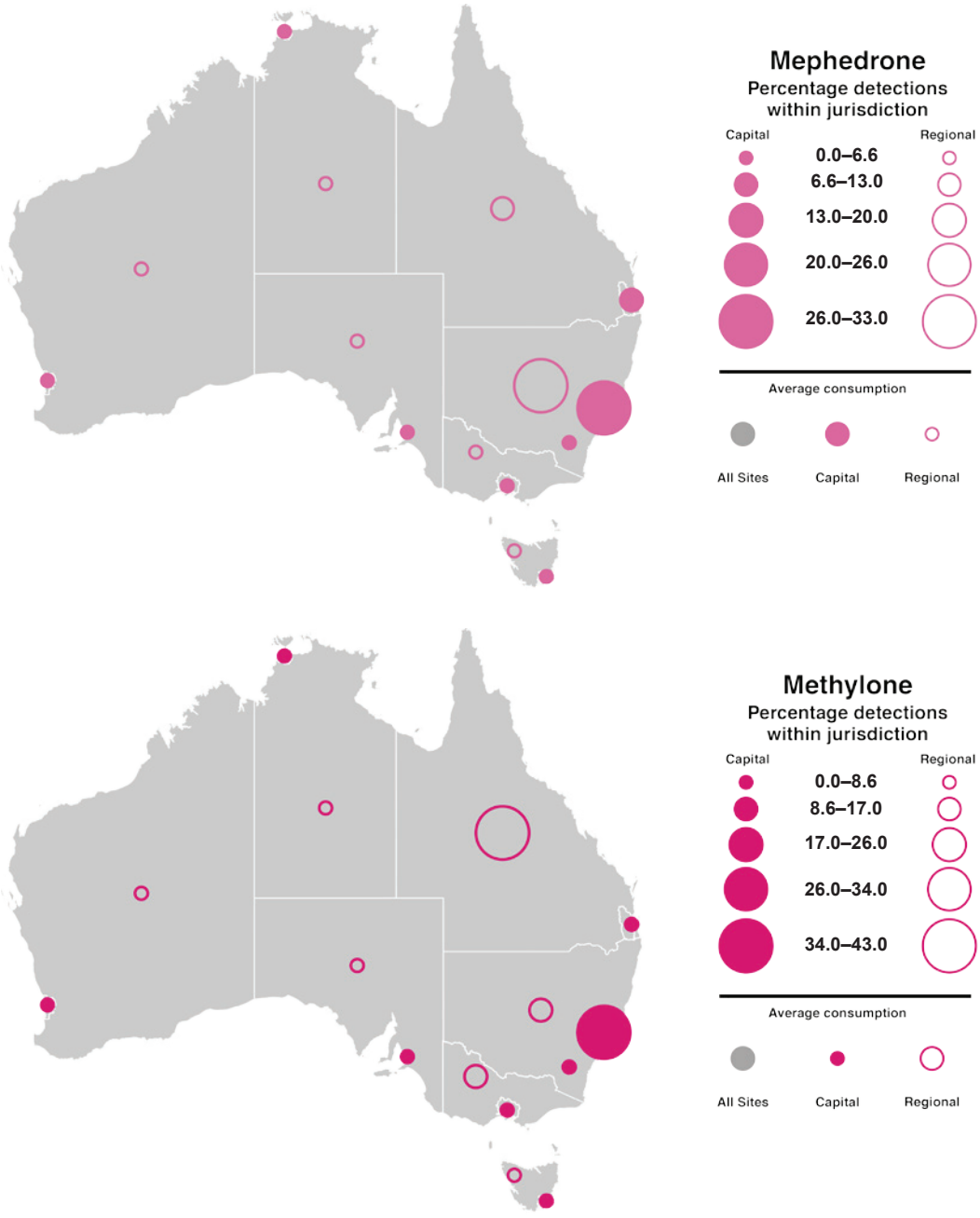


Figure 24 (continued): Estimated percentage positive detections per jurisdiction for mephedrone and methylone for April 2019. This is the number of detections as a percentage of the total number of samples analysed per jurisdiction. The number of collection days varied from 5–7.

Figure 24 (continued): Estimated percentage positive detections per jurisdiction for mephedrone and methylone for April 2019. This is the number of detections as a percentage of the total number of samples analysed per jurisdiction. The number of collection days varied from 5–7.



4.2 TEMPORAL CHANGES IN DRUG CONSUMPTION ESTIMATES BY JURISDICTION

The total level of each drug outlined in the preceding reports per state or territory was compared with subsequent collection periods included in the current report. Although every effort was 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).

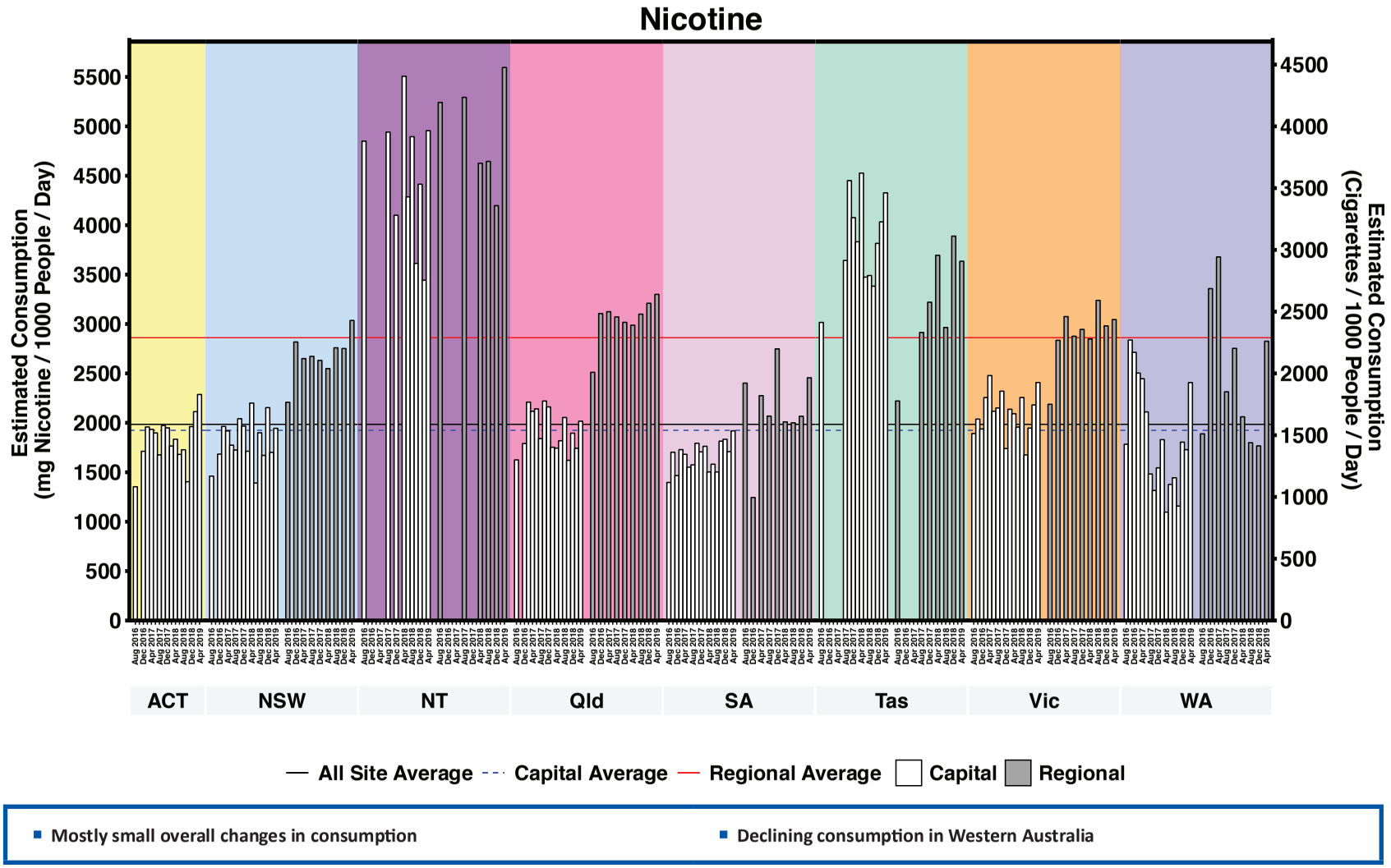
Note: the lines on each graph representing averages are the cumulative average across all sampling time points.

4.2.1 NICOTINE AND ALCOHOL

Over the first two years of the program, nicotine consumption remained largely steady in most parts of the country (Figure 25). Depending on the state or territory, increased use became apparent in the past year. In the current sampling periods of February and April, increases were seen across the country. These increases were more pronounced in the regional populations of the country. The high regional use of nicotine is reflected in the average use remaining well above capital city levels.

The difference between average capital city and regional centre consumption of alcohol within each state or territory remained minimal compared to nicotine. South Australia continued to be the only state where regional alcohol use was lower than in the capital city (Figure 26). Consumption levels remained essentially steady in states such as New South Wales, Queensland, Tasmania and Victoria, while a decrease in use in South Australia and the Northern Territory in the current period was observed. Western Australia saw a decline in consumption at the start of 2018 which has remained steady since then.

Figure 25: Estimated average consumption of nicotine by state/territory, where 1 cigarette provides 1.25 mg of nicotine.[6]



6 Nicotine consumption data have been adjusted to refine the factor used to convert consumed mass load to dose. Overall trends in nicotine consumption remain unchanged.

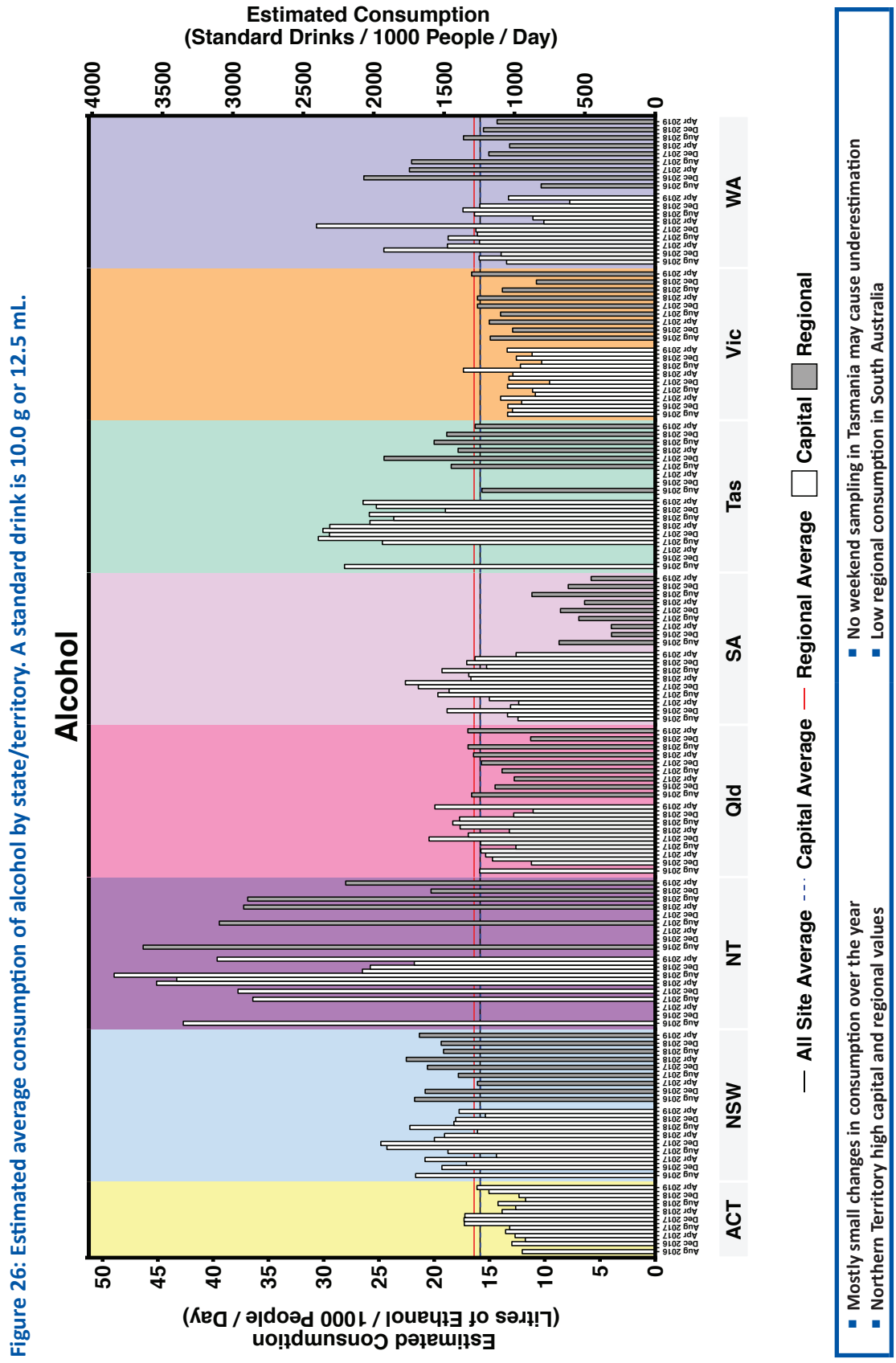


Figure 26: Estimated average consumption of alcohol by state/territory. A standard drink is 10.0 g or 12.5 mL.

4.2.2 STIMULANTS

A consistent upward trend in methylamphetamine consumption in the capital cities and regions of virtually each state and territory is evident over the total period of the program (Figure 27). Capital city South Australia is the clear exception, where the amounts detected declined dramatically at the start of 2018, followed by a small recovery and another decline in the current sampling period. Regional Western Australia also defied the rising national trend, albeit to a lesser extent.

The changes in use of methylamphetamine is also apparent over the long term in Queensland, South Australia and Western Australia (Figure 28). The decline in South Australia since early 2018 has been the longest continuous period over which the drug's use has been maintained at a lower level. Measured amounts of methylamphetamine in Queensland and Victoria are slowly increasing, particularly since the end of 2018.

Cocaine use in capital city Australia showed an overall decline in almost every state and territory in the previous reporting period. However, this trend was reversed in the current period with consumption of cocaine increasing almost everywhere (Figure 29). Levels of cocaine use in New South Wales remained high compared to other parts of Australia. Regional consumption of the drug has been variable with differences evident across the country. The averaged results for all sites in each state and territory also makes the generally lower regional use quite apparent, together with low consumption in Tasmania and Western Australia.

MDMA use across Australia remained low overall, compared to other stimulants. Levels of the drug were largely steady in many parts of the country in the first two years of the project, but increases have become apparent in the past year. This was the case in both capital city and regional areas of almost every state and territory (Figure 30). The per capita consumption of drug use in the capital city site of the Northern Territory remained high compared to most other parts of the country.

MDA use, corrected for the proportion derived from MDMA (Khan & Nicell 2011), was relatively low across the country (Figure 31). No long-term trends were apparent, with fluctuations a feature of the drug's use. Since 2018, levels of MDA in regional Northern Territory have been the lowest in the nation. The national regional average was skewed somewhat by the high MDA levels detected at site 012 in Queensland in August 2017.

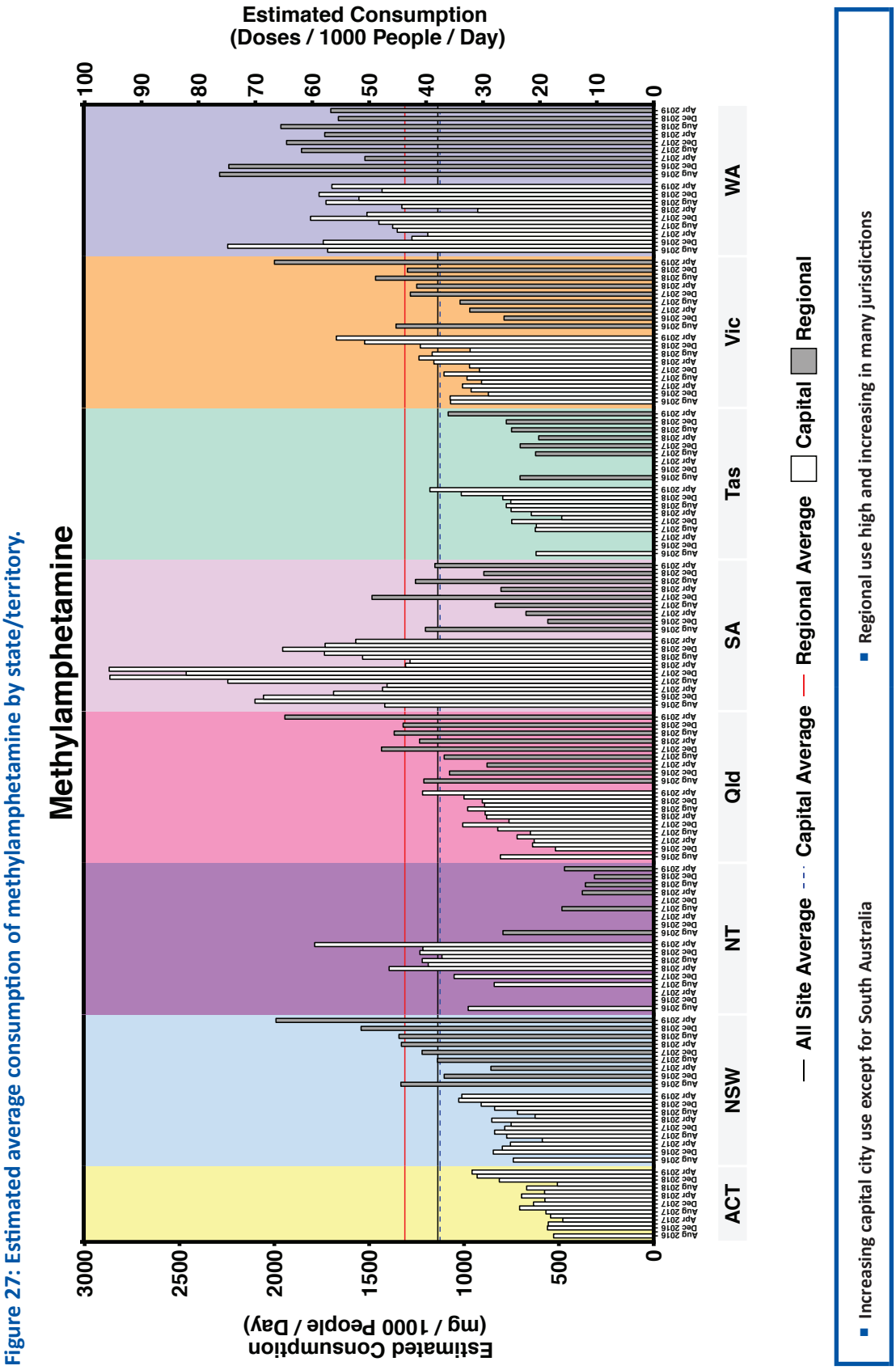


Figure 27: Estimated average consumption of methylamphetamine by state/territory.

Figure 28: Change in methylamphetamine consumption for sites with historical data. Both Victorian sites were the average of one week per year in 2013, 2014 and 2015.

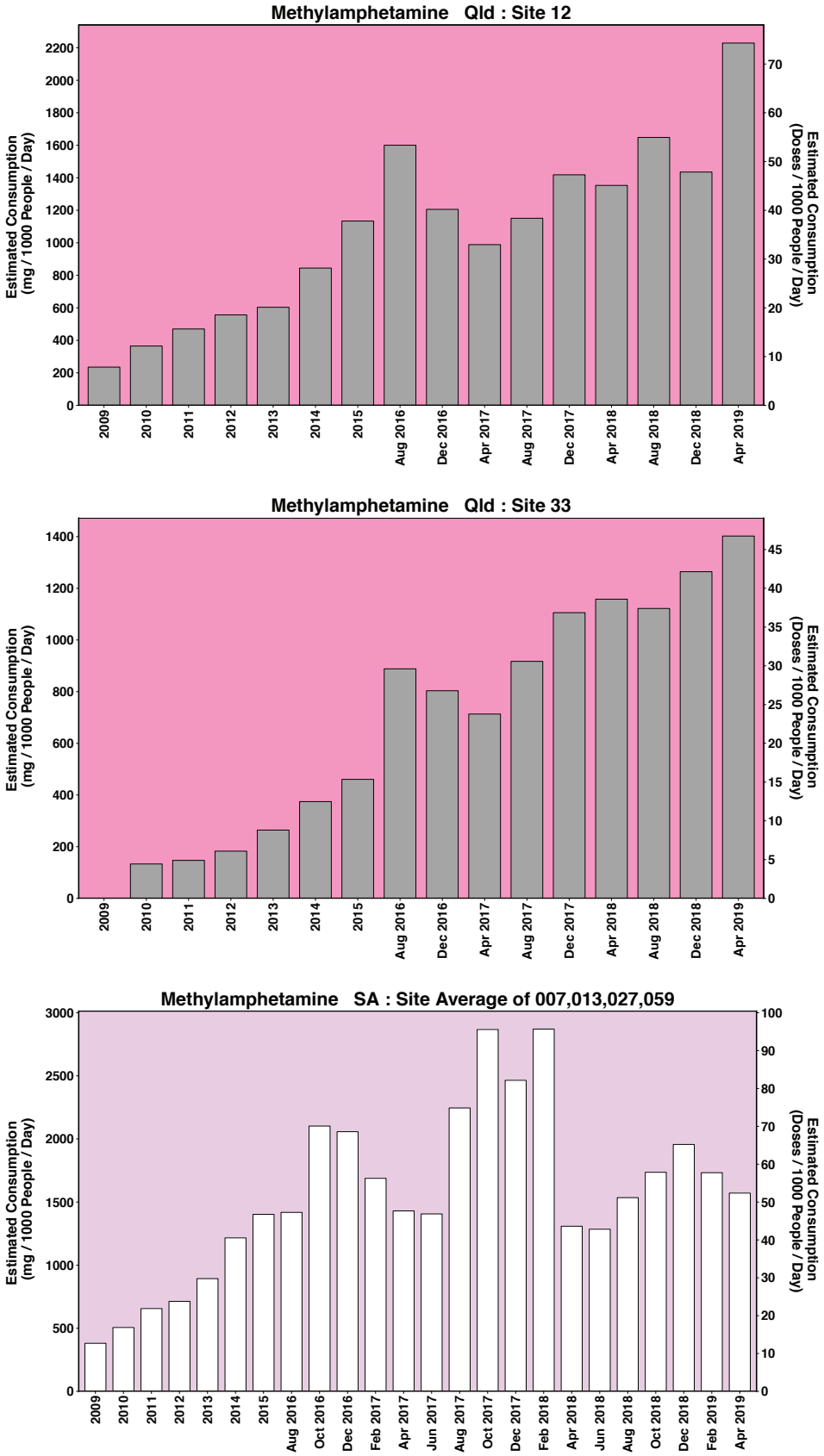
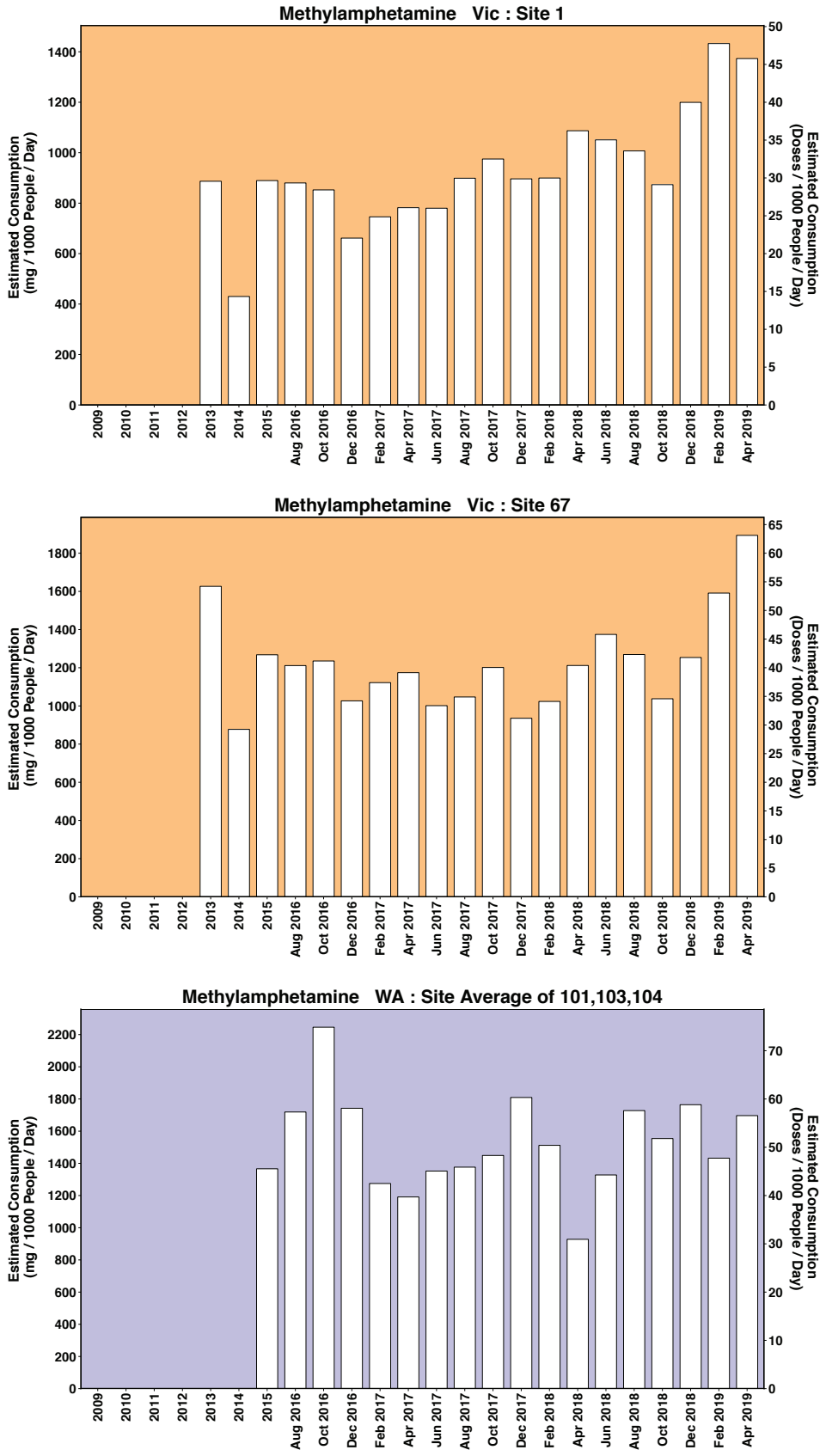


Figure 28 (continued): Change in methylamphetamine consumption for sites with historical data. Both Victorian sites were the average of one week per year in 2013, 2014 and 2015.



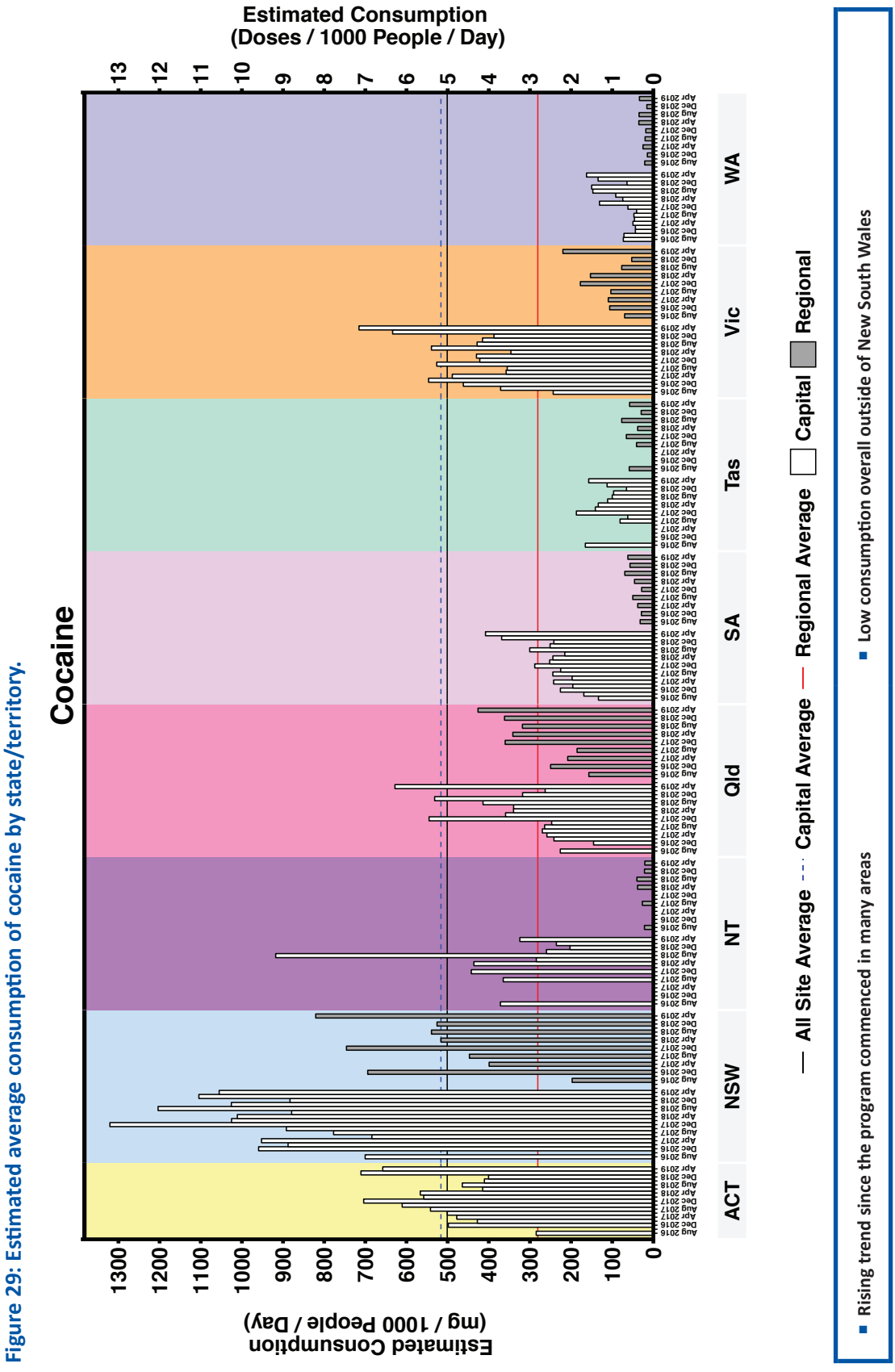


Figure 29: Estimated average consumption of cocaine by state/territory.

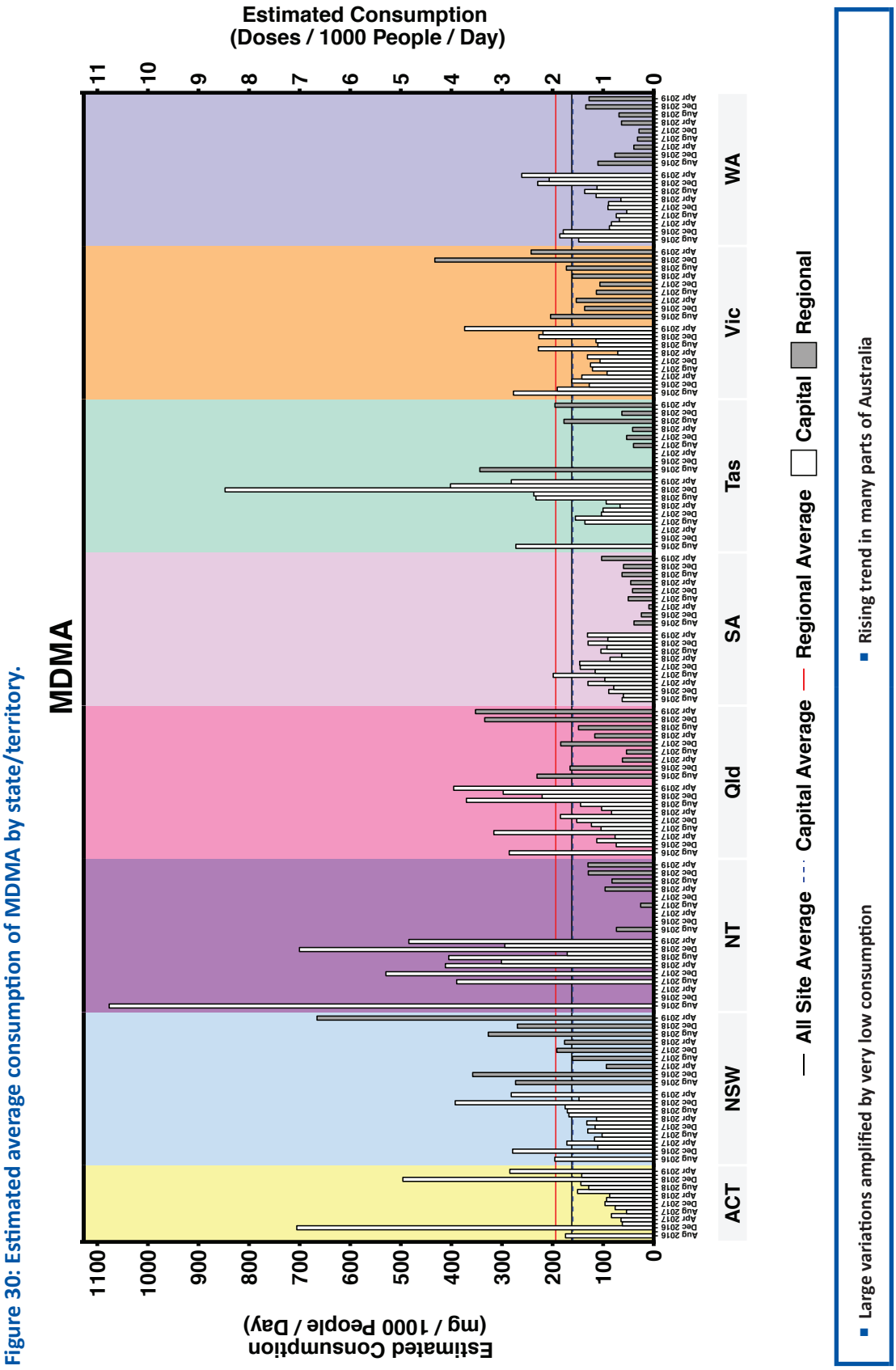


Figure 30: Estimated average consumption of MDMA by state/territory.

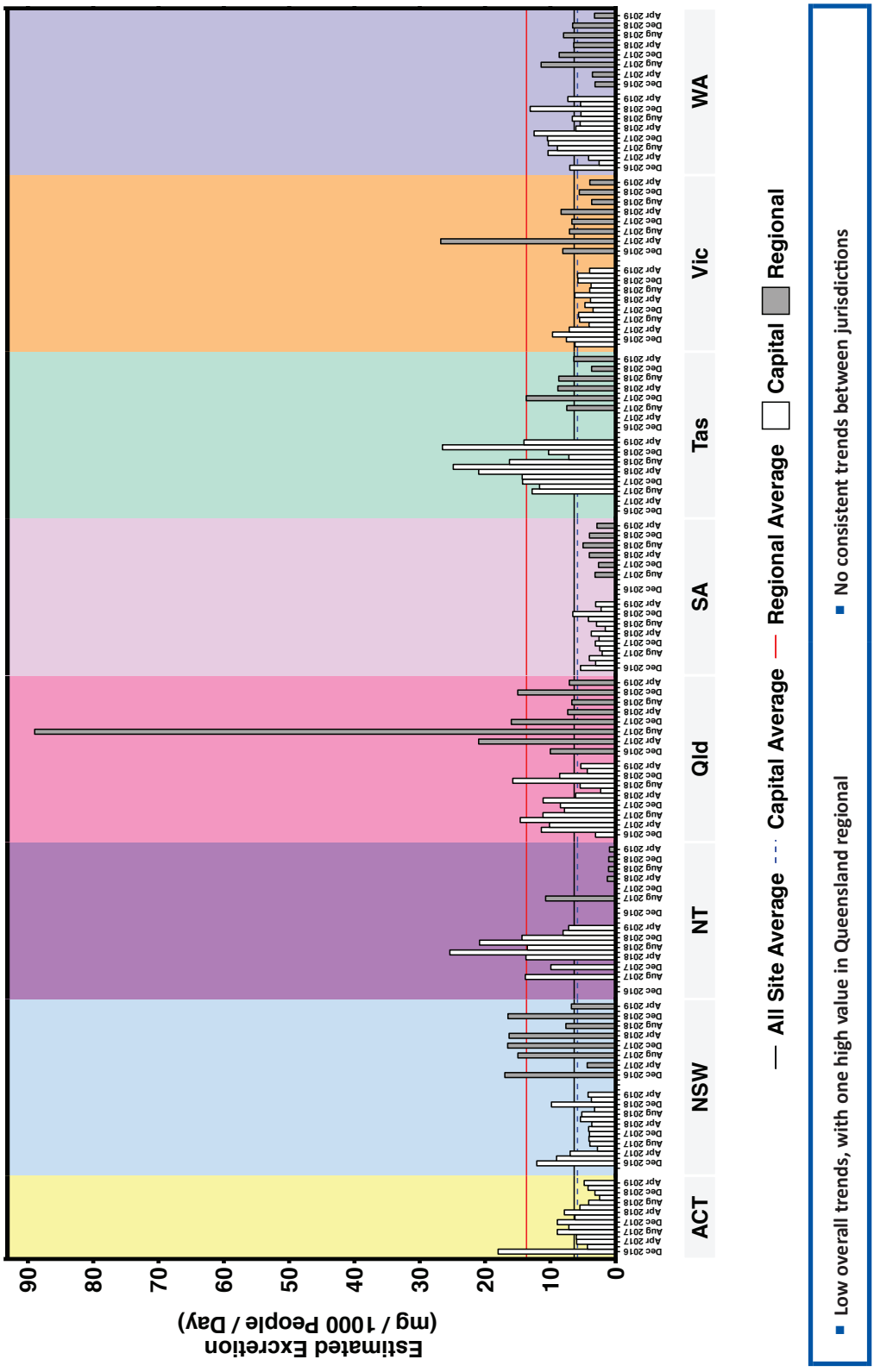


Figure 31: Estimated average excretion of MDA by state/territory.

4.2.3 OPIOIDS

The consumption of oxycodone is showing an overall upward trend since the inception of the program in many parts of Australia, especially regional areas (Figure 32). Capital city sites in Tasmania measured the highest consumption of the compound, but in the past year regional Tasmanian sites, as well as sites across Queensland and Victoria have become prominent. A feature of oxycodone use in Australia is the very high regional levels compared to the capital cities. Capital city New South Wales, the Northern Territory and Western Australia are amongst the lowest users of oxycodone.

Fentanyl use in regional Australia remain similarly high in comparison to capital cities (Figure 33). The longer-term upward trend in some states and territories has been arrested since middle to late 2018. The reversal in consumption of fentanyl was consistent across all parts of the country, except regional parts of the Northern Territory.

Heroin use in Australia occurs largely in the capital cities, especially Victoria. Different trends are emerging across the country (Figure 34). Use in the Australian Capital Territory, South Australia, Tasmania and Western Australia have been on the decline since the start of the program, while capital city New South Wales and Victoria have been on the increase. The use of the drug has been measured in capital city South Australia since 2013 (Figure 35). The declining levels of heroin consumption in the region have been part of a long term trend in South Australia.

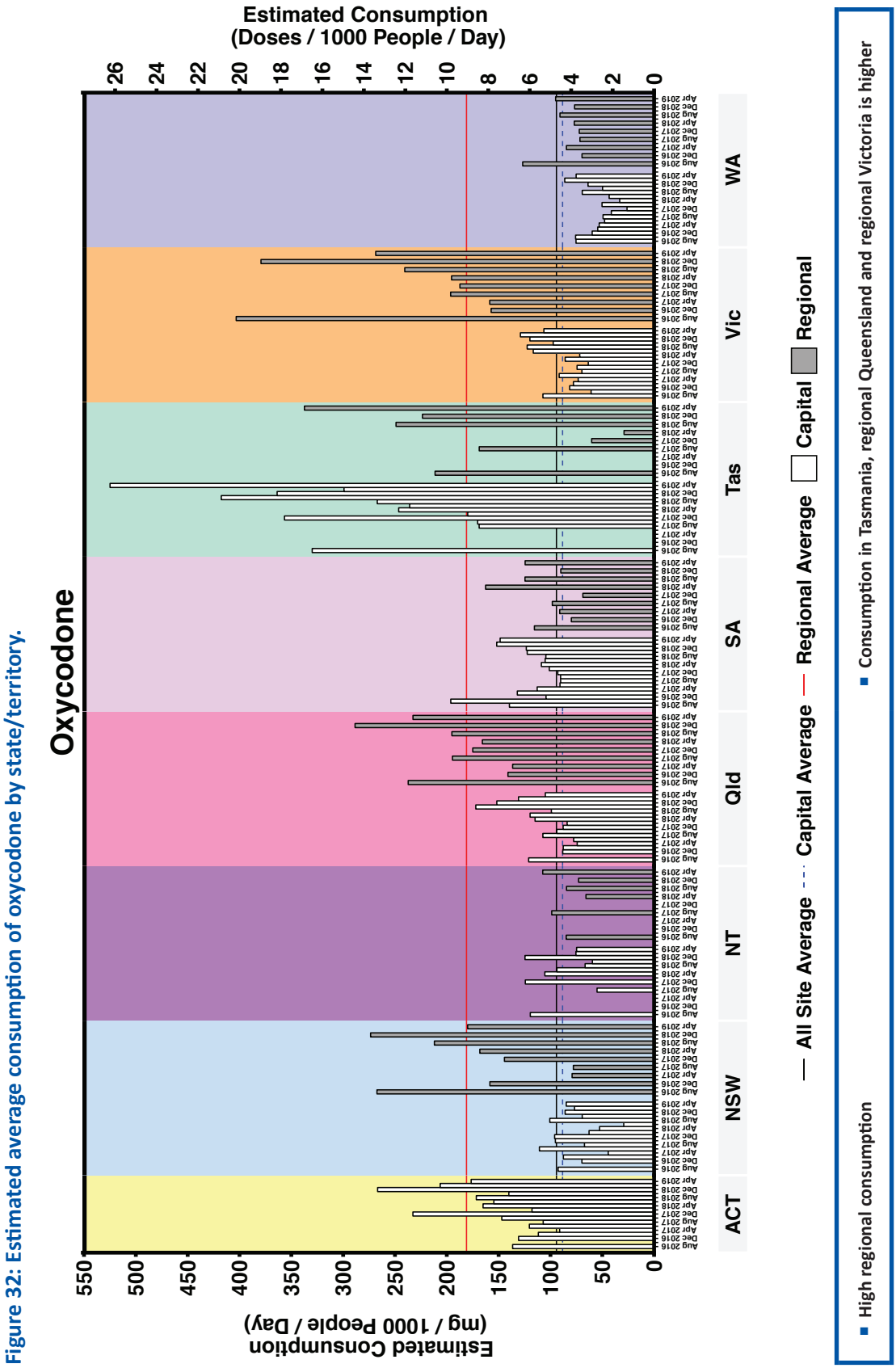


Figure 32: Estimated average consumption of oxycodone by state/territory.

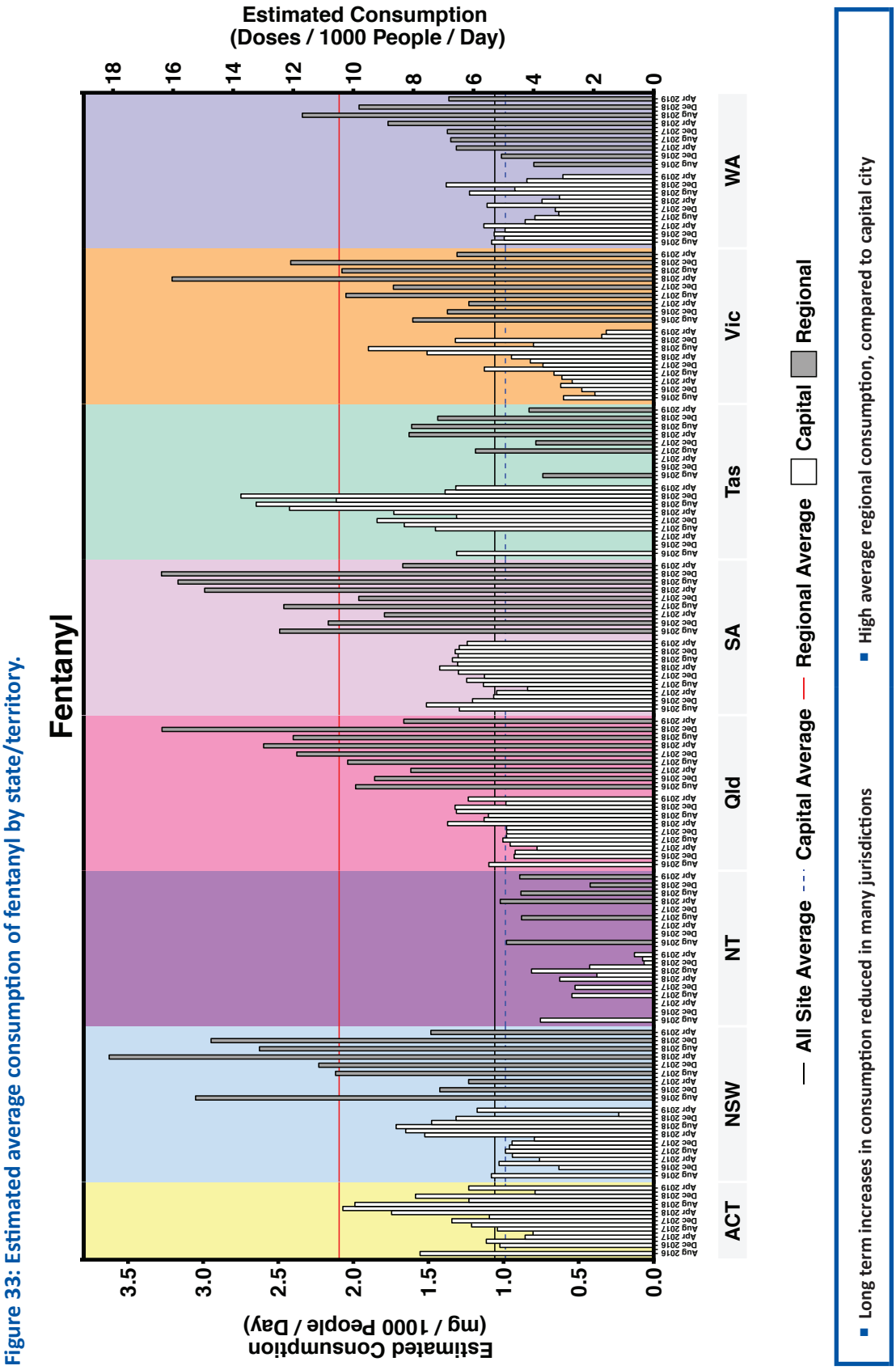


Figure 33: Estimated average consumption of fentanyl by state/territory.

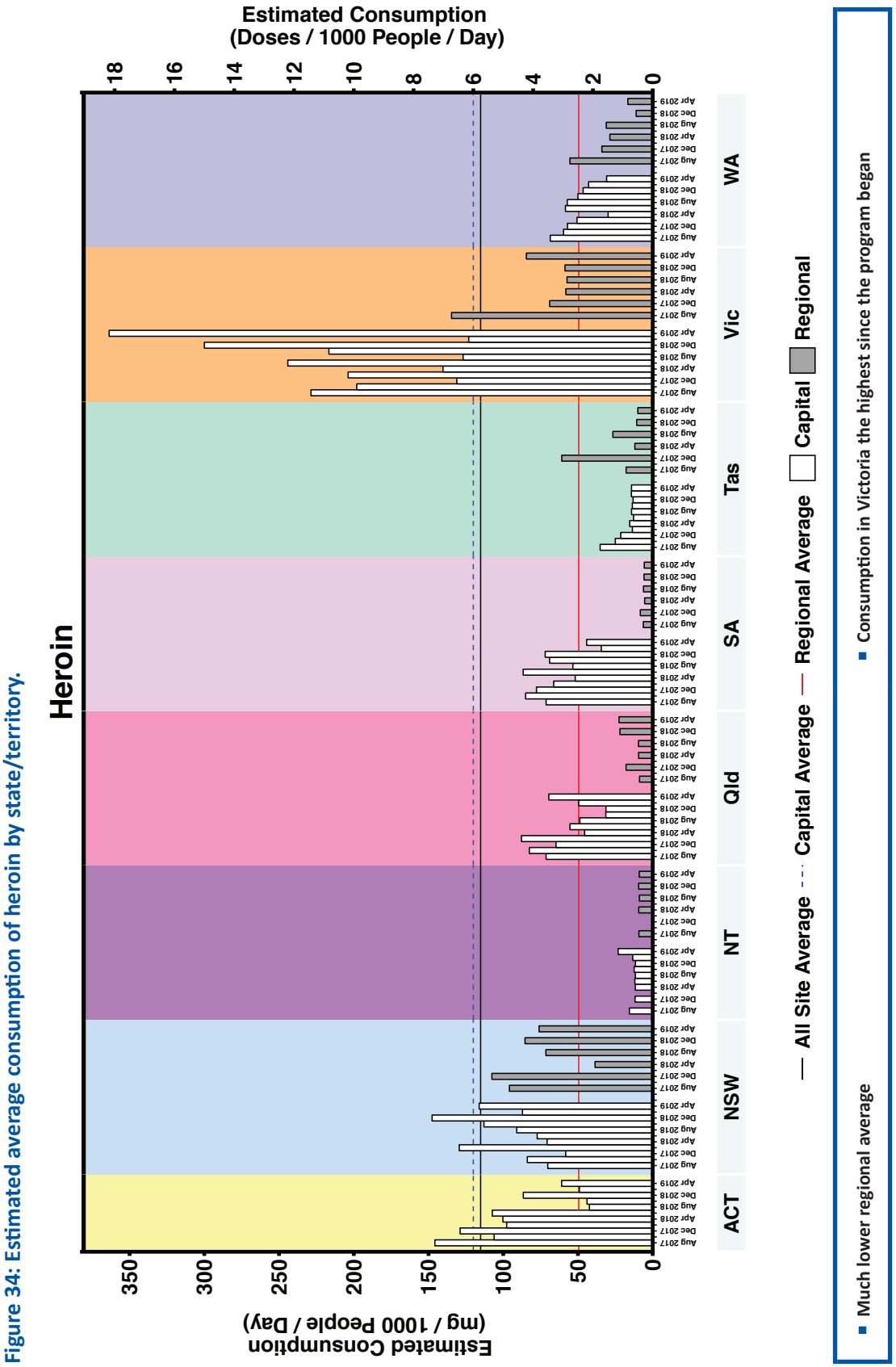
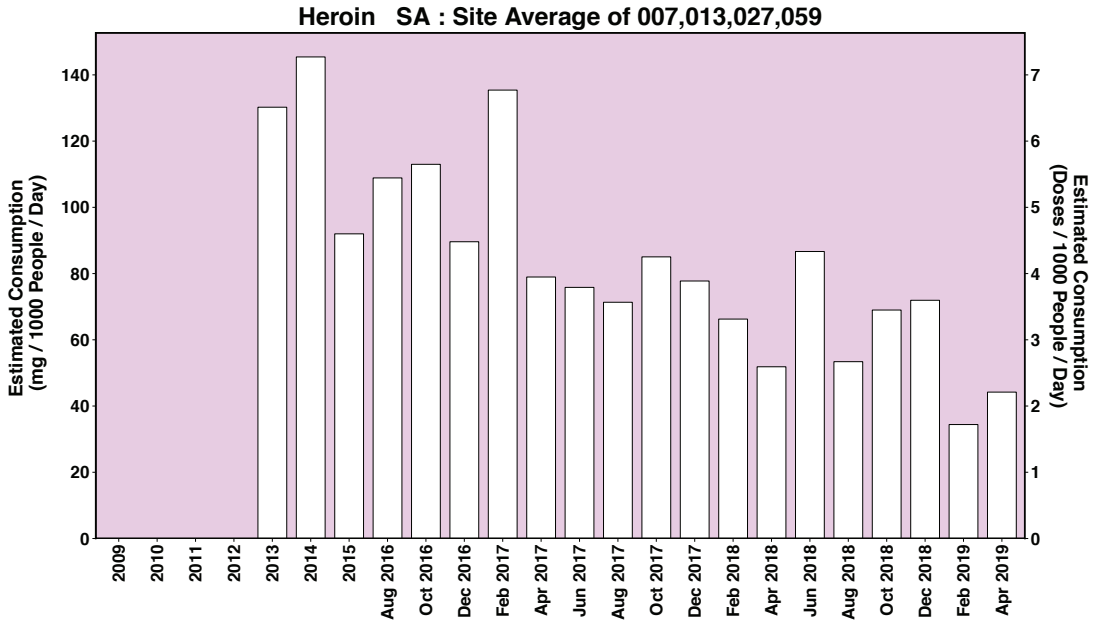


Figure 34: Estimated average consumption of heroin by state/territory.

Figure 35: Change in heroin consumption for South Australia.

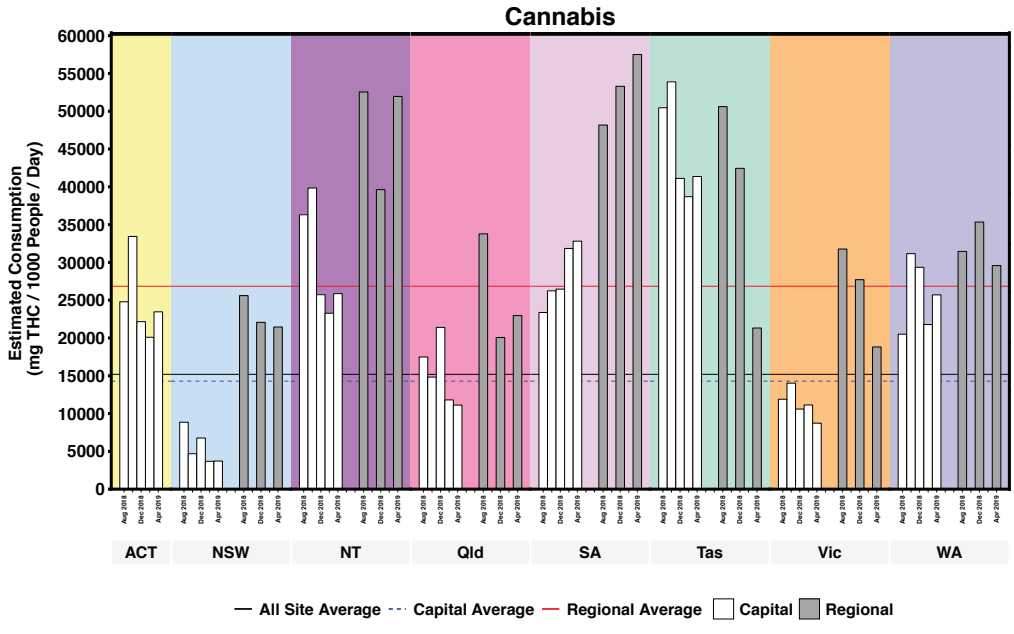


4.2.4 CANNABIS

Cannabis has been included in the program since August of 2018. Over this short period, small fluctuations were evident in parts of Australia, with some exceptions, including capital city New South Wales and regional Tasmania (Figure 36). Regional consumption was higher than capital city levels, with the highest consumption spread over several states and territories.

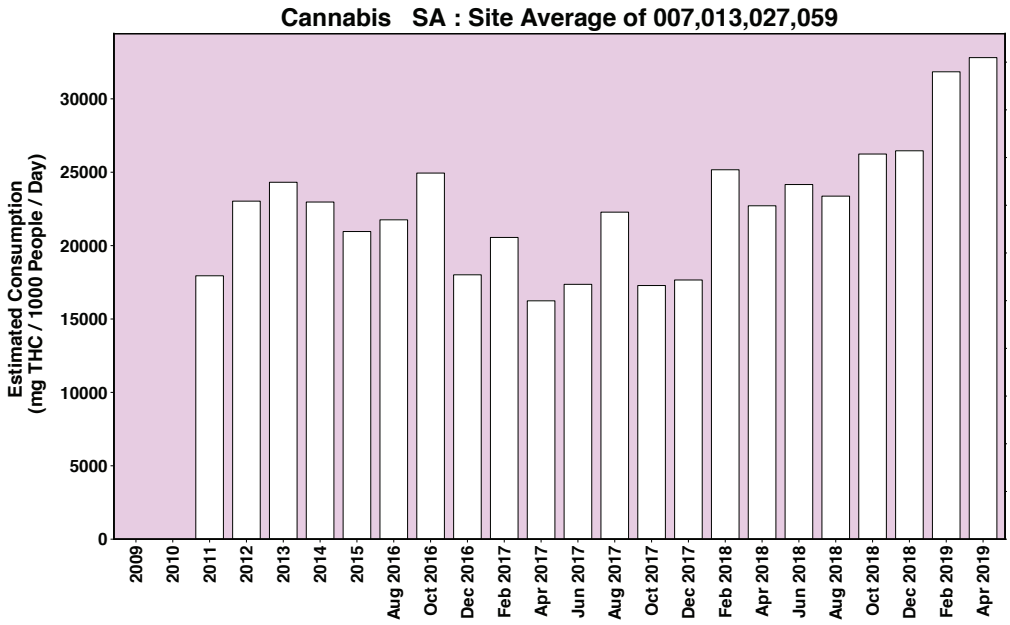
Consumption of cannabis has previously been measured in capital city South Australia. Use of the substance has seen small but steady increases over the course of the program (Figure 37).

Figure 36: Estimated average consumption of cannabis by state/territory.



- Generally higher in regional consumption
- Variable between states

Figure 37: Change in cannabis consumption in capital city South Australia. Cannabis is detected via the THC metabolite THC-COOH.



4.2.5 NEW PSYCHOACTIVE SUBSTANCES (NPS)

Methylone and mephedrone were only detected sporadically and at very low levels compared to other substances included in the report (April 2019 mephedrone and methylone results are shown in Table 2).

4.2.6 CAPITAL CITY AND REGIONAL AVERAGES

In order to show the national trends in the use of individual substances, all capital city and regional sites were combined separately and included in the report over the total sampling period (Figure 38). Fewer sites were sampled in between August 2016 and April 2017. Therefore, the contributing population was smaller between these dates and some approximations were necessary to account for the absence of densely populated regions (e.g. October 2016 for capital city New South Wales and Queensland).

For the population included in the report, methylamphetamine levels declined from October 2016 to June 2017. After that, use increased substantially over the course of 2017, particularly in regional areas. The reduction in use of the drug in South Australia in early 2018 was reflected in the overall capital city decline after that period. This has since been more than offset by increased use on the south eastern side of the country. Regional use has increased sharply from the previous to the current reporting period.

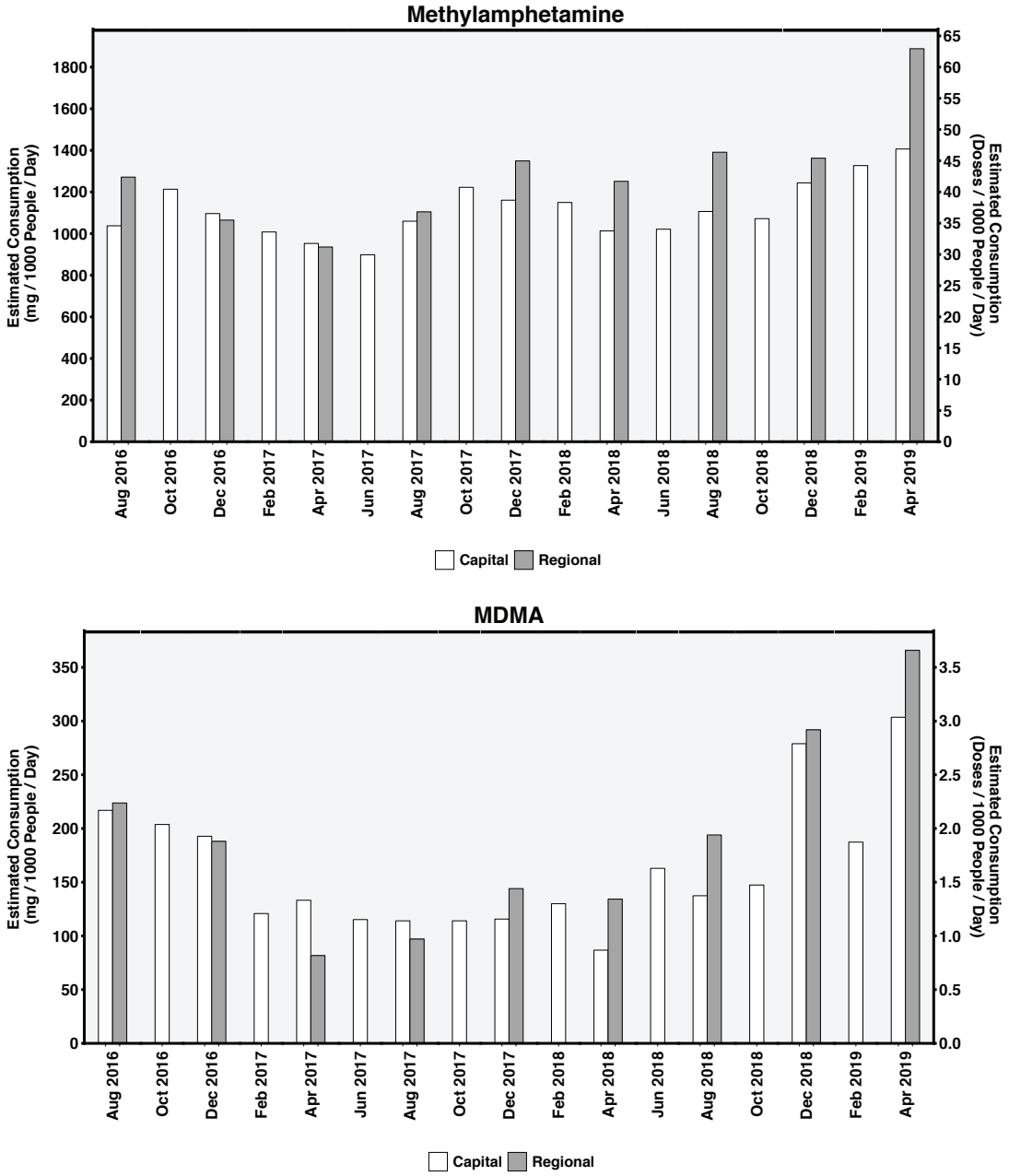
MDMA levels declined overall over the first part of the program, but then remained steady over the course of 2017. The initial rate of decline was more pronounced in regional areas (August 2016 to April 2017). From mid-2018 to the present, use of MDMA has increased in both capital city and regional parts of Australia to reach its highest levels since the beginning of the program.

Cocaine and heroin consumption showed some short-term variations, both in terms of capital city and regional levels. However, the long-term trend over the entire program shows that cocaine consumption is increasing. Heroin use in the capital cities is more variable, but similarly shows a long-term increase. The opposite is true in regional areas, with a steady decline in consumption of heroin. Capital city consumption was well above regional use over the entire program for both drugs.

In terms of legal substances with abuse potential, alcohol and nicotine consumption remained largely unchanged from the start of the program up to late 2018, with only small fluctuations evident (Figure 39). Since then, nicotine use has increased in capital cities and most recently also in regional areas. Nicotine consumption was higher in regional areas, whereas in the case of alcohol, averages were similar in capital cities and regional catchments. A distinct difference between capital cities and regional Australia was observed for the two pharmaceutical opioids monitored in the program. Capital city populations consumed both drugs at substantially lower levels compared to regional areas. Fentanyl use in 2018 stabilised after an increase over the course of 2017, but has declined since then. Oxycodone consumption in regional areas increased steadily after early 2017 and reached a peak in December 2018. In contrast, average capital city use of oxycodone has remained relatively stable. Nevertheless, a rise in use of oxycodone in the capital cities occurred in the latter part of 2018 and has been maintained since.

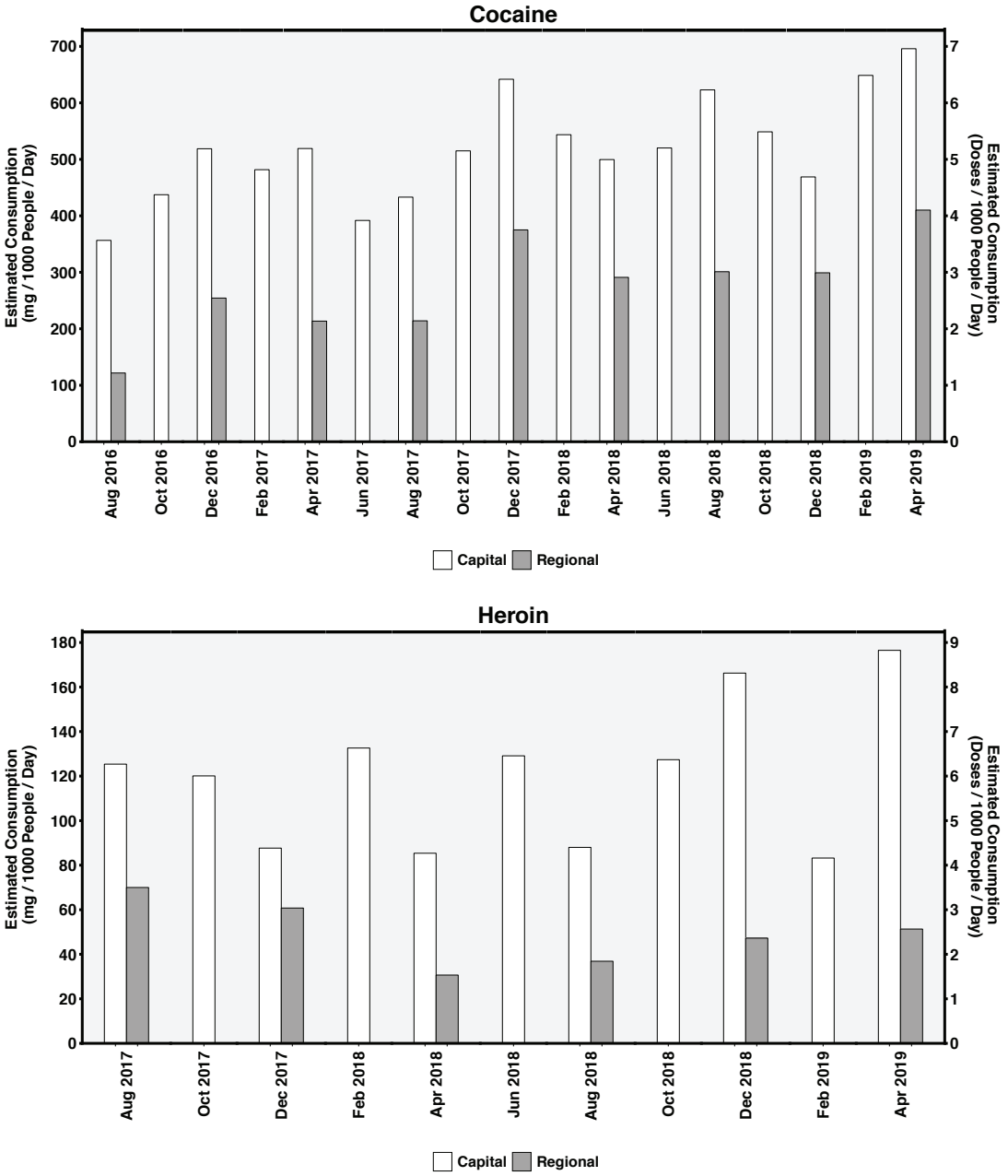
The remaining substances, cannabis, MDA, mephedrone and methylone had mixed results in the national context. Cannabis appeared essentially steady across capital city areas, whereas a slight decrease was apparent in regional areas (Figure 40). MDA also appeared stable across city sites, although regional sites had large variability which has partially been driven by sites in Queensland (for example, August 2017 high consumption rates were mainly influenced by site 012). The mephedrone and methylone detection rate has varied across the course of the program. Apart from a spike in December 2017, the mephedrone detection frequency has increased, while methylone has been on the decline.

Figure 38: The population-weighted average of all sites for methylamphetamine, MDMA, cocaine and heroin.



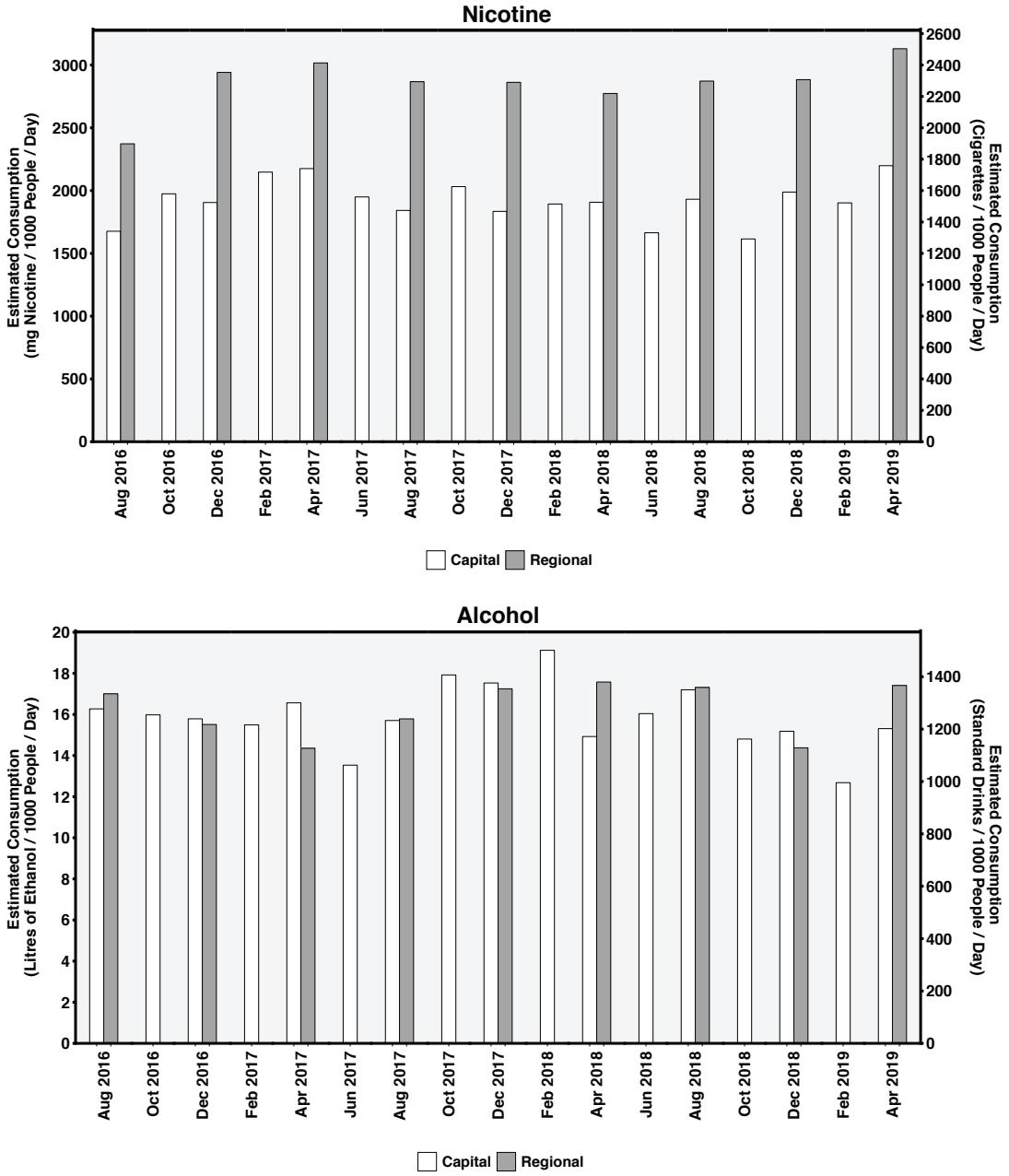
As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and April 2016 was used to provide the overall October estimate. Regional areas were only sampled every second collection period.

Figure 38 (continued): The population-weighted average of all sites for methylamphetamine, MDMA, cocaine and heroin.



As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and April 2016 was used to provide the overall October estimate. Regional areas were only sampled every second collection period.

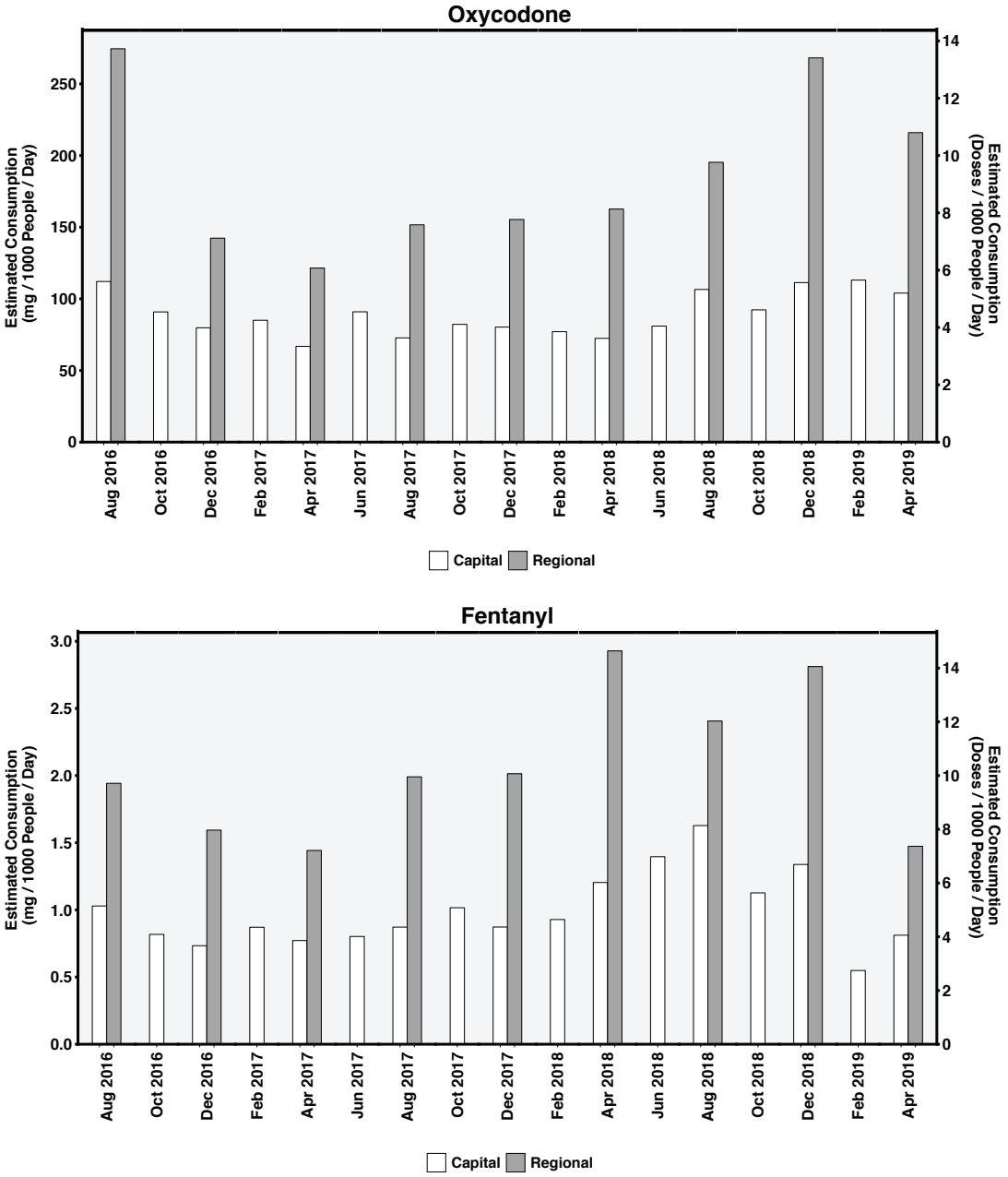
Figure 39: The population-weighted average of all sites for nicotine[7], alcohol, oxycodone and fentanyl.



As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and April 2016 was used to provide the overall October estimate. Regional areas were only sampled every second collection period.

7 Nicotine consumption data have been adjusted to refine the factor used to convert consumed mass load to dose. Overall trends in nicotine consumption remain unchanged.

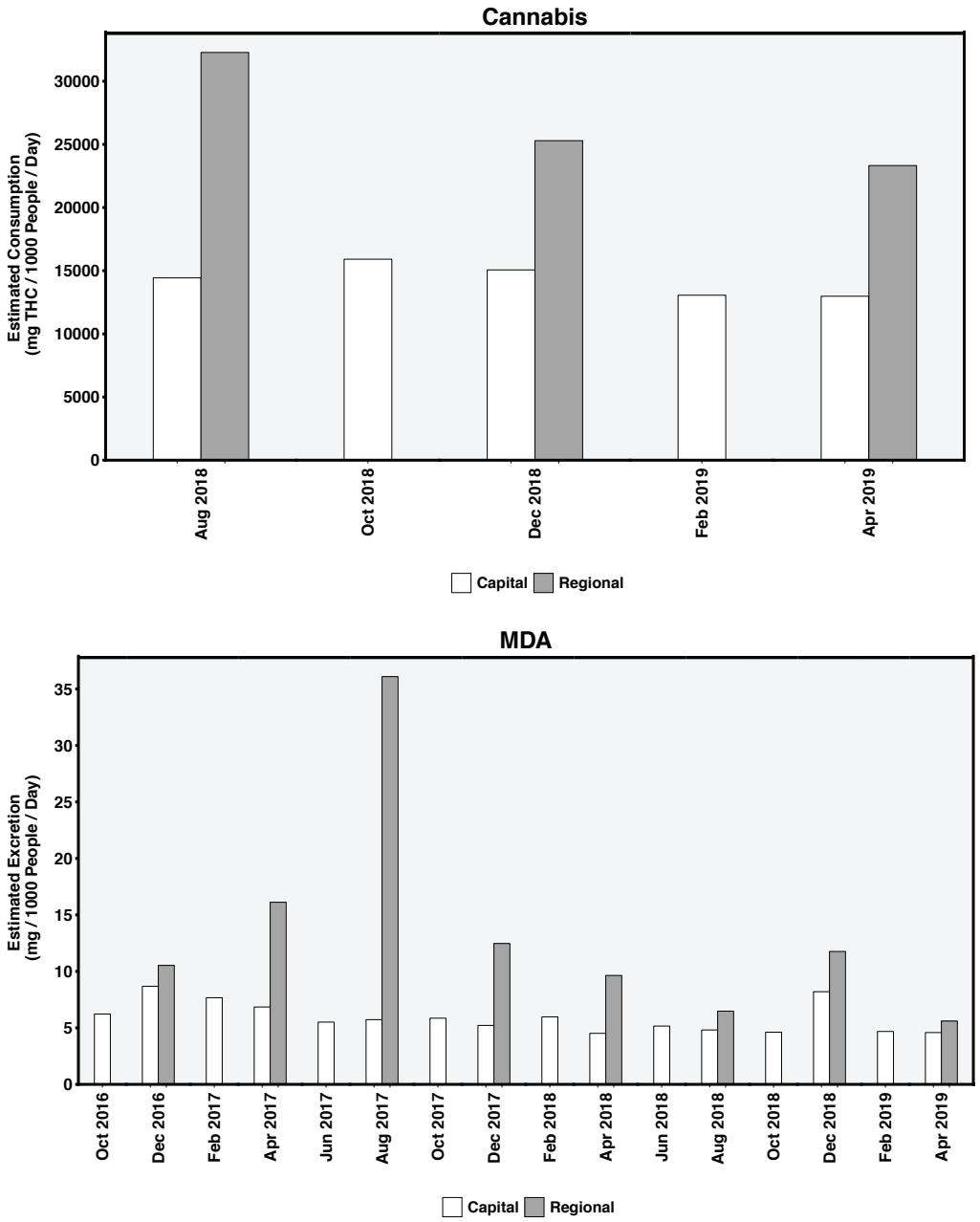
Figure 39 (continued): The population-weighted average of all sites for nicotine[7], alcohol, oxycodone and fentanyl.



As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and April 2016 was used to provide the overall October estimate. Regional areas were only sampled every second collection period.

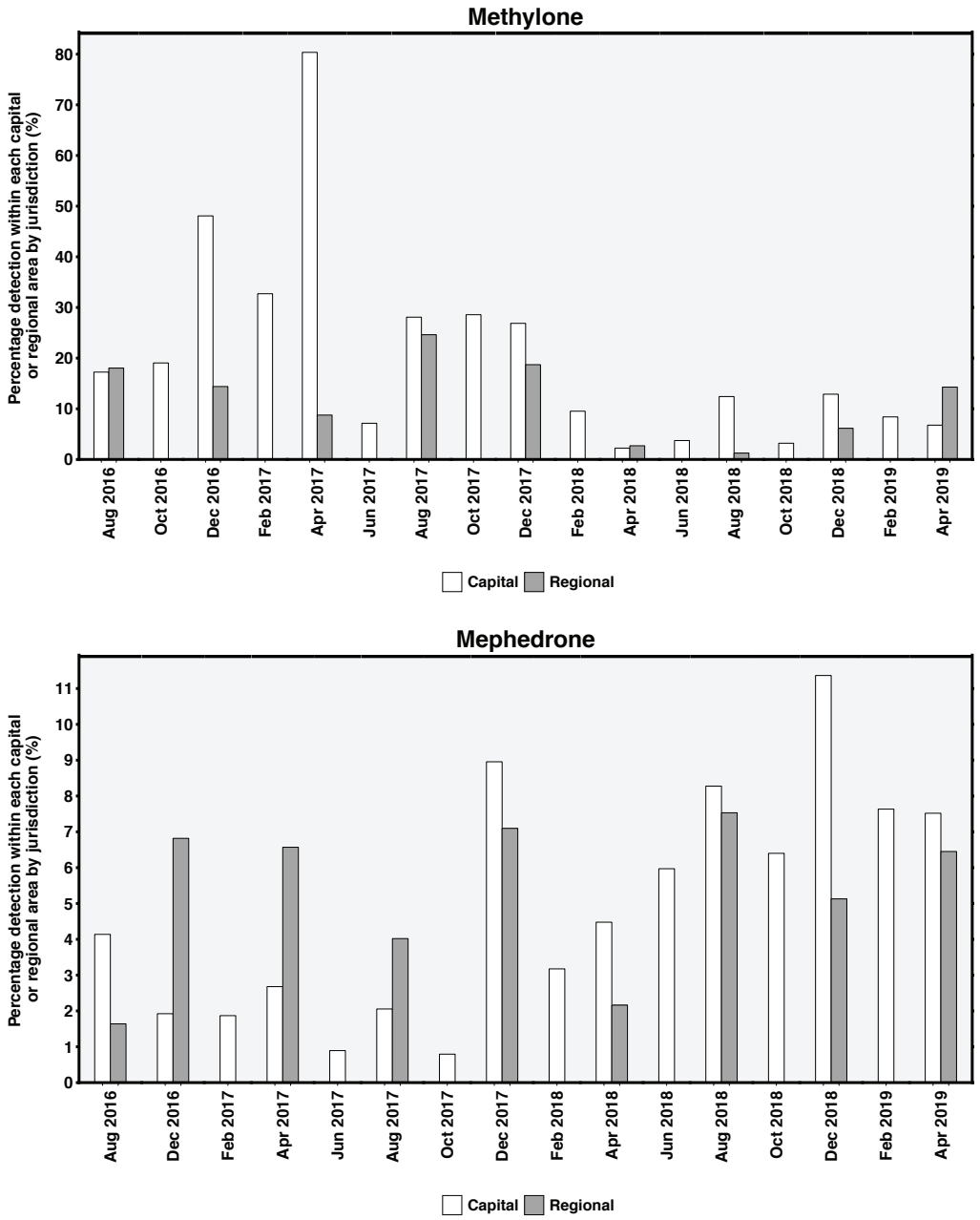
7 Nicotine consumption data have been adjusted to refine the factor used to convert consumed mass load to dose. Overall trends in nicotine consumption remain unchanged.

Figure 40: The population-weighted average of all sites for cannabis, MDA, methylone and mephedrone.



As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and April 2016 was used to provide the overall October estimate. Regional areas were only sampled every second collection period.

Figure 40 (continued): The population-weighted average of all sites for cannabis, MDA, methylone and mephedrone.



As Queensland and New South Wales capital city sites were not sampled in October 2016, their average consumption in August and April 2016 was used to provide the overall October estimate. Regional areas were only sampled every second collection period.

4.3 DRUG PROFILE FOR EACH STATE AND TERRITORY

For the purpose of comparing 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. Cannabis was omitted from this section since the definition of a typical dose of cannabis is not well defined and has not been included in this or previous reports. In the absence of pharmacokinetic excretion data for MDA, methylone and mephedrone, these compounds were similarly excluded from the section.

When the amount of drug measured in wastewater was normalised for population size and average dose consumed (conversion factors listed in Report 1, and in Appendix 1), alcohol and nicotine remained consistently the highest consumed drugs in all states and territories. For example, the national average consumption of nicotine and alcohol per 1,000 people per day were approximately 1,800 cigarettes per 1,000 people (Figure 4) and 1,300 standard drinks per day per 1,000 (Figure 5), whereas for methylamphetamine, the national average consumption was closer to 49 doses per 1,000 people per day (Figure 8).

Aside from nicotine and alcohol, of the illicit drugs with dose available, methylamphetamine use remained highest of the other drugs included in the report. This was the case across all regions of Australia, with the scale of use of methylamphetamine consistently high for both capital cities and regional sites (Figure 41 and Figure 42). In terms of the profiles of other drugs monitored by the NWDMP (cocaine, MDMA, oxycodone and fentanyl), no other consistent patterns of usage within the different states and territories were observed. The scale of use of oxycodone and fentanyl in Tasmania was much higher than anywhere else, while in New South Wales, the proportion of cocaine was high in the capital city sites. Apart from methylamphetamine, other drugs were present below the national averages in Western Australia.

Figure 41: Profile of average drug consumption by state or territory, for the Australian Capital Territory, New South Wales, Northern Territory and Queensland. 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 average of all time points for respective drugs.

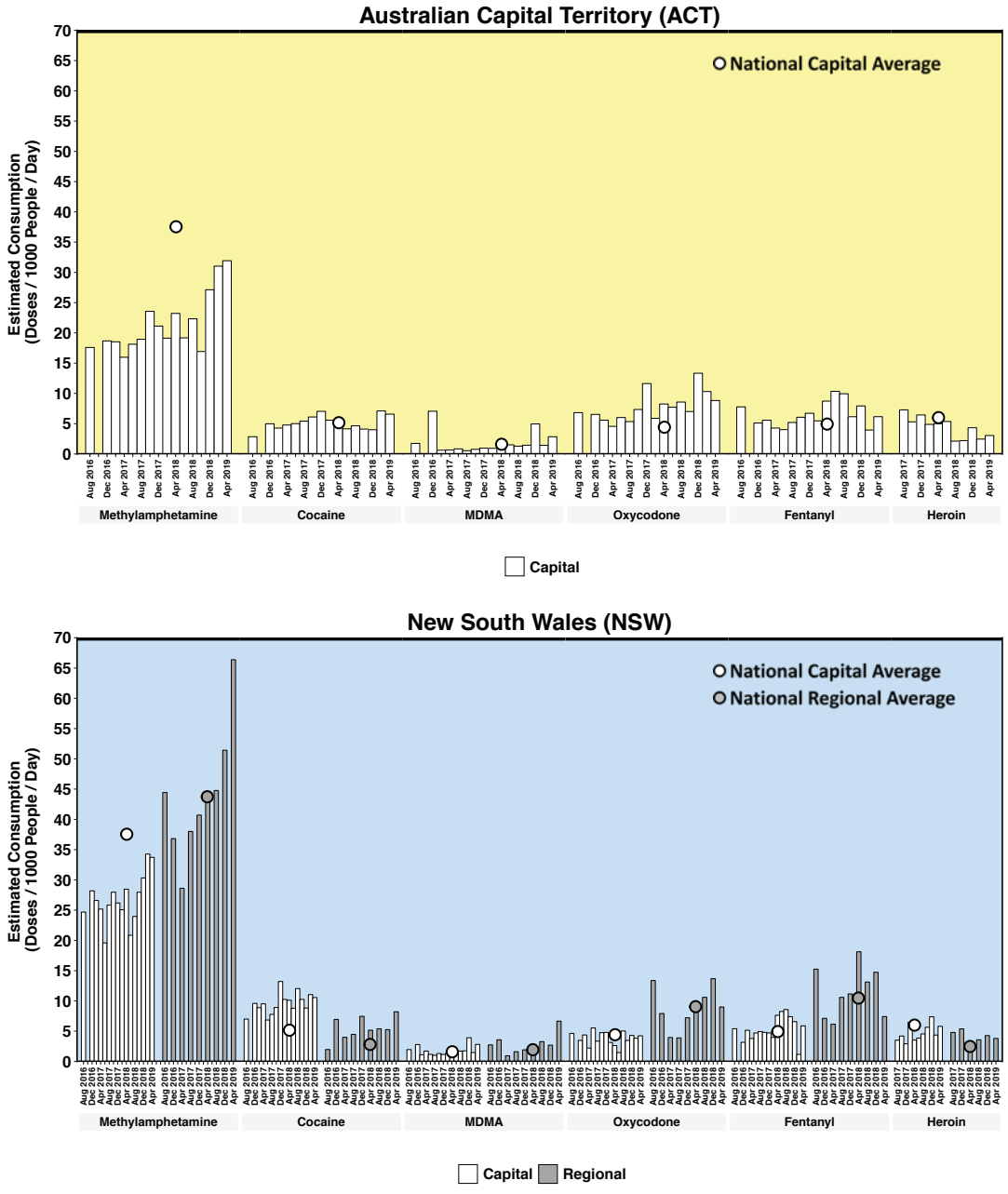
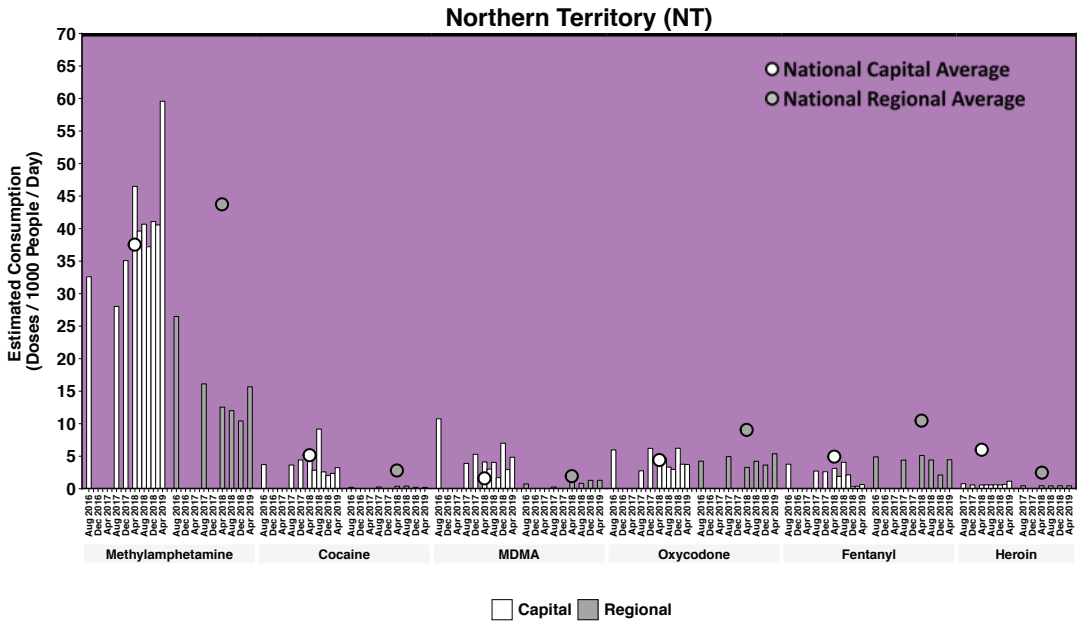


Figure 41 (continued): Profile of average drug consumption by state or territory, for the Australian Capital Territory, New South Wales, Northern Territory and Queensland.



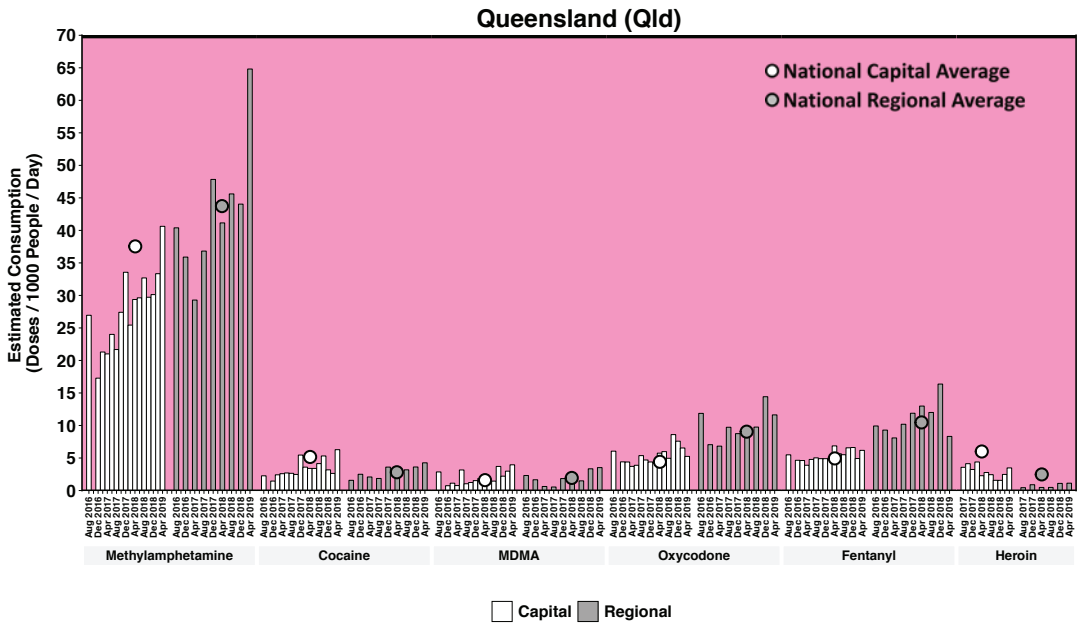


Figure 42: Profile of average drug consumption by state or territory, for South Australia, Tasmania, Victoria and Western Australia. Consumption is shown as the number of doses per 1,000 people per day to allow comparison of drugs of different types within the same region (state or territory). Note: the y axes for South Australia and Western Australia are higher than the other jurisdictions. The circles represent the cumulative average of all time points for respective drugs.

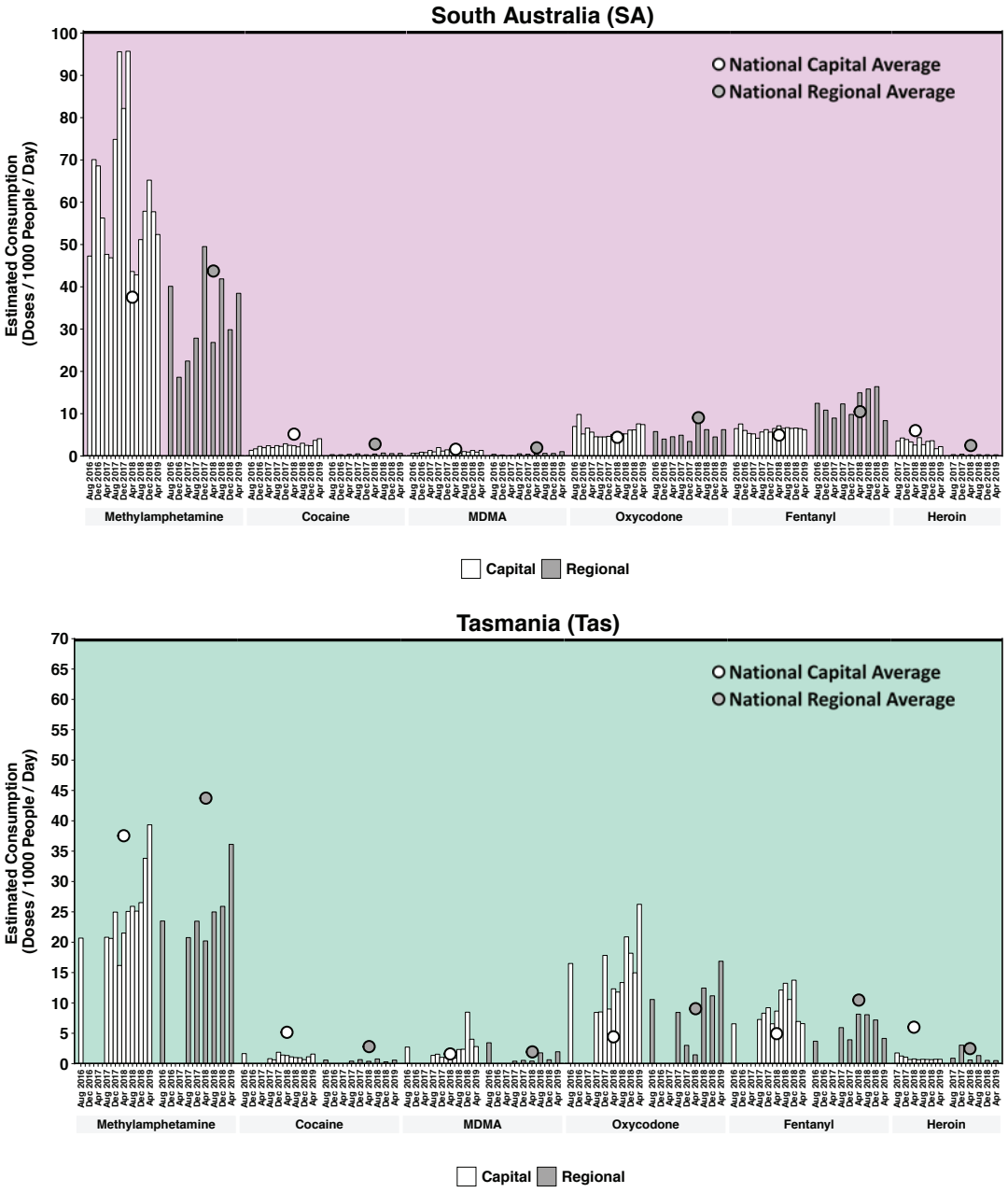
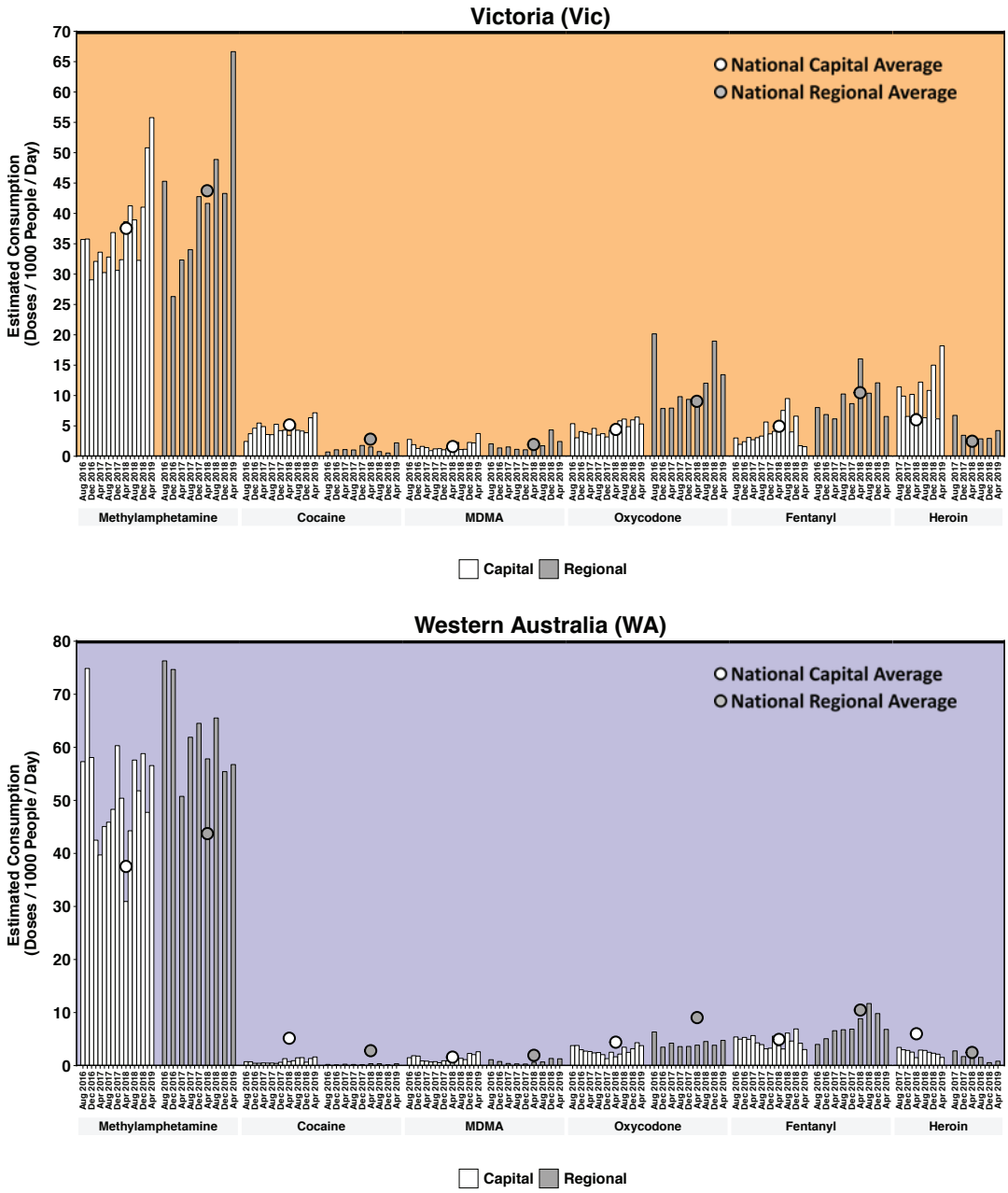


Figure 42 (continued): Profile of average drug consumption by state or territory, for South Australia, Tasmania, Victoria and Western Australia.



5: ACKNOWLEDGEMENTS

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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]
Mephedrone	Mephedrone	0.4	0.8	n.a.	n.a.
Methylamphetamine	Methylamphetamine	33	100	0.39[g]	30[b]
Methylone	Methylone	0.01	0.1	n.a.	n.a.
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.

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.

APPENDIX 2: SAMPLING DETAILS OF EACH SITE

Sampling details of each wastewater treatment plant for February and April 2019.[8]

Site Code	Capital/Regional	# Samples Feb 19	# Samples Apr 19	Population Category
ACT: 009	Capital	6	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	–	–	30,000 to 150,000
NSW: 071	Capital	–	–	>150,000
NSW: 016	Regional	–	7	30,000 to 150,000
NSW: 025	Regional	–	7	30,000 to 150,000
NSW: 040	Regional	–	–	<30,000
NSW: 051	Regional	–	–	<30,000
NSW: 068	Regional	–	7	>150,000
NSW: 081	Regional	–	–	<30,000
NSW: 115	Regional	–	7	30,000 to 150,000
NT: 010	Capital	7	7	30,000 to 150,000
NT: 078	Regional	–	6	<30,000
QLD: 002	Capital	7	7	>150,000
QLD: 005	Capital	5	7	>150,000
QLD: 011	Capital	7	7	>150,000
QLD: 012	Regional	–	7	>150,000
QLD: 020	Regional	–	–	<30,000
QLD: 024	Regional	–	7	30,000 to 150,000
QLD: 028	Regional	–	7	30,000 to 150,000
QLD: 029	Regional	–	–	30,000 to 150,000
QLD: 033	Regional	–	7	30,000 to 150,000
QLD: 039	Regional	–	–	<30,000
QLD: 042	Regional	–	7	30,000 to 150,000
QLD: 053	Regional	–	7	<30,000
QLD: 077	Regional	–	7	<30,000
QLD: 092	Regional	–	–	<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	–	6	<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

8 Sampling details of each wastewater treatment plant for the previous collection periods are available in Report 7, Appendix 2 and Report 6, Appendix 3.

APPENDIX 2 (CONTINUED): SAMPLING DETAILS OF EACH SITE

Sampling details of each wastewater treatment plant for February and April 2019.[8]

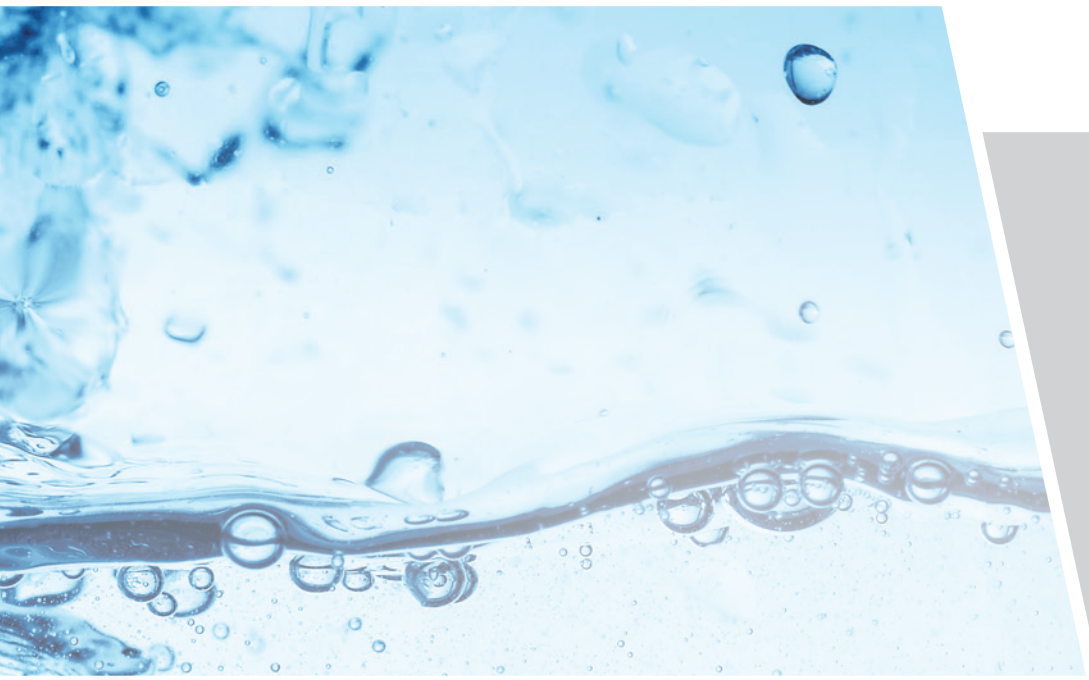
Site Code	Capital/Regional	# Samples Feb 19	# Samples Apr 19	Population Category
TAS: 004	Capital	5	5	<30,000
TAS: 019	Capital	5	5	<30,000
TAS: 041	Capital	5	5	<30,000
TAS: 018	Regional	–	5	<30,000
TAS: 038	Regional	–	–	<30,000
TAS: 048	Regional	–	5	<30,000
TAS: 058	Regional	–	–	<30,000
VIC: 001	Capital	7	7	>150,000
VIC: 067	Capital	7	7	>150,000
VIC: 037	Regional	–	7	>150,000
VIC: 046	Regional	–	–	30,000 to 150,000
VIC: 061	Regional	–	7	30,000 to 150,000
VIC: 062	Regional	–	–	<30,000
VIC: 066	Regional	–	7	30,000 to 150,000
VIC: 114	Regional	–	7	30,000 to 150,000
VIC: 121	Regional	–	7	<30,000
VIC: 122	Regional	–	7	<30,000
VIC: 123	Regional	–	7	<30,000
VIC: 124	Regional	–	7	<30,000
VIC: 125	Regional	–	7	30,000 to 150,000
WA: 101	Capital	7	7	>150,000
WA: 103	Capital	7	6	>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: 118	Regional	–	–	<30,000
WA: 120	Regional	–	7	30,000 to 150,000
WA: 129	Regional	–	6	<30,000
Total Days		131	350	**Total samples Feb & Apr 2019: 481**
Total Capital		20	20	
Total Regional		0	32	**Grand total number of samples Report 1–8: 3,741**
Total Sites		20	52	

8 Sampling details of each wastewater treatment plant for the previous collection periods are available in Report 7, Appendix 2 and Report 6, Appendix 3.

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

The proportion of samples that each drug was detected above LOD. Note: regional sites are only sampled every second period.

		Drug detections % (Above LOD)																
		Aug 2016	Oct 2016	Dec 2016	Feb 2017	Apr 2017	Jun 2017	Aug 2017	Oct 2017	Dec 2017	Feb 2018	Apr 2018	Jun 2018	Aug 2018	Oct 2018	Dec 2018	Feb 2019	Apr 2019
Alcohol	**Capital**	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Alcohol	**Regional**	100	–	100	–	100	–	100	–	100	–	100	–	100	–	100	–	100
Cannabis	**Capital**													100	100	100	100	98
Cannabis	**Regional**													100	–	100	–	100
Cocaine	**Capital**	97	97	96	96	97	96	90	90	95	99	97	99	99	100	99	92	95
Cocaine	**Regional**	45	–	52	–	53	–	53	–	56	–	82	–	77	–	76	–	60
Fentanyl	**Capital**	100	97	100	99	100	100	100	100	100	100	96	100	100	100	100	74	86
Fentanyl	**Regional**	96	–	94	–	99	–	100	–	100	–	100	–	100	–	100	–	98
Heroin	**Capital**							83	92	84	85	76	83	72	76	72	78	65
Heroin	**Regional**							37	–	59	–	22	–	24	–	24	–	31
MDA	**Capital**							98	92	100	100	100	100	100	100	100	100	100
MDA	**Regional**							86	–	95	–	95	–	95	–	93	–	97
MDMA	**Capital**	100	100	100	100	100	96	100	100	100	100	100	100	100	100	100	100	100
MDMA	**Regional**	95	–	96	–	100	–	98	–	100	–	98	–	100	–	100	–	100
Mephedrone	**Capital**	2	–	–	–	–	1	–	1	24	3	4	5	8	4	9	5	6
Mephedrone	**Regional**	–	–	3	–	3	–	1	–	12	–	3	–	3	–	6	–	3
Methylamphetamine	**Capital**	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Methylamphetamine	**Regional**	100	–	100	–	100	–	100	–	100	–	100	–	100	–	100	–	100
Methylone	**Capital**	45	19	47	28	79	7	28	46	59	10	2	4	12	3	13	8	7
Methylone	**Regional**	41	–	14	–	9	–	22	–	22	–	3	–	1	–	7	–	14
Nicotine	**Capital**	100	100	100	100	100	97	100	100	100	100	100	100	100	100	100	100	100
Nicotine	**Regional**	100	–	100	–	100	–	100	–	100	–	100	–	100	–	100	–	100
Oxycodone	**Capital**	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Oxycodone	**Regional**	100	–	100	–	100	–	100	–	100	–	100	–	100	–	100	–	100



CONCLUSIONS

CONCLUSIONS

For the eighth report of the National Wastewater Drug Monitoring Program, wastewater analysis was conducted in February and April 2019, with record consumption levels reported across a number of drug types. The program has identified variations in patterns of drug consumption, both 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.[9]

METHYLAMPHETAMINE

When comparing data for December 2018 and April 2019, the population-weighted average consumption of methylamphetamine in both capital city and regional sites increased to the highest levels recorded by the program. Regional average methylamphetamine consumption continues to exceed capital city average consumption. The Northern Territory[10] had the highest estimated average capital city consumption of methylamphetamine in April 2019, while Victoria had the highest estimated average regional consumption.

COCAINE

When comparing data for December 2018 and April 2019, the population-weighted average consumption of cocaine in both capital city and regional sites increased to the highest levels recorded by the program. Capital city average cocaine consumption continues to exceed regional average consumption. New South Wales had the highest estimated average capital city and regional consumption of cocaine in April 2019.

3,4-METHYLENEDIOXYMETHYLAMPHETAMINE (MDMA)

When comparing data for December 2018 and April 2019, the population-weighted average consumption of MDMA in both capital city and regional sites increased to the highest levels recorded by the program. Regional average MDMA consumption continues to exceed capital city average consumption. The Northern Territory[11] had the highest estimated average capital city consumption of MDMA in April 2019, while New South Wales had the highest estimated average regional consumption.

9 Throughout this report, all comparisons on the consumption of different drugs are based on doses consumed rather than drug mass.
10 As the Northern Territory only had two participating sites, results may not be representative of the Territory as a whole.
11 Ibid.

3,4-METHYLENEDIOXYAMPHETAMINE (MDA)

MDA is a metabolite of MDMA. When comparing data for December 2018 and April 2019, MDA excretion decreased in both capital city and regional sites to the lowest levels recorded by the program. Regional average MDA excretion continues to exceed capital city estimated excretion. Tasmania had the highest estimated capital city excretion of MDA in April 2019, while Queensland had the highest estimated average regional excretion.

HEROIN

When comparing data for December 2018 and April 2019, the population-weighted average consumption of heroin in both capital city and regional sites increased, with average capital city consumption in April 2019 the highest level recorded by the program. Capital city average heroin consumption continues to exceed regional average consumption. Victoria had the highest estimated average capital city and regional consumption of heroin in April 2019.

CANNABIS

The program began measuring cannabis consumption in August 2018. When comparing data for December 2018 and April 2019, the population-weighted average consumption of cannabis in both capital city and regional sites decreased. Regional average cannabis consumption continues to exceed capital city consumption. Tasmania had the highest estimated average capital city consumption of cannabis in April 2019, while South Australia had the highest estimated average regional consumption.

OXYCODONE

When comparing data for December 2018 and April 2019, the population-weighted average consumption of oxycodone decreased in both capital city and regional sites. Oxycodone consumption levels remain high, particularly in regional areas, with regional average oxycodone consumption continuing to exceed capital city average consumption. Tasmania had the highest estimated average capital city and regional consumption of oxycodone in April 2019.

FENTANYL

When comparing data for December 2018 and April 2019, the population-weighted average consumption of fentanyl decreased in both capital city and regional sites. Regional average fentanyl consumption continues to exceed capital city average consumption. Tasmania had the highest estimated average capital city consumption of fentanyl in April 2019, while Queensland and South Australia had the highest estimated average regional consumption.

NICOTINE

When comparing data for December 2018 and April 2019, the population-weighted average consumption of nicotine increased in both capital city and regional sites. Average nicotine consumption in regional sites continues to exceed capital city average consumption. The Northern Territory[12] had the highest estimated average capital city and regional consumption of nicotine in April 2019.

ALCOHOL

When comparing data for December 2018 and April 2019, the population-weighted average consumption of alcohol remained relatively stable in capital city sites and increased in regional sites. Average alcohol consumption in regional sites exceeded capital city average consumption. The Northern Territory[13] had the highest estimated average alcohol consumption in both capital city and regional sites in April 2019.

MEPHEDRONE

Consistent with previous reporting periods, mephedrone was mostly detected below the level at which it could be reliably quantified. The number of national detections of mephedrone decreased, from 25 in December 2018 to 24 in April 2019, with the number of detections in capital city sites exceeding the number of detections in regional sites. The number of sites where mephedrone was detected increased, from 5 in December 2018 to 8 in April 2019. Mephedrone was detected in New South Wales, Queensland and South Australia, with New South Wales reporting the highest number of detections in April 2019.

METHYLONE

Consistent with previous reporting periods, methylone was mostly detected below the level at which it could be reliably quantified. The number of national detections of methylone increased, from 26 in December 2018 to 40 in April 2019, with the number of detections in regional sites exceeding the number of detections in capital city sites. The number of sites where methylone was detected increased, from 9 in December 2018 to 11 in April 2019. Methylone was detected in New South Wales, Queensland and Victoria, with Queensland reporting the highest number of detections in April 2019.

12 As the Northern Territory only had two participating sites, results may not be representative of the Territory as a whole.
13 ibid.

NEXT REPORT

The ninth report of the National Wastewater Drug Monitoring Program is scheduled for public release in the first quarter of 2020.