2023 Quota Submission for Commercially Harvested Macropods in Queensland

Queensland Government

Prepared by: Macropod Management Program, Queensland Parks and Wildlife Services and Partnerships, Department of Environment and Science

September 2022

Executive summary

As of 2023 the quota management of the harvest area will be changed from 4 zones to 6 zones.The 6 zones will further reduce the risk of over harvesting and improve the sustainability of the commercially harvested macropod species. The zones will be labelled harvest zone 1 through to 5, and a no harvest zone being the sixth zone. For ease of comparison with previous years the new zones refer to the following in reference to the previous zones: The western zone is now zone 1, central north region is zone 2, central south region is zone 3, central east region is zone 4, and the eastern zone is zone 5.

The commercial macropod harvest in Queensland is focused on three species (red kangaroo *Osphranter rufus*, eastern grey kangaroo *Macropus giganteus*, and common wallaroo *Osphranter robustus*) located in six zones: no harvest zone, and harvest zones 1 to 5.

The harvest is administered through a quota submission which is released annually and outlines proposed quotas for each species in each zone for the following calendar year. Quotas are set up to 20% of the estimated population for each species in each zone, depending on survey intensity and the standard error associated with population estimates.

This quota submission outlines the following factors that relate to macropod populations:

- population trends (estimates obtained through aerial surveys)
- review of previous harvests
- the extent of non-commercial harvest mortality
- the extent of areas not subject to any harvest
- rainfall trends.

For 2022, aerial surveys were conducted at 20 monitor blocks across Queensland. Since regionalisation of the Queensland commercial macropod harvest was introduced in 2003, an estimate of macropod population size in zones 1 and 5 (former western and eastern zones) has been made annually. The model used to estimate these populations is based on a small sample area and the reduced sampling effort is reflected in a conservative quota. This model was updated in 2012 to incorporate almost a decade of survey data and to generate trigger points for the commercial quota allocation.

Overall combined 2022 population estimate totals for all three species increased across the state. Population estimates have decreased for eastern grey kangaroos in zone 4 (previously central eastern region – refer Introduction, page 1) and increased in zone 5 (previously eastern zone). Whilst the population estimates increased for eastern grey kangaroos in zone 2 and 3 (previously the central zone north and central zone south, respectively) the population estimates are below a predetermined trigger point. There is no quota allocated for this species in zone 2 and the quota for this species has been halved in zone 3 for 2023. The red kangaroo population estimates increased in all zones. Common wallaroo population estimates increased in zone 1 and 2 (previously the western zone and central north region, respectively) but decreased in zone 3, 4 and 5 (previously the central south region, central east region and the eastern zone, respectively). The population estimates for common wallaroos in zone 3 were also below predetermined trigger points and the quota has been halved in this zone for 2023.

Examination of long-term trends in population and block density estimates indicates that the 2022 estimates are comparable to fluctuations of previous years. Population estimates for all three commercially harvested species consistently number more than 1 million across the Queensland harvest zones.

In the 2021 harvest period, only 30.3% of the commercial harvest quota was utilised, with the highest percentage of quota used being 62.2% for common wallaroo in the central zone. The overall harvest was male biased, with females comprising 28% of the overall harvest.

Figures available as at 12 August 2022 indicate that the harvest will be well below quotas for each species in each zone in 2022. Non-commercial take under damage mitigation permits (DMPs) were also below the maximum available quota for the 2021 harvest period a trend that is likely to be repeated in 2022.

The three commercially harvested macropod species continue to be protected from harvesting within the harvest zones in national parks and state forests. The protected area within the harvest zones is 80,027km². Macropods are further protected from harvest in Queensland within the non-harvest zones.

Drought continues to be the overriding factor affecting macropod numbers throughout much of the harvest zones particularly in the central north and south. This is reflected in the reduced quotas in these regions for the 2023 harvest period.

Population estimates for 2022 and proposed sustainable use quotas for the 2023 commercial harvest. Note estimates in red signify a trigger point has been reached.

Species	Population estimate zone	2022 estimated population (rounded to the nearest 50)	2023 sustainable use quota (rounded to the nearest 50)	Proportion of population (% rounded to the nearest whole number)
Red kangaroo	Zone 1	1,080,500	108,050	10%
	Zone 2	3,439,150	687,850	20%
	Zone 3	906,800	181,350	20%
	Zone 4	337,950	67,600	20%
	Zone 5	267,300	26,750	10%
	Combined	6,031,700	1,071,600	17.8%
Eastern grey kangaroo	Zone 1	0	NA	NA
	Zone 2	461,050	NA	NA
	Zone 3	499,750	37,500	7.5%
	Zone 4	2,819,700	422,950	15%
	Zone 5	4,486,550	448,650	10%
	Combined	8,267,050	909,100	11.0%
Common wallaroo	Zone 1	480,750	48,100	10%
	Zone 2	672,650	100,900	15%
	Zone 3	118,800	8,900	7.5%
	Zone 4	43,200	6,500	15%
	Zone 5	653,050	65,300	10%
	Combined	1,968,450	229,700	11.7%

Contents

Introduction

The commercial harvesting in Queensland of three macropod species—red kangaroo *Osphranter rufus,* eastern grey kangaroo *Macropus giganteus* and common wallaroo *Osphranter robustus*—is regulated through:

- *Environment Protection and Biodiversity Conservation Act 1999*
- Queensland Wildlife Trade Management Plan for Export—Commercially Harvested Macropods 2018–2022
- *Nature Conservation Act 1992*
  - Nature Conservation (Animals) Regulation 2020
  - Nature Conservation (Macropod) Conservation Plan 2017
- Harvest Period Notice for taking macropods
- *Animal Care and Protection Act 2001*
- *Food Production (Safety) Act 2000.*

The Department of Environment and Science (DES) administers the harvest of macropods in Queensland in accordance with the International Union for Conservation of Nature (IUCN) Recommendation 18.24, 'the ethical, wise and sustainable use of some wildlife can provide an alternative or supplementary means of productive land-use, and can be consistent with and encourage conservation, where such use is in accordance with appropriate safeguards' (IUCN 1990) and the Wildlife Trade Management Plan for Export—Commercially Harvested Macropods 2018–22, 'to provide for the sustainable use of macropod species covered by the plan, in accordance with the principles of ecologically sustainable development' (Anon 2017).

Management of the harvest is facilitated via a quota that sets the number of animals that can be taken. Quotas are established largely based on aerial surveys of the commercially harvested species and have been used in Queensland since 1975. The Director-General of DES declares a harvest period open annually via the harvest period notice and sets quotas for this period having regard to the Queensland Wildlife Trade Management Plan for Export—Commercially Harvested Macropods 2018–22. Quotas are provided to the Commonwealth Minister for The Environment for endorsement.

Quotas in Queensland are set up to 20% of the estimated population for each species in each zone. Harvesting at these levels will ensure a sustainable yield and long-term conservation of macropod populations.

From 2003 to 2022, quotas have been set for each species for four harvest zones to ensure that harvest pressure is distributed across the range of the species. As of 2023 the quotas are set for each species in six harvest zones (figure 1):

Harvest zone from 2023 onwards

- no harvest zone (quota zero)
- zone 1 (formerly western zone)
- zone 2 (formerly north region of central zone)
- zone 3 (formerly south region of central zone)
- zone 4 (formerly east region of central zone)
- zone 5 (formerly eastern zone)

2003 – 2022 harvest zones

- no harvest zone (quota zero)
- eastern harvest zone
- central harvest zone
- western harvest zone.

This quota submission contains a summary of the recommended quotas for each of the species in each of the harvest zones for 2022. Additionally, the submission outlines the basis of how these quotas were determined.

The Harvest Period Notice for taking macropods in 2023 is due for release in December 2022. The release of this notice will allow the harvest period to be declared open on 1 January 2023. The notice will outline specific conditions for the 2023 harvest period.

The proposed quotas were calculated using a fixed proportion of the estimated macropod populations within the Queensland harvest areas. Proportions were adjusted for each species across the harvest zones in relation to the margins of error present in population estimates derived from aerial surveys. The maximum proportions used for each species were 15% of the populations for eastern grey kangaroos and common wallaroos and 20% of the population for red kangaroos for the central zone.

For the eastern and western zones, where survey effort is less extensive when compared to the central zone, the more conservative maximum proportion of 10% was applied for all three species.

These sustainable-use harvest proportions are based on research and modelling undertaken by Caughley et al. (1987) and Hacker et al. (2002) and are currently accepted by the scientific community, DES and the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) for determining state quota limits.

The quota submission also outlines the following factors that relate to macropod populations:

- population trends (estimates obtained through aerial surveys)
- review of previous harvests
- the extent of non-commercial harvest mortality
- the extent of areas not subject to any harvest
- rainfall trends.

Proposed quotas

Table 1. 2022 estimated populations and 2023 proposed quotas for each macropod species in each harvest zone. Note estimates in red signify a trigger point has been reached.

Species	Population estimate zone	2022 estimated population (rounded to the nearest 50)	2023 sustainable use quota (rounded to the nearest 50)	Proportion of population (% rounded to the nearest whole number)
Red kangaroo	Zone 1	1,080,500	108,050	10%
	Zone 2	3,439,150	687,850	20%
	Zone 3	906,800	181,350	20%
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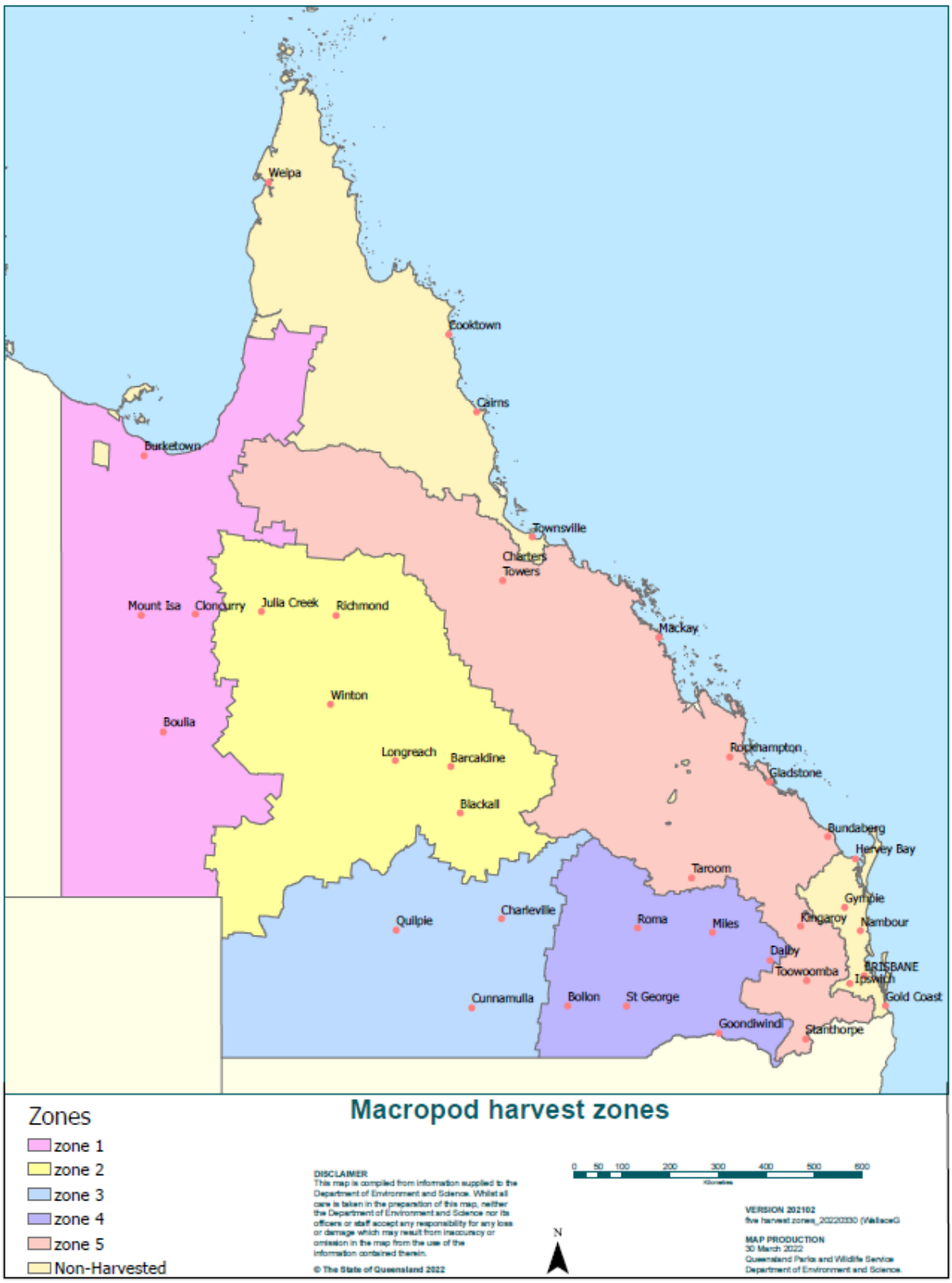
	Zone 2	672,650	100,900	15%
	Zone 3	118,800	8,900	7.5%
	Zone 4	43,200	6,500	15%
	Zone 5	653,050	65,300	10%
	Combined	1,968,450	229,700	11.7%

Figure 1. Queensland macropod harvest zones from 2023



Zone 1 consists of Boulia, Burke, Carpentaria, Cloncurry, Diamantina and Mount Isa regional councils.

Zone 2 consists of Barcaldine, Barcoo, Blackall-Tambo, Flinders, Longreach, McKinlay, Richmond and Winton shires.

Zone 3 consists of Bulloo, Murweh, Paroo and Quilpie shires.

Zone 4 consists of Balonne, Goondiwindi, Maranoa and Western Downs shires.

Zone 5 consists of Banana, Bundaberg, Burdekin, Central Highlands, Charters Towers, Croydon, Etheridge, Gladstone, Isaac, Livingstone, Lockyer Valley, Mackay, North Burnett, Rockhampton, Scenic Rim, Somerset, South Burnett, Southern Downs, Toowoomba and Whitsunday regional councils .

Long-term population trends

Population estimates

Since 1992, the Queensland Government has coordinated an annual program of aerial surveys to directly monitor populations of the three commercially harvested macropod species. These surveys occur over 22 representative monitor blocks across the state and are utilised to obtain population estimates that inform the quota. The methodology of the surveys is outlined in detail in Appendix 1. Since 2011 a correction factor of 1.85 has been applied to population estimates for common wallaroo in Queensland. Prior to this a correction factor of 1.2 was applied.

Current harvesting rates (quotas up to 20% of population estimates) are considered sustainable. None of the three commercially harvested species has shown a consistent decline in abundance since 1992 (figures 2, 3, 4 and 5), which would necessitate a reassessment of the harvest take and species conservation status. Whilst no consistent declines have been observed, the macropod populations in Queensland have fluctuated over time.

Figure 2. Macropod population trends across all Queensland harvest zones since 1992

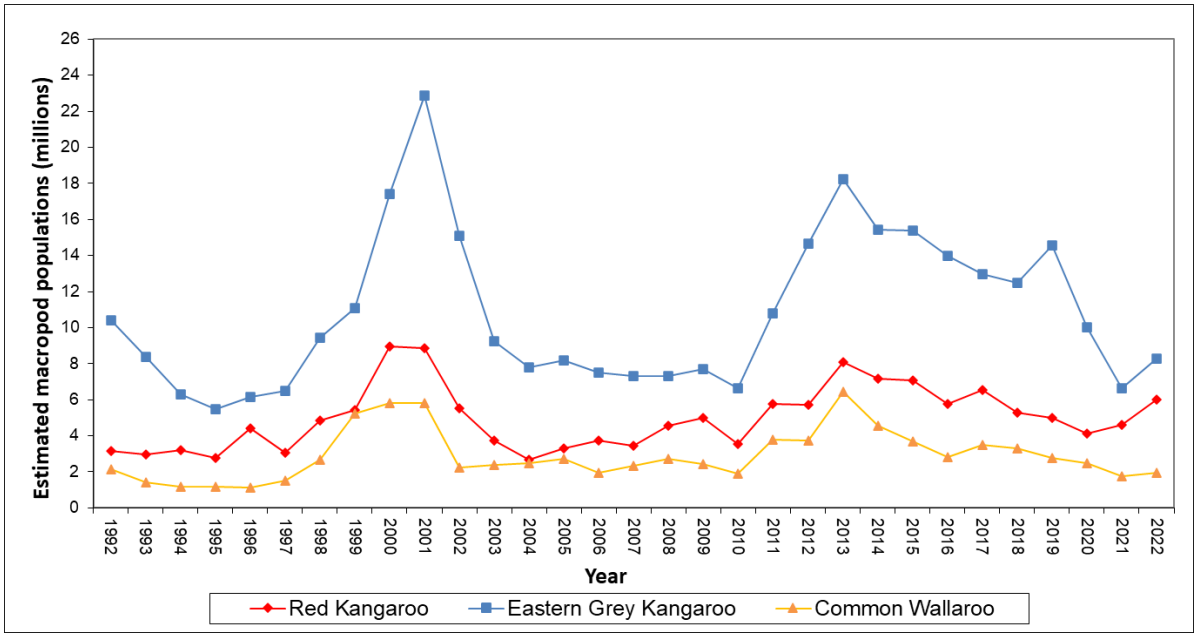


Figure 3. Red kangaroo population estimates (with one standard error) since 1992

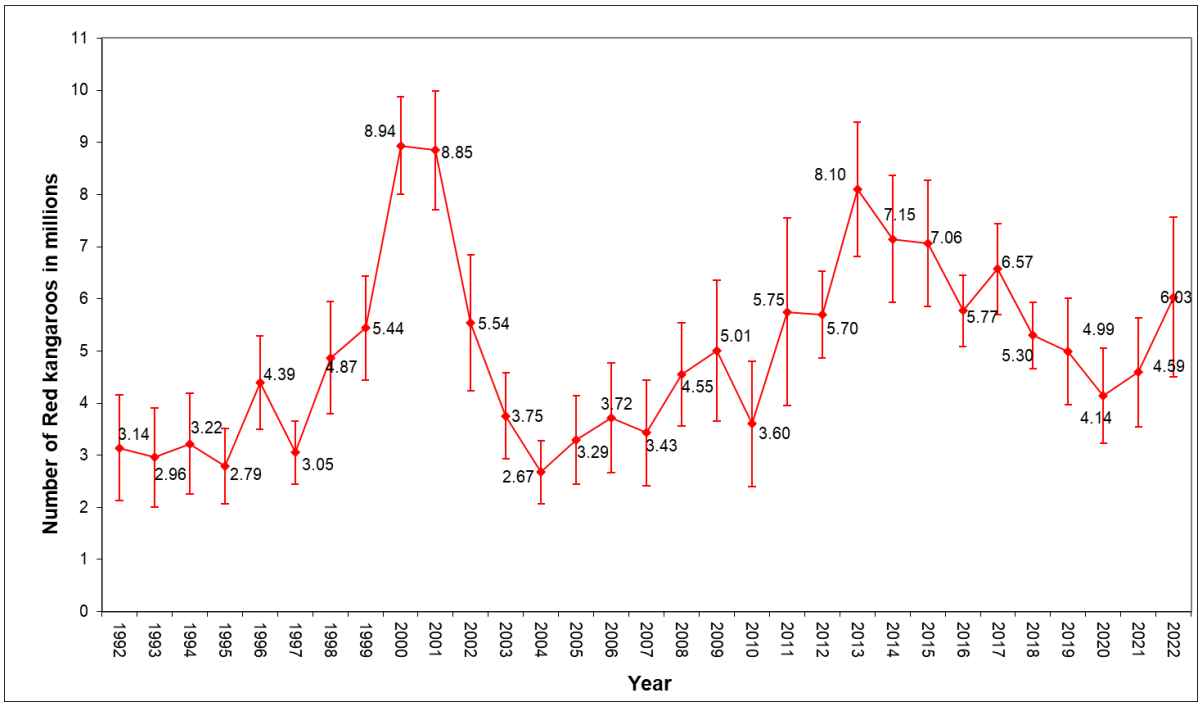


Figure 4. Eastern grey kangaroo population estimates (with one standard error) since 1992

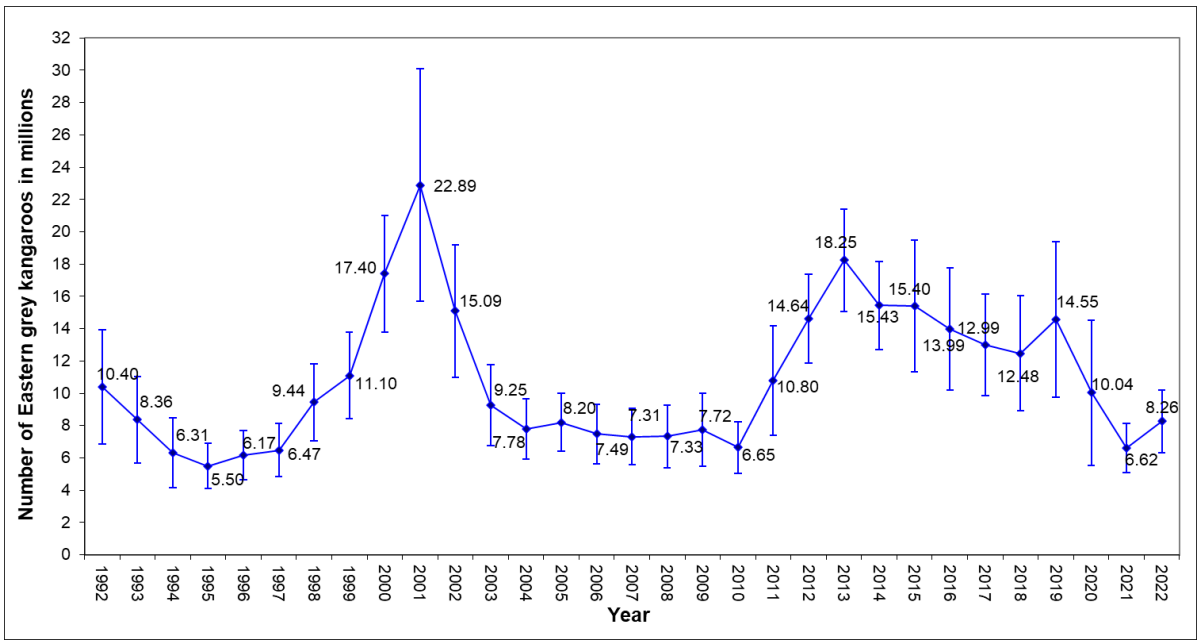
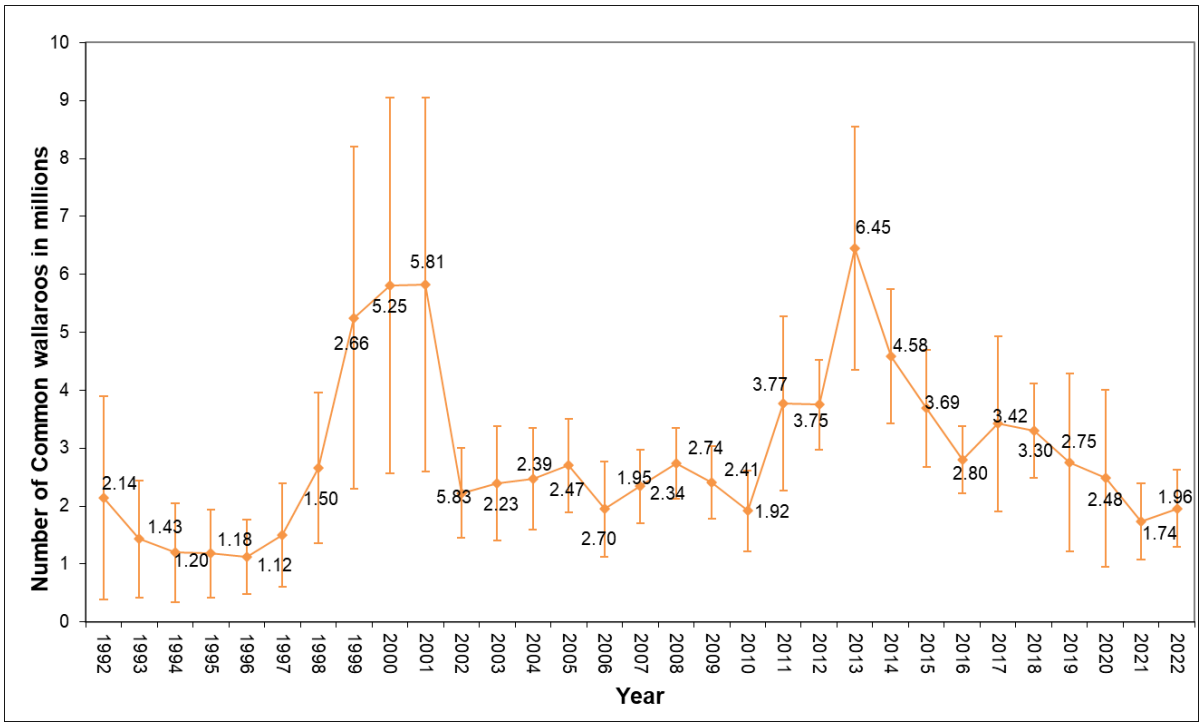


Figure 5. Common wallaroo population estimates (with one standard error) since 1992. Estimates include a 1.85 correction factor for 2011 to 2022 and a 1.2 correction factor all other years



Density estimates

To contribute to ensuring commercially harvested macropod species are maintained across their distributions, density estimates are calculated for representative survey blocks as part of the aerial surveys (Appendix 2). For the purposes of interpreting this data in an easily understood manner, the density estimates for each species have been grouped into zones (figure 6).

This data is monitored for any significant decreases in densities which is possible for all data collected since 2005. Examination of trends in density for the three commercially harvested macropod species in the areas outlined above for the period 2005–2021 demonstrates densities fluctuate over time (figures 7–11).

For red kangaroos densities are greatest in the zone 2 (figure 8), with densities lowest in the zone 5 (figure 11). Low densities in the zone 5 (eastern Queensland) are expected as this area incorporates the edge of the distributional range for this species.

For eastern grey kangaroos highest densities are recorded in the zone 4 (figure 10) and zone 5 (figure 11). Eastern grey kangaroos occur in consistently low densities in the zone 1 (western Queensland) at the edge of their distributional range. As such, there is no quota for eastern grey kangaroos in this zone (table 1). In 2022 no eastern grey kangaroos were counted in the zone 1 during aerial surveys. This does not necessarily mean they are completely absent from the zone. It is more likely that the survey effort was insufficient to detect extremely low densities.

Common wallaroos occur in highest densities in the zone 2 (figure 8). This area is further divided into two regions for the purposes of estimating populations due to the considerably higher densities recorded around Blackall, Tambo and Longreach when compared to the rest of the zones (figure 8 and Appendix 2). Lowest densities for this species occur in zone 4 (figure 10). Density fluctuations for this species do not follow the same patterns as those exhibited by red and eastern grey kangaroos (figures 7–11).

Figure 6. Zones used to calculate population estimates of commercially harvested macropods

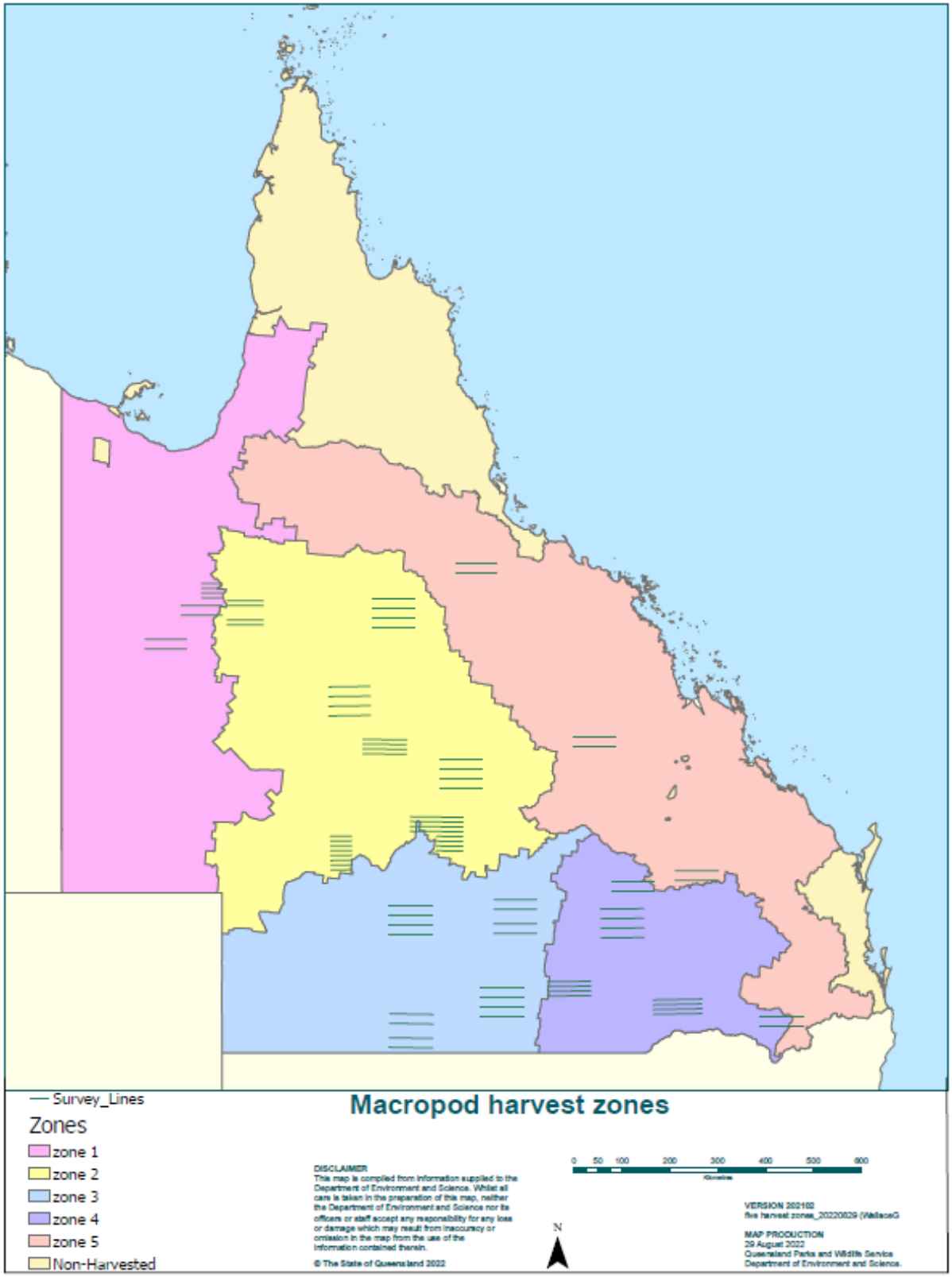
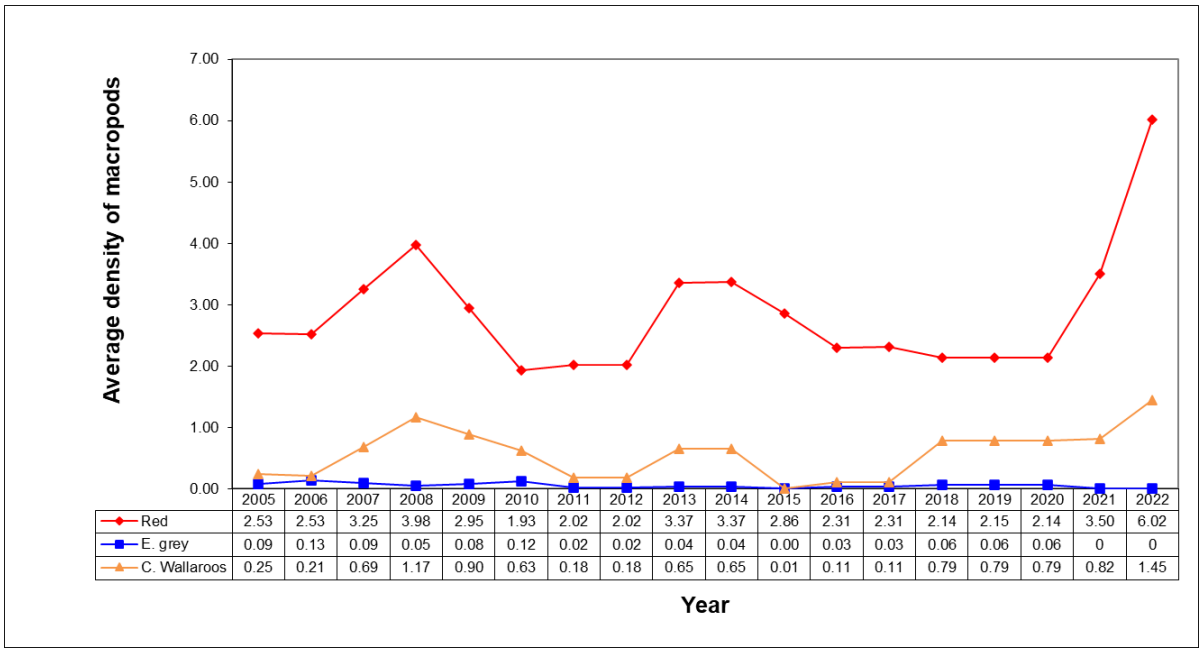
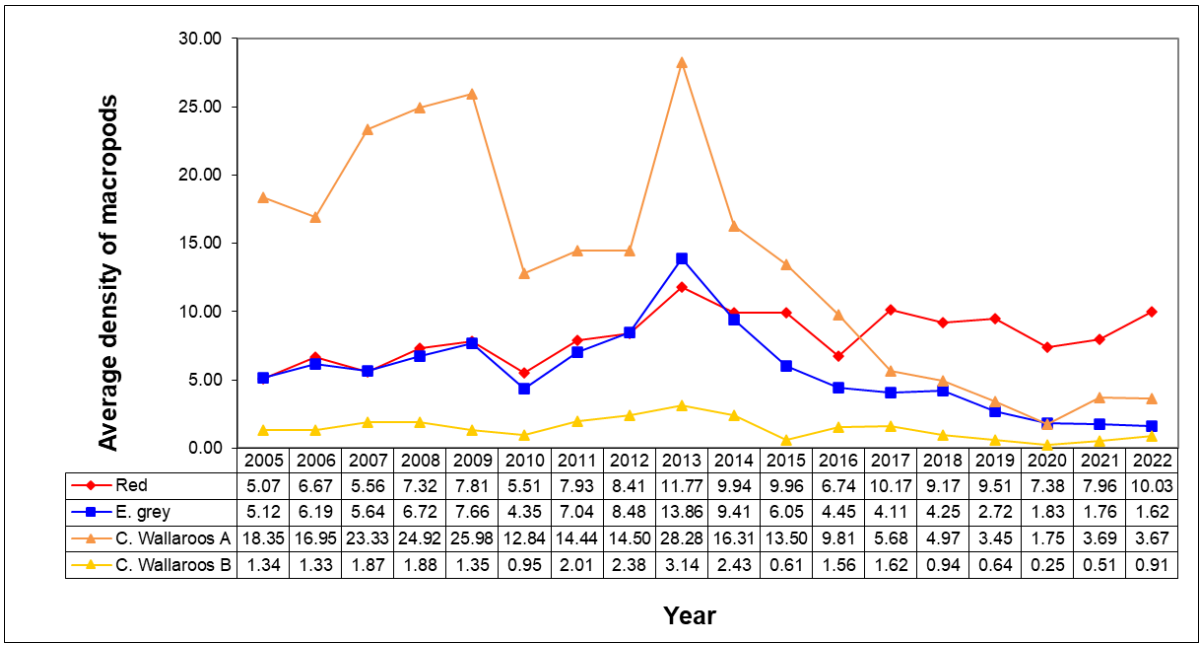


Figure 7. Average density per km^2 of commercially harvested macropods in Zone 1 population estimate region from 2005 to 2022



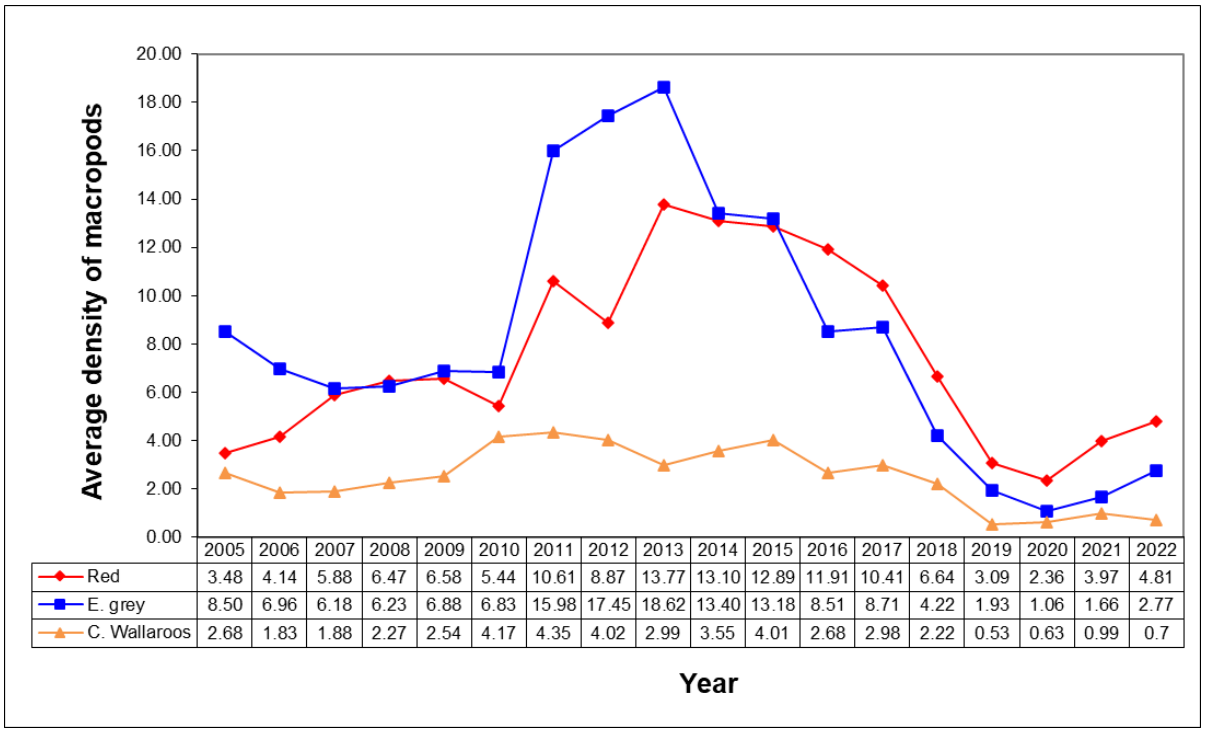
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Red	2.53	2.53	3.25	3.98	2.95	1.93	2.02	2.02	3.37	3.37	2.86	2.31	2.31	2.14	2.15	2.14	3.50	6.02
E. grey	0.09	0.13	0.09	0.05	0.08	0.12	0.02	0.02	0.04	0.04	0.00	0.03	0.03	0.06	0.06	0.06	0	0
C. Wallaroos	0.25	0.21	0.69	1.17	0.90	0.63	0.18	0.18	0.65	0.65	0.01	0.11	0.11	0.79	0.79	0.79	0.82	1.45

Figure 8. Average density per km^2 of commercially harvested macropods in Zone 2 population estimate region from 2005 to 2022 (common wallaroos are represented by two areas in Zone 2)



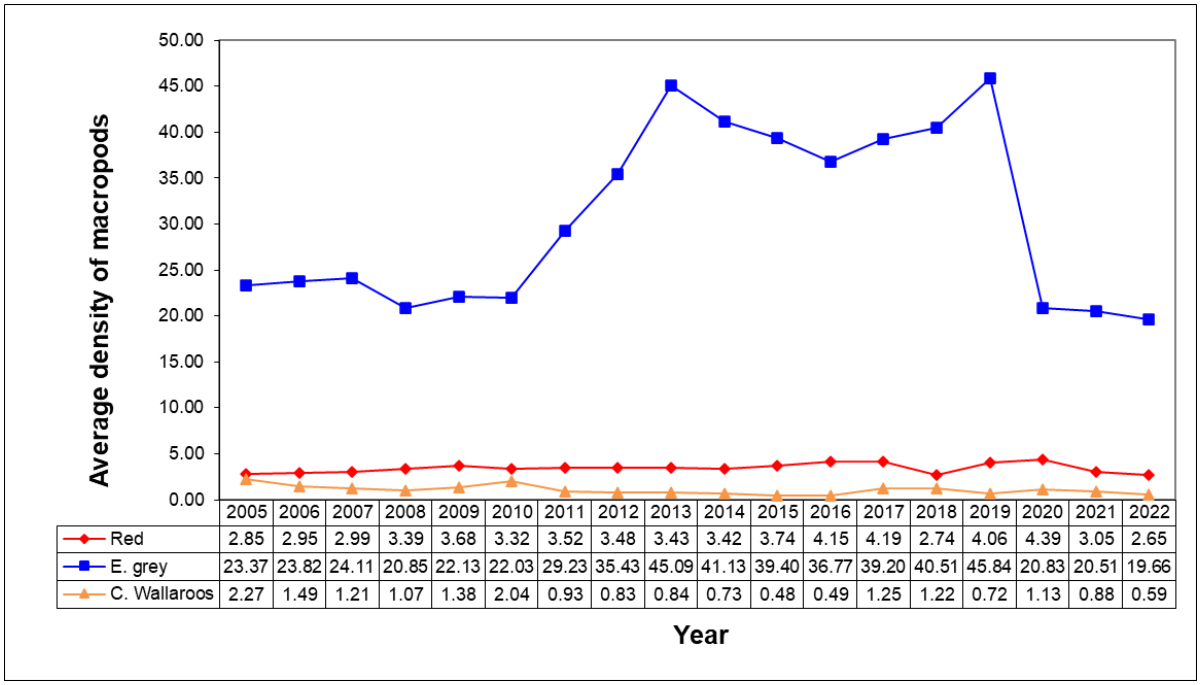
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Red	5.07	6.67	5.56	7.32	7.81	5.51	7.93	8.41	11.77	9.94	9.96	6.74	10.17	9.17	9.51	7.38	7.96	10.03
E. grey	5.12	6.19	5.64	6.72	7.66	4.35	7.04	8.48	13.86	9.41	6.05	4.45	4.11	4.25	2.72	1.83	1.76	1.62
C. Wallaroos A	18.35	16.95	23.33	24.92	25.98	12.84	14.44	14.50	28.28	16.31	13.50	9.81	5.68	4.97	3.45	1.75	3.69	3.67
C. Wallaroos B	1.34	1.33	1.87	1.88	1.35	0.95	2.01	2.38	3.14	2.43	0.61	1.56	1.62	0.94	0.64	0.25	0.51	0.91

Figure 9. Average density per km² of commercially harvested macropods in Zone 3 population estimate region from 2005 to 2022



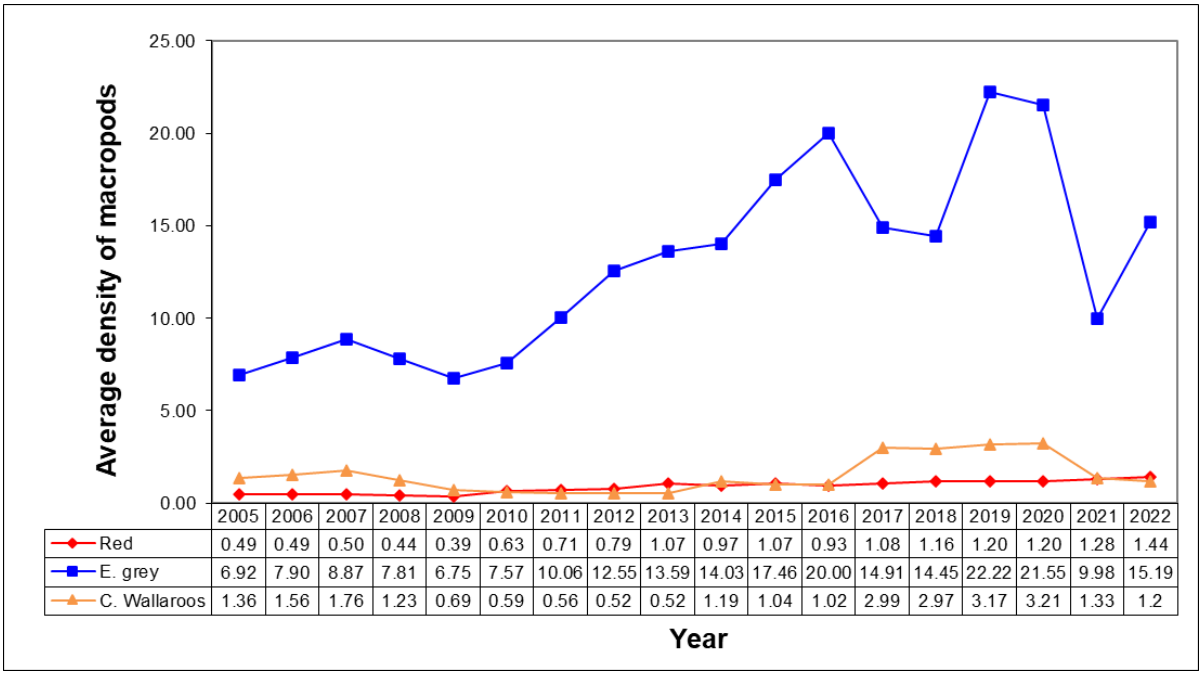
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Red	3.48	4.14	5.88	6.47	6.58	5.44	10.61	8.87	13.77	13.10	12.89	11.91	10.41	6.64	3.09	2.36	3.97	4.81
E. grey	8.50	6.96	6.18	6.23	6.88	6.83	15.98	17.45	18.62	13.40	13.18	8.51	8.71	4.22	1.93	1.06	1.66	2.77
C. Wallaroos	2.68	1.83	1.88	2.27	2.54	4.17	4.35	4.02	2.99	3.55	4.01	2.68	2.98	2.22	0.53	0.63	0.99	0.7

Figure 10. Average density per km² of commercially harvested macropods in Zone 4 population estimate region from 2005 to 2022



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Red	2.85	2.95	2.99	3.39	3.68	3.32	3.52	3.48	3.43	3.42	3.74	4.15	4.19	2.74	4.06	4.39	3.05	2.65
E. grey	23.37	23.82	24.11	20.85	22.13	22.03	29.23	35.43	45.09	41.13	39.40	36.77	39.20	40.51	45.84	20.83	20.51	19.66
C. Wallaroos	2.27	1.49	1.21	1.07	1.38	2.04	0.93	0.83	0.84	0.73	0.48	0.49	1.25	1.22	0.72	1.13	0.88	0.59

Figure 11. Average density per km² of commercially harvested macropods in Zone 5 population estimate region from 2005 to 2022



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Red	0.49	0.49	0.50	0.44	0.39	0.63	0.71	0.79	1.07	0.97	1.07	0.93	1.08	1.16	1.20	1.20	1.28	1.44
E. grey	6.92	7.90	8.87	7.81	6.75	7.57	10.06	12.55	13.59	14.03	17.46	20.00	14.91	14.45	22.22	21.55	9.98	15.19
C. Wallaroos	1.36	1.56	1.76	1.23	0.69	0.59	0.56	0.52	0.52	1.19	1.04	1.02	2.99	2.97	3.17	3.21	1.33	1.2

Trigger points

Pre-determined trigger points for each of the commercial harvest quotas were introduced to the Queensland Wildlife Trade Management Plan for Export (Commercially Harvested Macropods 2013–17) and are also incorporated in to the Queensland Wildlife Trade Management Plan for Export (Commercially Harvested Macropods 2018–22). Each trigger point represents a threshold level based on analysis of the long-term population estimate for each harvested species in each population estimate region.

Where an estimated population for a region falls below a trigger point of 1.5 standard deviations (SD) below the long-term average for that region then the harvest quota will be halved for that region in the next calendar year. If a population estimate falls below 2 SDs below the long-term average for that species in that region then there will be no quota for the following year.

Table 2 shows the calculated trigger points for the 2023 harvest period for each species in each zone compared with the 2022 population estimates for those regions. The estimated populations for eastern grey kangaroos and common wallaroos in zone 3 are below 1.5 SDs. Consistent with the Wildlife Trade Management Plan for Export—Commercially Harvested Macropods 2018–22 the harvest quotas for these species in this region has been halved for 2023.

The estimated populations for eastern grey kangaroos in zone 2 is below 2 SDs. Consistent with the Wildlife Trade Management Plan for Export—Commercially Harvested Macropods 2018–22 there will be no harvest quotas for this species in this region in 2023.

Table 2. Calculated trigger points for 2022 and the estimated populations of commercially harvested macropod species in each zone for 2021. Note estimates in red signify a trigger point has been reached

Species	Population estimate zone	2022 estimated population	2022 1.5 SD trigger point	2022 2 SD trigger point
Red kangaroo	Zone 1	1,080,524	198,210	155,799
	Zone 2	3,439,141	1,884,053	1,672,929
	Zone 3	906,797	611,602	487,848
	Zone 4	337,929	103,221	77,911
	Zone 5	267,281	75,484	62,093
Eastern grey kangaroo	Zone 1	0	NA	NA
	Zone 2	461,062	802,880	605,890
	Zone 3	499,764	506,031	362,985
	Zone 4	2,819,675	2,438,754	2,056,995
	Zone 5	4,486,536	1,310,774	998,002
Common wallaroo	Zone 1	480,766	27,028	16,064
	Zone 2	672,654	548,209	384,343
	Zone 3	118,813	122,380	84,600
	Zone 4	43,191	31,442	24,466
	Zone 5	653,029	212,484	153,799

Note: There is no quota set for eastern grey kangaroos in the western zone.

Comparison between 2021 and 2022 population estimates

The total population estimates, combined across all three harvest zones, for all three harvest macropod species (red, kangaroos, eastern grey kangaroos and common wallaroos) have increased in 2022 compared to 2021 (figure 12). However the total population estimates across all harvest zones does not reflect the regional variation that was pronounced in 2022 (table 3).

Since regionalisation of the Queensland commercial macropod harvest was introduced in 2003 an estimate of macropod population size in zone 1 and 5 (previously known as western and eastern zone, respectively) has been made. The model used to estimate these populations is based on a small sample area and the reduced sampling effort is reflected in a conservative quota (figure 14). This model was updated in 2012 to incorporate almost a decade of survey data and to generate trigger points for the commercial quota allocation.

Red kangaroos increased in all zones. Common wallaroos increased in zone 1 and 2 (previously western zone and central north region, respectively), whilst they decreased in zone 3, 4 and 5 (previously central south, central east region, and eastern zone, respectively). Eastern grey kangaroos increased in zone 2, 3 and 5, whilst they decreased in zone 4 in 2022 (figure 13). In 2021 there were two population estimates that reached trigger points for one species (eastern grey kangaroos) compared to three population estimates over 2 species (eastern grey kangaroos and common wallaroos) falling below trigger points in 2022 (table 3). Whilst eastern grey kangaroos in zone 3 are below a trigger, the population estimate has risen above the 2 SD trigger point where it has previously been since 2019.

No quota will be proposed for eastern grey kangaroos in the western zone because the population size in this harvest zone is small and at the geographic edge of this species distribution (figure 13 and figure 14).

Figure 12. Comparison of overall macropod populations in the commercial harvest zones 2021 and 2022 (with one standard error)

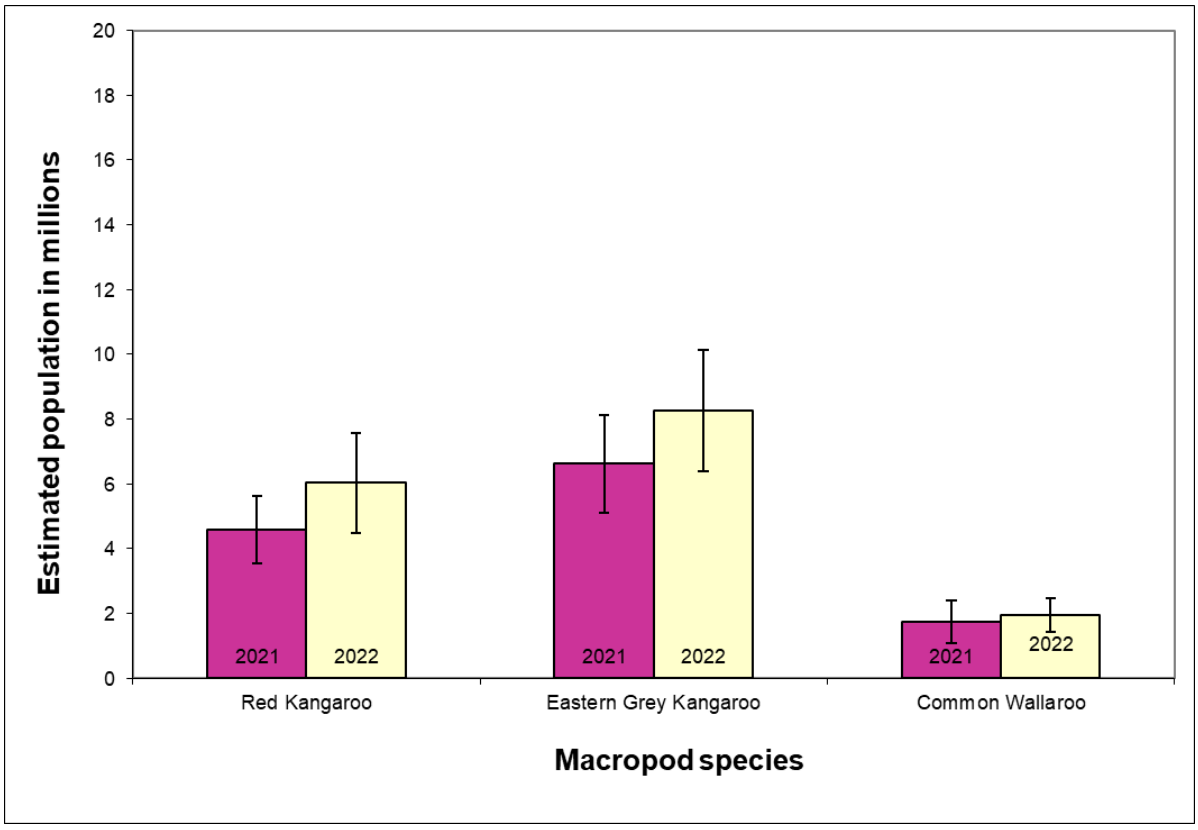


Table 3. Comparison between 2021 and 2022 macropod population estimates. Note estimates in red signify a trigger point has been reached

Species	Harvest zone	2021 population estimate (rounded to the nearest 50)	2022 population estimate (rounded to the nearest 50)
Red kangaroo	Zone 1	590,350	1,080,500
	Zone 2	2,639,100	3,439,150
	Zone 3	747,350	906,800
	Zone 4	390,300	337,950
	Zone 5	228,050	267,300
	Combined	4,595,150	6,031,700
Eastern grey kangaroo	Zone 1	0	0
	Zone 2	455,900	461,050
	Zone 3	295,450	499,750
	Zone 4	2,945,900	2,819,700
	Zone 5	2,928,300	4,486,550
	Combined	6,625,550	8,267,050
Common wallaroo	Zone 1	261,450	480,750
	Zone 2	525,600	672,650
	Zone 3	168,150	118,800
	Zone 4	68,800	43,200
	Zone 5	714,700	653,050
	Combined	1,738,700	1,968,450

Figure 13. Comparison of macropod populations from 2021 to 2022 by species and zone

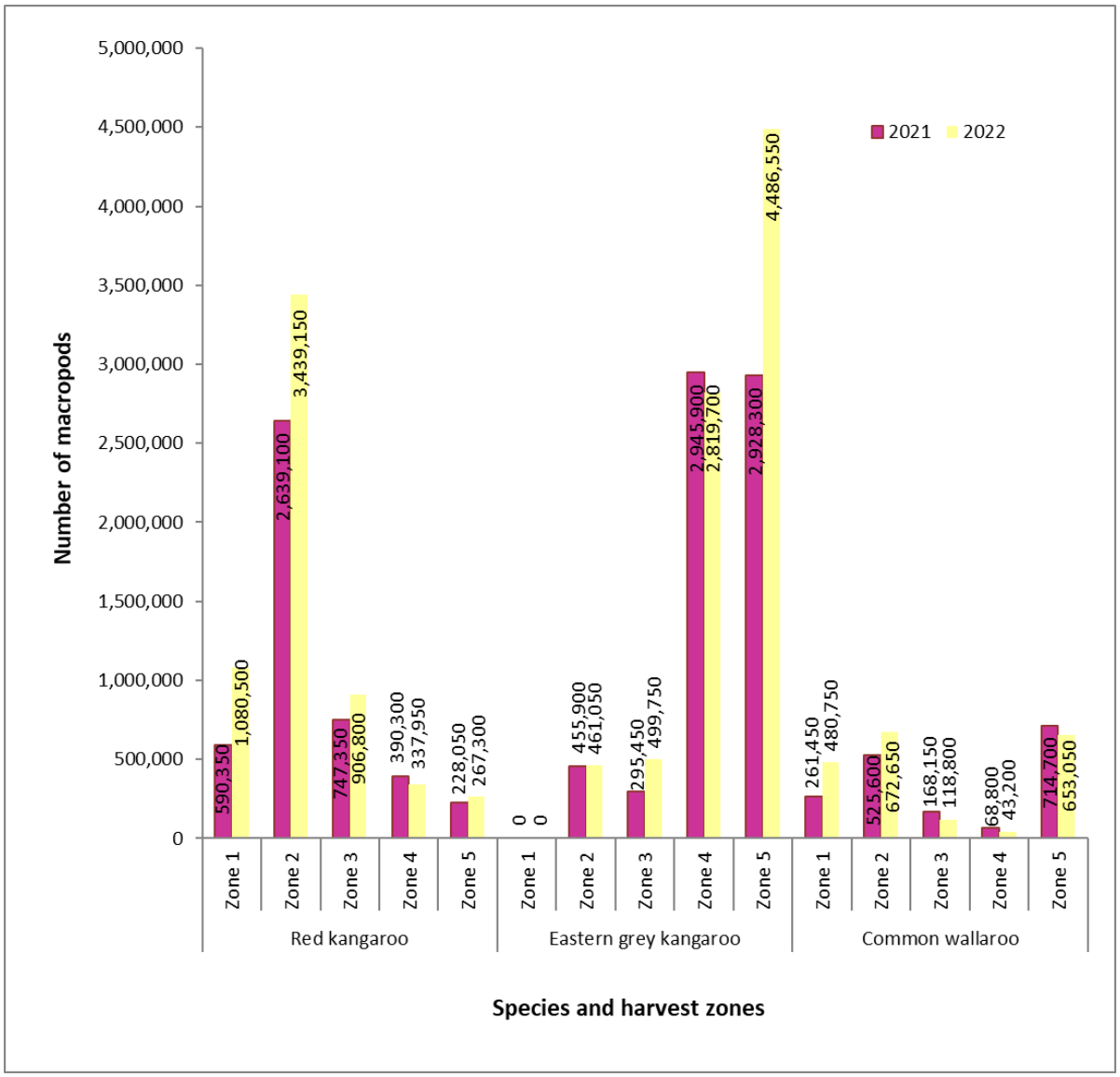
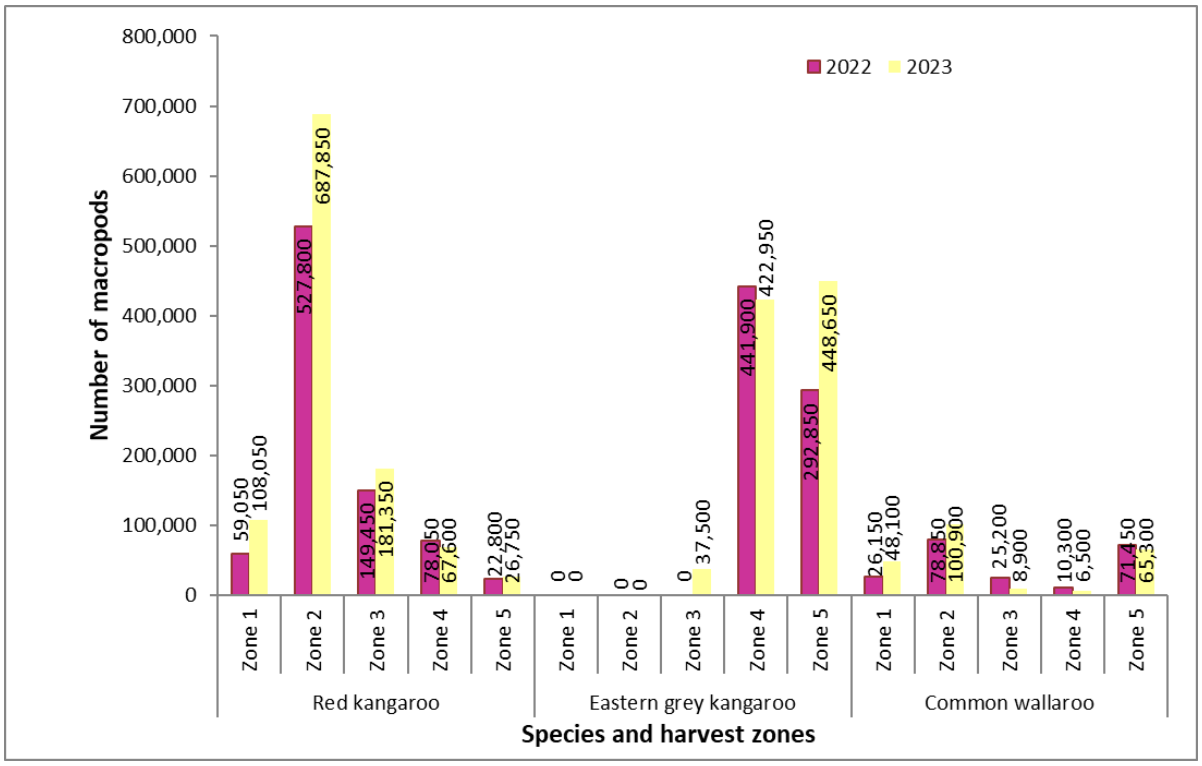


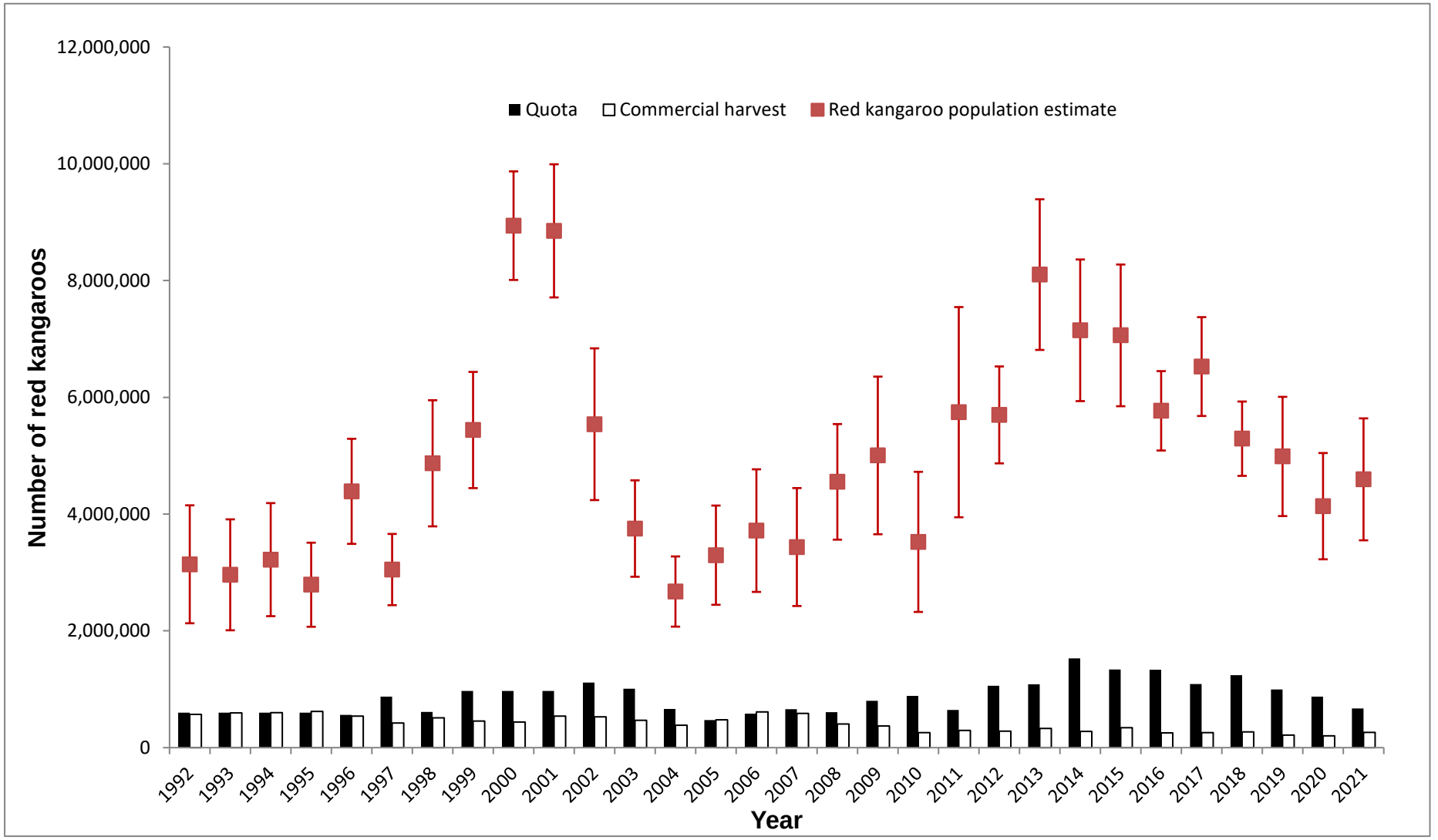
Figure 14. Comparison of 2022 actual and 2023 proposed harvest quotas



Long-term quota and harvest trends

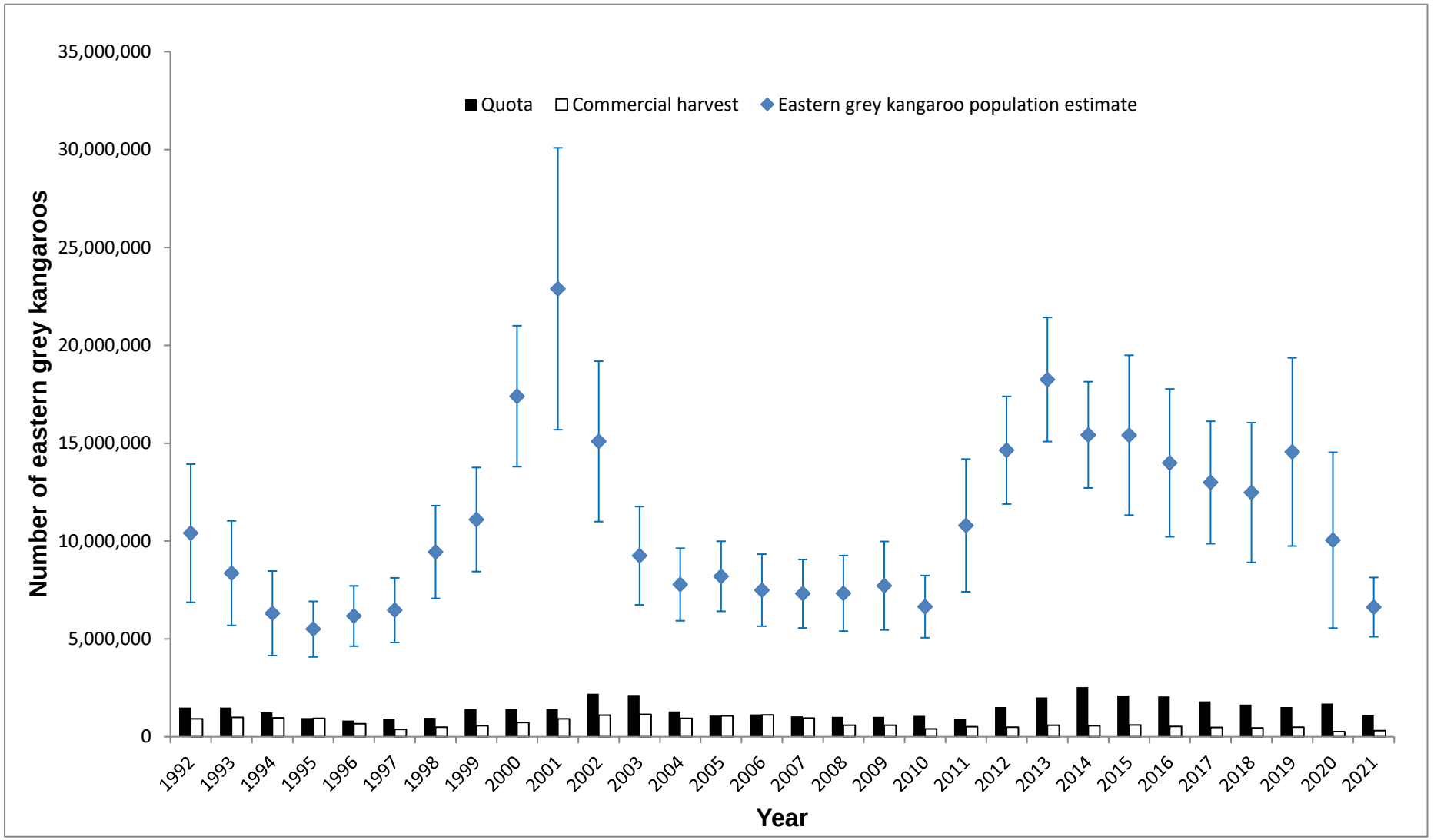
Figures 15 - 17 outline data on the three commercially harvested macropod species pertaining to estimated population, quota and harvest for the years 1992 to 2021. Please note that population estimates are based on aerial surveys conducted in the previous year to the quota and harvest. Combined population estimates, quota and harvest data have been used for the period post-regionalisation in 2003, to enable comparison with data collated prior to this period.

Figure 15. Long-term population estimates (± one standard error), quota and harvest data for the red kangaroo in Queensland



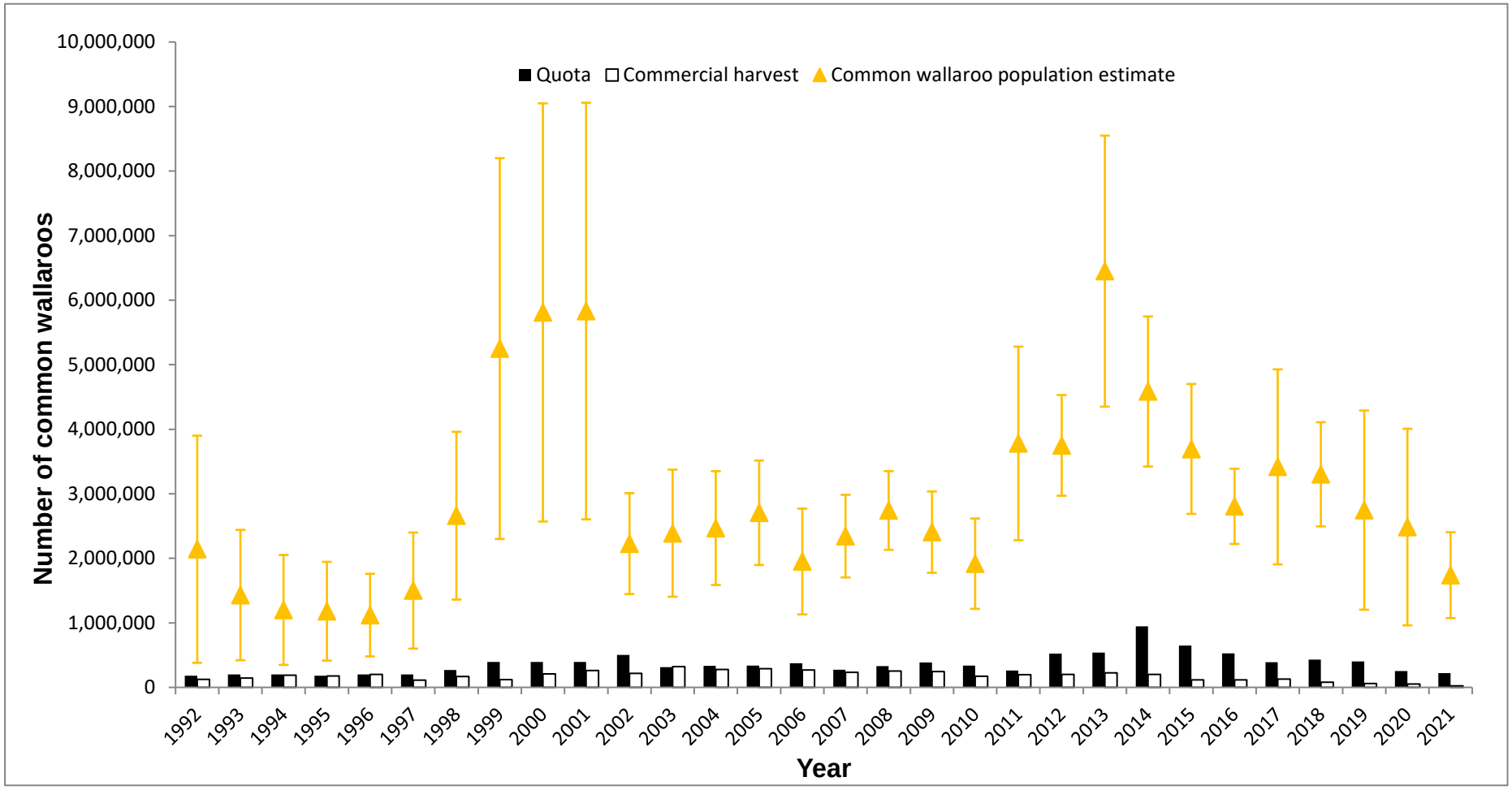
Note: population estimates are based on aerial surveys conducted the year before the harvest was taken.

Figure 16. Long-term population estimates (± one standard error), quota and harvest data for the eastern grey kangaroo in Queensland



Note: population estimates are based on aerial surveys conducted the year before the harvest was taken.

Figure 17. Long-term population estimates (± one standard error), quota and harvest data for the common wallaroo in Queensland



Note: population estimates are based on aerial surveys conducted the year before the harvest was taken.

As previously outlined, there has been no consistent decline in the populations of the three commercially harvested species since 1992 (figures 15 to 17). Of these species, the eastern grey kangaroo is consistently most abundant across the harvest zones, followed by the red kangaroo. Common wallaroos are the least numerous. Population estimates for all three species are in excess of one million across the harvest zones.

As quotas are set as a constant proportion of the populations, they fluctuate as population estimates fluctuate (figures 15 to 17). However, numerous factors influence harvest rates for commercial macropods. These include population levels, market forces, environmental conditions and access by harvesters. As a consequence, there is no clear pattern or trend in the proportion of the quota harvested since 1992.

Review of the 2021 harvest

Dealer returns for the year 2021 (entered up to 10 March 2022) indicate that there were 601,164 macropods taken in Queensland, which represents 30.3% of the overall combined quota. Of the animals harvested, there were 263,243 red kangaroos, 315,451 eastern grey kangaroos and 22,470 common wallaroos harvested (table 4 to 7). Quotas for individual species in each harvest zone were not exceeded in 2021. The maximum commercial take as a percentage of the approved quotas was 62.2% for common wallaroos in the central zone (tables 4 to 7).

Table 4. Total harvest in 2021

Species	Population estimate 2020	Quota 2021	Harvest take 2021	% quota used 2021	% population harvested 2021
Red kangaroo	4,135,700	673,050	263,243	39.1%	6.4%
Eastern grey kangaroo	10,043,400	1,087,450	315,451	29.0%	3.1%
Common wallaroo	2,484,750	220,650	22,470	10.2%	0.9%
Total	16,663,850	1,981,150	601,164	30.3%	3.6%

Note: population estimates are based on aerial surveys conducted in 2020, which were used to set the 2021 quota.

Table 5. Harvest of red kangaroos in 2021

Zone	Population estimate 2020	Quota 2021	Harvest take 2021	% quota utilised 2021	% population harvested 2021
Central	3,490,050	608,450	227,594	37.4%	6.5%
Eastern	211,250	21,150	12,234	57.8%	5.8%
Western	434,400	43,450	23,415	53.9%	5.4%
Total	4,135,700	673,050	263,243	39.1%	6.4%

Note: population estimates are based on aerial surveys conducted in 2020, which were used to set the 2021 quota.

Table 6. Harvest of eastern grey kangaroos in 2021

Zone	Population estimate 2020	Quota 2021	Harvest take 2021	% quota utilised 2021	% population harvested 2021
Central	3,834,900	468,000	206,009	44.0%	5.4%
Eastern	6,194,700	619,450	109,442	17.7%	1.8%
Western	13,800	0	0	NA	NA
Total	10,043,400	1,087,450	315,451	29.0%	3.1%

Note: population estimates are based on aerial surveys conducted in 2020, which were used to set the 2021 quota.

Table 7. Harvest of common wallaroos in 2021

Zone	Population estimate 2020	Quota 2021	Harvest take 2021	% quota utilised 2021	% population harvested 2021
Central	471,300	19,300	12,009	62.2%	2.5%
Eastern	1,692,100	169,200	8,951	5.3%	0.5%
Western	321,350	32,150	1,510	4.7%	0.5%
Total	2,484,750	220,650	22,470	10.2%	0.9%

Note: population estimates are based on aerial surveys conducted in 2020, which were used to set the 2021 quota.

Sex ratio by species and zone

The commercial harvest of macropods is typically biased towards males (figure 18) as they are usually larger and heavier than females. In 2020, the total harvest for each species was biased towards males by 69% or greater. Females composed less than 28% of the overall harvest (figure 19).

Figure 18. Overall sex ratio from 2006 to 2021 (percentages rounded to the nearest whole number)

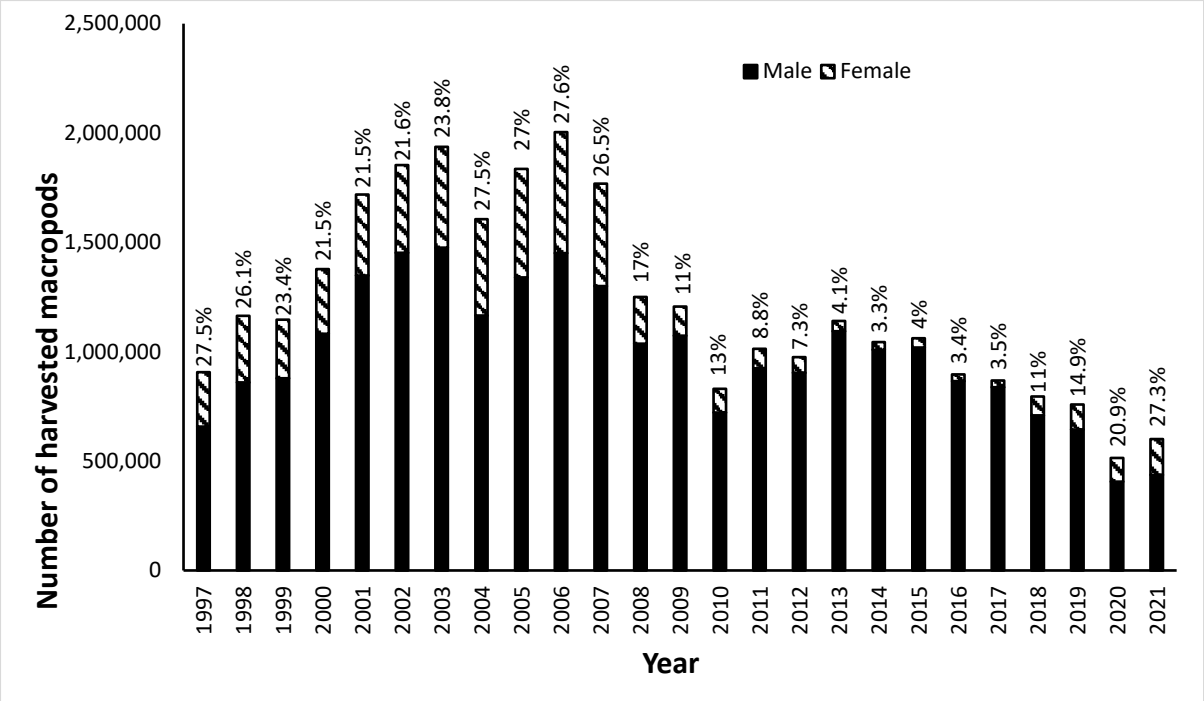
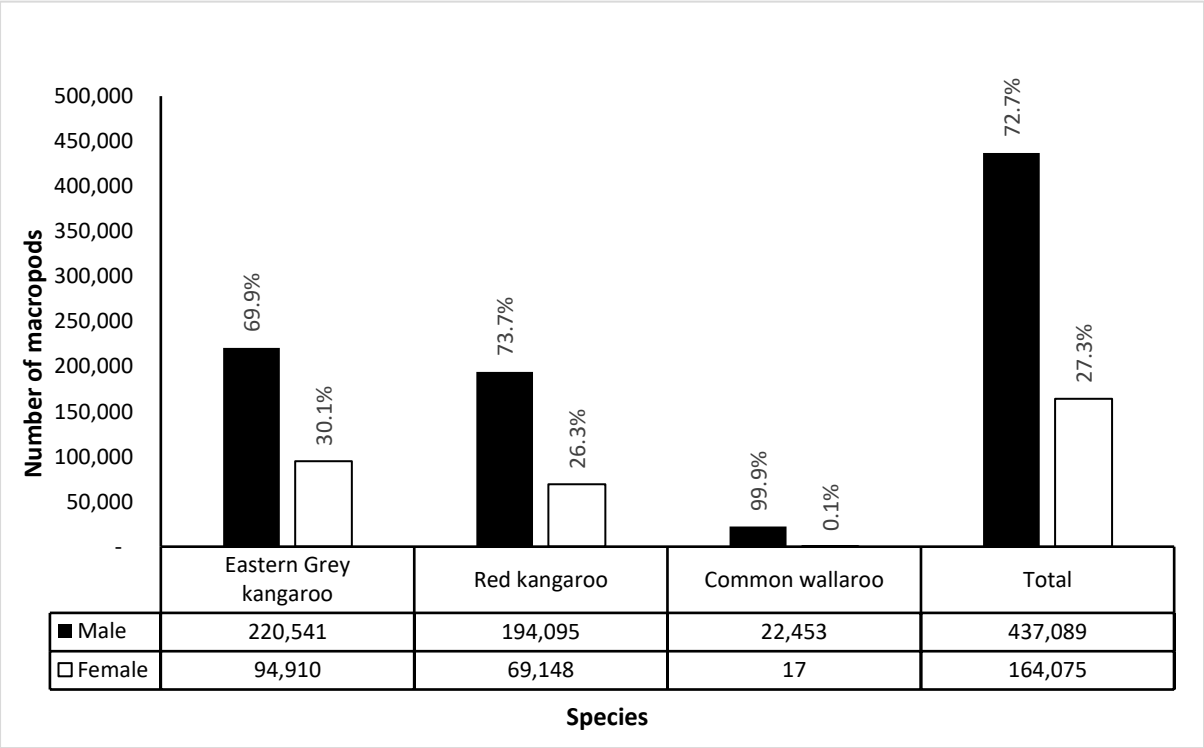


Figure 19. Proportion of 2021 harvest, male and female by species



Harvest update for 2022

The total number of tags issued as at 31 August 2022 was 641,400. A comparison of tag sales and harvest returns in relation to quotas in each zone is provided in table 8. Reported harvest is based on data from dealer returns, entered up to 31 August 2022. The number of tags sold does not exceed the maximum quota for each species in each zone therefore it is not possible for the commercial harvest quotas to be over allocated. Tag sales are below quota for all species in all zones. The 2022 harvest will be comprehensively reported on in the Queensland Commercial Macropod Management Program Annual Report 2022, due for release in March 2023.

Table 8. Tags issued and reported harvest for 2022 at 31 August

Species	Harvest zone	2022 sustainable use quota (rounded to the nearest 50)	Tags issued to 31 August 2022	Reported harvest to 31 August 2022
Red kangaroo	Central	755,300	224,350	104,631
	Eastern	22,800	18,100	5,746
	Western	59,050	29,050	10,389
Eastern grey kangaroo	Central	441,900	164,250	90,193
	Eastern	292,850	91,300	39,817
	Western	NA	NA	NA
Common wallaroo	Central	114,350	96,500	34,280
	Eastern	71,450	14,850	3,319
	Western	26,150	3,000	524

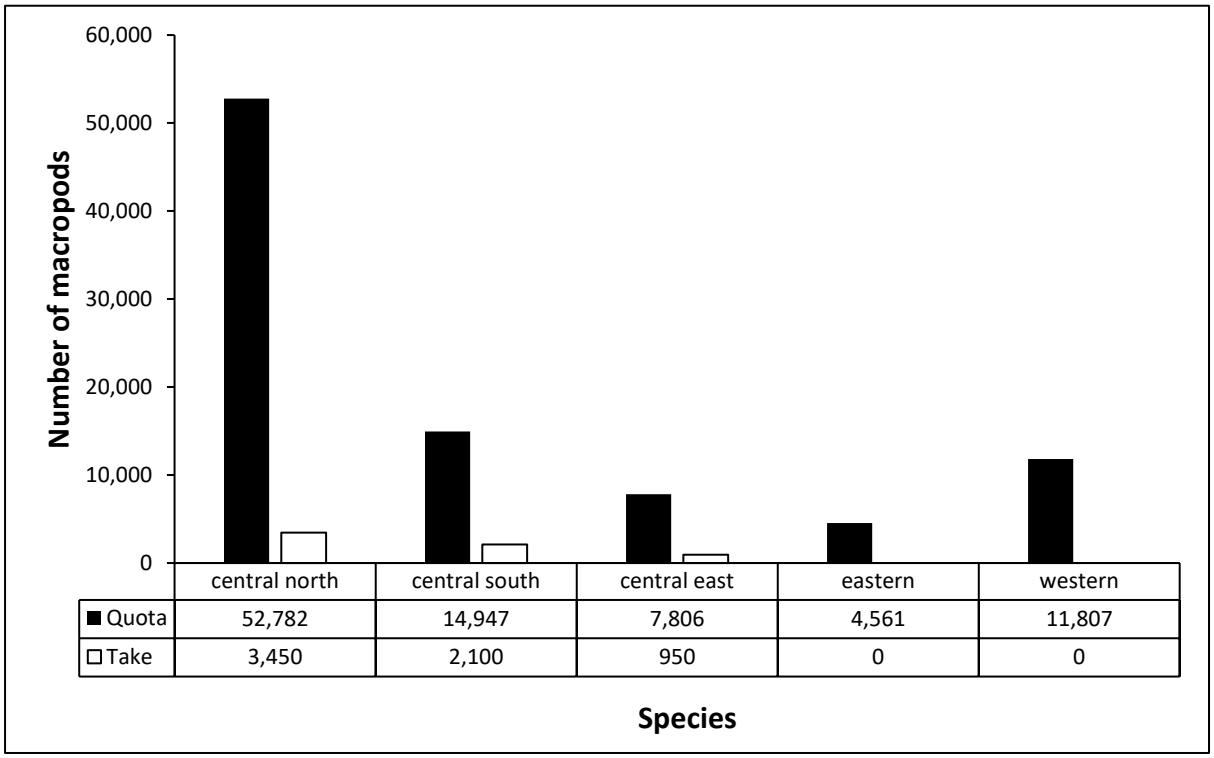
The extent of non-commercial harvest mortality

There are many forms of macropod mortality outside of the commercial harvest. It is possible for DES to collect and report data on two forms of non-commercial harvest mortality which can be considered when determining commercial quotas. These include Damage Mitigation Permits (DMPs) and disease outbreak mortality.

Damage mitigation permit

A Damage Mitigation Permit (DMP) may be granted where a protected animal (including commercially harvested macropods) is causing, or may cause, damage or loss; or represents a threat to human health or wellbeing. The total number of commercially harvested macropods allowed to be taken under these permits are limited to a maximum of 2% of the estimated population for each species. As of 2022 the 2% maximum refers to the population estimate in each zone rather than the entire harvest area. Restricting the granting of DMPs in this way provides a clear limit that ensures the lethal take of harvest macropods operates as a sustainable program. Further restrictions are also in place on the limit allocated to individuals in zones where the population estimated are below trigger points. The new assessment guidelines is on the department website (https://environment.des.qld.gov.au/licences-permits/plants-animals/damage-mitigation-permits). All DMP permits state that macropods must be taken in a way specified in the National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Non-commercial Purposes. Uptake of DMPs in 2021 is below the available quota (figures 20 to 22) and has fluctuated over the last 10 years (figure 23).

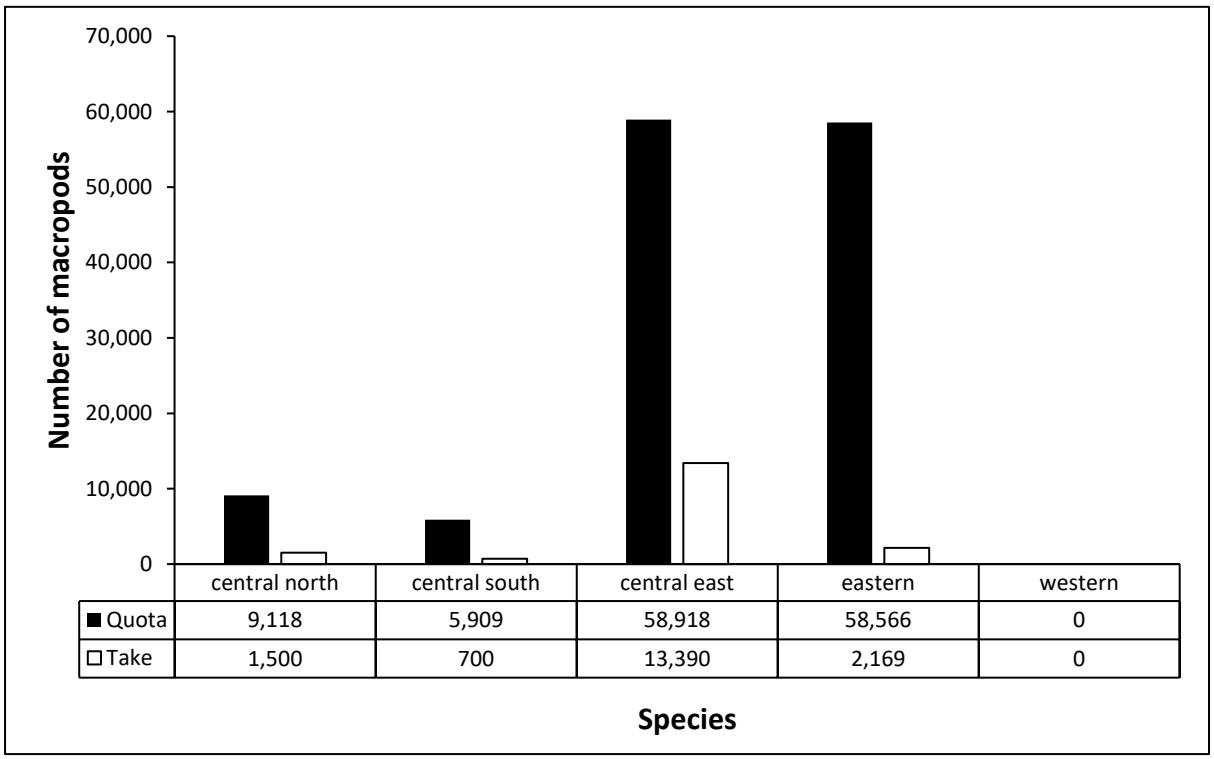
Figure 20. DMP macropod quota and take of red kangaroo for 2022 at 6 September



	central north	central south	central east	eastern	western
■ Quota	52,782	14,947	7,806	4,561	11,807
□ Take	3,450	2,100	950	0	0

Note: Figures are as recorded on 6 September 2022

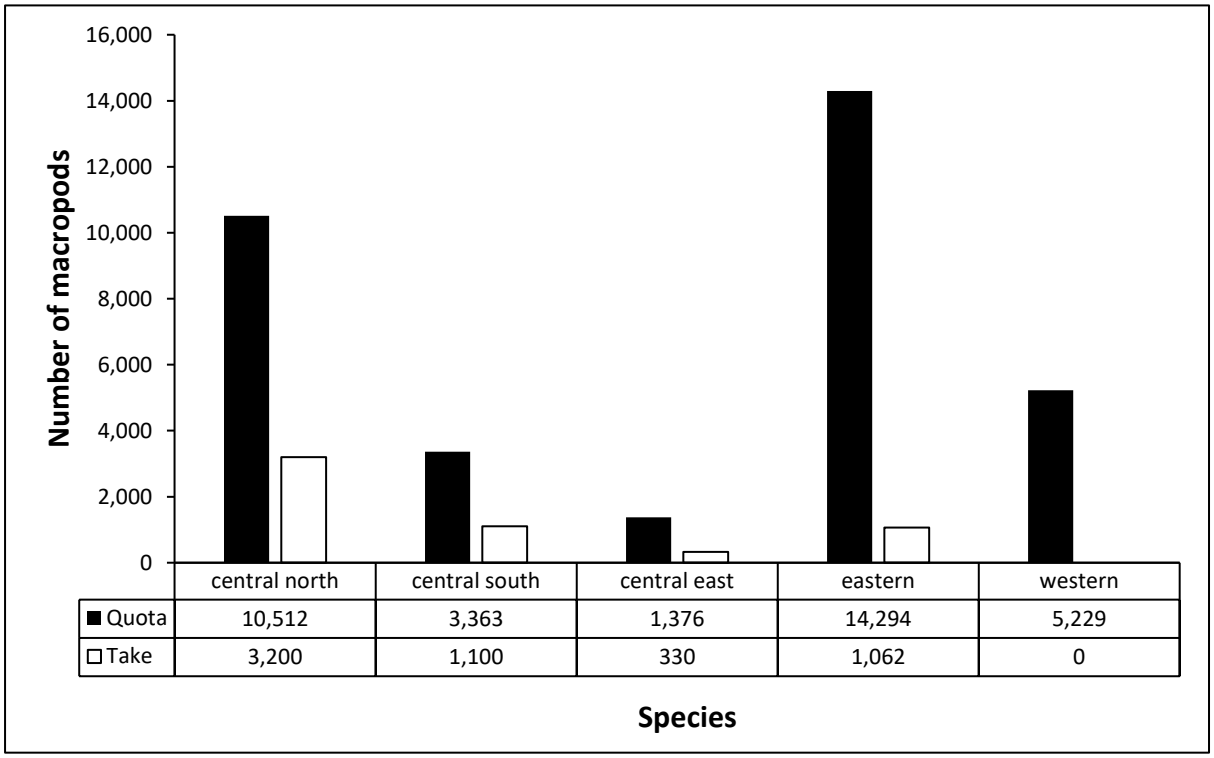
Figure 21. DMP macropod quota and take of eastern grey kangaroo for 2022 at 6 September



	central north	central south	central east	eastern	western
■ Quota	9,118	5,909	58,918	58,566	0
□ Take	1,500	700	13,390	2,169	0

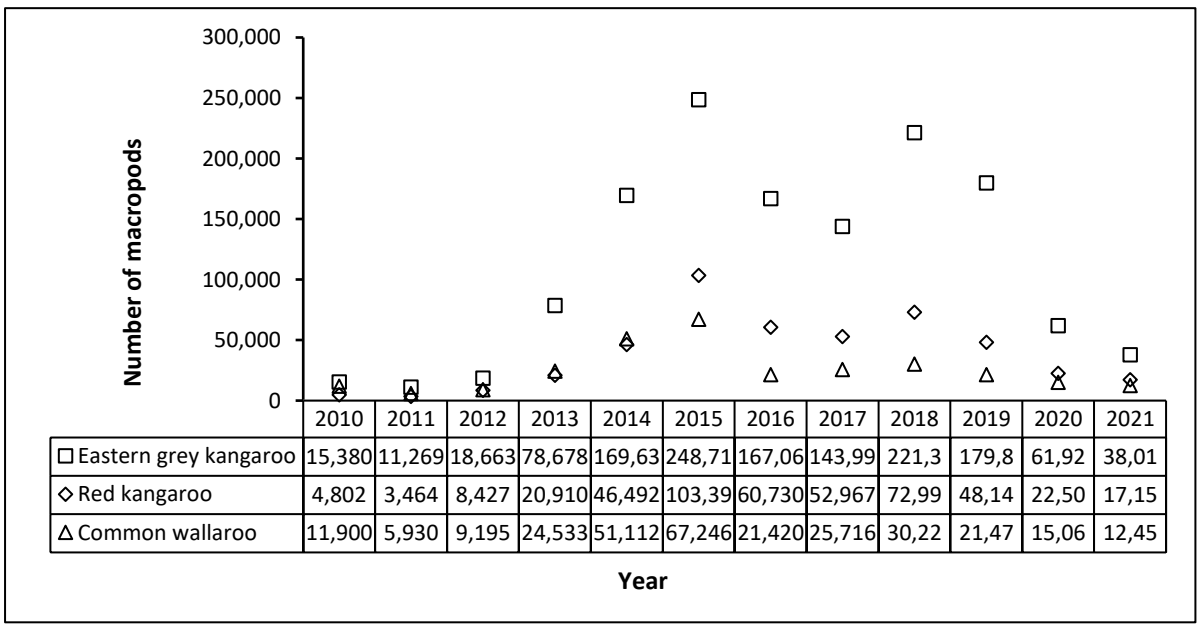
Note: Figures are as recorded on 6 September 2022

Figure 22. DMP macropod quota and take of common wallaroo for 2022 at 6 September



Note: Figures are as recorded on 6 September 2022

Figure 23. Macropods approved to be taken under a DMP 2010–2021



Disease outbreak mortality and its significance

No incidence of significant disease mortalities have been recorded for macropod populations in Queensland during 2021 or 2022. Most of the local government areas within the harvest zones have been drought declared for several years. These conditions reduce the available feed for all grazing species including macropods. The effect of prolonged drought is reflected in the estimated macropod populations in the central south and north population estimate regions.

Proportion of the population not subject to harvesting

Commercial harvesting of macropods has only occurred in three harvest zones in Queensland up until and including 2022. Cape York Peninsula and the south east corner of Queensland are designated Non-harvest zones (figure 1). Within the three commercial harvest zones macropods cannot be harvested within National Parks, State Forests, Conservationl Parks, Resources Reserves, Timber Reserves and Forest Reserves. Table 9 outlines the size of these land tenures within the commercial harvest zones.

Figures 24 to 26 show the general distribution of each of the commercially harvested macropods in relation to the population estimate regions. Red kangaroos are harvested in zone 1 to 4 and in the north of the zone 5 (figure 24). Eastern grey kangaroos are only harvested in zone 2 to 5 (figure 25). Common wallaroos have the broadest distribution (figure 26) throughout Queensland and can be harvested in all zones.

Table 9. Area of land tenures within the Queensland commercial harvest zones where harvesting of macropods is not permitted (at 23 September 2019)

	Western harvest zone km^2	Central harvest zone km^2	Eastern harvest zone km^2	Total km^2
National Park	21,448	11,781	16,844	50,073
State Forest	NA	10,788	16,407	27,195
Conservation Park	79	30	384	493
Resources Recserves	969	137	1,066	2,172
Forest Reserve	NA	NA	225	225
Timber Reserve	77	451	121	649
Total km^2	22,573	23,187	35,047	80,807

Figure 24. Red kangaroo *(Osphranter rufus)* distribution

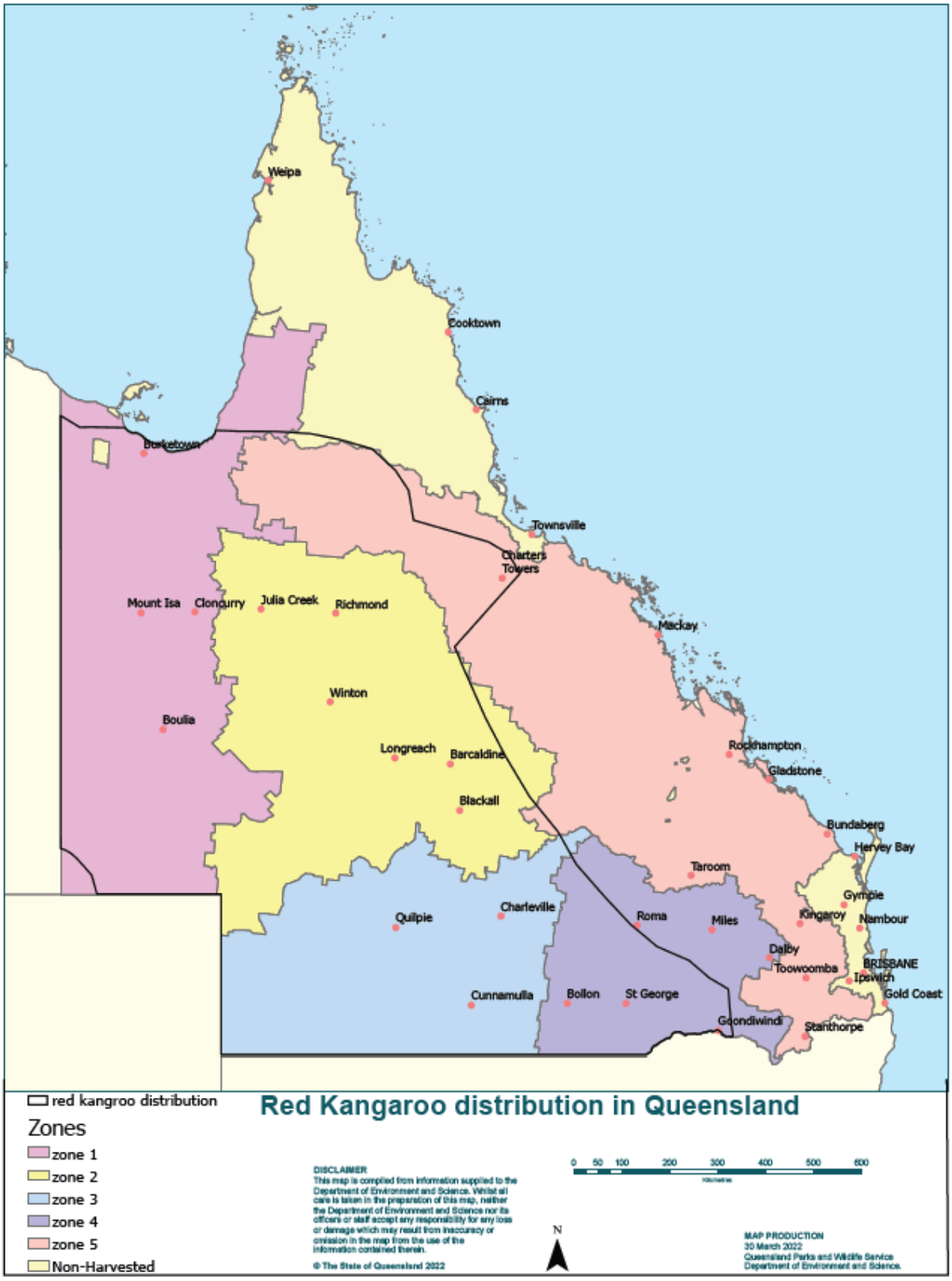


Figure 25. Eastern grey kangaroo (*Macropus giganteus)* distribution

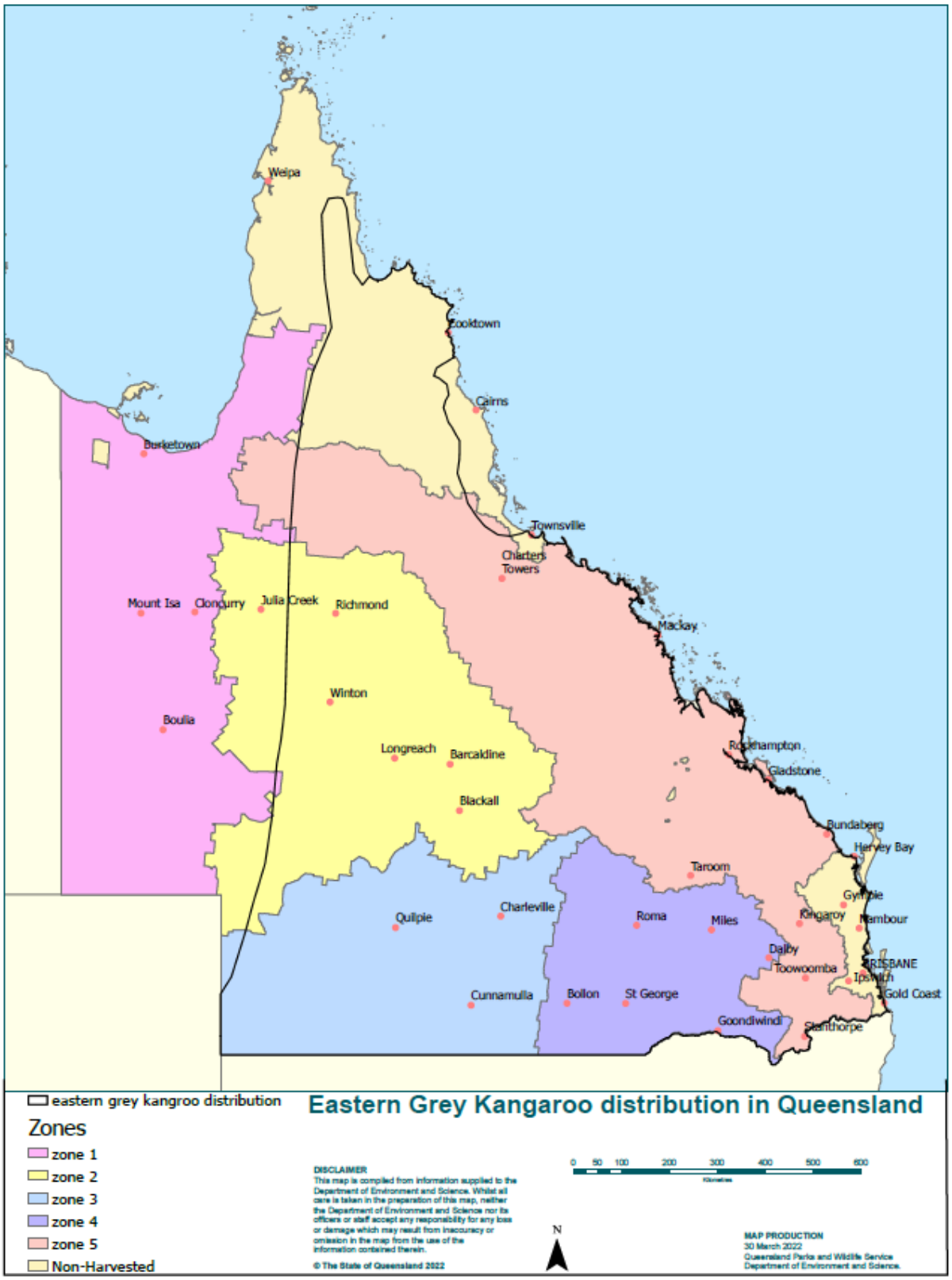
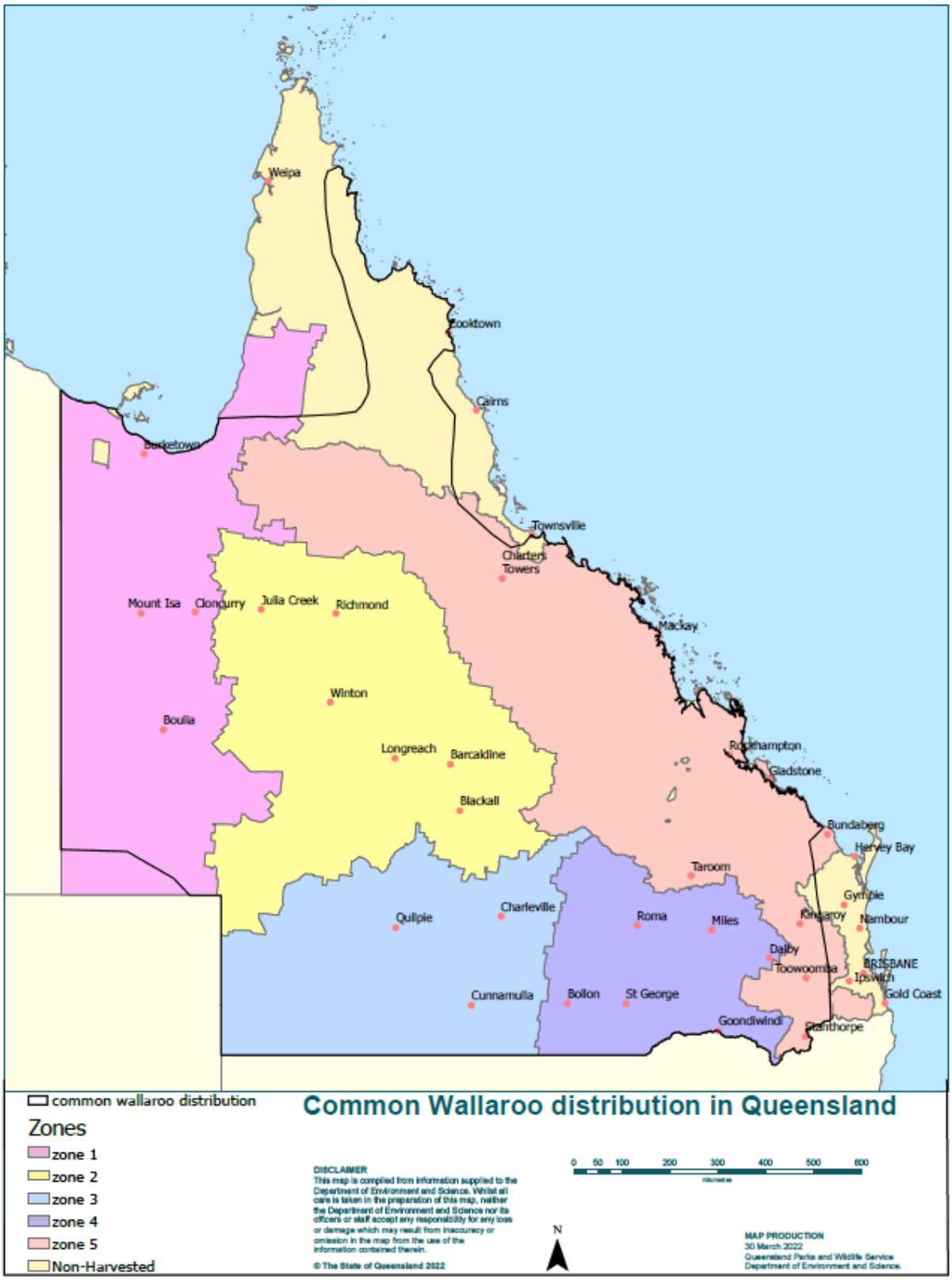


Figure 26. Common wallaroo *(Osphranter robustus)* distribution



Climate trends

Queensland's temperatures in 2021 were above average across the state with many areas throughout the year recording significantly greater than average temperatures in some months. Rainfall across the state was also higher than average with many parts of the harvest zones receiving drought breaking rain. The Central East harvest zone and the southern half of the eastern harvest zones received significant rainfall and localised flooding in some areas throughout the year. The southern Darling Downs recorded the wettest year ever in 2021 whilst some surrounding districts recorded their wettest in 20 years. Figure 27 displays the total rainfall in Queensland for 2021.

Despite the widespread rainfall to many areas the majority of the Queensland harvest zones remain drought declared as of 15 February 2022 (see figure 28). As a consequence, the population estimates for eastern grey kangaroos in zones 2 and 3 (previously labelled the central north and south regions) was below the predetermined trigger points for its fourth consecutive year. Macropod population densities are unlikely to respond to the widespread rainfall over the next 12 months but may increase in the coming years if wetter than average conditions continue. The majority of the macropod harvest zones have now been drought declared for an extended period with the recovery of natural habitats and wildlife populations expected to take time.

Despite the ongoing drought conditions sufficient rainfall occurred in some parts of the harvest zones over the last 12 months to produce feed for macropods, resulting in an increase in densities of some species in areas.

Figure 27. Queensland rainfall totals (mm) from 1 January to 31 December 2021

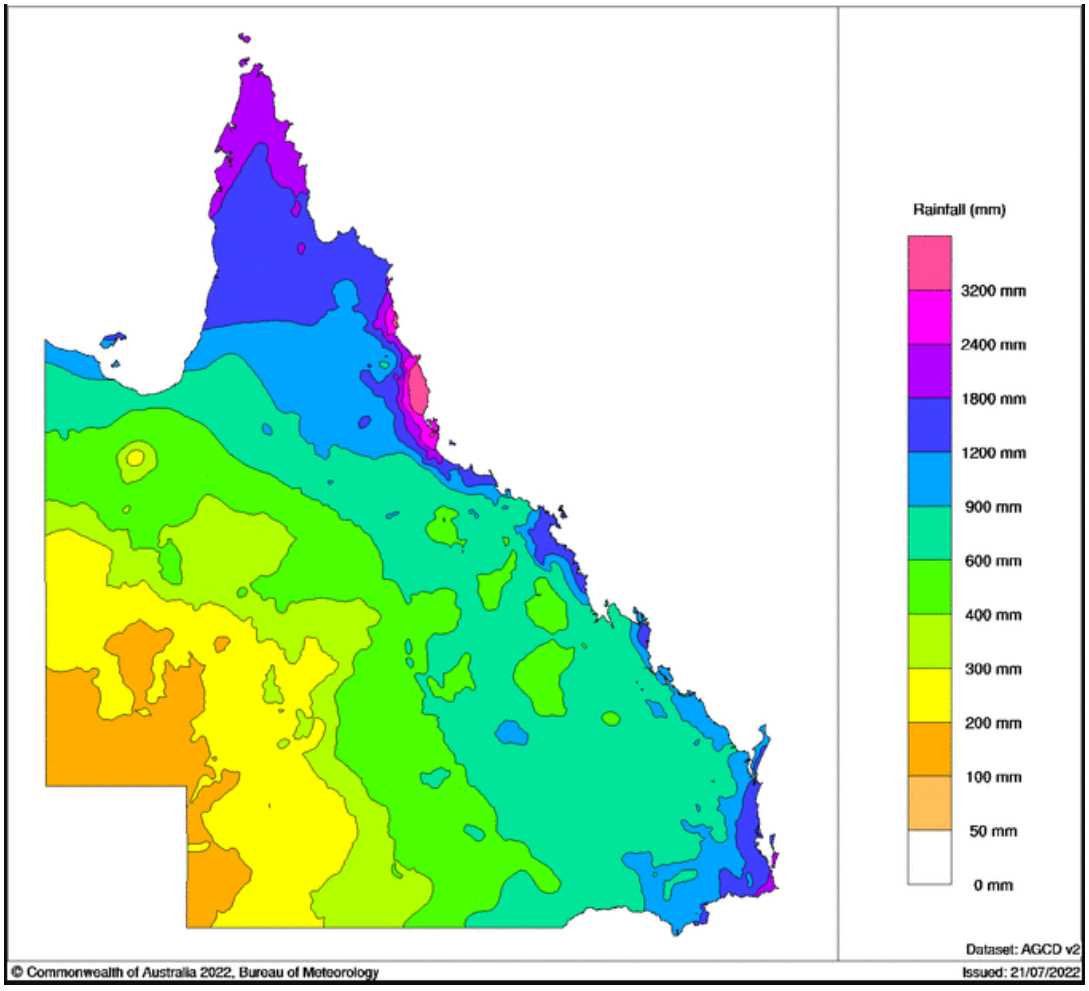
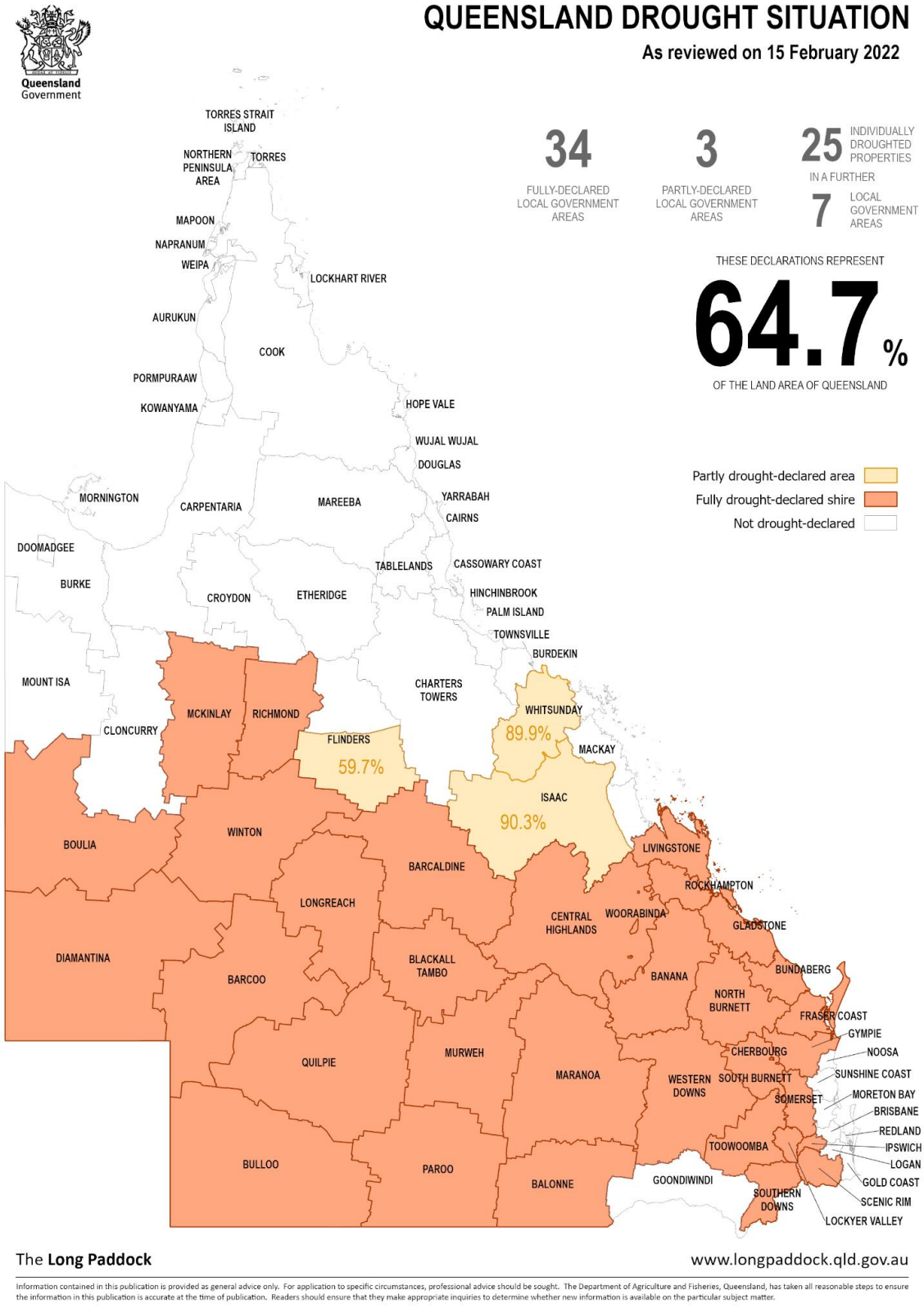


Figure 28. Queensland drought declarations at 15 Februay 2022



Summary and conclusion

The proposed quotas for the 2023 commercial macropod harvest in Queensland have been formulated by following an established methodology, which is largely based on constant proportions of population estimates and monitoring of long-term population trends. Population estimates are derived from representative aerial surveys across the harvest zones that are informed by the best available science.

Long-term trend data relating to population size since 1992, when Queensland began an annual program of helicopter surveys, demonstrates there has been no consistent increase or decline in the populations of red kangaroos, eastern grey kangaroos or common wallaroos in Queensland. However, populations do fluctuate over time. Population estimates indicate that more than 1 million macropods of each species occur in the harvest areas. Thus, current harvest rates can be viewed as not having a long-term detrimental impact on populations.

Since regionalisation of the Queensland commercial macropod harvest was introduced in 2003, an estimate of macropod population size in the eastern and western zones has been made. The model used to estimate these populations is based on a small sample area and the reduced sampling effort is reflected in a conservative quota. This model was updated in 2012 to incorporate almost a decade of survey data and to generate trigger points for the commercial quota allocation. The population estimates in zones 1 and 5 (previously the western and eastern zones, respectively) are a function of both the new model and the survey data for 2022. Aerial surveys were conducted at 20 monitor blocks across Queensland in 2022.

Overall combined population estimate totals for all three species increased across the state.

Population estimates have decreased for eastern grey kangaroos in zone 4 (previously the central east region) and increased in zone 5 (previously eastern zone) in 2022. Whilst the population estimates increased for eastern grey kangaroos in zone 2, 3 and 5 (previously the central zone north and central zone south region) the eastern grey population estimates are below a predetermined trigger point. There is no quota for this species in zone 2 and the quota for this species has been halved in zone 3 for 2023.

The red kangaroo population estimate increased in all zones.

Common wallaroo population estimates increased in zone 1 and 2 (previously the western zone central north region) but decreased in zone 3, 4 and 5 (previously the central south region, central east region and the eastern zone, respectively). Although overall combined population estimates for all three species increased across the state there were still 3 population estimates below trigger points in 2022.

For the 2021 commercial harvest period no quotas were exceeded, with the maximum percentage of quota utilised being 62.2% for common wallaroos in the central zone. Sex ratios from harvest data continue to be biased towards males with the overall percentage of females harvested below 28%. Thus, the last completed harvest period provides no indication of adverse pressure on populations that would influence proposed quotas.

For the 2022 harvest period as at 31 August tag sales are below quota for all species in all zones.

Usage of DMPs in 2021 were below the 2% of the population estimate quota for all species for all zones. The current percentages for usage of DMP quotas for 2022 are also below the quota limit of 2% for for all species in each region and zone.

The three commercially harvested macropod species are protected from harvesting within the harvest area through national parks and state forests. These ‘refuges’ occur in patches throughout the distributional ranges of all three species. Macropods are further protected from harvest in Queensland within the non-harvest zones.

Much of the harvest zones remain drought declared as many of them have for the past seven years. Though some areas received significant rainfall and localised flooding throughout the year, some areas recorded the wettest year ever in 2021 and some surrounding districts recorded their wettest in 20 years. Macropod population densities are unlikely to respond to the widespread rainfall over the next 12 months but may increase in the coming years if wetter than average conditions continue. Should the widespread dry conditions continue in the drought declared regionsit is possible that observed macropod numbers will decrease in 2023.

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Appendixes

Appendix 1 Summary of the methodology for population monitoring and quota derivation for Queensland

Aerial surveys

Since 1992, the Queensland Government has conducted an annual program of aerial surveys by helicopter to directly monitor populations of the three large macropod species covered by the Wildlife Trade Management Plan for Export—Commercially Harvested Macropods 2018–2022. This method employs line transect methodology (Buckland et al.1993), which is significantly more robust to variations in sightability than standard fixed-wing methods and provides more accurate and precise population estimates (Clancy et al. 1997). A detailed description of the methodology employed in these surveys is provided in Clancy et al. (1997).

Surveys are conducted over 22 fixed monitor blocks, covering an area of 136,000km^2 (figure 1) or 25% of the original fixed-wing survey area sampled by the Australian National Parks and Wildlife Service (ANPWS) between 1984 and 1995. In each helicopter survey block, between two to eight east-west running 50–90km transect lines have been placed systematically 10km apart. Sampling intensity within each block is approximately 2.5%.

The placement of the original 10 of the 22 survey blocks used in this monitoring program was designed to provide appropriate coverage of representative densities of macropods over the core harvest area of 630,000km^2 (Pople et al. 1998). In response to the introduction of regional management to Queensland in 2003, a further 12 survey blocks were added to provide broader coverage of the entire harvest area and to ensure all bioregions were sampled. Placement of these new survey blocks was optimised using fixed-wing survey data collected across the harvest zone during 2001. These surveys provided data to reassess the representativeness of the existing helicopter monitor blocks and to investigate alternative scenarios for future survey design. Analysis of these data in combination with harvest data has led to improved stratification of the survey area and hence increased the power to extrapolate data from survey monitor blocks to other regions in the harvest zone. These investigations were conducted in collaboration with the University of Queensland as part of the Australian Research Council (ARC) funded ROOSPIRT Linkage project (Pople et al. 2006).

No correction factors are applied to surveys of eastern grey and red kangaroos as comparisons of ground and aerial surveys conducted by Clancy et al. (1997) concluded that the helicopter line transect technique is both accurate and precise in determining population densities for both these species over a range of habitats, seasons and densities. Whilst the method is less accurate for common wallaroos there is still a close correlation between the results of helicopter surveys and those of ground counts. Estimates derived from ground surveys for common wallaroo density are approximately 1.9–2.0 times that recorded for helicopter surveys. Accordingly, since 1998, the Queensland Government has applied a conservative correction factor of 1.2 to the wallaroo density estimates derived from helicopter surveys. In 2011, this conservative correction factor has been increased to 1.85 in line with that used in New South Wales.

Frequency and coverage of aerial surveys

Due to the costs and logistics associated with conducting helicopter aerial surveys over 22 monitor blocks, not all monitor blocks are surveyed on an annual basis. To ensure adequate coverage of the harvest area in Queensland and to enable accurate tracking of population trends, all blocks are surveyed at least once every two years. Decisions on the frequency and coverage of the aerial survey program were based on analyses completed by the University of Queensland as part of the ARC funded ROOSPIRT Linkage project. This redesign of the monitoring program also sought to introduce a level of bioregional stratification to provide for improved potential to monitor populations at that scale as a possible prelude to the introduction of further harvest zones in Queensland.

The main feature of the current monitoring program is the establishment of pairs of closely correlated monitor blocks within each of the bioregions. The process of pairing monitor blocks was based on linear modelling that examined the relationships between macropod population densities, rainfall and harvest off-take for all monitoring blocks within each bioregion. The process of pairing blocks and the development and refinement of these linear models enables the frequency of monitoring of blocks to

be reduced without compromising the efficacy of the monitoring program. Using this approach monitoring blocks with bioregional pairs will be monitored on a rotating basis with each block being subject to surveys every two years.

Linear models utilising data on rainfall, harvest off-take and population rates of increase for the monitored block within a pair are then used to predict population changes in the unmonitored block of the pair. The models are refined annually as further data is collated and enhancements are made to the modelling process. In the situation where there is only a single monitor block within a bioregion or where a monitor block samples a unique macropod community, such as the Blackall block which contains moderate densities of all three species and particularly high densities of common wallaroo, these blocks are sampled annually. In order to calibrate the models and to provide a benchmark of the states' macropod populations, a survey of the complete set of 22 monitor blocks will be completed every five years. The table below summarises the current stratification, pairing and sampling frequency for all 22 of the fixed aerial survey monitor blocks used in the Queensland monitoring program.

Due to the significantly lower macropod densities and associated lower harvest densities recorded historically from the eastern and western harvest zones, these two zones are not surveyed with the same intensity as the central harvest zone. Within both the eastern and western harvest zones, population density estimates are based on helicopter aerial surveys of three monitor blocks established in 2004 and monitored on a two yearly rotation. The results are used in association with data derived from fixed-wing aerial surveys conducted over parts of these zones during 2001 to adjust approximations of the population rates of increase calculated by comparing fixed-wing survey data from 1981–82, 1984 and 2001 with the most recent helicopter aerial survey data and past ground surveys completed in equivalent habitats.

Population estimation

Population estimates are calculated by extrapolating the mean monitor block densities to a larger harvest area of 1,097,410km^2 for eastern grey kangaroos, 1,105,587km^2 for red kangaroos and 1,104,222km^2 for common wallaroos. To improve precision and remove bias in density estimates used in the calculation of population sizes and their standard errors, the data collected since 2003 have been stratified (Buckland et al. 1993) by observer and bioregion. Helicopter surveys are conducted with two observers, which results in twice the sampling intensity as one observer. To account for differences between observers, the data was post-sampling stratified by applying 'goodness of fit' models to the data from each observer using the computer program 'Distance' (Buckland et al. 1993). 'Distance' was then used to obtain an overall macropod density estimate for the survey block. The survey blocks were stratified by bioregion, and their weighted (by sampling intensity) density estimates used to calculate population sizes for the harvest area according to the methods and calculations outlined in Clancy et al. 1994 and 1997. For all species, stratification of the data by observer and bioregion has not significantly changed the population size estimate but has reduced the standard error associated with that estimate. However, with common wallaroos the standard errors associated with the population estimate remain high due to the high variability in densities across the state.

Quota derivation

Sustainable harvest quotas are calculated using a fixed proportion of the estimated macropod populations within the Queensland harvest area. The proportions used vary between species and are adjusted across the harvest zones in relation to the margins of error present in population estimates. The maximum proportions used for each species are 15% of populations for eastern grey kangaroos and common wallaroos and 20% of the population for red kangaroos. These maximum proportions are only applied to populations within the central harvest zone where survey effort is greatest and hence confidence limits for population estimates are within acceptable limits. In both the eastern and western harvest zones more conservative harvest proportions of 10% for all three species are applied. These sustainable-use harvest proportions are based on research and modelling undertaken by Caughley et al. (1987) and Hacker et al. (2002) and are currently accepted by the scientific community, the Queensland Department of Environment and Science and the Commonwealth Department of Sustainability, Environment, Water, Population and Communities for determining state quota limits.

Stratification, pairing and sampling frequency for fixed aerial survey monitor blocks in Queensland

Harvest zone	Bioregion	Monitor block	Years 1 and 3	Years 2 and 4	Year 5
Central	Brigalow Belt South	Injune	✓		✓
		Taroom		✓	✓
		Westmar	✓		✓
		Roma		✓	✓
	Mulga Lands	Charleville	✓	✓	✓
		Cunnamulla	✓		✓
		Bollon		✓	✓
		Quilpie	✓		✓
		Hungerford		✓	✓
	Mitchell Grass Down	Blackall	✓	✓	✓
		Winton	✓		✓
		Longreach		✓	✓
		Julia Creek	✓		✓
		Hughenden		✓	✓
	Desert Uplands	Barcaldine	✓	✓	✓
	Channel Country	Windorah	✓	✓	✓
Eastern	Not stratified	Inglewood		✓	✓
		Emerald		✓	✓
		Charters Towers		✓	✓
Western	Not stratified	Duchess	✓		✓
		Cloncurry	✓		✓

Appendix 2. Densities per km^2 of the commercially harvested macropod species 2004–2022

	Eastern grey kangaroo																		
Block	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Barcaldine	20.6	13.1	22.7	17.65	23.1	29.50	12.87	23.92	24.09	44.10	24.96	19.3	14.71	13.65	15.19	5.03	5.08	5.71	6.50
Blackall	7.57	7.10	6.22	7.51	8.28	11.19	7.08	6.08	9.87	19.41	10.59	8.75	5.29	4.97	3.16	1.64	2.07	0.38	0.98
Bollon	25.6	25.3		30.53		31.74	30.14		47.2		32.01	24.9		27.58		29.50		12.95	7.78
Charleville	17.5	19.9	15.9	12.05	11.2	12.95	12.23	28.11	25.12	26.77	11.77	8.4	10.47	9.32	5.25	2.13	1.78	3.67	3.97
Charters Towers		1.63		5.02		5.33	5.57		3.37		3.14	2.01		1.53		1.32		2.45	4.25
Cloncurry	0.01		0.16		0.02		0.21	0.012		0.07		0.00	0.06		0.12			0.00	0.00
Cunnamulla	13.2		9.97		11.4		11.64	32.82		41.04		35.8	18.73		9.15	5.10	2.46	2.53	6.09
Duchess	0.00		0.00		0.00		0.00	0.00		0.00		0.00	0.00		0.00			0.00	
Emerald		3.95		3.41		4.05	5.04		2.75		7.01	5.29		7.88		7.67		3.94	6.25
Hughenden	0.77	0.58		1.16		0.97	0.79		0.53		1.17	1.41		1.01		1.43		1.47	0.73
Hungerford	1.16	1.10		0.77		0.94	0.65		2.20		4.00	3.79		3.36		0.13		0.08	0.95
Inglewood		8.72		18.62		9.75	12.33		29.10		32.73	49.8		42.02		66.87		23.77	28.21
Injune	13.5	18.8		18.62	6.82		16.60	17.75		31.32		22.5	40.62		25.97		17.15	21.22	
Julia Creek	1.08	0.87	1.05		0.76		0.28	0.28		0.84		0.84	0.2		0.49			0.06	0.00
Longreach	9.05	8.48		6.63		6.61	6.13		18.07		20.17	5.25		3.85		4.67		3.60	2.77
Quilpie	1.86		0.97		1.42		2.79	1.57		3.61		4.65	2.66		0.87	0.34	0.00	0.37	0.05
Roma	25.0	24.9	25.4	25.12		23.43	19.30		27.16		40.56	32.2		31.74		39.34		23.10	22.62
Taroom	8.12	13.3		8.44		7.87	7.36		14.98		13.24	12.6		8.19		13.00		9.74	22.03
Westmar	25.5		23.1		21.1		22.08	37.25		62.54		77.9	66.07		82.67		30.64	24.76	27.02
Windorah	1.58	2.69	1.14	1.39	2.39	1.26	0.86	2.68	1.24	1.80	0.79	1.02	2.13	1.34	0.29	0.10	0.06	0.07	0.03
Winton	4.86	2.98	3.74		4.78		2.43	3.57		6.61		5.79	4.46		5.11		1.50	1.02	0.32

	Red kangaroo																		
Block	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Barcaldine	6.07	4.07	11.07	6.72	9.03	9.83	7.58	10.05	7.83	12.30	9.2	16.24	8.54	8.25	7.49	5.52	3.86	5.90	11.33
Blackall	3.99	3.29	4.55	3.78	6.45	7.24	4.70	12.37	14.17	17.47	10.35	11.58	9.69	8.52	7.89	8.78	5.63	5.93	5.58
Bollon	4.13	8.87		8.35		11.16	9.90		7.78		7.27	9.83		8.87		7.18		6.68	5.02
Charleville	4.55	5.48	7.36	9.57	7.58	8.47	6.46	14.69	5.53	7.03	4.97	5.06	6.32	3.75	4.06	3.72	1.44	3.68	1.79
Charters Towers		0.02		0.05		0.00	0.70		0.24		0.21	0.62		0.59		0.28		0.20	0.00
Cloncurry	2.14		4.18		6.17		3.01	3.34		5.91		4.06	3.45		2.97			2.86	7.82
Cunnamulla	3.54		4.59		9.02		10.65	18.27		28.76		27.29	16.54		6.94	5.56	5.75	7.01	9.34
Duchess	2.92		0.87		1.78		0.85	0.71		0.82		1.66	1.61		1.32			4.14	
Emerald		0.00		0.00		0.00	0.02		0.05		0.00	0.00		0.00		0.00		0.00	0.00
Hughenden	1.97	1.59		1.59		1.29	0.92		2.22		2.67	1.52		2.62		3.54		3.92	4.79
Hungerford	1.04	2.57		3.90		4.41	2.60		7.01		8.75	9.7		9.83		0.65		2.94	3.74
Inglewood		0.00		0.00		0.00	0.50		0.00		0.00	0.00		0.00		0.00		0.00	0.00
Injune	1.02	0.14	0.05		0.72		0.00	0.86		0.04		0.00	0.11		0.00		0.00	0.05	
Julia Creek	4.08	5.13	4.91		5.39		3.16	3.30		8.10		5.6	4.58		5.54			1.73	2.34
Longreach	9.53	11.86		11.33		14.71	12.24		14.43		19.26	4.79		15.90		25.72		25.75	35.21
Quilpie	2.19		1.39		5.13		2.06	4.70		9.80		9.51	12.27		7.87	2.41	1.76	2.25	4.37
Roma	2.19	1.62	2.54	2.66		2.37	2.26		3.47		5.02	2.83		2.96		4.96		2.98	4.29
Taroom	0.02	0.37		0.00		0.00	0.00		0.00		0.00	0.00		0.00		0.00		0.00	0.00
Westmar	0.97		0.59		0.55		1.14	1.49		1.14		2.28	4.69		3.27		4.42	2.48	1.24
Windorah	4.42	4.52	7.32	4.48	9.85	12.62	6.67	10.47	10.77	11.84	8.11	12.29	12.16	16.95	11.80	3.22	2.41	2.80	4.32
Winton	3.69	5.02	5.62		6.05		3.32	4.44		9.73		16.98	8.57		10.86		8.00	9.72	6.62

	Common wallaroo																		
Block	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Barcaldine	6.59	12.30	8.63	16.42	19.98	16.20	5.52	8.306	5.53	9.02	4.69	6.79	4.89	3.57	3.57	0.87	1.63	1.90	2.09
Blackall	18.02	21.17	22.15	34.98	39.14	49.05	23.82	21.54	20.2	54.43	28.58	24.86	11.29	9.32	6.89	3.44	1.60	0.78	1.04
Bollon	4.72	2.64		1.55		1.67	0.36		2.44		0.7	0.31		2.38		1.01		1.42	0.60
Charleville	7.21	6.20	5.79	4.66	4.70	5.36	11.80	13.43	10.65	5.09	4.47	4.07	3.81	1.24	0.60	0.60	0.64	1.44	0.82
Charters Towers		0.30		2.84		0.61	1.07		0.51		1.03	0.22		0.23		0.63		0.41	1.35
Cloncurry	0.00		0.30		0.64		0.51	0.260		0.14		0.02	0.21		1.32			0.73	2.93
Cunnamulla	1.68		0.45		0.64		1.95	0.611		0.70		2.53	2.60		2.10	0.99	0.87	1.08	1.09
Duchess	0.57		0.11		1.69		0.74	0.093		1.16		0.00	0.00		0.26			0.90	
Emerald		0.02		0.00		0.78	0.02		0.33		0.19	0.32		0.25		0.25		0.32	0.15
Hughenden	1.65	1.28		2.28		0.24	0.41		0.94		0.93	0.22		1.59		0.55		1.21	1.65
Hungerford	1.19	0.36		0.24		0.48	0.25		0.47		1.27	1.93		2.33		0.08		0.28	0.24
Inglewood		3.08		4.03		0.34	1.01		1.22		3.18	3.42		11.16		11.60		4.47	3.12
Injune	0.01	2.30	1.34		0.91		4.05	0.00		0.63		0.84	0.60		0.33		2.31	0.88	
Julia Creek	2.74	0.00	0.04		0.11		0.01	0.00		0.00		0.00	0.03		0.00			0.00	0.00
Longreach	17.96	21.57		18.59		12.69	9.18		17.77		15.67	8.84		4.17		6.05		8.40	7.89
Quilpie	5.41		0.78		3.36		2.69	3.007		5.58		7.51	3.42		3.76	0.45	0.87	1.17	0.64
Roma	1.35	3.74	2.49	2.08		1.16	3.45		0.87		1.01	0.75		1.45		1.15		0.45	0.66
Taroom	0.22	2.04		0.17		1.05	0.25		0.02		0.38	0.18		0.35		0.20		0.10	0.17
Westmar	0.74		0.02		0.13		0.30	0.00		0.01		0.00	0.28		0.54		0.38	0.75	0.21
Windorah	2.14	2.30	1.81	2.72	3.03	3.07	2.42	3.185	3.32	5.29	2.82	1.46	4.86	4.12	2.47	0.46	0.20	0.02	0.18
Winton	1.73	1.78	1.70		3.14		0.96	4.191		6.35		0.76	1.14		1.30		0.26	0.82	1.82