

2023 Quota Report

Commercial Kangaroo Harvest South Australia



**Government
of South Australia**

Department for
Environment and Water

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Scope and Context

Legislation

All kangaroo species in South Australia are protected under the *National Parks and Wildlife Act 1972* (NPW Act), have value in ecosystem processes, and contribute to biodiversity. The NPW Act (section 60G) allows for the sustainable harvest of the following species of kangaroo:

- Red Kangaroo (*Macropus rufus*)
- Western Grey Kangaroo (*M. fuliginosus*)
- Eastern Grey Kangaroo (*M. giganteus*)
- Euro (*M. robustus*)
- Tammar Wallaby (*M. eugenii*)

The wildlife trade provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) regulate the export of kangaroo products from Australia. The harvest and export of these protected species requires a management plan endorsed under the NPW Act, and a Wildlife Trade Management Plan endorsed under the EPBC Act.

As of 1 January 2020, the SA Commercial Kangaroo Management Plan 2020-2024 (Management Plan) was approved by the Minister for Environment and Water under the NPW Act, and approved by the Commonwealth Minister for Environment under the EPBC Act on 13 March 2020.

In accordance with the Management Plan, harvest quotas are set annually for each species of harvested kangaroo. Quotas are detailed in the annual Quota Report endorsed by the Director of National Parks and Wildlife and forwarded to the Australian Department of Climate Change, Energy, the Environment and Water for information. Where quotas are set outside the standard quota parameters detailed in the Management Plan, they must be endorsed in writing by the Commonwealth Department of Climate Change, Energy, the Environment and Water.

This quota report has been developed in accordance with the Management Plan. The quota report provides detail on quota-setting procedures and the Sustainable Use Quotas for five kangaroo species for 2023. It also sets out the Special Land Management Quota for 2023, that may be issued when all Sustainable Use quota has been allocated and land management issues remain. A summary of harvest statistics for 2021 and the incomplete year of 2022 (January-October) are also included in the Report.

Harvest regions used for quota setting

In accordance with the provisions of the Management Plan, annual harvest quotas are based on the results of direct surveys of kangaroo populations or model estimates.

Five harvest regions have been defined in the Management Plan: Western Pastoral, Eastern Pastoral, Western Agricultural, Eastern Agricultural and Southern Agricultural.

The harvest regions contain sub-regions (detailed in Table 1 and Figure 1) primarily based on the administrative boundaries of the former Soil Conservation Board districts (or an amalgamation thereof). Population estimates and commercial quotas for 2023 are derived and set at the harvest sub-region level. Sub-region quotas can be re-distributed within, but not between, each harvest region in response to spatial and temporal changes in kangaroo distribution as per the Management Plan.

Table 1: Kangaroo harvest regions and sub-regions in South Australia

Harvest Region	Harvest Sub-region
Eastern Pastoral	North Flinders
	North East Pastoral
	Eastern Districts
	Mallee
Western Pastoral	Marla-Oodnadatta, Marree (inside dog fence) Marree (outside dog fence) Kingoonya Gawler Ranges
Eastern Agricultural	South Flinders Yorke Mid North
Western Agricultural	Eyre East Eyre West
Southern Agricultural	Hills and Fleurieu Kangaroo Island Upper South East Lower South East

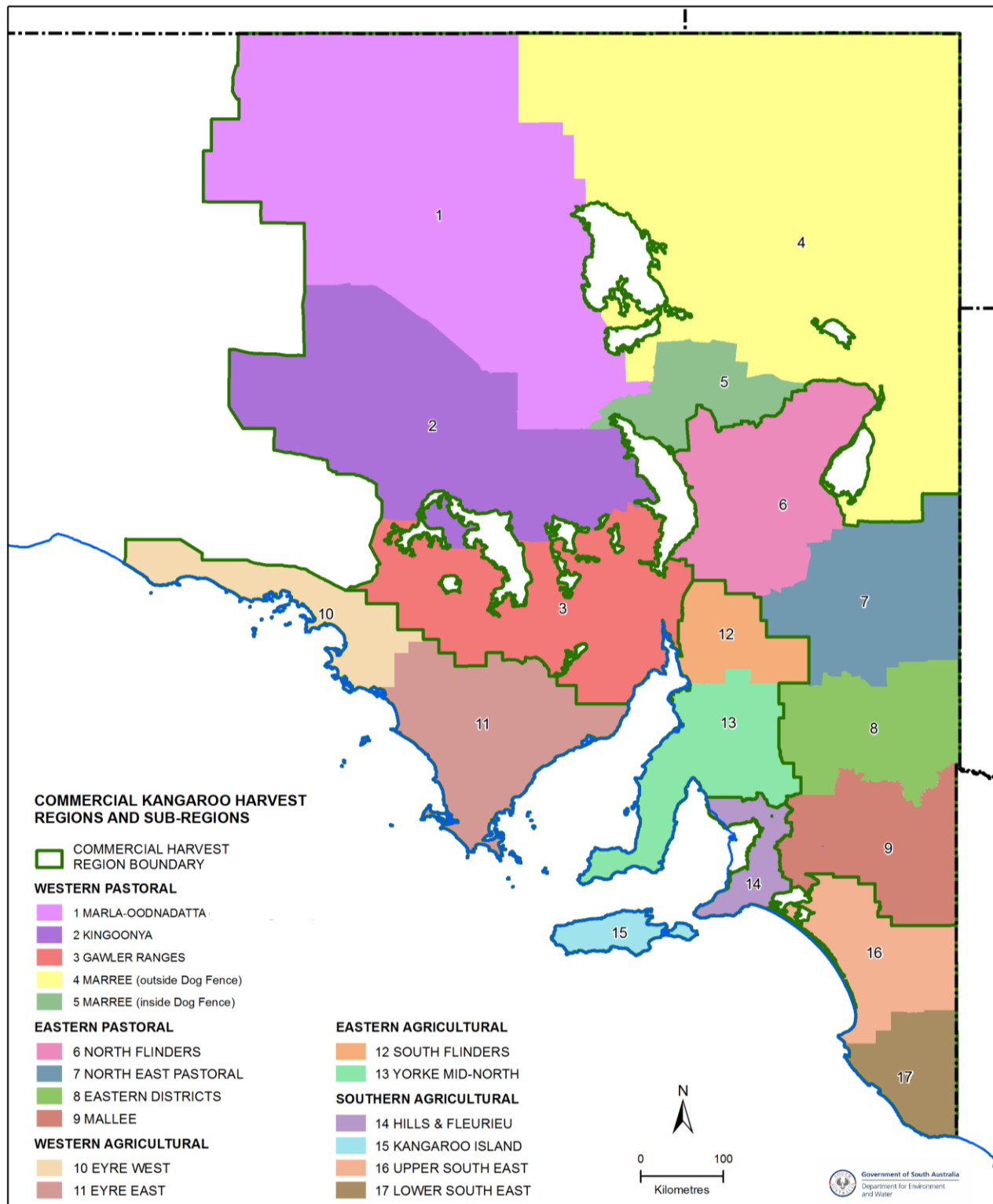


Figure 1: Map of harvest regions and sub-regions of South Australia

Kangaroo monitoring methods

A combination of aerial and ground surveys (walking and driving) were used to survey kangaroo populations across South Australia between May and September 2022. Aerial survey lines have been established at regular intervals across all sub-regions where possible, and the same lines are surveyed at the same time every survey year to allow comparison of results between years. Ground surveys are employed in sub-regions where aerial surveys are considered unsafe, or dense vegetation prohibits observers from effectively counting kangaroos.

Aerial surveys

Aerial surveys for Western Grey and Red Kangaroos have been conducted annually since 1978 using standard transect lines. Surveys are conducted using standard 200m fixed-strip width transect methodology with a fixed-wing aircraft (see Grigg et al. 1999 for further detail). Two observers (one on each side of the aircraft) count kangaroos as the aircraft maintains a speed of 185km/hour (100 knots) and altitude of 76m (250 feet) above the ground. Raw counts are converted to density estimates for each harvest sub-region by applying species specific habitat correction factors.

During May 2022, a low level (250 feet) helicopter survey using mark-recapture line transect distance sampling was conducted in the Lower South East sub-region to develop a more robust population estimate. The helicopter flew east-west transects across 14 blocks that were stratified for land use type. Each block was approximately 100km² in area, with transects spaced 2km apart. Ground surveys were used to develop a ratio of Eastern and Western Grey kangaroos that was then applied to the aerial count as the two species cannot be distinguished in the air.

Ground survey

Two types of ground surveys were used where aerial surveys were not possible; these were driving and walking surveys. Both survey methods used the line transect 'Distance' sampling method (Buckland et al. 2001, Miller 2016). The ground surveys were designed to obtain sufficient data for line transect analyses to typically return results with a coefficient of variance less than 25%. The coefficient of variation represents the dispersion of data around the mean estimate and is explained in more detail under the proportional harvest strategy section in this report.

Walking surveys are generally used to count Euros. The technique aims to assess Euro densities in targeted areas of suitable habitat, such as areas of rocky hilly terrain, within the species' distribution. Typically, a small sample area is surveyed in each harvest sub-region. These localised densities are used to develop regional densities for Euros, by multiplying obtained survey densities by the amount of suitable Euro habitat in each region.

Driving surveys were used in the Hills and Fleurieu, Lower South East and Kangaroo Island sub-regions. Approximately 550km of transect stratified for habitat type and based on public unsealed roads were surveyed once in each sub-region. In the Hills and Fleurieu sub-region approximately 70km of transect was added to replace transects that were removed last year due to safety concerns. In the Hills and Fleurieu and Lower South East sub-regions, the target species were Western Grey Kangaroos and Eastern Grey Kangaroos (Lower South East only); therefore, based on kangaroo activity patterns, transects were surveyed either in the early morning or the late afternoon. Spotlight driving surveys were used on Kangaroo Island to survey the Tammar Wallaby, as this species is mostly active at night.

Kangaroo population models

Spatial population models for Red Kangaroos and Western Grey Kangaroos in established sub-regions (i.e. where long-term data exists) have been used to set quotas since 2021. The population models have been developed in collaboration with Dr Tom Prowse of the University of Adelaide (Prowse, 2021).

Eight sub-regions in the established harvest area (i.e. where long-term data exists) were surveyed during 2022. Direct survey-based population estimates were compared to the model population estimates for these sub-regions (Appendix 1). Where management actions, differed between the two estimates, or the model predictions were outside of the expected bounds (e.g. Yorke Mid North for Red Kangaroos), the most conservative (i.e. lower) population estimate was used. Management actions, such as reducing or suspending quota when population estimates crossed a population threshold, were determined from this conservative estimate. This resulted in the model fitted estimates or predictions being used for all sub-regions in the established harvest area, except for Marree (outside dog fence), and Yorke Mid North for Red Kangaroos.

Quota setting procedures

Proportional harvest strategy

Sustainable Use and Special Land Management Quotas outlined in this report represent a constant proportional harvest strategy for kangaroos in South Australia.

Quotas are set at a maximum of 20% of the estimated population size of Red Kangaroos, 15% of Western Grey Kangaroos, Eastern Grey Kangaroos and Euros, and 10% of Tammar Wallabies.

Conservative quota percentages have been applied to sub-regions that are not surveyed on an annual basis and where a population model does not exist.

Conservative quotas are also applied where the coefficient of variation (CV) associated with the density estimate is greater than 25%. For data with CVs greater than 25%, quotas are reduced by 3% of the standard proportion of the population estimate (e.g. for Euros, quotas are reduced from 15% to 12% of the population estimate) as per the Management Plan.

Some of the variation in the data can be explained by the patchy nature of kangaroos in the landscape, however high levels of variation suggest that there is more uncertainty in the mean estimate. For aerial survey data, the CV is calculated as the standard error (~ standard deviation (SD) on a set of independent estimates) of the density estimates across all transects for each harvest sub-region using the ratio estimate (Sinclair et al. 2006). The standard error is then divided by the mean density of kangaroos for the harvest sub-region to give the CV, which is expressed as a percentage. For ground survey data the CV is calculated as the SD divided by the mean.

Quotas for 2023 are set at both the harvest region and sub-regional levels to enable more accurate management of quota throughout the year. Quotas are rounded down to the nearest hundred animals.

Low population thresholds

In accordance with the Management Plan, thresholds are set to restrict or close commercial harvest in each sub-region when the population estimate falls below a particular level. The thresholds are based on the long-term average of population size calculated for each harvest sub-region where sufficient data is available. If survey results or model estimates indicate a population has fallen below 1.5 SD of the long-term mean, the harvest quota will be reduced to 10% of the population

estimate. If survey results or model estimates indicate that the population has fallen below 2 SD of the long-term mean, the harvest quota will be suspended. These restrictions will remain in place until surveys indicate populations have increased.

High Abundance Quota

High Abundance Quota (HAQ) is intended for reducing kangaroo populations during times of high abundance. The HAQ is an additional quota to the Sustainable Use Quota and issued at the discretion of the Director of National Parks and Wildlife (refer to Aim 4 of Management Plan for more information).

No HAQ has been issued for 2023.

Special Land Management Quota

Special Land Management Quota (SLMQ) for 2023 has been set at 1.5% of the total estimated population for each species. SLMQ may be released in situations where the Sustainable Use Quota has been fully allocated and land managers are experiencing ongoing kangaroo related land management impacts.

SLMQ allows the Department to respond to the needs of land managers in a timely manner, while encouraging the commercial take of kangaroos if possible. This quota component is only for the harvest of kangaroos that would otherwise be culled under non-commercial Permits to Destroy Wildlife, and is designed to minimise the number of kangaroos destroyed under these permits and not utilised. Permits to Destroy Wildlife are not considered as part of the quota, but numbers of kangaroos permitted for destruction on permits are reported in the annual Harvest Report.

Survey frequency

In accordance with the Management Plan, survey frequency has been reduced to every three years where the harvest is above the low harvest threshold (set at 1.5% of the average population estimate for each sub-region). Where the harvest is below this threshold, surveys will stop in the established harvest regions (Western Pastoral, Eastern Pastoral, Western Agricultural, Eastern Agricultural), or be reduced to every five years in the Southern Agricultural harvest region (as per the Management Plan).

2022 surveys

Sub-regions surveyed 2022

Based on a risk assessment analysis that included harvest rate, previous population density, timing of last survey, natural disasters that had occurred since last survey (e.g. bush fires) and availability of model estimates, 10 sub-regions were surveyed during 2022 for the Red and Grey kangaroos.

Sub-regions surveyed included three 'core' sub-regions that are monitored annually to help inform the population models (North East Pastoral, South Flinders and Eastern Districts), as well as the following sub-regions: Marla-Oodnadatta, Kingoonya, Gawler Ranges, Mallee, Yorke Mid North, Hills and Fleurieu, Lower South East and Kangaroo Island (wallabies only).

In sub-regions that were not surveyed this year and where long-term data exists, the kangaroo population model (either Red Kangaroo or Western Grey Kangaroo model) was used to predict the population density.

Euros have a consistently low harvest across all sub-regions where they are present. During 2022, Euros were surveyed in North East Pastoral and North Flinders sub-regions. In sub-regions that were not surveyed during 2022, population estimates derived from surveys undertaken in 2018, 2019, 2020 and 2021 have been used to set quota for 2023. For surveys conducted between 2018 and 2021 the quota percentage has been reduced to 10% of the population estimate.

Low harvest threshold

Harvest rates have fallen below the low harvest threshold for the following species and sub-regions as per Table 2 based on 2021 harvest. No further surveys will be conducted in these sub-regions until harvest rates exceed the threshold for at least one species, or the maximum time between surveys lapses. Note that 'core' sub-regions (North East Pastoral, South Flinders and Eastern Districts) surveyed annually to inform population models are exempt from this rule.

Table 2: Sub-regions where kangaroo species have fallen below the low harvest threshold, calculated as 1.5% of the average population estimate for each species in each sub-region.

** Harvest was suspended for sub-region during the previous year.*

Species	Sub-region
Red Kangaroo	Marla – Oodnadatta*
	Marree (outside dog fence)*
Western Grey Kangaroo	Eastern Districts
	Gawler Ranges
	Kingoonya
Euro	Marree (inside dog fence)
	North Flinders
	Eastern Districts
	North East Pastoral*

Population estimates

Red Kangaroo

The estimated size of the Red Kangaroo population across the harvest area is 1,626,425. This is an increase of 17% from the previous year total of 1,387,013 and 18% lower than the 20 year rolling average of 1,706,694 (2002-2021 data from model estimates). The increase in Red Kangaroo numbers observed this year is likely in response to improved environmental conditions across South Australia.

The previous year's population estimate (2021 Quota Report) has been used for Marree (outside dog fence (ODF)) and the 2022 survey data estimate has been used for Yorke Mid North (Figure 2) because model predictions were outside of the expected bounds.

Density estimates for 2022 were below the long-term average for Marla-Oodnadatta, Marree IDF, Marree ODF, North Flinders, North East Pastoral and Yorke Mid North.

Density estimates from the survey data were below the second low population threshold in Marree ODF, but were above both thresholds using the population model outputs. In this instance, a conservative approach has been taken and quota has been set based on the survey data population estimate. This means that quota has remained suspended in this sub-region (Figure 2). Quota has also been suspended in the Marla-Oodnadatta sub-region based on the model population estimate. Harvest has now been suspended for two consecutive years in both of these sub-regions.

Red Kangaroos have increased in Marla- Oodnadatta sub-region and the density estimate is now above both population thresholds. After two consecutive years of this sub-region being closed to commercial harvesting, a full quota has been issued for 2023.

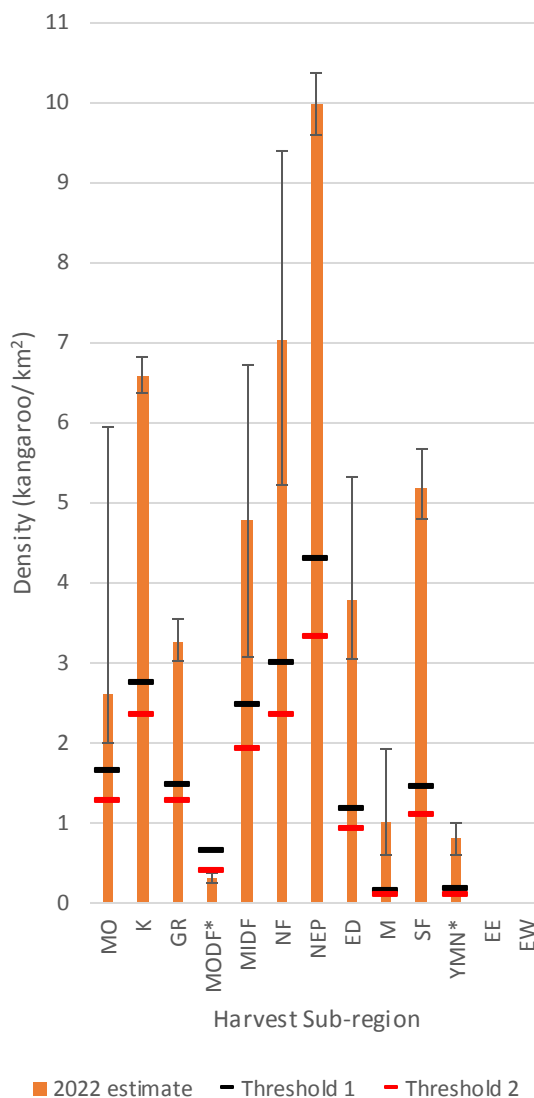


Figure 2: Red Kangaroo 2022 population density estimates in each sub-region (excluding the Southern Agricultural harvest region) compared to low population threshold 1 (black) and 2 (red). Estimates for NEP, ED, SF, M, MO, K, and GR are fitted model estimates based on 2022 survey data. All other estimates are model predictions. MO = Marla-Oodnadatta, K = Kingoonya, GR = Gawler Ranges, MODF = Marree (outside dog fence), MIDF = Marree (inside dog fence), NF = North Flinders, NEP = North East Pastoral, ED = Eastern Districts, M = Mallee, SF = South Flinders, YMN = Yorke Mid North, EE = Eyre East, EW = Eyre West. Error bars represent 95% confidence intervals.

*MODF estimate and associated thresholds calculated from survey 2021 data. YMN estimate and associated thresholds are taken from the 2022 survey data.

Mainland Western Grey Kangaroo

The estimated size of the Western Grey Kangaroo population across the harvest area (excluding Southern Agricultural harvest region) is 1,125,586. This is a 50% increase from the 2021 population estimate of 752,185 and 6% above the 20 year rolling average of 1,065,015 (2002-2021 data from model estimates). The increase in population is most likely in response to the recent high rainfall conditions across most of South Australia.

The population in the Southern Agricultural harvest region is estimated at 279,505, an increase of 18% from the 2021 population estimate of 228,094. Population estimates from 2021 surveys have been used for both Kangaroo Island and Upper South East. A helicopter survey was conducted during May 2022 for the Lower South East and these data have been used to produce the 2022 population estimate. Figure 3 shows the population estimates from 2019-2022 for the Southern Agricultural sub-regions.

Density estimates for 2022 were below the long-term average in Kingoonya, Gawler Ranges, North East Pastoral and South Flinders.

Western Grey Kangaroos have decreased slightly in North East Pastoral sub-region and fallen below the first low population threshold based on the model estimate (Figure 4). A reduced quota has been set at 10% of the population estimate as per the Management Plan.

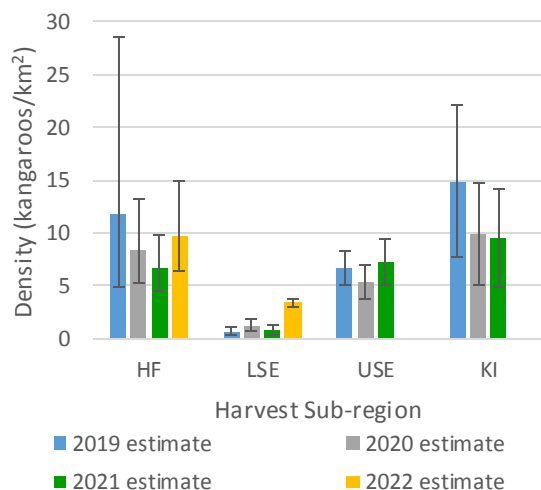


Figure 3: Density estimates 2019 (blue), 2020 (grey), 2021 (green) and 2022 (yellow) for Western Grey Kangaroos in sub-regions of the Southern Agricultural harvest region. 2022 estimate for LSE was conducted via helicopter, previous estimates were via driving surveys. HF = Hills and Fleurieu, LSE = Lower South East, USE = Upper South East, KI = Kangaroo Island. Error bars represent 95% confidence intervals.

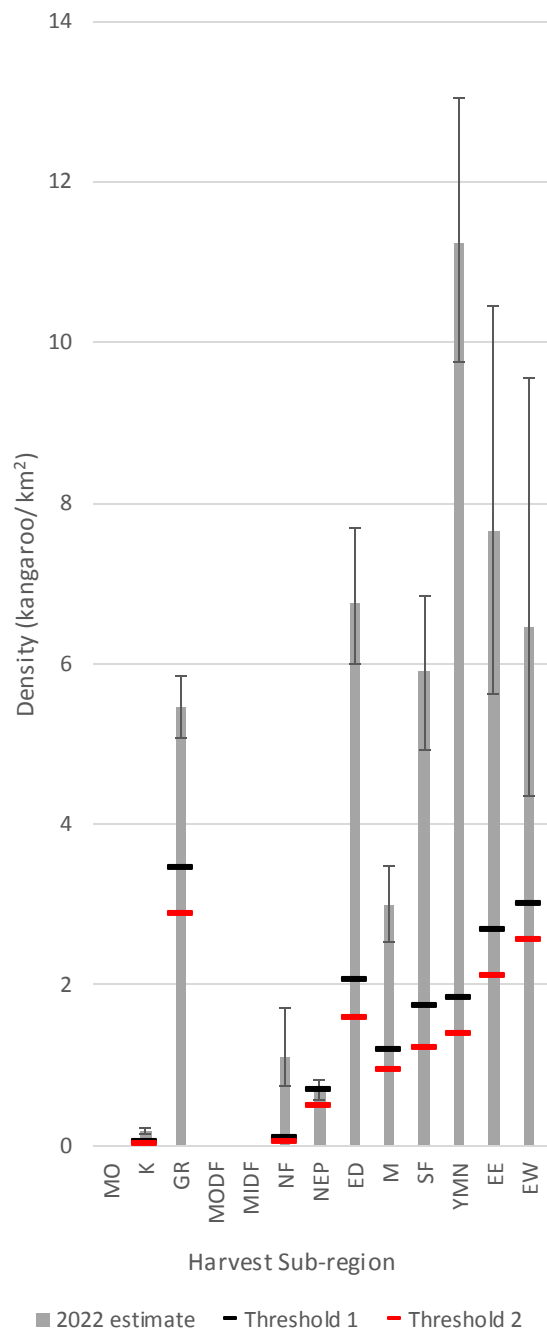


Figure 4: Western Grey Kangaroo 2022 population density estimates in each sub-region (excluding the Southern Agricultural harvest region) compared to low population threshold 1 (black) and 2 (red). Estimates for K, GR, NEP, SF, M, YMN are fitted model estimates based on 2022 survey data. MO = Marla-Oodnadatta, K = Kingoonya, GR = Gawler Ranges, MODF = Marree (outside dog fence), MIDF = Marree (inside dog fence), NF = North Flinders, NEP = North East Pastoral, ED = Eastern Districts, M = Mallee, SF = South Flinders, YMN = Yorke Mid North, EE = Eyre East, EW = Eyre West. Error bars represent 95% confidence intervals

Euro

During 2022, two sub-regions were surveyed for Euros – North Flinders and North East Pastoral (Figure 5). Other population estimates have used data collected between 2018 and 2021.

The estimated size of the Euro population across the commercial harvest area is 375,921, an increase of 24% from the 2021 estimate of 302,821 and 23% below the 20 year rolling average of 491,041 (2002 -2021). The increase in the Euro population is most likely due to the rainfall experienced by the state over the previous 12- 18 months.

Densities from the 2022 surveys were below the long-term average (1997-2021) for North Flinders and North East Pastoral.

Driving surveys were conducted in North Flinders and walking surveys were conducted in North East Pastoral. This change in technique reflects the availability of roads in suitable areas for surveying Euros in North Flinders, and allowed for a broader area to be surveyed than via walking surveys. .

The 2022 density estimate for North Flinders indicates that the Euro population has increased since 2021 (Figure 5), however, the density is still below the second low population threshold and sustainable use quota will be suspended for 2023. However, it is likely that there will be localised impacts from Euros within the sub-region and Special Land Management Quota may be used to address these issues.

The North East Pastoral density estimate (Figure 5) was above both low population thresholds, and therefore after two consecutive years of harvest being suspended in the sub-region, a full quota has been issued for 2023.

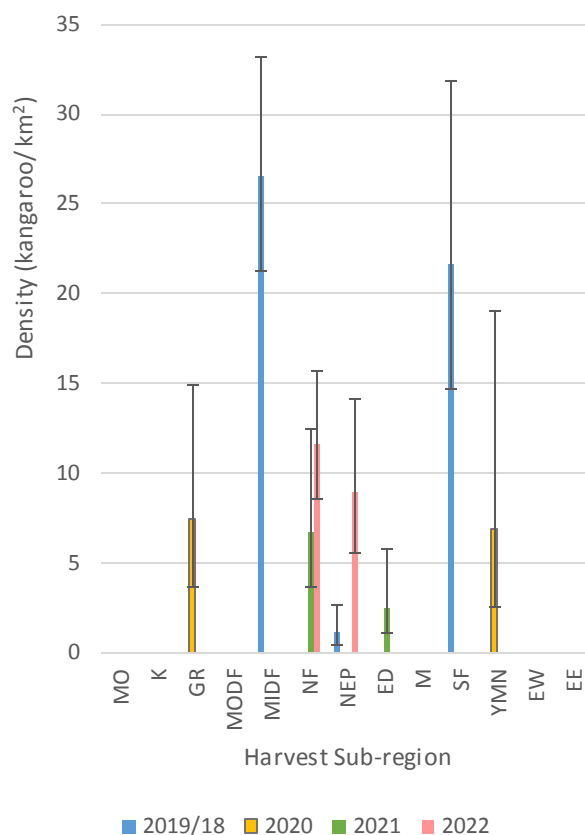


Figure 5: Population density estimates for Euros in the sub-regions surveyed 2018/19 in blue, 2020 in yellow, 2021 in green and 2022 in pink. MO = Marla-Oodnadatta, K = Kingoonya, GR = Gawler Ranges, MODF = Marree (outside dog fence), MIDF = Marree (inside dog fence), NF = North Flinders, NEP = North East Pastoral, ED = Eastern Districts, M = Mallee, SF = South Flinders, YMN = Yorke Mid North, EE = Eyre East, EW = Eyre West. Error bars represent 95% confidence intervals.

Kangaroo Island Western Grey Kangaroo

Kangaroo Island was not surveyed during 2022 as no animals were harvested during 2021. The population density estimate of 9.5/km² or 41,781 kangaroos has been used to set the 2023 quota for Western Grey Kangaroos on the island. The quota has been held at 10% of the population estimate as per the 2022 Quota Report.

Tammar Wallaby

Tammar wallabies have posed a challenge to survey on Kangaroo Island. Since 2019 several survey methods have been trialled, which include; helicopter flights with thermal cameras, spotlight road surveys, thermal binocular road surveys and finally an unmanned aerial vehicle (UAV) flown at night with thermal cameras. Due to the nocturnal behaviour and small size of the species, the helicopter flights did not observe adequate numbers to provide a robust population estimate. While night time road based surveys produced higher estimates than the helicopter surveys, these were still restricted to road availability and had limited visibility in some areas due to roadside vegetation.

During December 2020 and February 2021, four trial sites were flown across private property and one national park to trial the use of UAV with thermal cameras as a survey method. The trial showed that wallabies could be consistently distinguished from kangaroos and brush-tailed possums. Wallabies were observed near the edge of native vegetation, with the majority of sightings occurring in the paddocks. The data collected validated our assumption that most wallabies were not visible from the road during spotlight surveys due to roadside vegetation. However, the confidence in the data was low due to the low number of survey sites.

During March 2022, further six sites were surveyed to increase the number of sites to 10. These additional sites were randomly distributed across the island. Line transect distance sampling method was used to analyse the thermal imaging as per Lethbridge 2019. Thermal binocular surveys were also conducted at the same time as the UAV survey, with the aim of potentially using thermal binoculars as an ongoing survey method.

The thermal imaging data produced an overall density estimate of 89.8/km² (10 sites), with a coefficient of variation of 20.6%, below the acceptable level of 25%. The UAV density estimate is over 800% higher than the spotlight data estimate of 9.6/km² (2020).

Further analysis of the UAV data will be conducted to create a landscape metric model, and comparing the results of the thermal binoculars and UAV.

The quota for wallabies for 2023 has been set at a conservative 5% of the population estimate to account for data being collected over two years and to allow for further analysis of the data and fine-tuning of survey methods in the future.

Eastern Grey Kangaroo

The 2022 population density estimate for Eastern Grey Kangaroos is 8.0/km², which equates to a population estimate of 92,317 across the Lower South East sub-region. The 2022 population estimate is an increase of 341% of the 2021 population estimate of 20,933 kangaroos.

Since 2019 the sub-region has been surveyed annually via driving surveys, however anecdotal evidence suggested that driving surveys were under estimating kangaroo density in the sub-region. In addition to this, the kangaroo industry had consistently harvested the full sustainable use quota each year since the sub-region was opened for commercial harvesting on 1 January 2020. During May 2022 DEW undertook a helicopter survey of kangaroos in the Lower South East sub-region to develop a more robust survey method for the region and re-set the sustainable use quota. Details of the helicopter survey conducted were provided in the 2022 Quota Report, version 2, July 2022.

Based on the helicopter findings, an additional sustainable use quota, set at a conservative 7.5% of the population estimate for Eastern and Western Grey kangaroos was released for use between 1 July and 31 December 2022. As the survey timing for the Lower South East has been moved to May from September, these data have been used again to set the quota for 2023. The sustainable use quota has been set at 15% of the population estimate.

Adaptive management experiments

Aim 6 of the Management Plan allows for adaptive management experiments to improve the management of kangaroos.

No adaptive management experiments were carried out during 2022.

Harvest statistics

Harvest 2021

During 2021, the commercial kangaroo harvest in South Australia was 97,389 including Special Land Management Quota (data from 2021 Commercial Kangaroo Harvest Report for South Australia). This figure represents 22% of the approved quota of 449,200 (including Special Land Management Quota, Table 3). Special Land Management Quota of 800 Western Grey Kangaroos for Western Agricultural Harvest Region and 500 Eastern Grey Kangaroos for the Lower South East Harvest Sub-region were released during 2021. A total of 416 Western Grey Kangaroos and 391 Eastern Grey Kangaroos were harvested under Special Land Management Quota. The total commercial harvest based on kangaroo field processor returns was 98,073, a discrepancy of 0.2% between field processor and meat processor returns was noted.

Table 3: Harvest summary calculated for 2021 from meat processor returns (including Special Land Management Quota). Note that Special Land Management Quotas of 800 Western Grey Kangaroos for Western Agricultural Harvest Region and 500 Eastern Grey Kangaroos for the Lower South East Harvest Sub-region were released during 2021.

Species	Quota	Harvest	% Quota Harvested
Red Kangaroo	214,100	41,775	20%
Western Grey Kangaroo	165,100	42,063	25%
Euro	60,800	7,918	13%
Eastern Grey Kangaroo	5,700	5,633	>99%
Tammar Wallaby	3,500	0	0%
Total	449,200	97,389	22%

The Eastern Agricultural harvest region had the greatest percentage of quota harvested for Red Kangaroos (48%) and Euros (24%) compared to the other harvest regions. The Southern Agricultural harvest region had the highest percentage of Western Grey Kangaroos harvested (66%) and was the only harvest region with quota available for Eastern Grey Kangaroos and Tammar Wallabies. For the second consecutive year 99% of the quota for Eastern Grey Kangaroos was harvested. No harvest occurred during 2021 on Kangaroo Island, despite there being a conservative quota for both Western Grey Kangaroo and Tammar Wallaby on the island. The extent of harvest for each harvest region and species is shown in Table 4 based on kangaroo field processor returns.

Table 4: Harvest statistics for 2021 from field processor returns. Excludes Special Land Management Quota.

Harvest Region	Red Kangaroo			Western Grey Kangaroo			Euro			Eastern Grey Kangaroo			Tammar Wallaby		
	Quota	Harvest	Harvest %	Quota	Harvest	Harvest %	Quota	Harvest	Harvest %	Quota	Harvest	Harvest %	Quota	Harvest	Harvest %
Western Pastoral	108,200	16,006	15%	33,200	3,704	11%	15,900	1,259	8%	0	0	-	0	0	-
Eastern Pastoral	73,600	19,027	26%	39,600	4,361	11%	28,500	2,699	9%	0	0	-	0	0	-
Western Agricultural	14,700	7,082	48%	10,800	1,734	16%	8,700	3,923	45%	0	0	-	0	0	-
Eastern Agricultural	108,200	16,006	15%	36,700	13,230	36%	15,900	1,259	8%	0	0	-	0	0	-
Southern Agricultural	0	0	-	29,000	19,046	66%	0	0	-	5,200	5,198	>99%	2,900	0	0%
Total	304,700	58,121	19%	149,300	42,075	28%	53,100	7,881	15%	5,200	5,198	>99%	2,900	0	0%

Harvest January to October 2022

A total of 80,069 kangaroos were harvested by field processors during the first 10 months of 2022 (1 January 2021 – 31 October 2022; Table 5). This represents 19% of the combined sustainable use kangaroo harvest quota for the year. Based on current harvest rates, the projected harvest for 2022 for all species is 96,083, recognising the sustainable use quota for Eastern Grey Kangaroos is anticipated to be fully harvested. This will represent a 23% harvest of the combined quotas.

The harvest projection for 2022 (Table 5) is similar to that harvested during 2021 of 97,073 (calculated from field processor returns, excluding Special Land Management Quota).

A harvest summary for each species in each harvest region for the 2021 year-to-date (1 January – 31 October) is shown in Table 6.

Harvesting on Kangaroo Island commenced this year (2022), with small numbers of both Tammar Wallabies and Western Grey Kangaroos harvested from the island to date.

Table 5: Harvest statistics for 2022 from field processor returns. Excludes Special Land Management Quota.

Species	Quota	Actual (1 Jan - 31 October)		Projected (1 Jan – 31 Dec)	
		Harvest	Harvest as % of Quota	Harvest	Harvest as % of Quota
Red Kangaroo	236,200	39,750	17%	47,700	20%
Western Grey Kangaroo	143,900	29,976	21%	35,971	25%
Euro	23,300	5,325	23%	6,390	27%
Eastern Grey Kangaroo	6,900	4,940	72%	5,928	86%
Tammar Wallaby	2,900	78	3%	94	3%
Total	413,200	80,069	19%	96,083	23%

Table 6: Harvest region harvest summary calculated from field processor returns for 1 January to 31 October 2022. Excludes Special Land Management Quota.

Harvest Region	Red Kangaroo			Western Grey Kangaroo			Euro			Eastern Grey Kangaroo			Tammar Wallaby		
	Quota	Harvest	Harvest %	Quota	Harvest	Harvest %	Quota	Harvest	Harvest %	Quota	Harvest	Harvest %	Quota	Harvest	Harvest %
Western Pastoral	133,500	16,557	12%	26,600	3,136	12%	14,200	1,551	11%	0	0	-	0	0	-
Eastern Pastoral	93,300	16,314	17%	21,300	3,812	18%	1,000	5	1%	0	0	-	0	0	-
Western Agricultural	0	0	-	32700	642	2%	0	0	-	0	0	-	0	0	-
Eastern Agricultural	9,400	6,879	73%	29,700	10,726	36%	8,100	3,769	47%	0	0	-	0	0	-
Southern Agricultural	0	0	-	33,600	11,660	35%	0	0	-	6,900	4,952	72%	2,900	78	3%
Total	236,200	39,750	17%	143,900	29,976	21%	23,300	5,325	23%	6,900	4,952	72%	2,900	78	3%

2023 Quotas

Commercial kangaroo harvesting quotas for the 2023 quota year for South Australia are shown in Table 7. The 2023 harvest region quotas for each species are shown in Tables 8-12. Quota for Western Grey and Eastern Grey Kangaroos have been edited to reflect the total quota issued during 2022 and includes additional quota released for both species in the Lower South East. The highest recorded annual quotas were 555,000 for Red Kangaroos (1997), 280,000 for Western Grey Kangaroos (1997), and 103,000 for Euros (1997).

Table 7: Commercial kangaroo harvesting quotas for 2023 and comparison with the 2022 quota. Quotas do not include Special Land Management Quota.

Species	2022	2023	% Change 2022-2023
Red Kangaroo	236,200	313,800	33%
Western Grey Kangaroo	143,900	200,200	39%
Euro	23,300	29,300	26%
Eastern Grey Kangaroo	6,900	13,800	100%
Tammar Wallaby	2,900	19,200	562%
Total Quota	413,200	576,300	39%

Regional harvest quotas for 2023

Table 8: Red Kangaroo population estimates in 2022 and harvest quotas for 2023. Population densities and estimates are produced from the Red Kangaroo population model except where stated otherwise. Not Applicable (NA) denotes sub-regions where the species is not present, based on its distribution, therefore no surveys are conducted and no quota has been set in these sub-regions.

Harvest region	Area (km ²)	Pop density/ km ²	Pop estimate	Harvest %	Quota
Western Pastoral					166,000
Marla – Oodnadatta ^{1,2,3}	128,908	2.6	155,064	17	26,300
Kingooonya ²	73,392	6.6	479,507	20	95,900
Gawler Ranges ²	45,811	3.3	149,435	20	29,800
Marree (inside dog fence) ¹	14,680	4.8	70,254	20	14,000
Marree (outside dog fence) ^{1,4}	177,517	0.3**	26,628	0	0
Eastern Pastoral					133,400
North Flinders	34,622	7.0	243,029	20	48,600
North East Pastoral ²	31,448	10.0	313,805	20	62,700
Eastern Districts ²	22,920	3.8	90,835	20	18,100
Mallee ^{2,3}	23,994	1.0	23,825	17	4,000
Eastern Agricultural					14,400
South Flinders ²	11,883	5.2	61,546	20	12,300
Yorke Mid North ^{2,5}	22,217	0.8	12,497	17	2,100
Western Agricultural					0
Eyre West	22,459	NA	NA	0	0
Eyre East	31,164	NA	NA	0	0
Total	641,015		1,626,425		313,800
Special Land Management Quota⁶					24,300
Total quota available for 2023					338,100

¹ Model population prediction scaled to 45% area suitability for Marla-Oodnadatta and 50% area suitability for Marree(outside dog fence).

² Sub-region surveyed during 2022, survey data was incorporated into the population model to produce a model fitted estimate

³ Quota has been reduced to 17% of the population estimate as the coefficient of variation was greater than 25%.

⁴ Survey estimate used from 2021 survey.

⁵ Survey estimate from 2022 has been used instead of model estimate

⁶ Special Land Management Quota has been set at 1.5% of the total population estimate for the commercial harvest area.

****** Red kangaroo populations in Marree(outside dog fence) sub-regions have reached the second low population threshold and quota has been suspended.

Table 9: Western Grey Kangaroo population estimates in 2022 and harvest quotas for 2023. Population densities and estimates are produced from the Western Grey Kangaroo population model. Not Applicable (NA) denotes sub-regions where the species is not present, based on its distribution, therefore no surveys are conducted and no quota has been set in these sub-regions.

Harvest region	Area (km ²)	Pop. density/ km ²	Pop. estimate	Harvest %	Quota
Western Pastoral					39,300
Marla – Oodnadatta ¹	128,908	NA	NA	NA	NA
Kingooonya ¹	73,392	0.2	12,660	15	1,800
Gawler Ranges ¹	45,811	5.5	250,183	15	37,500
Marree (inside dog fence)	14,680	NA	NA	NA	NA
Marree (outside dog fence)	177,517	NA	NA	NA	NA
Eastern Pastoral					42,700
North Flinders	34,622	1.1	38,319	15	5,700
North East Pastoral ¹	31,448	0.7*	21,593	10	2,100
Eastern Districts ¹	22,920	6.8	162,276	15	24,300
Mallee ¹	23,994	3.0	71,301	15	10,600
Eastern Agricultural					34,900
South Flinders ¹	11,883	5.9	70,319	15	10,500
Yorke Mid North ¹	22,217	11.2	163,271	15	24,400
Western Agricultural					50,200
Eyre West	22,459	6.4	106,444	15	15,900
Eyre East	31,164	7.7	229,220	15	34,300
Southern Agricultural					33,100
Hills and Fleurieu ²	7,137	9.8	66,846	15	10,000
Lower South East ³	11,508	3.4	39,565	15	5,900
Upper South East ⁴	18,238	7.2	131,314	10	13,100
Kangaroo Island ⁴	4,398	9.5	41,781	10	4,100
Total	682,296		1,405,091		200,200
Special Land Management Quota⁵					21,000
Total quota available for 2023					221,200

¹ Sub-region surveyed during 2022, survey data was incorporated into the population model to produce a fitted estimate.

² Driving surveys were used to determine population estimates in the Hills and Fleurieu. Driving transects were stratified based on habitat type and densities applied across habitat blocks, excluding large towns.

³ Helicopter survey was completed during May 2022 using a block design stratified for land use type, population estimate and quota have been updated.

⁴ Quota has been reduced to 10% of the population estimate as previous population estimates have been used.

⁵ Special Land Management Quota has been set at 1.5% of the total population estimate for the commercial harvest area.

Table 10: Euro population estimates in 2022 and harvest quotas for 2023. Not Applicable (NA) denotes sub-regions where the species is not present, based on its distribution, therefore no surveys are conducted and no quota has been set in these sub-regions.

Harvest region	Area (km ²)	% Area suitable	Pop density /km ²	Pop estimate	Harvest %	Quota
Western Pastoral						14,200
Marla – Oodnadatta	128,908	0	NA	NA	NA	NA
Kingoonya	73,392	0	NA	NA	NA	NA
Gawler Ranges ³	45,811	25	7.4	84,521	10	8,400
Marree (inside dog fence) ¹	14,680	15	26.5	58,353	10	5,800
Marree (outside dog fence)	177,517	0	NA	NA	NA	NA
Eastern Pastoral						7,000
North Flinders ⁵	34,622	25	11.6**	100,404	0	0
North East Pastoral ⁵	31,448	15	8.9	41,983	15	6,200
Eastern Districts ⁴	22,920	15	2.5	8,595	10	800
Mallee	23,994	0	NA	NA	NA	NA
Eastern Agricultural						8,100
South Flinders ²	11,883	20	21.6	51,406	10	5,100
Yorke Mid North ³	22,217	20	6.9	30,659	10	3,000
Western Agricultural						0
Eyre West	22,459	0	NA	NA	NA	NA
Eyre East	31,164	0	NA	NA	NA	NA
Total	641,015			375,921		29,300
Special Land Management Quota⁶						5,600
Total quota available for 2023						34,900

¹ Sub-region surveyed during 2018, quota reduced to 10% of population estimate.

² Sub-regions surveyed during 2019, quota reduced to 10% of population estimate.

³ Sub-region surveyed during 2020, quota reduced to 10% of population estimate.

⁴ Sub-regions surveyed during 2021, quota reduced to 10% of population estimate.

⁵ Sub-region surveyed during 2022.

⁶ Special Land Management Quota has been set at 1.5% of the total population estimate for the commercial harvest area.

**Harvest is suspended in North Flinders.

Table 11: Eastern Grey Kangaroo population estimates in 2022 and harvest quotas for 2023. Not Applicable (NA) denotes sub-regions where the species is not present, based on its distribution, therefore no surveys are conducted and no quota is set in these areas.

Harvest region	Area (km ²)	Pop density/ km ²	Pop estimate	Harvest %	Quota
Southern Agricultural					
Hills and Fleurieu	7,137	NA	NA	NA	NA
Upper South East	18,238	NA	NA	NA	NA
Lower South East ¹	11,508	8.0	92,317	15	13,800
Kangaroo Island	4,398	NA	NA	NA	NA
Total	41,281		92,317		13,800
Special Land Management Quota²					1,300
Total quota available for 2023					15,100

¹ Helicopter survey was completed during May 2022 using a block design stratified for land use type.

² Special Land Management Quota has been set at 1.5% of the total population estimate for the commercial harvest area.

Table 12: Tammar Wallaby population estimates in 2022 and harvest quotas for 2023. Not Applicable (NA) denotes sub-regions where the species is not present based on its distribution and therefore no surveys are conducted and no quota is set in these areas.

Harvest region	Area (km ²)	Pop density/ km ²	Pop estimate	Harvest %	Quota
Southern Agricultural					
Hills and Fleurieu	7,137	NA	NA	NA	NA
Upper South East	18,238	NA	NA	NA	NA
Lower South East	11,508	NA	NA	NA	NA
Kangaroo Island ¹	4,398	89.5	384,671	5	19,200
Total	41,281		384,671		19,200
Special Land Management Quota²					5,700
Total quota available for 2023					24,900

¹ Night time drone survey with thermal cameras was conducted during Dec 2020, Feb 2021 and Feb 2022 across 10 survey sites on the island. Population estimate is calculated as the area of Kangaroo Island minus towns and water bodies as a conservative approach. Quota has been reduced to 5% of the population estimate as a conservative approach given this is a new method.

² Special Land Management Quota has been set at 1.5% of the total population estimate for the commercial harvest area.

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2022 Quota Report, Version 2, July 2022 (2022) Department for Environment and Water.

Appendix 1

Table A1: Results of model and survey density estimates for Red Kangaroos and Western Grey Kangaroos as they relate to management actions, full quota issued, reduced quota issued (population below first low population threshold) or harvest suspended (population below second low population threshold). In sub-regions where the model and survey estimate produced different management actions, the more conservative management action was used. Results used in this quota report are highlighted in bold.

Harvest Region	Last Survey Year	Red Kangaroo		Western Grey Kangaroo	
		Survey Result	Model Result	Survey Result	Model Result
Western Pastoral					
Marla – Oodnadatta	2022	Full quota	Full quota	-	-
Kingoonya	2022	Full quota	Full quota	Full quota	Full quota
Gawler Ranges	2022	Full quota	Full quota	Full quota	Full quota
Marree (inside dog fence)	2021	NA	Full quota	-	-
Marree (outside dog fence) ¹	2021	Suspended quota	Full quota	-	-
Eastern Pastoral					
North Flinders	2021	NA	Full quota	NA	Full quota
North East Pastoral	2022	Full quota	Full quota	Full quota	Reduced quota
Eastern Districts	2022	Full quota	Full quota	Full quota	Full quota
Mallee	2022	Full quota	Full quota	Full quota	Full quota
Eastern Agricultural					
South Flinders	2022	Full quota	Full quota	Full quota	Full quota
Yorke Mid North ²	2022	Full quota	Full quota	Full quota	Full quota
Western Agricultural					
Eyre West	2021	-	-	Full quota	Full quota
Eyre East	2021	-	-	Full quota	Full quota

¹ Survey estimate from 2021 used

² Survey estimate from 2022 used

Published by the Department for Environment and Water
Government of South Australia
November 2022

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ABN 36702093234

Report prepared by:
Department for Environment and Water
Conservation and Wildlife Branch
National Parks and Wildlife Service Division

www.environment.sa.gov.au



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