

# Kangaroo harvest quotas for Victoria, 2026

D.S.L Ramsey

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We honour Elders past and present whose knowledge and wisdom has ensured the continuation of culture and traditional practices.

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# **Kangaroo harvest quotas for Victoria, 2026**

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# Summary

## Context:

In Victoria, grey kangaroos (Eastern Grey Kangaroo (EGK), *Macropus giganteus* and Western Grey Kangaroo (WGK), *M. fuliginosus*) are commercially harvested under the *Victorian Kangaroo Harvest Management Plan 2024–2028* (KHMP 2024–2028) (DEECA 2023). The KHMP outlines the standards and rules for the commercial harvesting of kangaroos in Victoria and considers relevant State and Commonwealth legislation which dictates that commercial harvesting of wild kangaroos must be sustainable and humane. The KHMP is implemented through the Kangaroo Harvesting Program (KHP), which allows for the ecologically sustainable and humane commercial harvesting of wild grey kangaroo populations in the state.

The KHMP provides for the commercial harvest of grey kangaroos in designated harvest zones. To ensure the ecological sustainability of the KHMP, there is a need to recommend a maximum level of take and subsequently set harvest quotas for the KHP. The recommended total take considers both kangaroos harvested commercially under the KHP, and the predicted number of grey kangaroos permitted to be controlled within each harvest zone through the Authority to Control Wildlife (ATCW) permit system under the *Wildlife Act 1975*. This ensures that the total take does not exceed the ecologically sustainable criteria recommended in Scroggie and Ramsey (2020).

## Aims:

The aim of this project was to use the results of the most recent aerial survey, undertaken in 2024, to determine the recommended maximum total take of EGKs and WGKs for the 2026 calendar year, and to apportion the total between the commercial KHP program and the numbers predicted to be controlled under ATCW permits.

## Methods:

The total numbers of kangaroos taken under both ATCW permits and the KHP during 2025 were tallied with the totals imputed for the last month of the year. The maximum recommended take (ATCW and KHP combined) for 2026 was specified as 10% of the population of kangaroos in each of five harvest zones, estimated during aerial and ground surveys of the state undertaken in 2024, with separate quotas being calculated for EGKs and WGKs. The numbers of each species expected to be controlled in each harvest zone during 2026 under ATCW permits were then forecast from historical ATCW permit data (2002–2025) using time-series modelling. The KHP quota was then calculated by subtracting the predicted ATCW numbers from the total recommended take. Where the predicted ATCW numbers exceeded the total recommended take for a harvest zone, the corresponding KHP quota was set to zero for that zone.

## Results:

The total take of grey kangaroos during the 2025 calendar year (imputed for the last month) through both the ATCW permit system and the KHP amounted to 257,003 kangaroos, which was approximately 11.1% of the estimated abundance for 2024 and greater than the recommended 10% total take designated under the KHMP. The total recommended take for 2026 across the five harvest zones was set at 21,100 WGKs and 186,700 EGKs (a total of 207,800 grey kangaroos). The corresponding total number of grey kangaroos forecast to be controlled under the ATCW permit system for the 2026 calendar year was 102,100 EGKs and 11,100 WGKs, comprising approximately 55% and 53% respectively of the recommended total take. After subtracting the number forecast to be taken under ATCW permits for each harvest zone, the 2026 commercial KHP quota allocation of grey kangaroos was 95,450, including 84,600 EGKs and 10,850 WGKs.

## Conclusions and implications:

Numbers of kangaroos of both species controlled under ATCW permit provisions during 2025 were tracking to be the highest on record, likely driven by drought conditions over much of western Victoria. Highest proportional take included EGKs in the Grampians zone (16%) and WGKs in the Loddon Mallee zone (21%). Although a single year where the total take is above the recommended maximum may not have any detrimental long-term effects, continued take at levels greater than 15% of the estimated population is not considered sustainable and risks driving populations in these zones to unacceptably low levels. The next aerial and ground survey of kangaroos is scheduled for late 2026, which will provide an important update on the status of Victoria's kangaroo population. The total number of grey kangaroos forecast to be taken in 2026

under the ATCW provisions across the five harvest zones is 113,200. If the forecast proves accurate, this will result in approximately 54% of the recommended total take being taken under ATCW permits. This allocation is the first time that forecast number of kangaroos taken under ATCW permits has exceeded the commercial KHP quota. A key purpose for establishing Victoria’s KHP was to provide landholders with an alternative to undertaking their own legal kangaroo control (DEECA 2023). If this purpose is to be achieved, then a review of mechanisms that allows landholders to make greater use of the KHP may be warranted.

Recommended total take, forecast ATCW numbers and KHP commercial quotas for 2026 are given in Table S1 below.

## Recommendations

- We recommend a total take of 186,700 EGKs and 21,100 WGKs for the area covered by the five harvest zones for the KHP and ATCW processes combined. The recommended apportionment between the KHP and ATCW for each harvest zone and the two Grey Kangaroo species is specified in Table S1 below.
- Due to the high levels of take of EGKs in the Grampians Zone and WGKs in the Loddon Mallee zone during 2025, careful management of numbers taken through both ATCW permits and the KHP will be required during 2026 to limit the likelihood of total take exceeding the recommended maximum.
- The total take for each harvest zone should be monitored carefully and KHP quota adjusted progressively during the year to maintain the total take within the 10% recommended maximum across the state.
- Consideration should be given to mechanisms that allow landholders to make greater use of commercial harvesters to achieve kangaroo control through the KHP, rather than relying on the ATCW permit process.

**Table S1. Recommended total take of grey kangaroos, the forecast number of Authority To Control Wildlife (ATCW) permits and the corresponding number recommended for harvest under the Kangaroo Harvesting Program (KHP). EGK = Eastern Grey Kangaroo and WGK = Western Grey Kangaroo).**

Zone	Species	Allowable total take	Forecast ATCW	KHP
Barwon South-West	EGK	24,900	12,050	12,850
	WGK	1,200	450	750
Grampians	EGK	27,300	16,950	10,350
	WGK	11,200	1,100	10,100
Loddon Mallee	EGK	40,800	25,850	14,950
	WGK	8,700	9,550	0
Hume	EGK	77,100	41,050	36,050
Gippsland	EGK	16,600	6,200	10,400
<b>TOTAL</b>	<b>EGK</b>	<b>186,700</b>	<b>102,100</b>	<b>84,600</b>
	<b>WGK</b>	<b>21,100</b>	<b>11,100</b>	<b>10,850</b>

# 1 Introduction

Commercial harvesting of kangaroos in Victoria commenced in 2019 with regulatory guidelines outlined in the *Victorian Kangaroo Harvest Management Plan 2024–2028* (KHMP 2024–2028) (DEECA 2023). This plan articulates an intention to undertake ecologically sustainable management of Eastern (*Macropus giganteus*; EGK) and Western Grey Kangaroo (*M. fuliginosus*; WGK) populations in Victoria across five harvest zones. As lethal control is widely used to manage ecological and economic impacts of kangaroos, a key component in the overarching goal of the plan is to ensure harvesting is ecologically sustainable. This is managed by setting the recommended total take at 10% of the estimated total population abundance. There are two legal mechanisms that allow lethal control of kangaroos in Victoria. First, provisions under the *Wildlife Act 1975* (Victoria) allow landholders to apply for a Authority to Control Wildlife (ATCW) permit to undertake legal control of kangaroos on their land where they are causing damage to property, risks to human health or safety or impacts to other biodiversity values. These permits are administered by DEECA's Conservation Regulator. Second, commercial harvesting of Eastern and Western Grey Kangaroos is permitted under the Kangaroo Harvesting Program (KHP). These two mechanisms for permitting lethal control require coordinated management to ensure that total harvest pressure is sustainable.

Scroggie and Ramsey (2019) developed a system for setting quotas based on a policy of the maximum proportion harvested in a given calendar year not exceeding 10% of the total population abundance. The recommended total take (10%) is divided between the five harvest zones and between the two grey kangaroo species in proportion to their total population abundance. Because the total numbers of kangaroos of a given species controlled in each zone includes those taken under both ATCW and KHP processes, the regulatory framework includes mechanisms for apportioning the total take between these two systems. This is achieved by setting a commercial quota for the KHP and using available administrative controls to adjust the KHP quota in light of the numbers controlled under ATCW permits.

The proportional harvest approach to quota-setting leads naturally to a decrease or increase in the number of grey kangaroos harvested as the population decreases or increases. A 10% maximum total take is also considered conservative; other Australian jurisdictions have long permitted harvesting of wild macropod populations at rates of up to 15% (Hacker et al. 2004; McLeod et al. 2004), mostly in more arid and variable climates than prevail in much of Victoria. There is little evidence of negative impacts on the long-term abundances of macropods in these interstate populations. For this reason alone, the sustainability of a 10% rate of harvest in Victoria seems well-supported. The sustainability of the 10% recommended maximum is also supported by population modelling undertaken by Scroggie and Ramsey (2020), which found that harvesting at this rate was unlikely to significantly affect the extinction risk of Victorian grey kangaroo populations.

This report presents an analysis to guide the setting of quotas for the commercial harvest of kangaroos through the KHP for the 2026 calendar year. The analysis is based primarily on estimates for the EGK and WGK populations derived from aerial surveys conducted during September/October 2024. In Victoria, aerial surveys occur every two years and therefore, recommended maximum total take is based on the most recent population estimate. Previous research has identified that the risks of overharvesting using a biennial survey frequency is low in temperate environments such as Victoria, especially when combined with a conservative harvest fraction of 10% (Pople 2008). Additionally, we used historical ATCW permit information to predict the likely numbers of EGKs and WGKs permitted for control under ATCW permits during 2026 and subsequently applied these numbers to adjust the commercial KHP quotas for each of the five harvest zones.

## 2 Methods

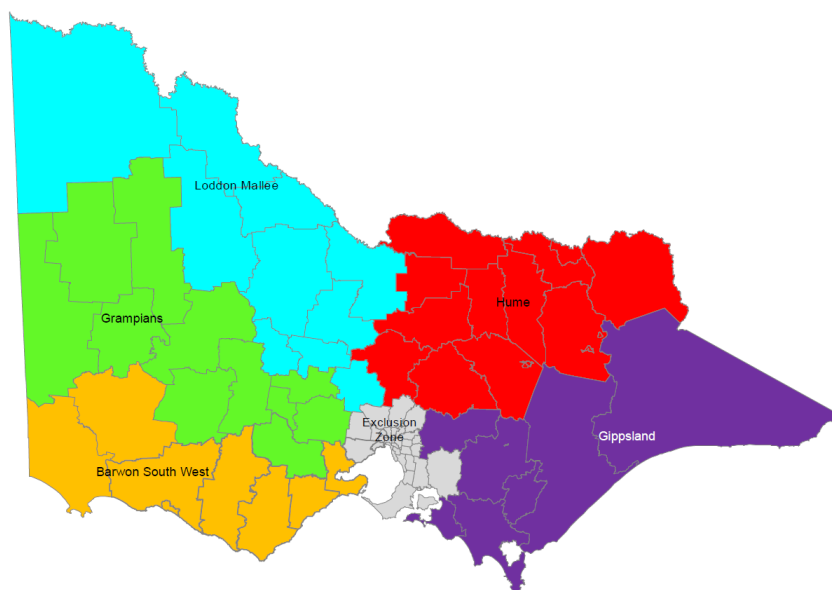
### Kangaroo abundance estimates

In previous years, quota setting has been supported by aerial surveys of grey kangaroos across the entire state, with the exception of highly urbanised areas, and areas with dense forest canopy. Additional ground surveys are also undertaken to assist with apportionment of the total grey kangaroo population between EGKs and WGKs. Full details of those previous aerial surveys are given in Scroggie et al. (2025).

Apportionment of the total grey kangaroo population estimate between EGKs and WGKs is conducted based on a spatial model fitted to simultaneously collected ground survey data for these two species, supplemented with recent data from government wildlife atlas databases (Victorian Biodiversity Atlas and Atlas of Living Australia). These aerial and ground surveys are currently conducted every two years, with the next survey scheduled for last quarter of 2026. Consequently, in this report, we rely on estimates of total abundance for EGKs and WGKs derived from the 2024 aerial and ground surveys to provide a basis for setting ecologically sustainable quotas for 2026 (Scroggie and Moloney 2024b).

### Recommended maximum total take of grey kangaroos for 2026

Abundance estimates for the two grey kangaroo species derived from the 2024 aerial survey were used to set the recommended total take for the forthcoming 2026 calendar year, in each of five harvest zones (Figure 1). The recommended total take was calculated as 10% of the estimated abundance, separately for EGKs and WGKs, in each of the five harvest zones.



**Figure 1. Kangaroo harvest zones for Victoria.**

Current harvest zones adopted from 2025 under the *Victorian Kangaroo Harvest Management Plan 2024–2028* (KHMP 2024–2028). Note the presence of an Exclusion Zone comprising an additional ten LGAs on the periphery of Melbourne where no commercial harvesting will be permitted from 2025 onwards. ATCW control is still permitted in the Exclusion Zone.

### Forecasting numbers of kangaroos to be taken under ATCW permits during 2026

It is not possible to know in advance how many ACTW permits to control grey kangaroos of either species may be granted for a given harvest zone in a forthcoming year, because this is subject to demand for permits from landholders (which is known to vary significantly over time). As in previous quota-setting work, we have adopted the approach of forecasting the likely number of ATCW permits to be granted for the two species of grey kangaroos during the 2026 calendar year based on time-series modelling of historical ATCW permit numbers. Historical ATCW data were provided by the Office of the Conservation Regulator and were available for each KHP harvest zone for the years 2001–2025. ATCW data for 2025 were complete up to the

30 November 2025, with the likely numbers for December (31 days) imputed using the average daily number of permits for each zone before being used in the time-series models.

The time series for each kangaroo species, in each harvest zone was modelled using a hierarchical time-series model. This model assumed a Gaussian distribution for the ATCW numbers, which were first log transformed to ensure the data were approximately normally distributed. The temporal dynamics in ATCW numbers were modelled using a Gaussian process (GP), which accounts for the temporal correlation in the time series data. A GP is a flexible alternative to other autoregressive models, such as Autoregressive Integrated Moving Average (ARIMA) models (Hyndman and Athanasopoulos 2019), because the former can capture complex non-linear dynamics in the time series data. Zone-specific GPs were fitted to the data, using a squared exponential covariance function, by specifying random intercepts for each zone. Other predictors in the model included kangaroo species (EGK/WGK) and the values for a drought index, the Standardised Precipitation–Evapotranspiration Index (SPEI). The SPEI is a drought index that measures the balance between precipitation and potential evapotranspiration over time and helps quantify how dry or wet a region is compared to its long-term climate average (Vicente-Serrano et al. 2010). The SPEI was calculated for each harvest zone for each year between 2001 and 2024, using a three-month moving average calculated by the SPEI package in R (Beguería and Vicente-Serrano 2013). We then lagged the SPEI by one year for use in the model. The fitted model was then used to forecast the likely ATCW uptake for the 2026 calendar year for both EGKs and WGKs in each harvest zone. For these predictions, we assumed that the SPEI was close to its long-term average for each zone (i.e. near ‘normal’ conditions). The model was fitted in a Bayesian framework using the brms package in R (Buerkner 2015). The adequacy of the fitted model was checked by calculating posterior predictive distributions comparing predicted and observed summaries of the data (Gelman et al. 1996).

Although these forecasts provide some indication of the level of ATCW uptake during 2026, there is still a risk that actual ATCW numbers might exceed the forecast, due to unforeseen circumstances not accounted for in the modelling. This may occur in one or more harvest zones. In this situation, decision-makers should, by necessity, reduce the commercial KHP quota for the affected zone to reduce the likelihood of the total take exceeding the 10% recommended maximum.

## **KHP harvest quotas for 2026**

Once the predicted number of EGKs and WGKs permitted for control under ATCW permit provisions was forecast for 2026, the recommended maximum total take of both WGKs and EGKs for 2026 was apportioned between the predicted ATCW numbers and the KHP by subtracting the predicted ATCW numbers from the total take, separately for each harvest zone.

### 3 Results

#### Total take of grey kangaroos during 2025

The total take of grey kangaroos during the 2025 calendar year (imputed for December) through both the ATCW permit system and the KHP for each harvest zone amounted to 257,003 kangaroos, which was approximately 11.1% of the estimated abundance for 2024 and greater than the recommended 10% total proportional take (Table 1). Total percentage take of both EGKs and WGKs were 11.2% and 10.6%, respectively (Table 1). In addition, the total take for some species in particular harvest zones, were relatively high (16% for EGKs in the Grampians zone and 21% for WGKs in the Loddon Mallee zone) (Table 1). Overall, the total take of kangaroos exceeded the recommended maximum of 10% for every harvest zone, with the exception of WKGs in the Barwon South-West and Grampians zones (Table 1). It should be noted that the numbers reported for 2025 are imputed for the last month of the year and therefore, are likely to change when the final annual numbers become available.

**Table 1. Take of kangaroos from the Kangaroo Harvesting Program (KHP) and Authority to Control Wildlife (ATCW) permit process for the 2025 calendar year, and the estimated total take as a percentage (%) of the 2024 kangaroo abundance.**

The take for both ATCW and KHP was imputed for the last quarter of the 2025 calendar year. Percent take greater than the recommended 10% are highlighted in bold. EGK = Eastern Grey Kangaroo and WGK = Western Grey Kangaroo.

Zone	Species	ATCW	KHP	Quota	Total	%
Barwon South-West	EGK	20,950	7,525	24,900	28,475	<b>11.4</b>
	WGK	382	60	1,200	442	3.7
Grampians	EGK	33,466	11,124	27,300	44,590	<b>16.3</b>
	WGK	1,244	2,126	11,200	3,370	3
Loddon Mallee	EGK	20,995	20,082	40,800	41,077	<b>10.1</b>
	WGK	18,622	0	8,700	18,622	<b>21.4</b>
Hume	EGK	70,240	29,056	77,100	99,296	<b>12.9</b>
Gippsland	EGK	13,144	7,987	16,600	21,131	<b>12.7</b>
<b>Total</b>	<b>EGK</b>	<b>158,796</b>	<b>75,774</b>	<b>186,700</b>	<b>234,570</b>	<b>11.2</b>
<b>Total</b>	<b>WGK</b>	<b>20,248</b>	<b>2,186</b>	<b>21,100</b>	<b>22,434</b>	<b>10.6</b>

#### Recommended total take for grey kangaroos for 2026

Abundance estimates derived from the 2024 aerial and ground surveys are given in Table 2. These estimates also include the Exclusion Zone, to allow comparison with total population estimates made in previous years. Separate estimates are derived for each species and each harvest zone. Across the entire area surveyed, the estimated total abundance for both grey kangaroo species combined was 2.31 million (95% CI: 1.95–2.79 million) (Scroggie and Moloney 2024a; Scroggie and Moloney 2024b).

**Table 2. Estimated abundances of grey kangaroos for the five harvest zones and the Exclusion Zone.**

Abundances were estimated from aerial and ground surveys undertaken during 2024. SE – standard error, LCL, UCL – lower and upper 95% confidence intervals of the estimates. The estimates are rounded to the nearest 1,000 kangaroos. EGK = Eastern Grey Kangaroo and WGK = Western Grey Kangaroo. No estimate for WGK is provided for zones where this species is absent (Gippsland, Hume, Exclusion Zone).

Zone	Species	Estimate	SE	LCL	UCL
Barwon South-West	EGK	249,000	43,423	180,000	337,000
	WGK	12,000	3,189	7,000	19,000
Grampians	EGK	273,000	41,936	204,000	366,000
	WGK	112,000	22,983	75,000	164,000
Loddon Mallee	EGK	408,000	75,486	286,000	572,000
	WGK	87,000	16,186	59,000	123,000
Hume	EGK	771,000	104,702	583,000	993,000
Gippsland	EGK	166,000	29,300	116,000	226,000
Exclusion Zone	EGK	228,000	69,188	135,000	393,000
<b>TOTAL</b>	EGK	2,094,000	199,547	1,758,000	2,545,000
	WGK	212,000	32,514	156,000	281,000

Based on the population estimates provided in Table 2, we calculated the recommended maximum total take (ATCW+KHP) for each species and harvest zone (Table 3). These are simply calculated as 10% of the total estimated abundance. No recommended total take for WGKs was calculated for the Hume and Gippsland harvest zones, as WGKs are entirely absent from these areas. Since these estimates were derived from the 2024 aerial and ground surveys, they are the same as those used for the 2025 quota estimates (Scroggie and Moloney 2024a).

**Table 3. Recommended maximum total take of grey kangaroos for 2026 in each of the five harvest zones.**

Recommended maximum total takes are set at 10% of the total abundance estimated in 2024 and are rounded to the nearest 50.

Zone	Eastern Grey Kangaroo	Western Grey Kangaroo	Grey Kangaroos Combined
Barwon South-West	24,900	1,200	26,100
Grampians	27,300	11,200	38,500
Loddon Mallee	40,800	8,700	49,500
Hume	77,100	-	77,100
Gippsland	16,600	-	16,600
<b>TOTAL</b>	186,700	21,100	207,800

## Forecast numbers of grey kangaroos predicted to be taken under ATCW permits during 2026

The hierarchical time-series model fitted to historic (2002–2025) ATCW permit data for the two grey kangaroo species from each of the harvest zones was an adequate fit to the data, as judged by posterior predictive distributions comparing predicted and observed summaries of the data (Figure's A1, A2 – Appendix). The conditional  $R^2$ , which considers the variance in the data explained by the model, was 0.89 (95% CI, 0.875–0.907) and the marginal  $R^2$ , which considers the variance explained by the fixed-effects only, was 0.63 (95% CI, 0.29–0.80) indicating the model provided a good fit to the variation in the ATCW numbers.

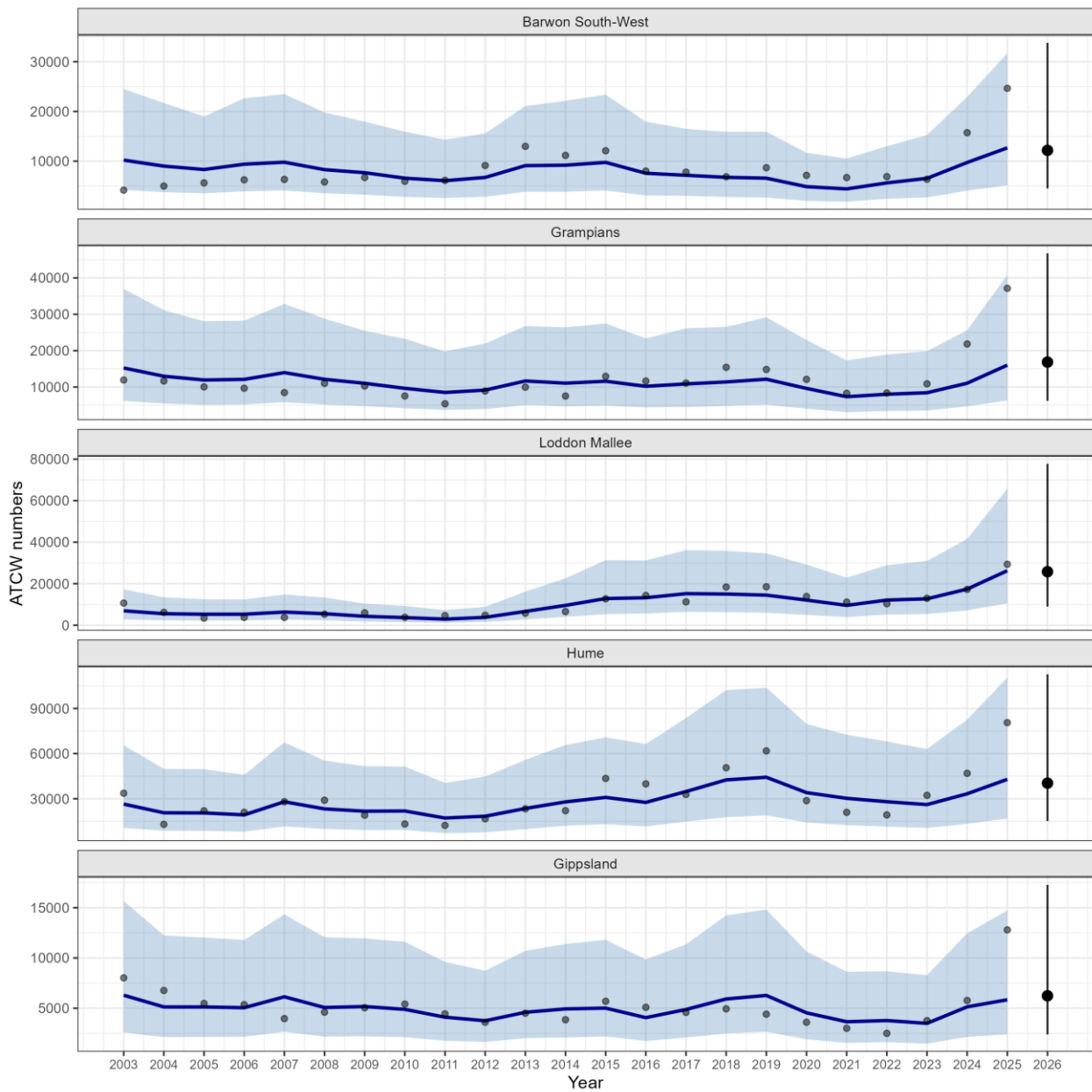
ATCW numbers were significantly, negatively related to the SPEI drought index as well as kangaroo species (Table A1 – Appendix). Consequently, ATCW numbers tended to be higher when drought conditions prevailed during the preceding 12 months. ATCW numbers were also lower for WGKs than EGKs. The fitted model enabled a forecast of ATCW numbers for the 2026 calendar year, using the long-term average SPEI for each zone as well as kangaroo species as the predictors (Table 4). The forecast ATCW values are illustrated alongside the historic data, which cover EGKs and WGKs respectively, and include the forecasts for 2026 (along with 90% credible intervals) (Figures 2 and 3).

ATCW numbers forecast for 2026 were predicted to be 24% and 45% higher than the numbers forecast for 2025 for EGKs and WGKs, respectively (Scroggie and Moloney 2024a). This outcome has been driven by a surge in ATCW permits during the last few years, with the number of kangaroos controlled through ATCW permits during 2025 being the highest on record (Figures 2 and 3).

**Table 4. Forecast Authority to Control Wildlife (ATCW) permit numbers for 2026 for each harvest zone and species.**

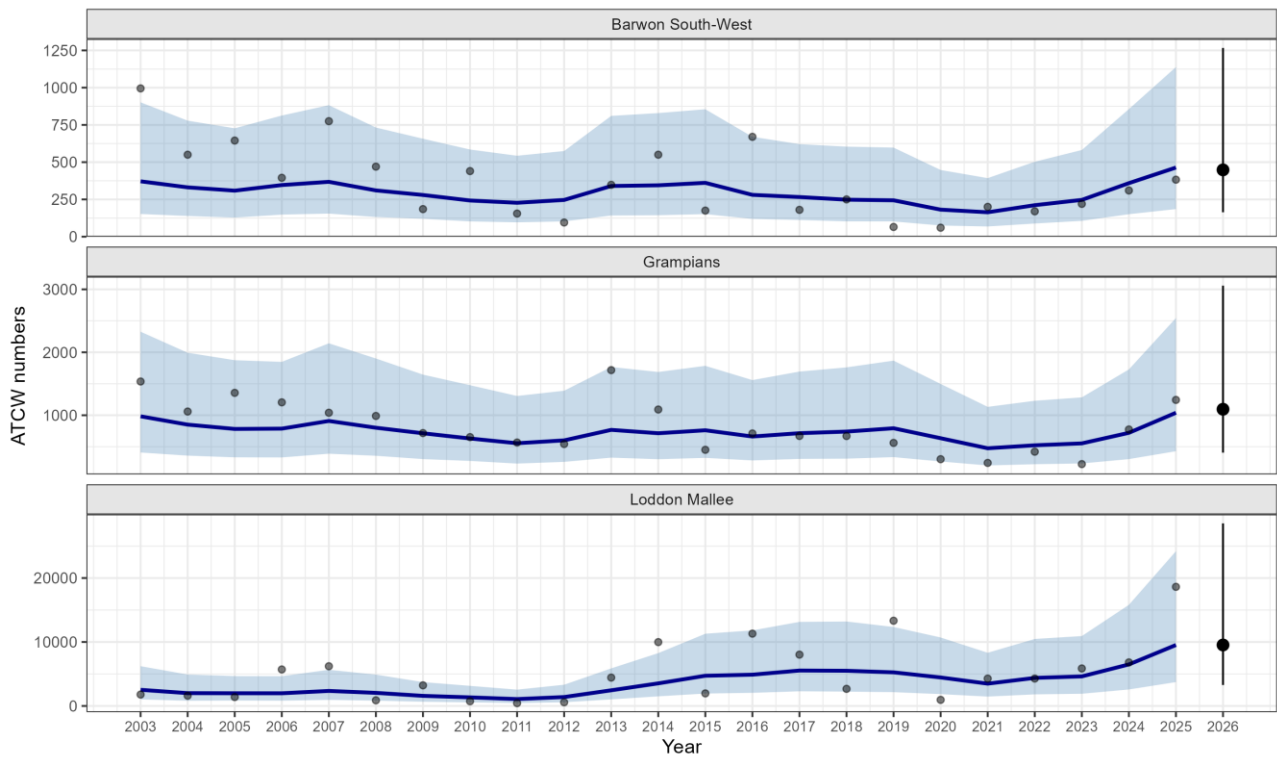
Numbers are rounded to the nearest 50 kangaroos. LCL – lower 95% confidence limit UCL – upper 95% confidence limit. EGK = Eastern Grey Kangaroo and WGK = Western Grey Kangaroo.

Zone	Species	Forecast ATCW	LCL	UCL
Barwon South-West	EGK	12,050	4,500	33,550
	WGK	450	150	1,250
Grampians	EGK	16,950	6,450	46,700
	WGK	1,100	400	3,050
Loddon Mallee	EGK	25,850	8,900	74,450
	WGK	9,550	3,300	28,550
Hume	EGK	41,050	15,750	111,700
Gippsland	EGK	6,200	2,350	17500



**Figure 2. Time series of Eastern Grey Kangaroos controlled under Authority to Control Wildlife (ATCW) permits for each harvest zone from 2003 to 2025.**

The predicted ATCW numbers for 2026 (error bars give the  $\pm$  90% confidence intervals) are predicted from the fitted time-series model.



**Figure 3. Time series of Western Grey Kangaroos controlled under Authority to Control Wildlife (ATCW) permits for each harvest zone from 2003 to 2025.**

The predicted ATCW numbers for 2026 ( $\pm$  90% confidence interval) are that predicted by the fitted model.

## Commercial quotas for the Kangaroo Harvest Program 2026

The commercial quotas for the KHP were calculated from the recommended total take (Table 3) and the forecast ATCW estimates (Table 4). After deducting the forecast ATCW totals from the recommended total take, the total number of kangaroos allocated to the KHP was 95,450, comprising 84,600 EGKs and 10,850 WGKs (Table 5). This is the first time that forecast ATCW numbers have exceeded the allocation to the KHP. All harvest zones received some commercial quota allocation with the exception of WGKs in the Loddon Mallee zone, where forecast ATCW was predicted to exceed the recommended total take (Table 5). Consequently, no commercial quota has been allocated for this species in the Loddon Mallee zone.

The proportion of the recommended total take that was allocated to ATCWs varied between 11% for Western Greys in the Grampians zone and 133% for Western Greys in the Loddon Mallee Zone. Overall, we anticipate that 61% and 63% of the recommended total take would be in the form of ATCWs, for EGKs and WGKs, respectively (Table 5).

Policy makers may decide to set the commercial KHP quota for 2026 based on these ATCW forecasts. This is a recommended starting position only, because actual ATCW numbers may track higher or lower as the year progresses. Policy makers will then need to adjust the KHP allocations to reduce the likelihood of the total take exceeding the 10% recommended maximum.

**Table 5. Total allowable total take of grey kangaroos, the forecast number of Authority to Control Wildlife (ATCW) permits and the corresponding number recommended for harvest under the Kangaroo Harvesting Program (KHP).**

ATCW % – ATCW take as a percentage of the recommended total take. Numbers of kangaroos are rounded to the nearest 50. EGK = Eastern Grey Kangaroo and WGK = Western Grey Kangaroo.

Zone	Species	Recommended Total take	Forecast ATCW	KHP	ATCW %
Barwon South-West	EGK	24,900	12,050	12,850	48.4
	WGK	1,200	450	750	37.5
Grampians	EGK	27,300	16,950	10,350	62.1
	WGK	11,200	1,100	10,100	9.8
Loddon Mallee	EGK	40,800	25,850	14,950	63.4
	WGK	8,700	9,550	0	109.8
Hume	EGK	77,100	41,050	36,050	53.2
Gippsland	EGK	16,600	6,200	10,400	37.3
<b>TOTAL</b>	<b>EGK</b>	<b>186,700</b>	<b>102,100</b>	<b>84,600</b>	<b>54.7</b>
	<b>WGK</b>	<b>21,100</b>	<b>11,100</b>	<b>10,850</b>	<b>52.6</b>

## 4 Conclusions

The total take of EGKs and WGKs during 2025 from both the ATCW permit process and the KHP were 12% and 6% greater than the recommended total take, respectively. This total take equated to 11.2% and 10.6% of the total population size of each species, and is greater than the recommended 10% total take designated under the KHMP. It should be noted that the numbers reported for 2025 are imputed for the last month of the year and therefore, are likely to change when the final annual numbers become available.

Based on the numbers to date, kangaroos of both species controlled under ATCW permit provisions during 2025 were the highest on record, most likely driven by drought conditions over much of western Victoria. Species and zones with the highest proportional take included EGKs in the Grampians zone (16%) and WGKs in the Loddon Mallee zone (21%). While a single year of overharvesting may not have detrimental long-term effects, continued lethal control at these levels is not considered sustainable and risks driving populations in these zones to unacceptably low levels (Scroggie and Ramsey 2020). Consequently, the level of kangaroo control undertaken in these zones, in particular, will need careful management going forward, especially if drought conditions continue into 2026.

The next aerial and ground survey of kangaroos is scheduled for late 2026 and should provide important information on the status of Victoria's kangaroo population. Although populations have generally increased since monitoring began in 2017, drought conditions encountered over much of western Victoria during 2025, together with high rates of commercial and ATCW culling may cause declines in kangaroo abundance. The currently adopted approach of setting recommended total take as a proportion of the most recent population size provides a mechanism for limiting the impacts of kangaroo control when the population declines, as does the current policy of undertaking comprehensive aerial surveys of the population every two years.

Forecast total demand for ATCW permits in 2026 across the five harvest zones amounted to a total of 102,100 EGKs and 11,100 WGKs. These forecasts suggest that the numbers of kangaroos controlled under ATCW permits will overall comprise 55% and 53% respectively of the maximum recommended take for the two species. The remaining quota is potentially available for allocation to commercial harvesters under the KHP. The exception to this was for WGKs in the Loddon Mallee zone, where numbers taken under ATCW permits were forecast to be greater than the recommended total take. Therefore, no commercial quota has been allocated for this species in this zone. In any case, actual ATCW numbers in other zones may track higher or lower than forecast as the year progresses, and policy makers will need to adjust the KHP allocations to ensure that the total take does not exceed the recommended maximum for each species, in each zone. Progressive checking of ATCW allocations throughout the calendar year will allow periodic adjustment of the commercial quota to minimise the chances of the total take exceeding the recommended ecologically sustainable criterion of 10% of total abundance.

This is the first time that forecast demand for kangaroos under ATCW permits has exceeded the allocation under the KHP. This has been driven by a recent surge in ATCW applications and indicates a move to more reliance on the ATCW permit process as the primary means of kangaroo control. The main rationale for the introduction of commercial harvesting was to provide landholders with an alternative mechanism for achieving kangaroo control that should lead to less wastage of carcasses and improved animal welfare outcomes (DEECA 2023). Consequently, policy makers should consider mechanisms that allow landholders to make greater use of commercial harvesters to achieve kangaroo control through the KHP, rather than relying on the ATCW permit process.

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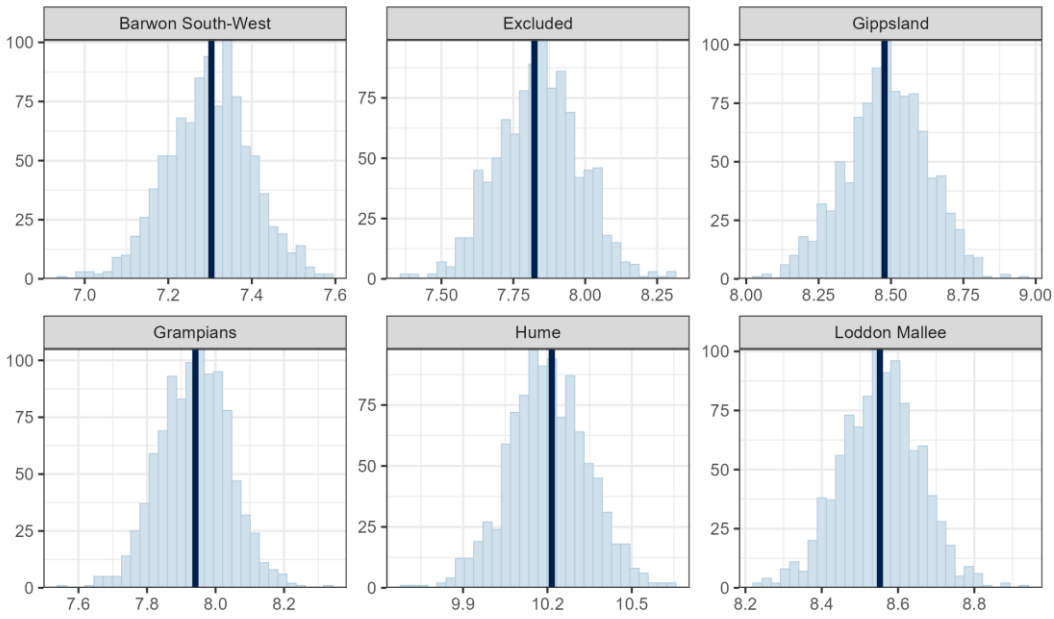
## 6 Appendix

**Table A1. Parameter estimates from the hierarchical Bayesian time-series model fitted to the historical Authority To Control Wildlife (ATCW) numbers for each kangaroo species in each of five harvest zones.**

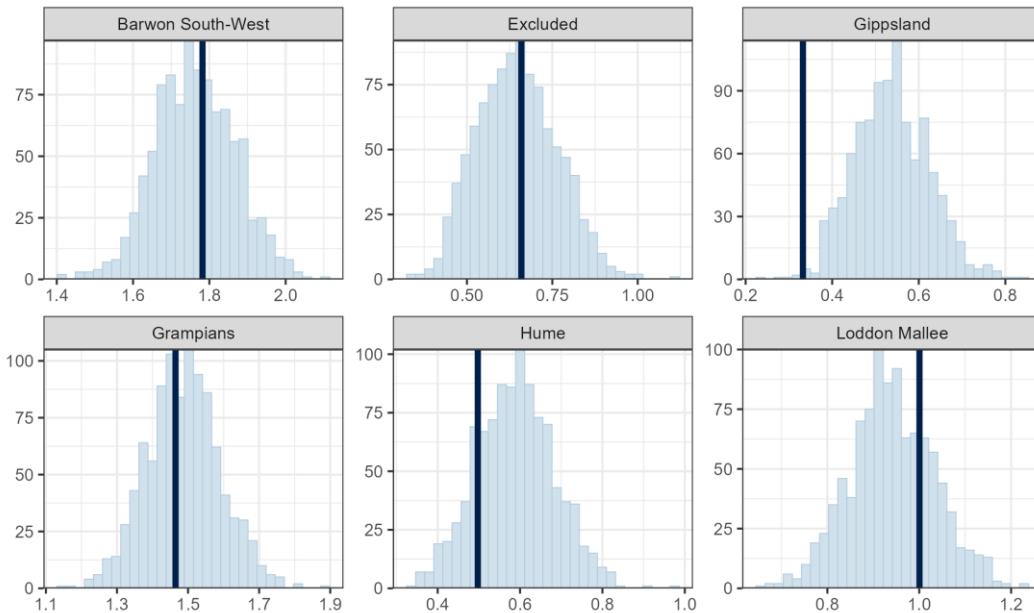
CI – 95% credible interval, Pd – probability of direction, Rhat – MCMC convergence diagnostic, ESS – effective sample size. SD – random-effects standard deviation. WGK = Western Grey Kangaroo.

Parameter	Estimate	95% CI	Pd (%)	Rhat	ESS
<b>Intercept</b>	9.09	7.94, 10.32	100	1.0	2714
<b>SPEI</b>	-0.25	-0.39, -0.11	99.9	1.0	4780
<b>Species (WGK)</b>	-2.30	-4.01, -0.66	99.4	1.0	2712
<b>SD (Zone)</b>	0.54	0.02, 2.10	100	1.0	2020
<b>SD (Zone/Species)</b>	0.90	0.46, 1.98	100	1.0	2437
<b>Residual error</b>	0.49	0.43, 0.55	100	1.0	2390

Observed vs predicted Mean ATCW (log scale)



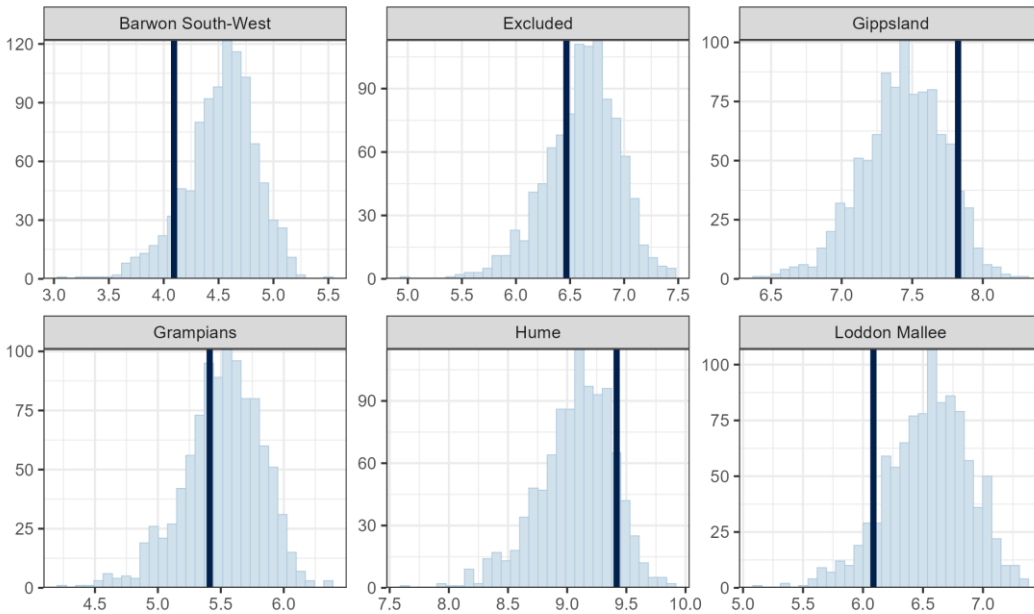
Observed vs predicted SD (log scale)



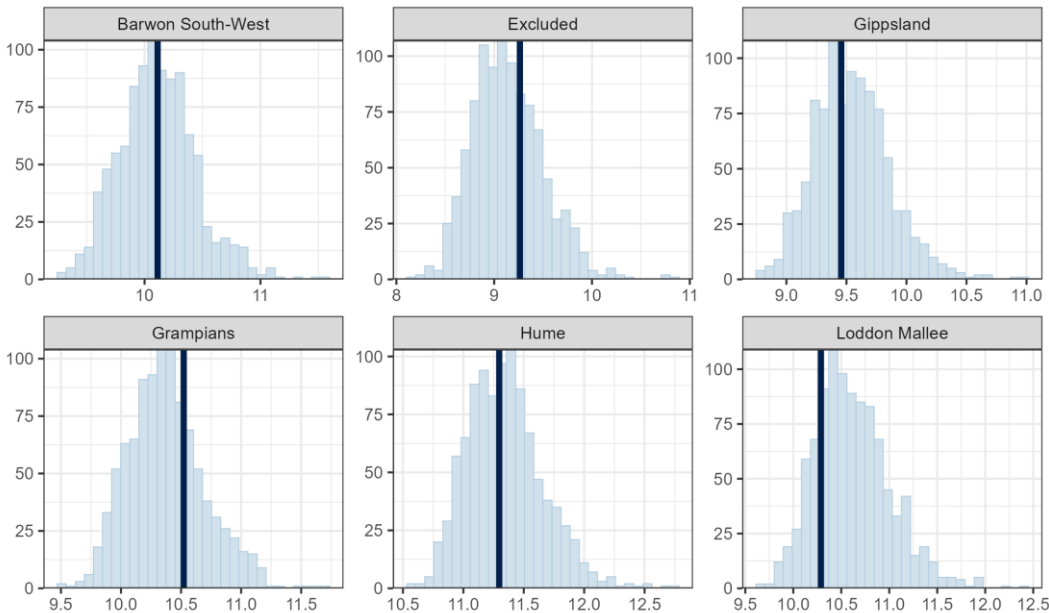
**Figure A1. Posterior predictive checks (Gelman et al. 1996) comparing summary statistics of the Authority To Control Wildlife (ATCW) number (on log scale) predicted by the dynamic multilevel model, with the observed ATCW number for each species in each harvest zone.**

The summary statistics are the mean and standard deviation of the ATCW, on the log scale. Pale-blue histograms give the distribution of the summary statistic predicted by the model and dark-blue bars give the summary statistic for the observed ATCW statistic.

Observed vs predicted Min ATCW (log scale)



Observed vs predicted Max ATCW (log scale)



**Figure A2. Posterior predictive checks (Gelman et al. 1996) comparing summary statistics of the Authority To Control Wildlife (ATCW) number (on log scale) predicted by the dynamic multilevel model, with the observed ATCW number for each species in each harvest zone.**

The summary statistics are the minimum and maximum ATCW, on the log scale. Pale-blue histograms give the distribution of the summary statistic predicted by the model and dark-blue bars give the summary statistic for the observed ATCW statistic.

