2022 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

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Executive summary

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 four zones: no harvest zone, eastern harvest zone, central harvest zone and western harvest zone.

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 2021, all 22 survey monitor blocks in Queensland were surveyed. 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.

Overall combined population estimate totals for all three species declined across the state. Population estimates have decreased for eastern grey kangaroos in the eastern zone. In the central zone north and central zone south the eastern grey population estimates are below a predetermined trigger point and there is no quota for this species in these regions for 2022. The red kangaroo population estimate for the central zone and western zone increased slightly but decreased slightly in the central zone east region. Common wallaroo population estimates increased in the central zone but decreased in the eastern zone.

Examination of long-term trends in population and block density estimates indicates that the 2021 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 2020 harvest period, only 18.2% of the commercial harvest quota was utilised, with the highest percentage of quota used being 77.9% for common wallaroo in the central zone. The overall harvest was male biased, with females comprising 21% of the overall harvest.

Figures available as at 31 July 2021 indicate that the harvest will be well below quotas for each species in each zone in 2020. Non-commercial take under damage mitigation permits (DMPs) were also below the maximum available quota for the 2020 harvest period a trend that is likely to be repeated in 2021.

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 80,027km^2. 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 2022 harvest period.

Population estimates for 2021 and proposed sustainable use quotas for the 2022 commercial harvest. Note estimates in red signify a trigger point has been reached.

Species	Population estimate region	2021 estimated population (rounded to the nearest 50)	2022 sustainable use quota (rounded to the nearest 50)	Proportion of population (% rounded to the nearest whole number)
Red kangaroo	Central north	2,639,100	527,800	20%
	Central south	747,350	149,450	20%
	Central east	390,300	78,050	20%
	Central total	3,776,750	755,300	20%
	Eastern	228,050	22,800	10%
	Western	590,350	59,050	10%
	Combined	4,595,150	837,150	18.2%
Eastern grey kangaroo	Central north	455,900	0	NA
	Central south	295,450	0	NA
	Central east	2,945,900	441,900	15%
	Central total	3,697,250	441,900	12%
	Eastern	2,928,300	292,850	10%
	Western	0	NA	NA
	Combined	6,625,550	734,750	11.1%
Common wallaroo	Central north	525,600	78,850	15%
	Central south	168,150	25,200	15%
	Central east	68,800	10,300	15%
	Central total	762,550	114,350	15%
	Eastern	714,700	71,450	10%
	Western	261,450	26,150	10%
	Combined	1,738,700	211,950	12.2%

Contents

Introduction

The commercial harvesting in Queensland of three macropod species—red kangaroo *Macropus rufus,* eastern grey kangaroo *Macropus giganteus* and common wallaroo *Macropus 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
  - Nature Conservation (Macropod Harvest Period) Notice
- *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.

Since 2003, quotas have been set for each species for four harvest zones to ensure that harvest pressure is distributed across the range of the species (figure 1):

- 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 Nature Conservation (Macropod Harvest Period 2022) Notice 2021 is due for release in December 2021. The release of this notice will allow the harvest period to be declared open on 1 January 2022. The notice will outline specific conditions for the 2022 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 the Environment and Energy 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. 2021 estimated populations and 2022 proposed quotas for each macropod species in each harvest zone. Note estimates in red signify a trigger point has been reached.

Species	Population estimate region	2021 estimated population (rounded to the nearest 50)	2022 sustainable use quota (rounded to the nearest 50)	Proportion of population (% rounded to the nearest whole number)
Red kangaroo	Central north	2,639,100	527,800	20%
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Eastern grey kangaroo	Central north	455,900	0	NA
	Central south	295,450	0	NA
	Central east	2,945,900	441,900	15%
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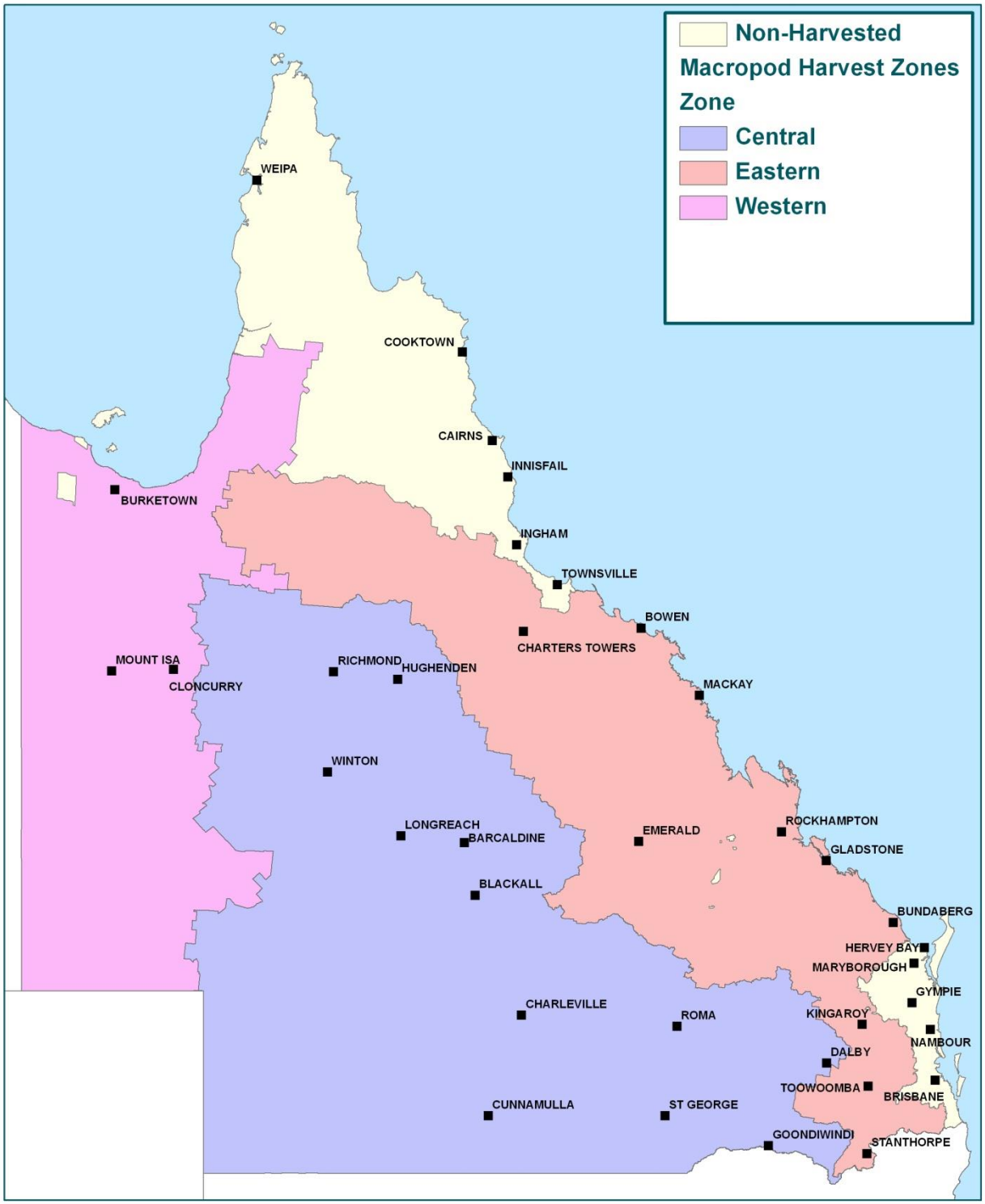
	Central east	68,800	10,300	15%
	Central total	762,550	114,350	15%
	Eastern	714,700	71,450	10%
	Western	261,450	26,150	10%
	Combined	1,738,700	211,950	12.2%

Figure 1. Queensland macropod harvest zones



The central harvest zone is further divided into three regions for the purposes of estimating the populations of commercially harvested macropods. They are the central north, central south, and central east as displayed in figure 6.

The regional councils in the central north population estimate region are Barcaldine, Barcoo, Blackall-Tambo, Flinders, Longreach, McKinlay, Richmond and Winton.

The regional councils in the central south population estimate region are Bulloo, Murweh, Paroo and Quilpie.

The regional councils in the central east population estimate region are Balonne, Goondiwindi, Maranoa and Western Downs.

The eastern harvest zone 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 .

The western harvest zone consists of Boulia, Burke, Carpentaria, Cloncurry, Diamantina and Mount Isa 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 19921

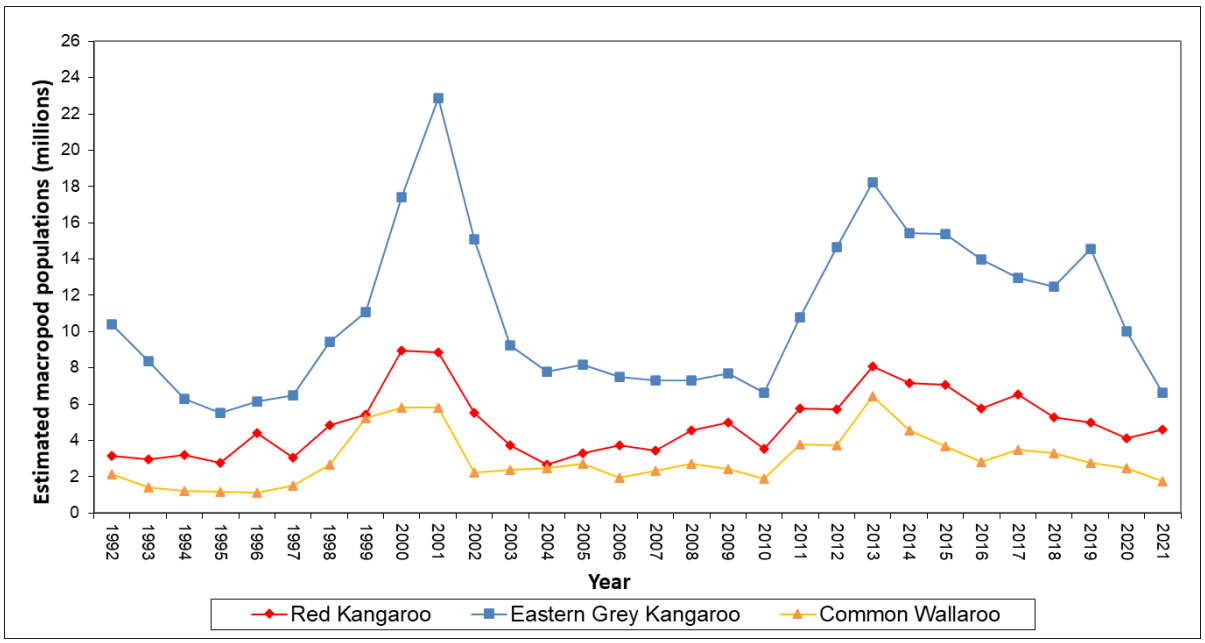


Figure 3. Red kangaroo population estimates (with one standard error) since 1992

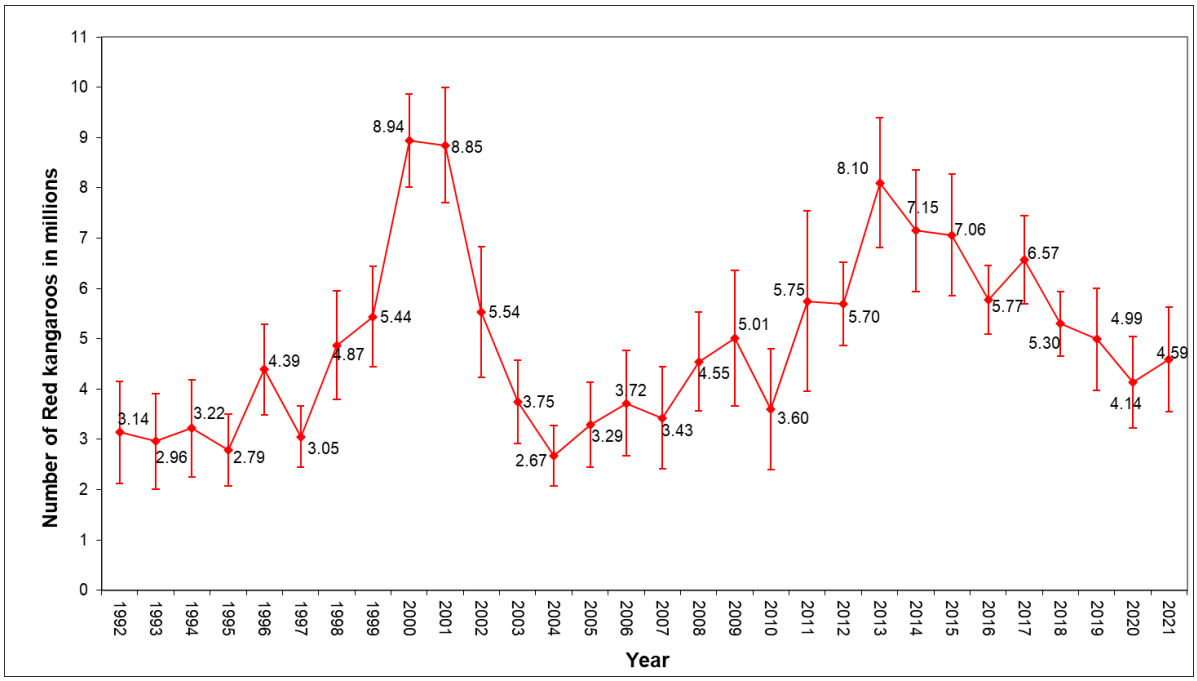


Figure 4. Eastern grey kangaroo population estimates (with one standard error) since 1992

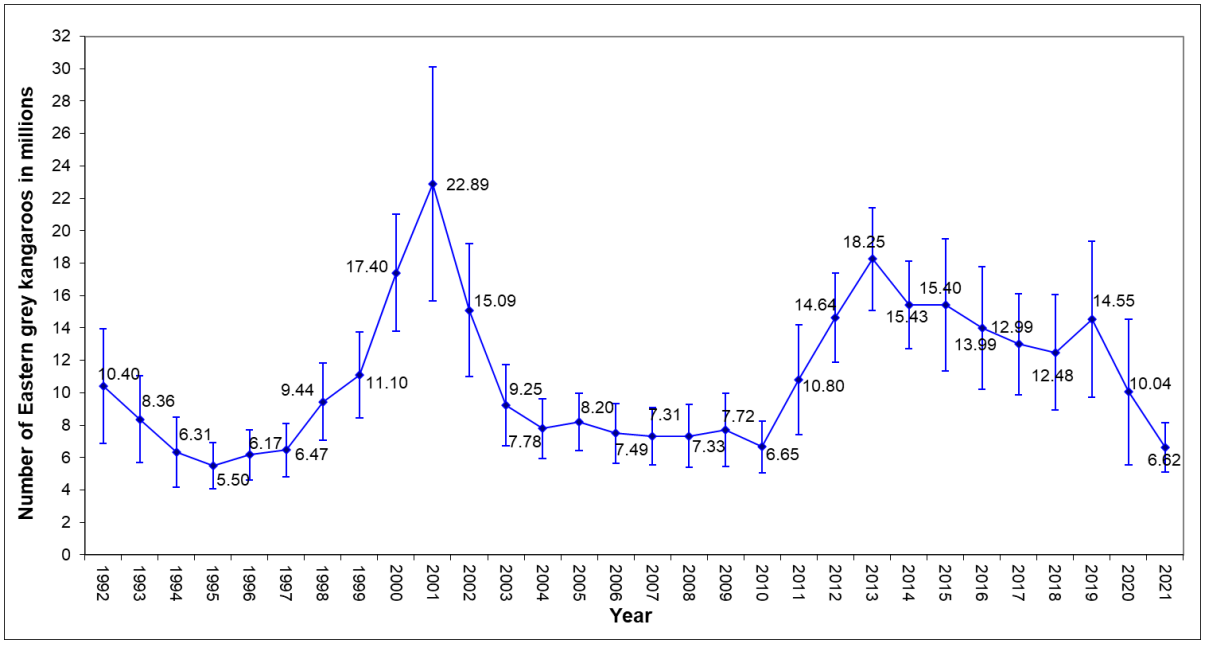
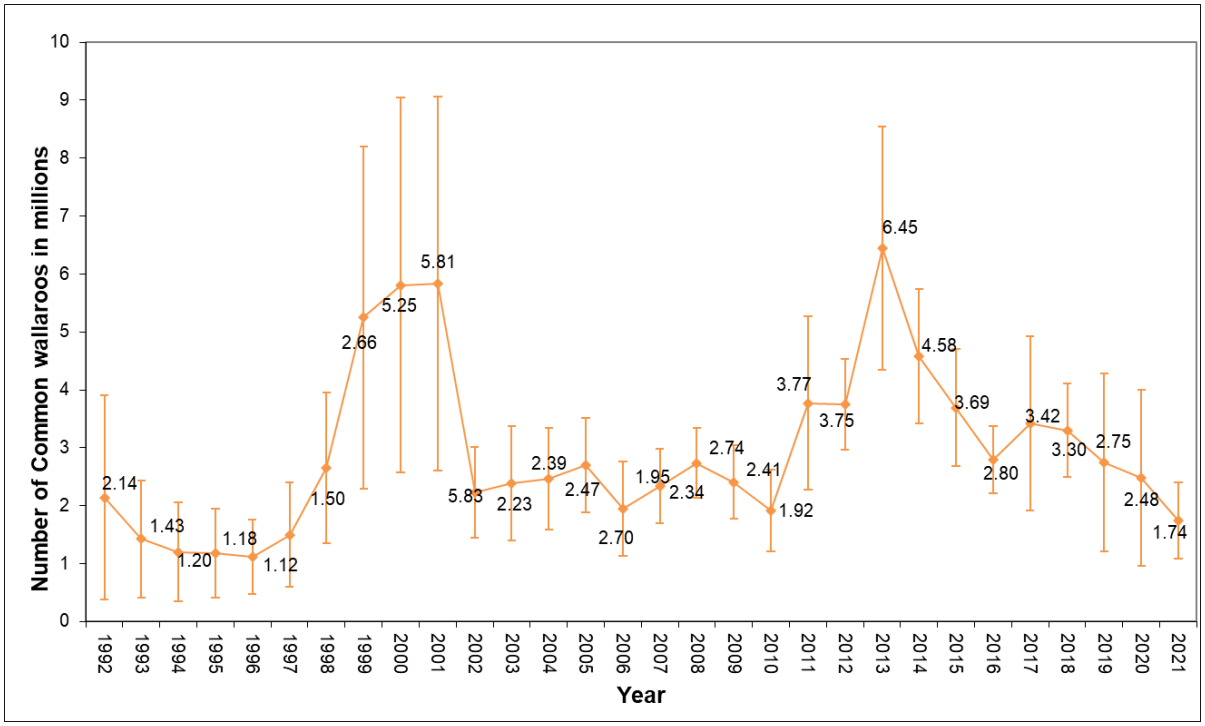


Figure 5. Common wallaroo population estimates (with one standard error) since 1992. Estimates include a 1.85 correction factor for 2011 to 2021 and a 1.2 correction factor all other years



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 the eastern and western harvest zones, with the central harvest zone divided into three regions, central zone north (Mitchell Grass dominant), central zone south (Mulga Lands dominant) and central zone east (Brigalow Belt dominant) (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 2005–2020 demonstrates densities fluctuate over time (figures 7–11).

For red kangaroos densities are greatest in the central zone north (figure 7), with densities lowest in the eastern zone (figure 10). Low densities in the eastern zone 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 central zone east (figure 9) and eastern zone (figure 10). Eastern grey kangaroos occur in consistently low densities in the western zone at the edge of their distributional range. As such, there is no quota for eastern grey kangaroos in this zone (table 1). In 2021 no eastern grey kangaroos were counted in the western zone 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 central zone north (figure 7). 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 7 and Appendix 2). Lowest densities for this species occur in the western zone (figure 11) and central zone east (figure 9). 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. Regions used to calculate population estimates of commercially harvested macropods

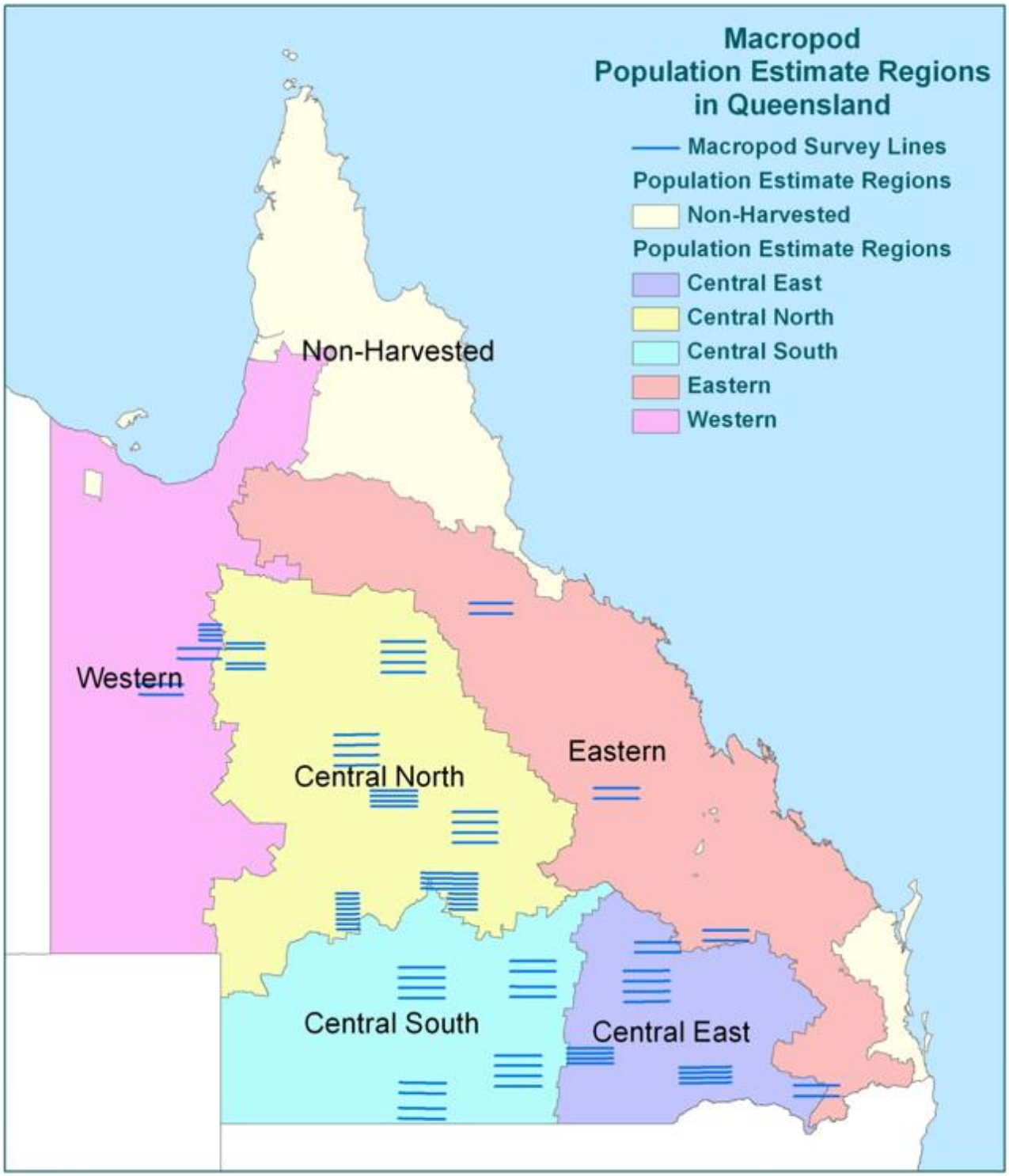
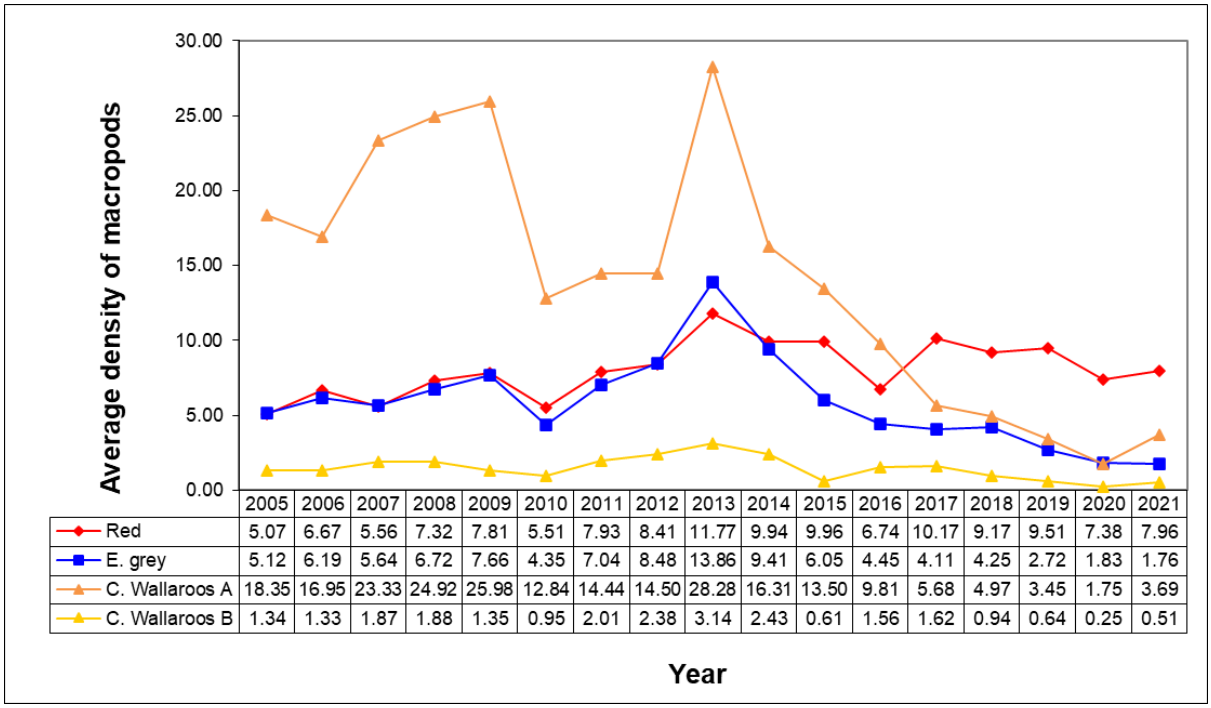
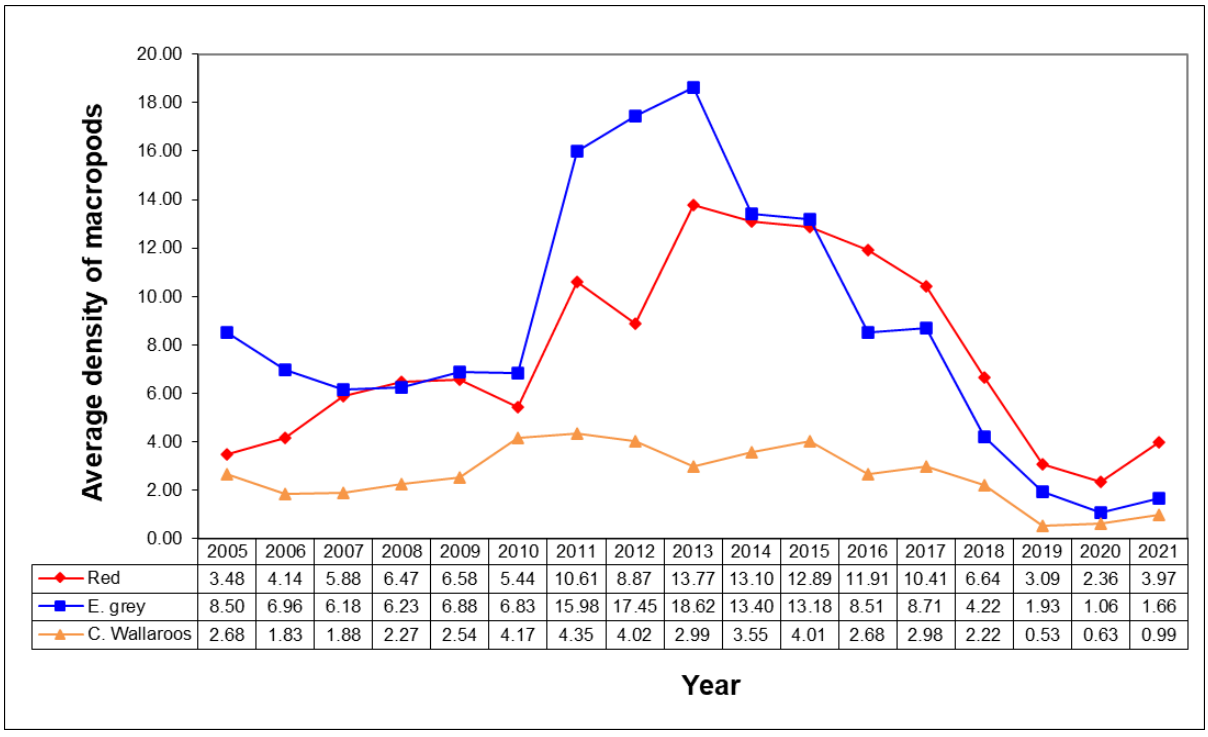


Figure 7. Average density per km² of commercially harvested macropods in the Central North population estimate region from 2005 to 2021 (common wallaroos are represented by two areas in the Central North zone)



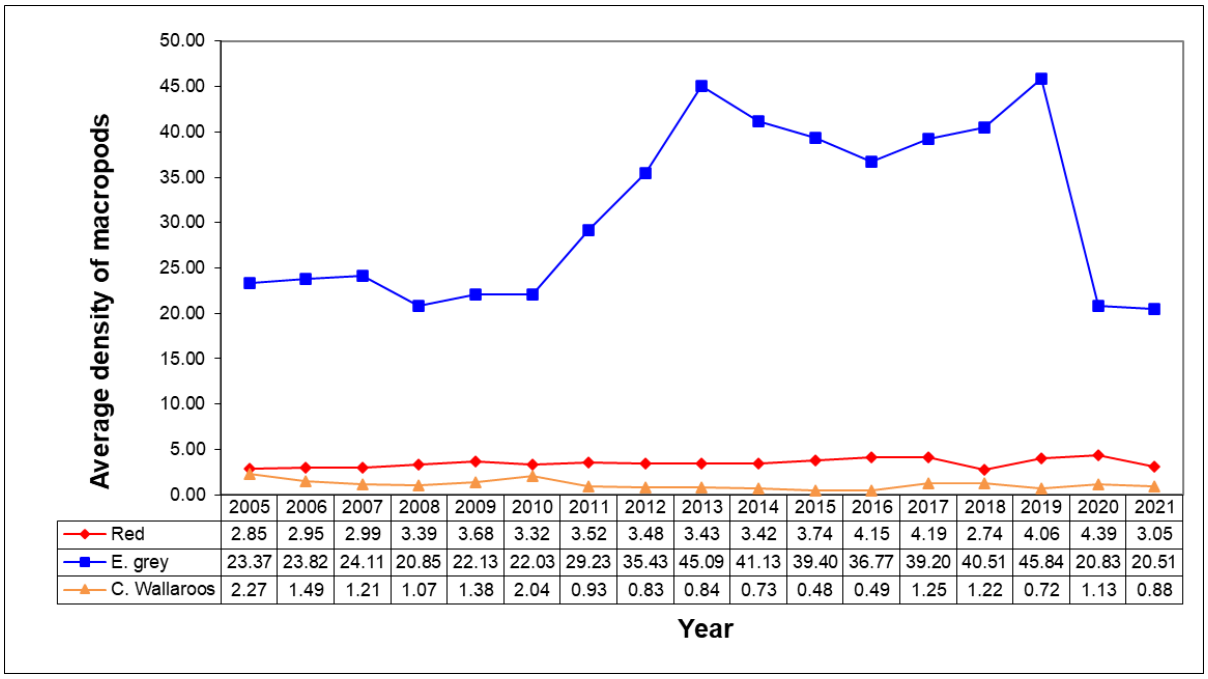
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Red	5.07	6.67	5.56	7.32	7.81	5.51	7.93	8.41	11.77	9.94	9.96	6.74	10.17	9.17	9.51	7.38	7.96
E. grey	5.12	6.19	5.64	6.72	7.66	4.35	7.04	8.48	13.86	9.41	6.05	4.45	4.11	4.25	2.72	1.83	1.76
C. Wallaroos A	18.35	16.95	23.33	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
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

Figure 8. Average density per km² of commercially harvested macropods in the Central South population estimate region from 2005 to 2021



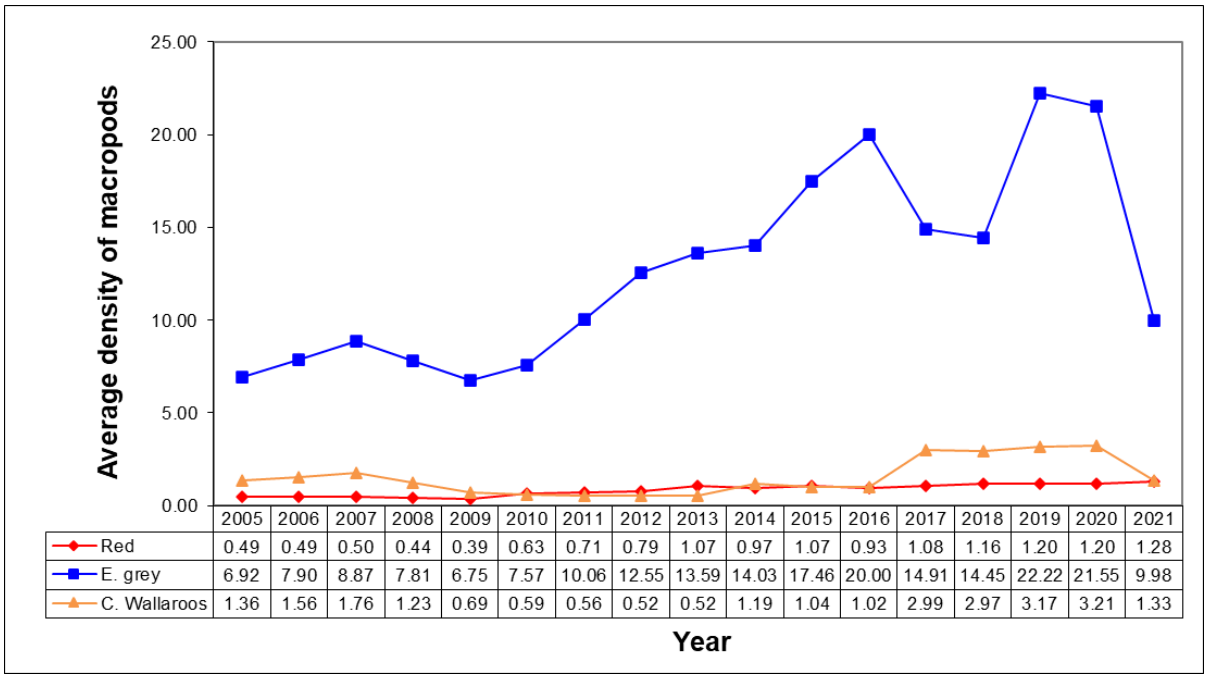
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Red	3.48	4.14	5.88	6.47	6.58	5.44	10.61	8.87	13.77	13.10	12.89	11.91	10.41	6.64	3.09	2.36	3.97
E. grey	8.50	6.96	6.18	6.23	6.88	6.83	15.98	17.45	18.62	13.40	13.18	8.51	8.71	4.22	1.93	1.06	1.66
C. Wallaroos	2.68	1.83	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

Figure 9. Average density per km² of commercially harvested macropods in the Central East population estimate region from 2005 to 2021



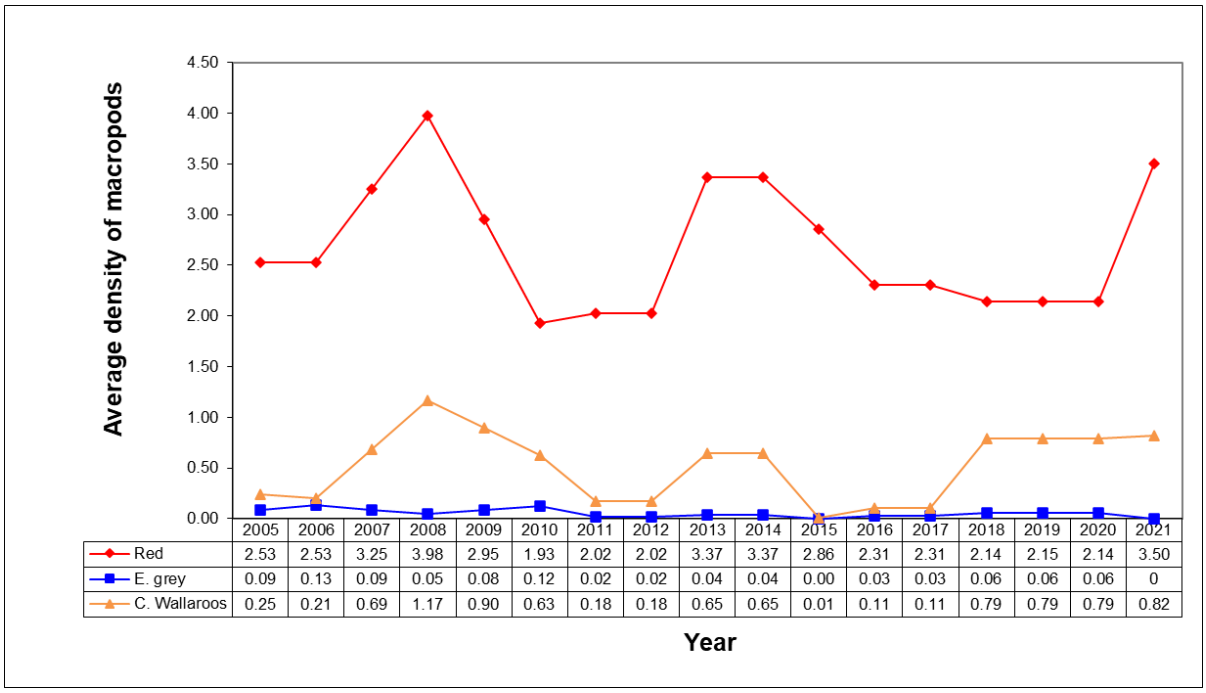
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Red	2.85	2.95	2.99	3.39	3.68	3.32	3.52	3.48	3.43	3.42	3.74	4.15	4.19	2.74	4.06	4.39	3.05
E. grey	23.37	23.82	24.11	20.85	22.13	22.03	29.23	35.43	45.09	41.13	39.40	36.77	39.20	40.51	45.84	20.83	20.51
C. Wallaroos	2.27	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

Figure 10. Average density per km² of commercially harvested macropods in the Eastern population estimate region from 2005 to 2021



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
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
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
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

Figure 11. Average density per km^2 of commercially harvested macropods in the Western population estimate region from 2005 to 2021



	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
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
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
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

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.

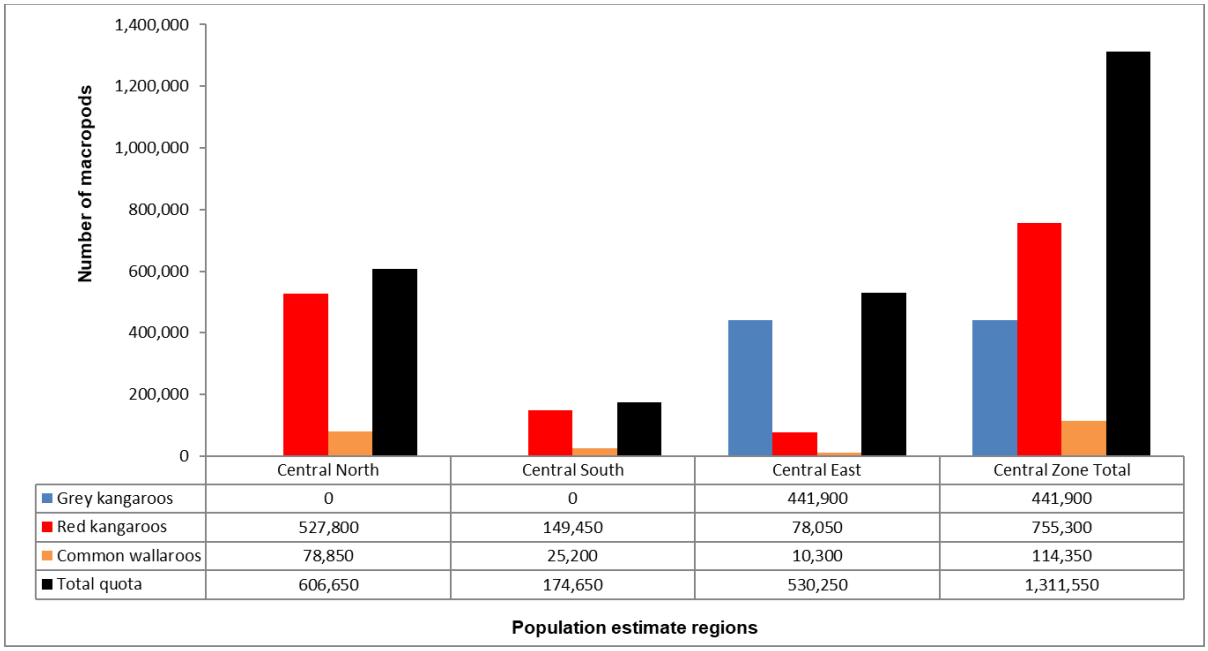
Table 2 shows the calculated trigger points for the 2022 harvest period for each species in each region compared with the 2021 population estimates for those regions. The estimated populations for eastern grey kangaroos in the central north and central south are below 2 SDs. Consistent with the Wildlife Trade Management Plan for Export—Commercially Harvested Macropods 2018–22 there will be no harvest quotas for this species in these regions in 2022 (figure 12).

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

Species	Population estimate region	2021 estimated population	2021 1.5 SD trigger point	2021 2 SD trigger point
Red kangaroo	Central North	2,639,085	1,872,369	1,662,201
	Central South	747,358	613,024	488,158
	Central East	390,321	101,713	76,542
	Eastern	228,035	75,579	62,983
	Western	590,356	202,399	163,237
Eastern grey kangaroo	Central North	455,917	890,701	683,902
	Central South	295,440	529,337	382,077
	Central East	2,945,919	2,464,310	2,079,316
	Eastern	2,928,298	1,269,008	963,161
	Western	0	NA	NA
Common wallaroo	Central North	525,599	569,400	400,430
	Central South	168,151	130,667	91,159
	Central East	68,814	31,648	24,580
	Eastern	714,692	205,183	147,210
	Western	261,465	25,940	15,583

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

Figure 12. Detail of the calculated harvest quotas for 2022 in the central zone including reductions due to population estimates being below trigger points



Comparison between 2020 and 2021 population estimates

The total population estimates, combined across all three harvest zones, for eastern grey kangaroos and common wallaroos have declined, whilst red kangaroos increased slightly in 2021 compared to 2020 (figure 13). However the total population estimates across all harvest zones does not reflect the regional variation that was pronounced in 2021 (table 3).

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 (figure 15). 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 and common wallaroos increased in the central harvest zone, whilst eastern grey kangaroos and common wallaroos decreased in the eastern harvest zone in 2021 (figure 14). In 2020 there were five population estimates that reached trigger points amongst all three species compared to only one species (eastern grey kangaroos) falling below trigger points in two harvest regions in 2021 (table 3).

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 14 and figure 15).

Figure 13. Comparison of overall macropod populations in the commercial harvest zones 2020 and 2021 (with one standard error)

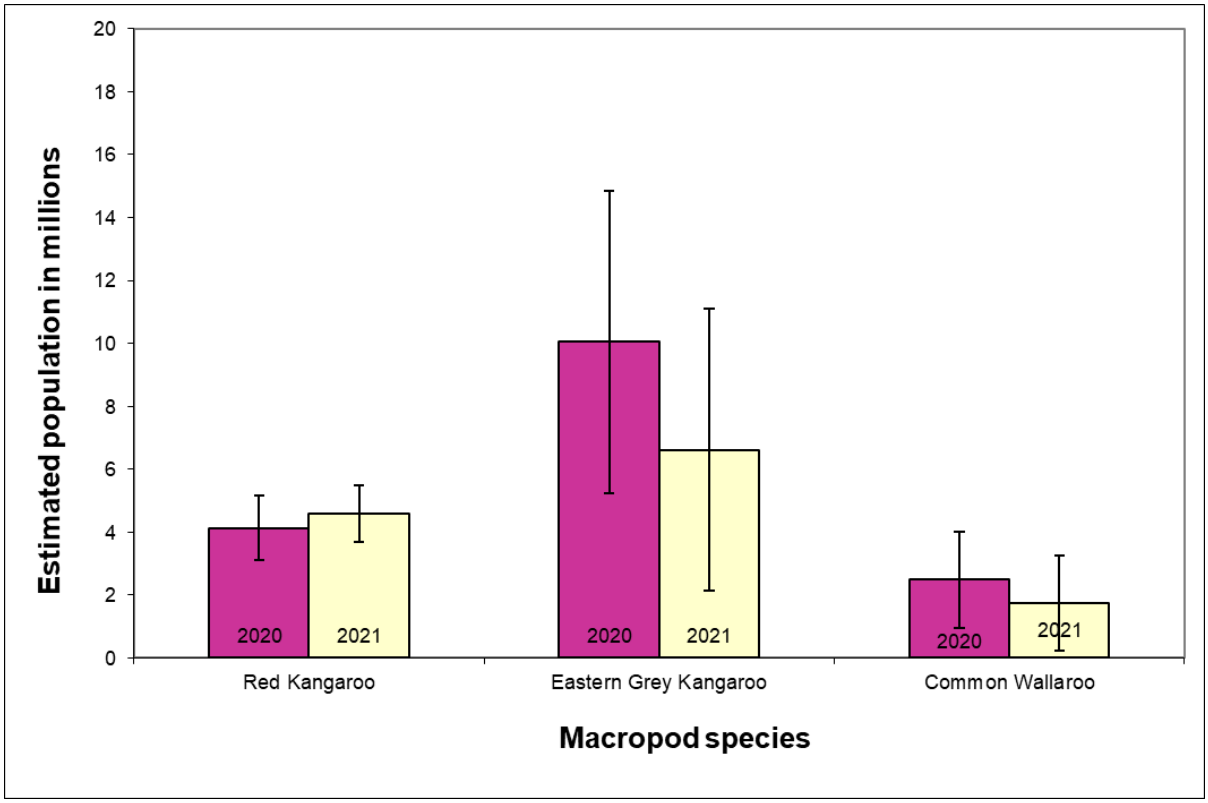


Table 3. Comparison between 2020 and 2021 macropod population estimates. Note estimates in red signify a trigger point has been reached

Species	Harvest zone	2020 population estimate (rounded to the nearest 50)	2021 population estimate (rounded to the nearest 50)
Red kangaroo	Central north	2,481,700	2,639,100
	Central south	447,850	747,350
	Central east	560,500	390,300
	Eastern	211,250	228,050
	Western	434,400	590,350
	Combined	4,135,700	4,595,150
Eastern grey kangaroo	Central north	523,850	455,900
	Central south	191,200	295,450
	Central east	3,119,850	2,945,900
	Eastern	6,194,700	2,928,300
	Western	13,800	0
	Combined	10,043,400	6,625,550
Common wallaroo	Central north	288,200	525,600
	Central south	108,300	168,150
	Central east	74,800	68,800
	Eastern	1,692,100	714,700
	Western	321,350	261,450
	Combined	2,484,750	1,738,700

Figure 14. Comparison of macropod populations from 2020 to 2021 by species and zone

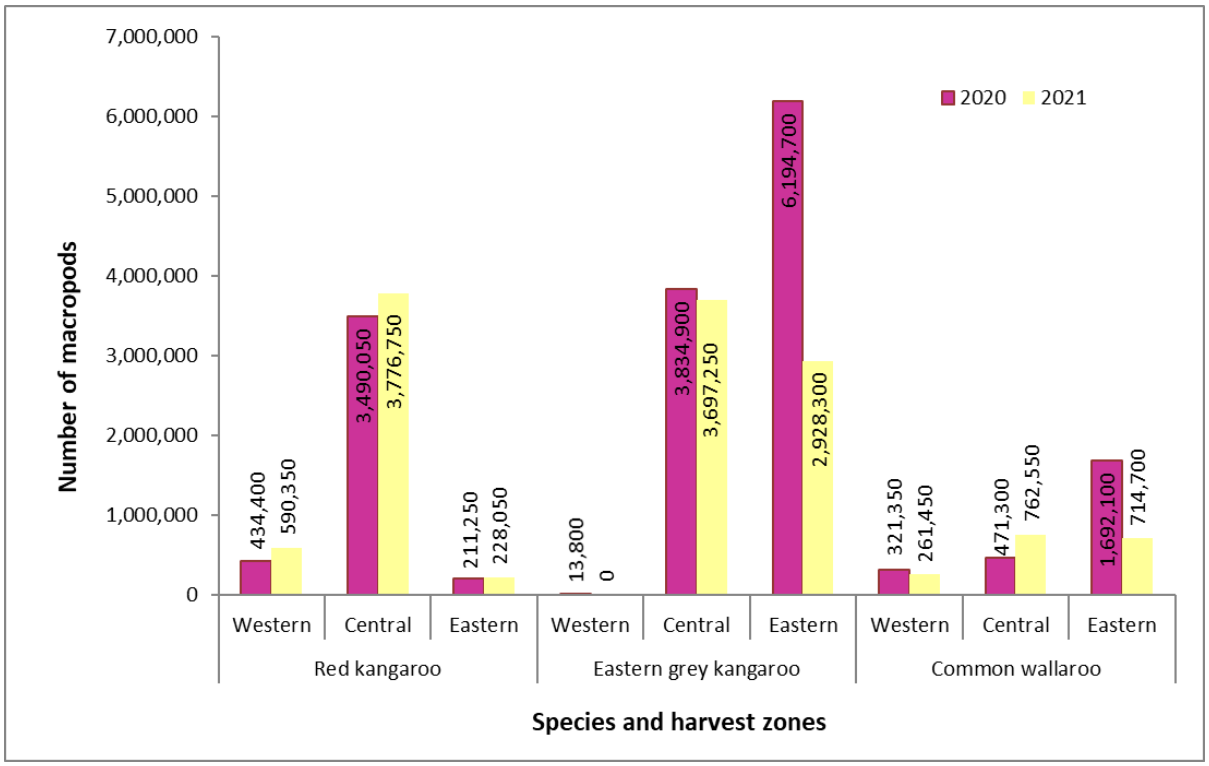
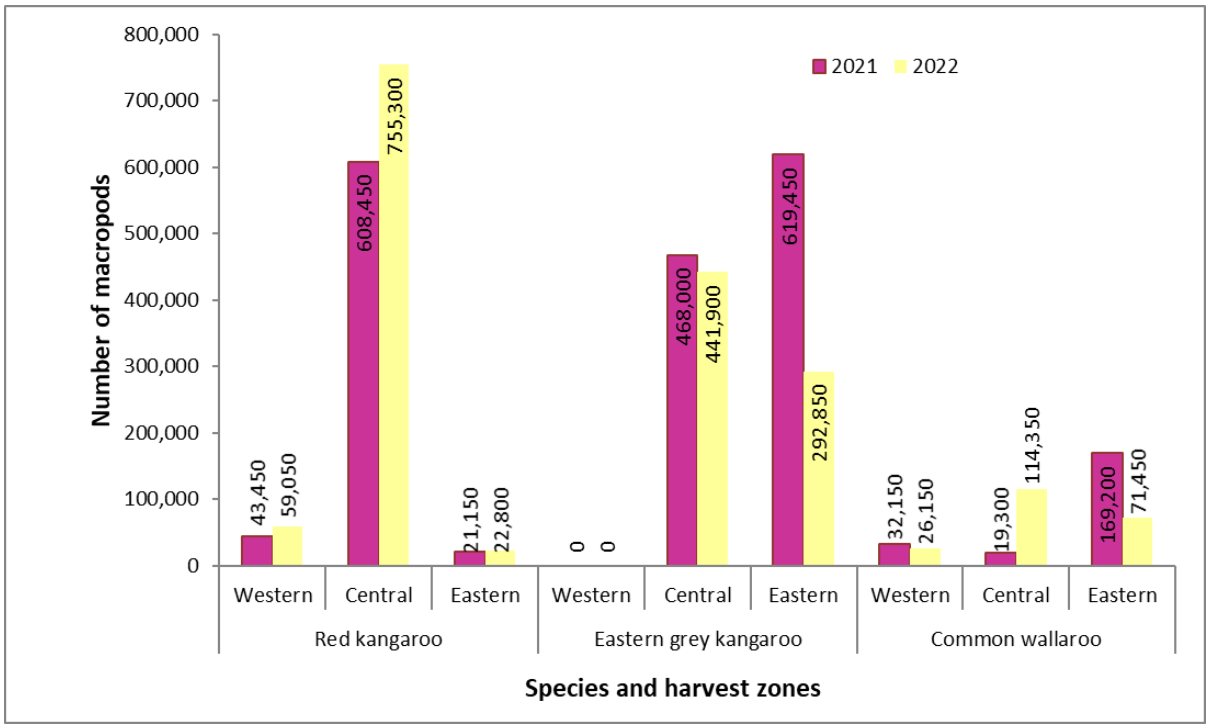


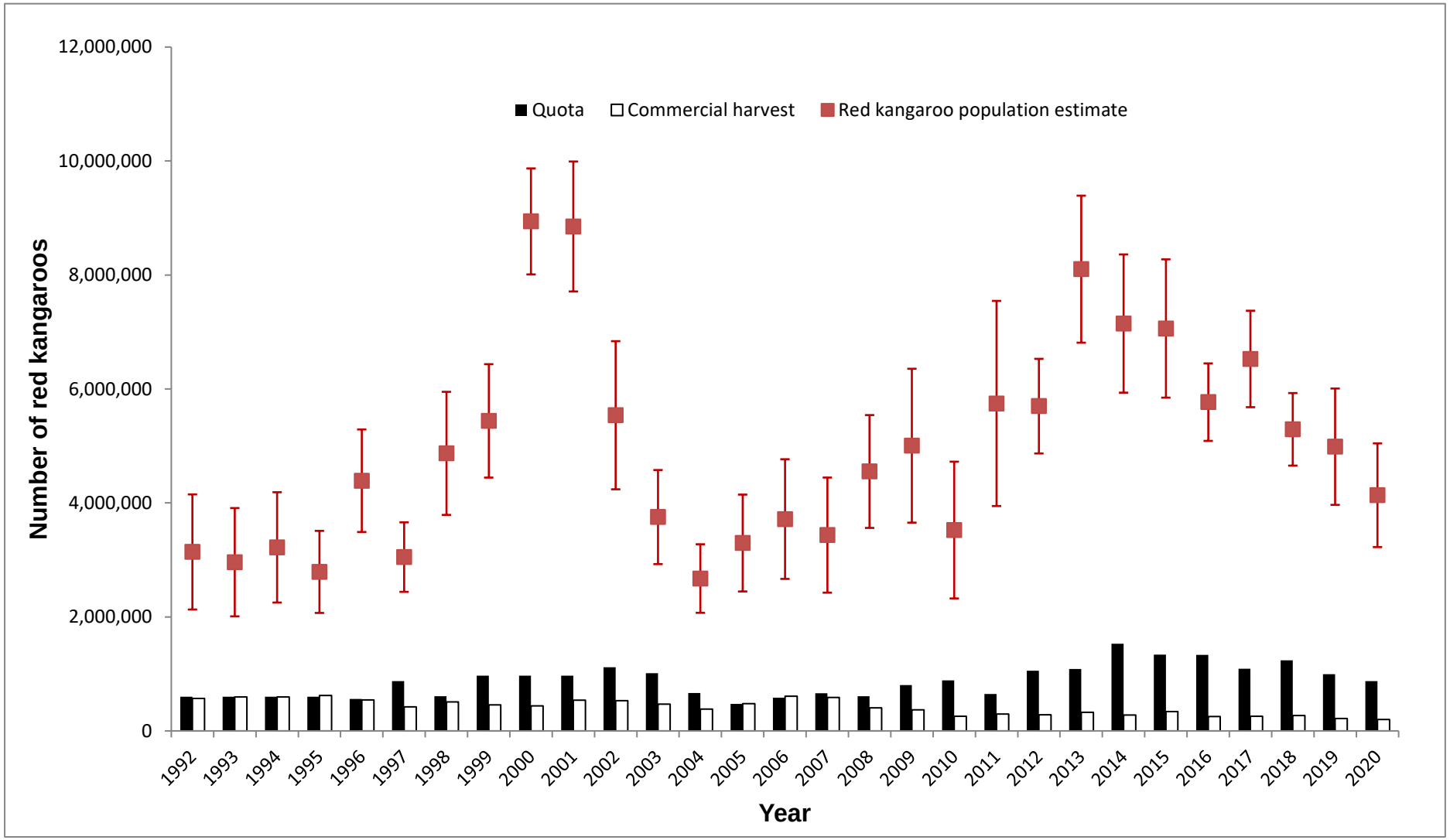
Figure 15. Comparison of 2021 actual and 2022 proposed harvest quotas



Long-term quota and harvest trends

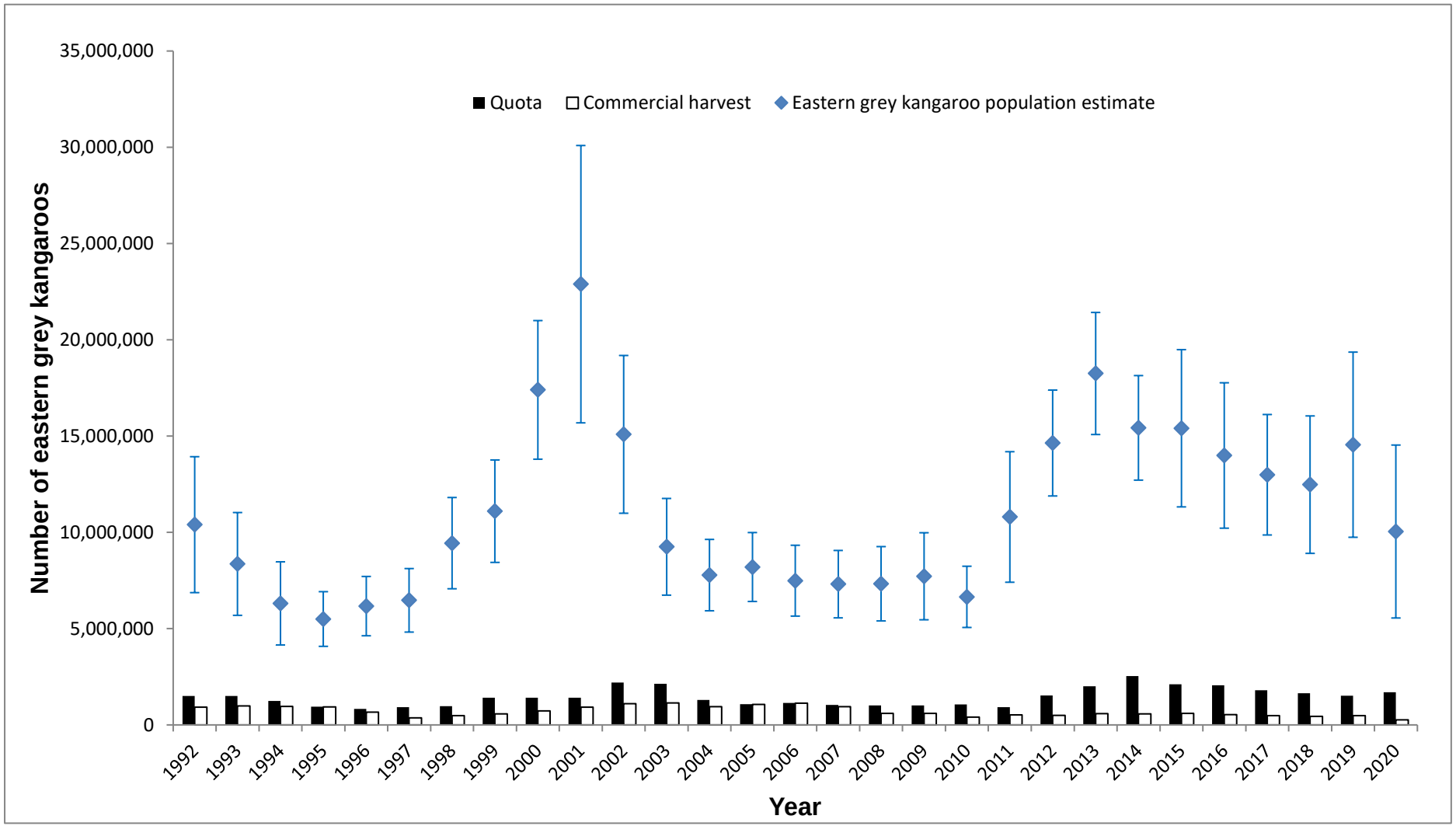
Figures 16 - 18 outline data on the three commercially harvested macropod species pertaining to estimated population, quota and harvest for the years 1992 to 2020. Please note that population estimates are based on aerial surveys conducted in the previous year to the quota and harvest. Combined population 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 16. Long-term population estimates (± one standard error), quota and harvest data for the red kangaroo in Queensland



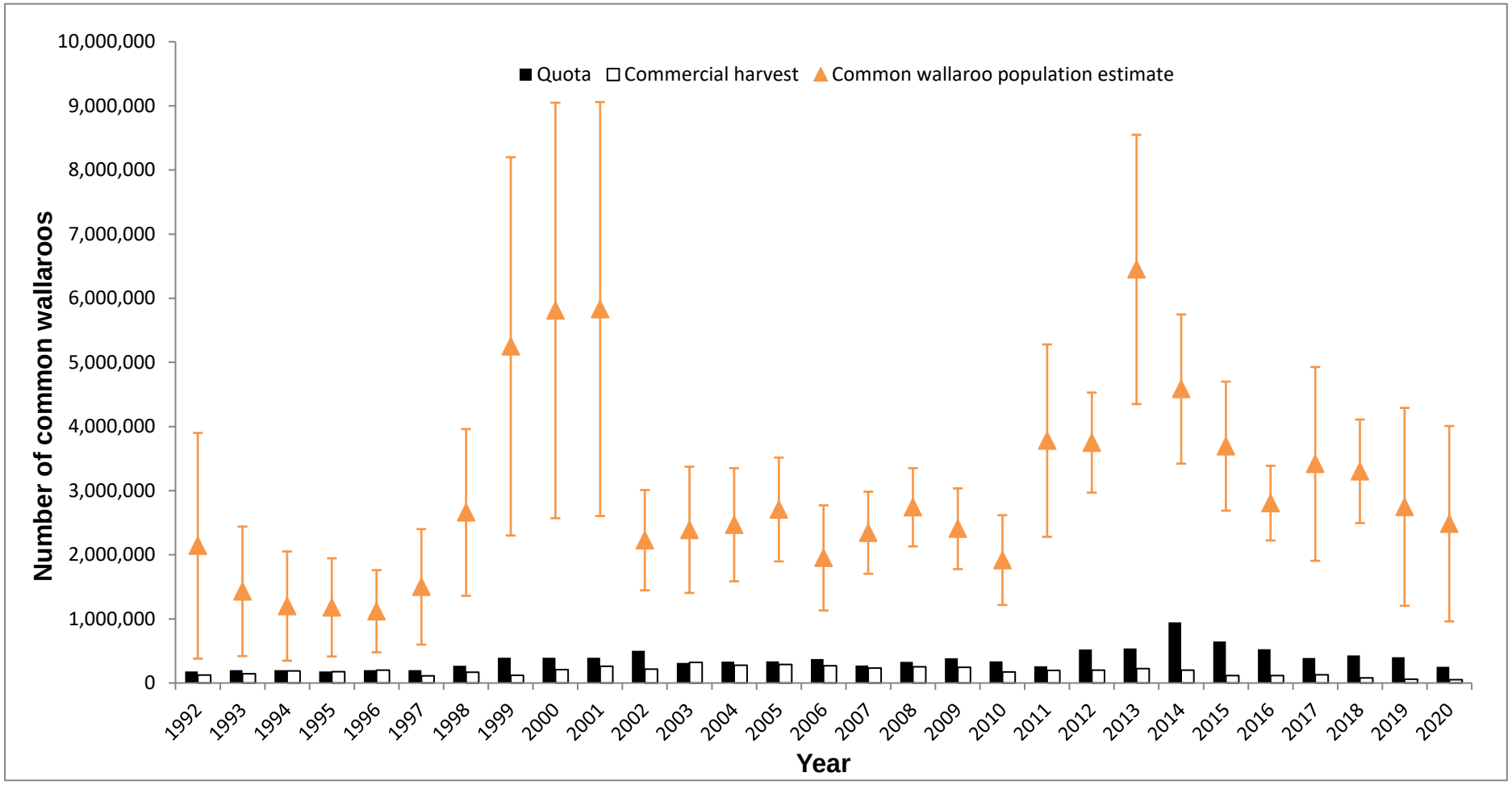
Note: population estimates are based on aerial surveys conducted the year before the harvest was taken.

Figure 17. 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 18. 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 16 to 18). 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 16 to 18). 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 2020 harvest

Dealer returns for the year 2020 (entered up to 5 February 2021) indicate that there were 514,144 macropods taken in Queensland, which represents 18.2% of the overall combined quota. Of the animals harvested, there were 200,779 red kangaroos, 263,409 eastern grey kangaroos and 49,956 common wallaroos harvested (table 4). Quotas for individual species in each harvest zone were not exceeded in 2020. The maximum commercial take as a percentage of the approved quotas was 77.9% for common wallaroos in the central zone (tables 4 to 7).

Table 4. Total harvest in 2020

Species	Population estimate 2019	Quota 2020	Harvest take 2020	% quota used 2020	% population harvested 2020
Red kangaroo	4,987,100	874,900	200,779	22.9%	4.0%
Eastern grey kangaroo	14,553,200	1,696,550	263,409	15.5%	1.8%
Common wallaroo	2,746,700	253,700	49,956	19.7%	1.8%
Total	22,287,000	2,825,150	514,144	18.2%	2.3%

Note: population estimates are based on aerial surveys conducted in 2019, which were used to set the 2020 quota.

Table 5. Harvest of red kangaroos in 2020

Zone	Population estimate 2019	Quota 2020	Harvest take 2020	% quota utilised 2020	% population harvested 2020
Central	4,341,450	810,300	179,794	22.2%	4.1%
Eastern	211,250	21,150	8,952	42.3%	4.2%
Western	434,400	43,450	12,033	27.7%	2.8%
Total	4,987,100	874,900	200,779	22.9%	4.0%

Note: population estimates are based on aerial surveys conducted in 2019, which were used to set the 2020 quota.

Table 6. Harvest of eastern grey kangaroos in 2020

Zone	Population estimate 2019	Quota 2020	Harvest take 2020	% quota utilised 2020	% population harvested 2020
Central	8,141,500	1,056,750	175,523	16.6%	2.2%
Eastern	6,397,900	639,800	87,886	13.7%	1.4%
Western	13,800	0	0	NA	NA
Total	14,553,200	1, 696,550	263,409	15.5%	1.8%

Note: population estimates are based on aerial surveys conducted in 2019, which were used to set the 2020 quota.

Table 7. Harvest of common wallaroos in 2020

Zone	Population estimate 2019	Quota 2020	Harvest take 2020	% quota utilised 2020	% population harvested 2020
Central	754,550	54,450	42,393	77.9%	5.6%
Eastern	1,670,800	167,100	6,610	4.0%	0.4%
Western	321,350	32,150	953	3.0%	0.3%
Total	2,746,700	253,700	49,956	19.7%	1.8%

Note: population estimates are based on aerial surveys conducted in 2019, which were used to set the 2020 quota.

Sex ratio by species and zone

The commercial harvest of macropods is typically biased towards males (figure 19) as they are usually larger and heavier than females. In 2020, the total harvest for each species was biased towards males by 76% or greater. Females composed less than 21% of the overall harvest (figure 20).

Figure 19. Overall sex ratio from 2006 to 2020 (percentages rounded to the nearest whole number)

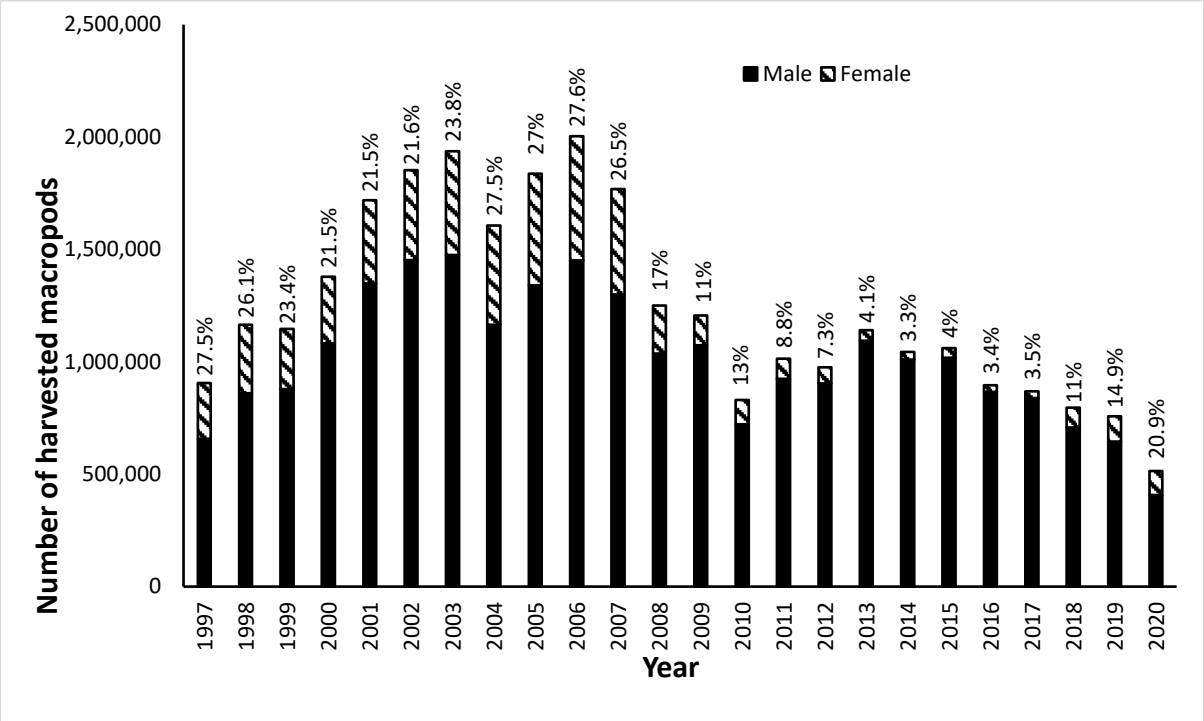
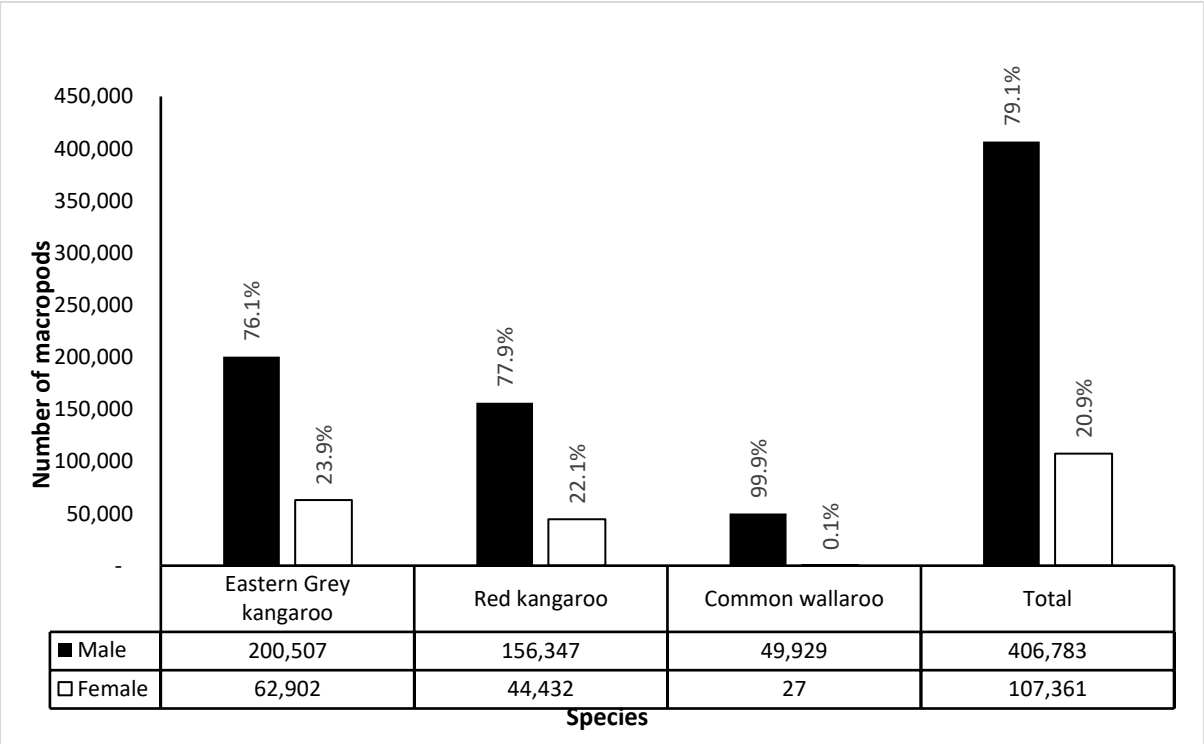


Figure 20. Proportion of 2020 harvest, male and female by species



Harvest update for 2021

The total number of tags issued as at 31 July 2021 was 503,125. A comparison of tag sales and harvest returns in relation to quotas in each zone is provided in table 8. 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 well below quota for all species in all zones, except for central zone common wallaroo tags which has the quota issued. Although the tag quota has been issued for this species and zone only 34% of the quota has been harvested and it is therefore unlikely quotas will be met for any species in any zone during 2021. The 2021 harvest will be comprehensively reported on in the Queensland Commercial Macropod Management Program Annual Report 2021, due for release in March 2022.

Table 8. Tags issued and reported harvest for 2021 at 31 July

Species	Harvest zone	2021 sustainable use quota (rounded to the nearest 50)	Tags issued to 31 July 2021	Reported harvest to 31 July 2021
Red kangaroo	Central	608,450	179,300	92,582
	Eastern	21,150	13,200	4,352
	Western	43,450	16,380	6,401
Eastern grey kangaroo	Central	468,000	165,700	92,438
	Eastern	619,450	93,745	41,655
	Western	NA	NA	NA
Common wallaroo	Central	19,300	19,300	6,494
	Eastern	169,200	13,700	3,068
	Western	32,150	1,800	434

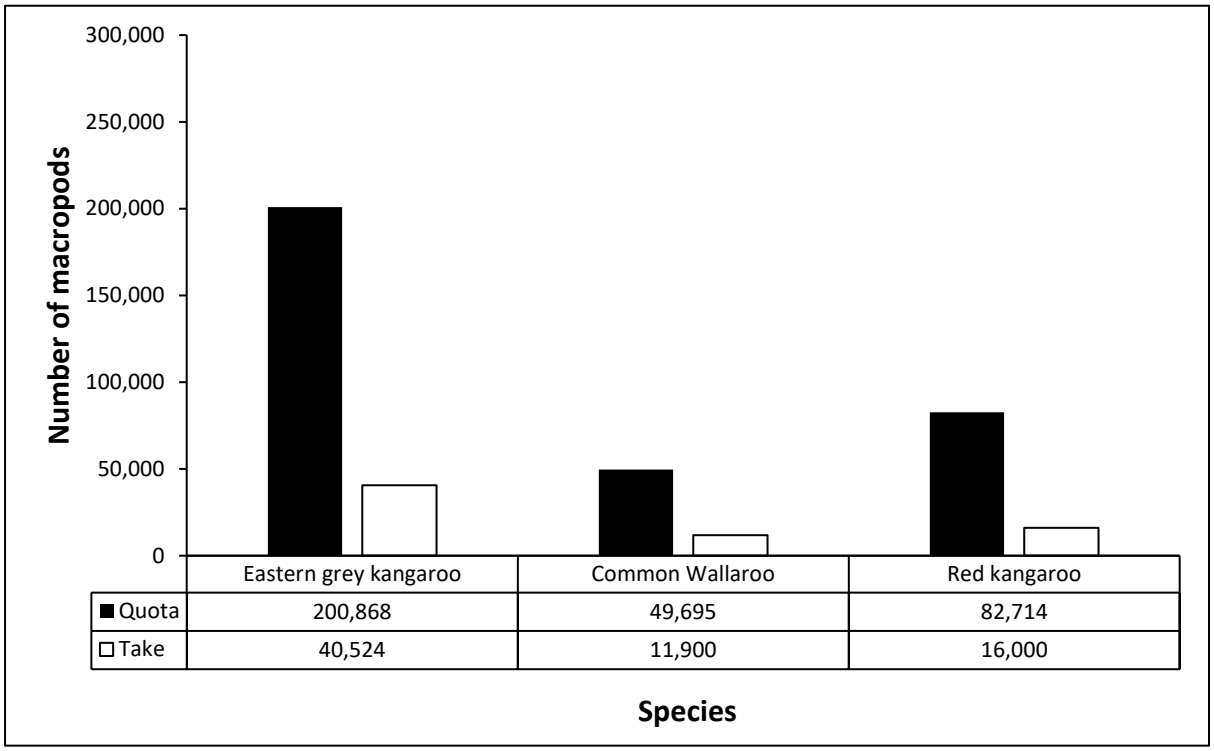
The extent of non-commercial harvest mortality

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. 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 (figure 21) and has fluctuated over the last 10 years (figure 22).

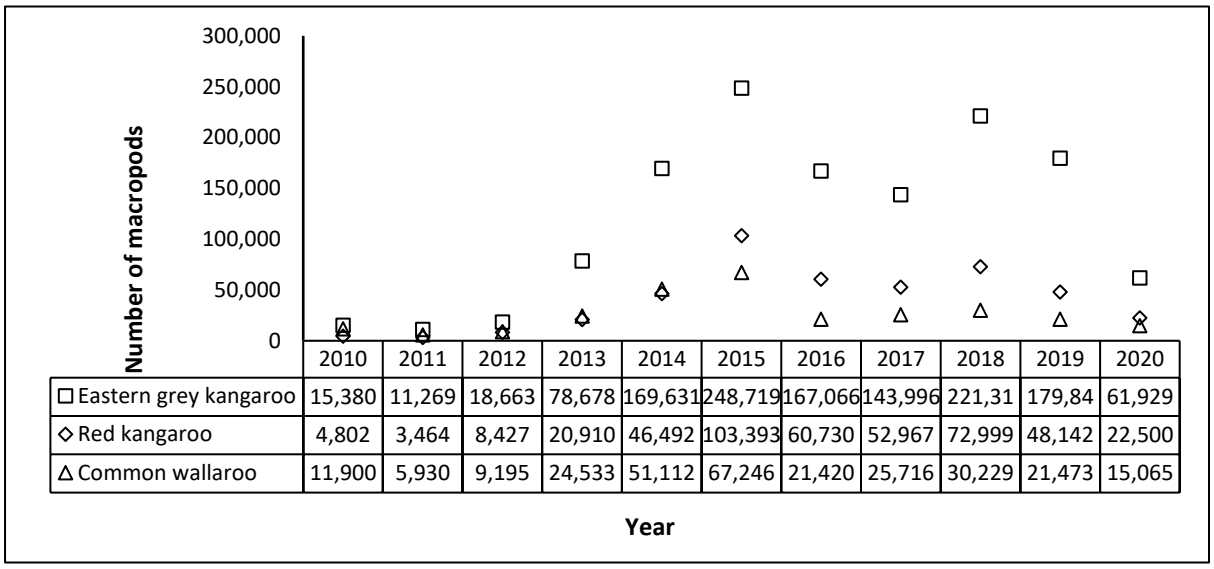
Figure 21. DMP macropod quota and take for 2021 at 17 August



	Eastern grey kangaroo	Common Wallaroo	Red kangaroo
■ Quota	200,868	49,695	82,714
□ Take	40,524	11,900	16,000

Note: Figures are as recorded on 17 August 2021

Figure 22. Macropods approved to be taken under a DMP 2010–2020



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
□ Eastern grey kangaroo	15,380	11,269	18,663	78,678	169,631	248,719	167,066	143,996	221,31	179,84	61,929
◇ Red kangaroo	4,802	3,464	8,427	20,910	46,492	103,393	60,730	52,967	72,999	48,142	22,500
△ Common wallaroo	11,900	5,930	9,195	24,533	51,112	67,246	21,420	25,716	30,229	21,473	15,065

Disease outbreak mortality and its significance

No incidence of significant disease mortalities have been recorded for macropod populations in Queensland during 2020 or 2021. 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 decrease in estimated macropod populations in the central south and north population estimate regions.

Proportion of the population not subject to harvesting

Commercial harvesting of macropods can only occur in three harvest zones in Queensland. 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 23 to 25 show the general distribution of each of the commercially harvested macropods in relation to the population estimate regions. Red kangaroos are harvested in the western and central harvest zones and in the north of the eastern harvest zone (figure 23). Eastern grey kangaroos are only harvested in the eastern and central harvest zones (figure 24). Common wallaroos have the broadest distribution (figure 25) throughout Queensland and can be harvested in the central, eastern and western 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 23. Red kangaroo *(Osphranter rufus)* distribution

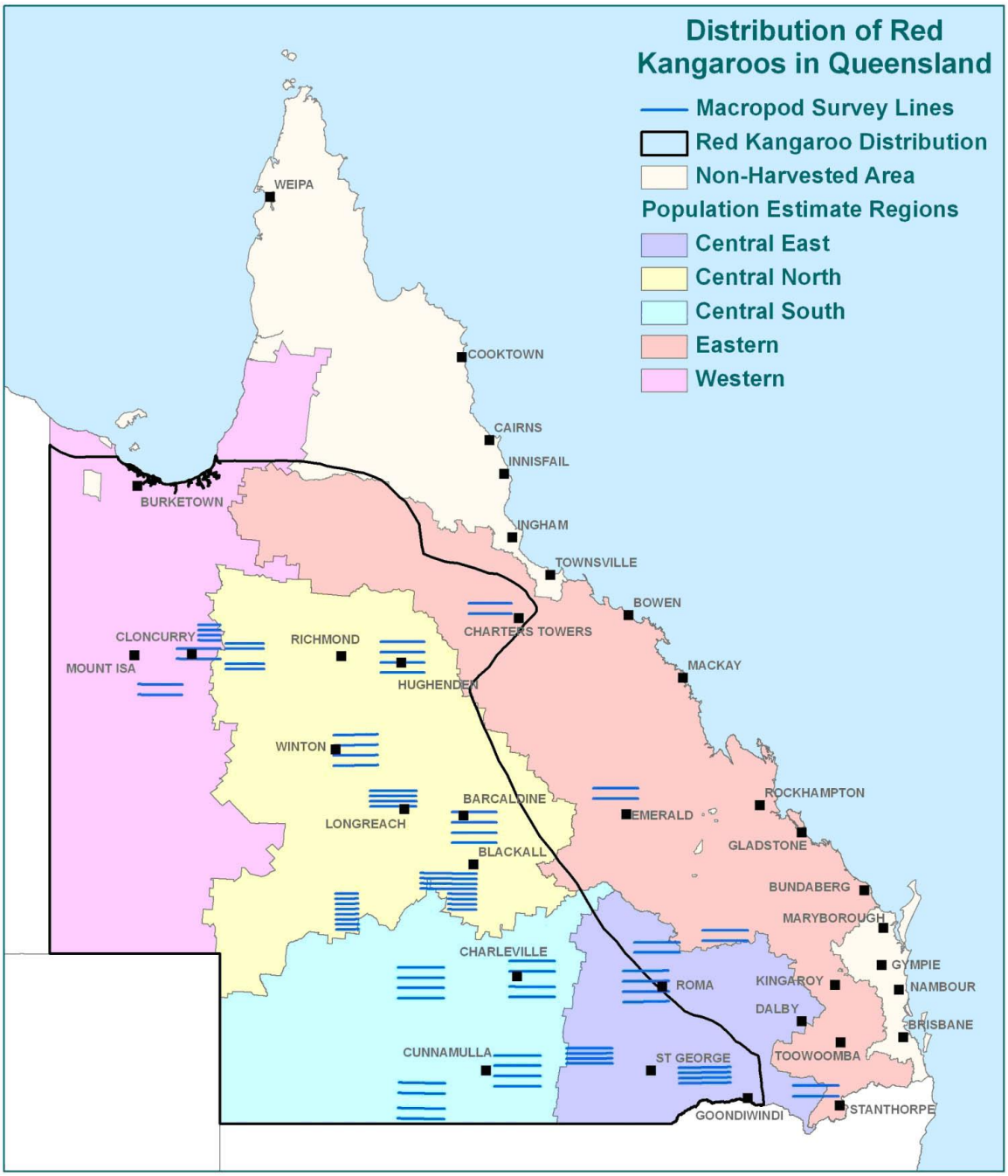


Figure 24. Eastern grey kangaroo (*Macropus giganteus)* distribution

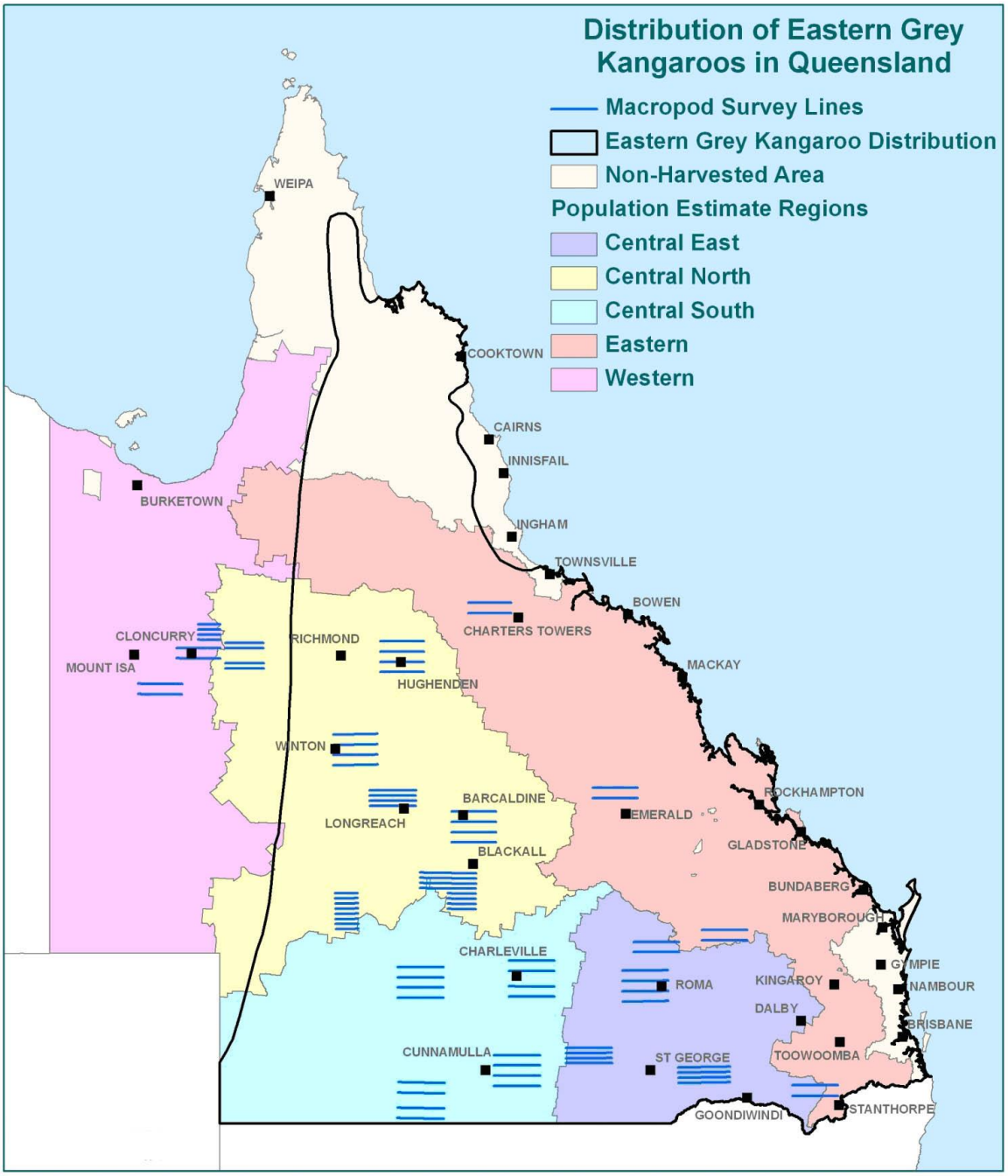
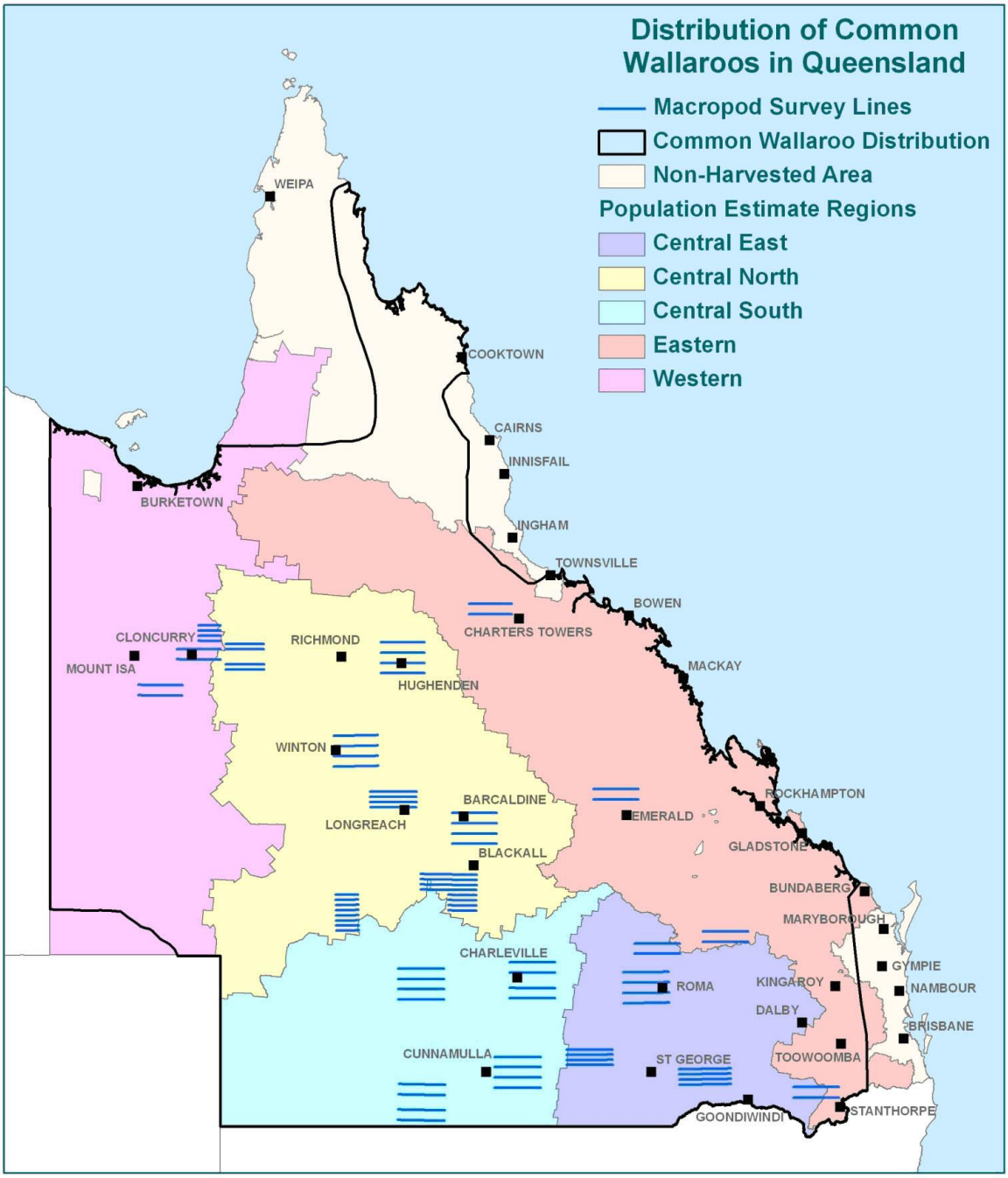


Figure 25. Common wallaroo *(Osphranter robustus)* distribution



Climate trends

Queensland tempearatures in 2020 were above average across the state and the fifth warmest year on record. Whilst rainfall was below average in northern and eastern Queensland, it was close to average elsewhere (figure 26). There was widespread rainfall and flooding to western and northern Queensland at the start of the year and in the south-east in December (Bureau of Meteorology 2020).

Much of the commercial harvest zones have now been drought declared for eight consecutive years (figure 27). As a consequence, the population estimates for eastern grey kangaroos in the central north and south regions was below the predetermined trigger points for its third consecutive year.

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 26. Queensland rainfall totals (mm) from 1 January to 31 December 2020

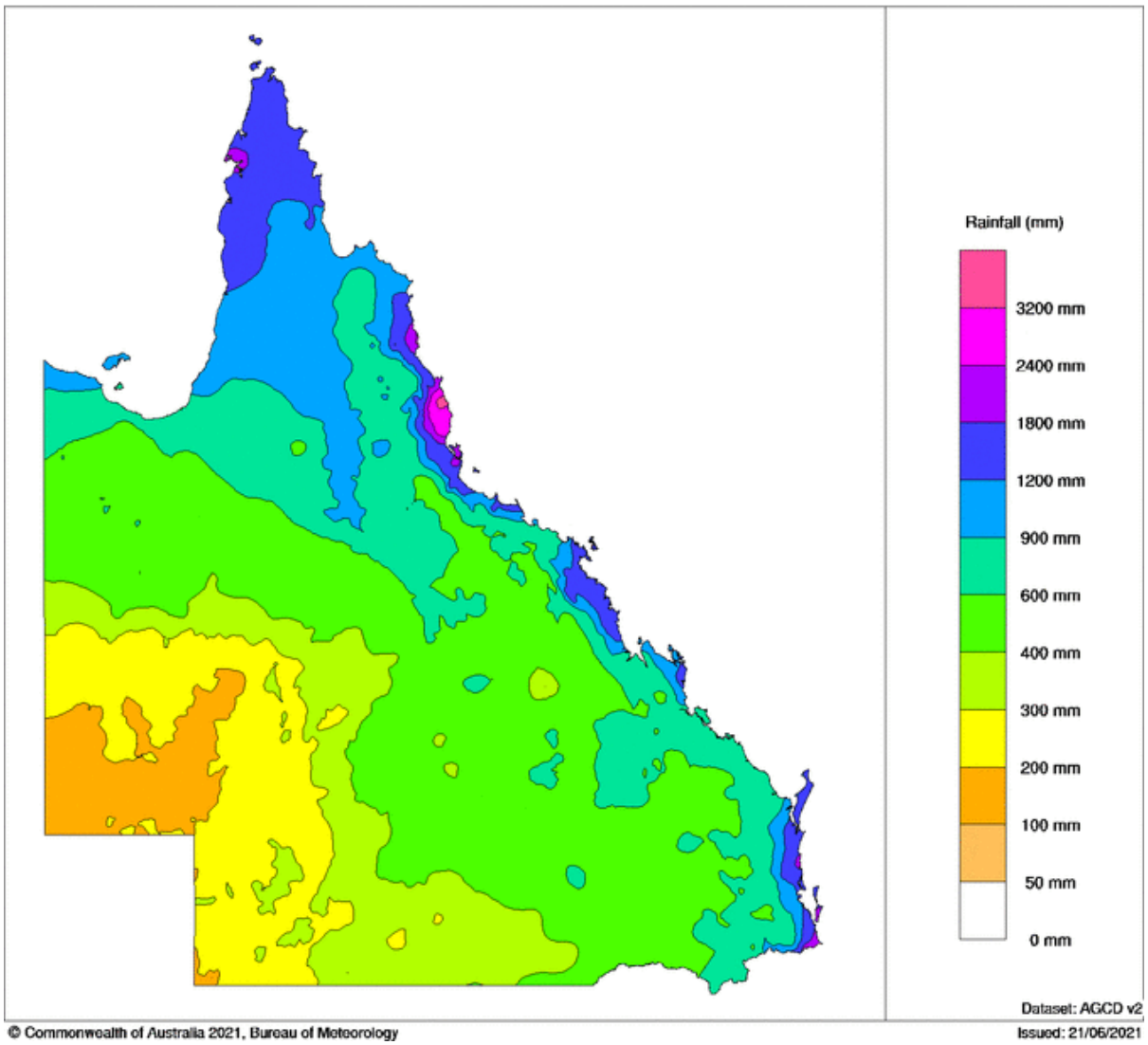
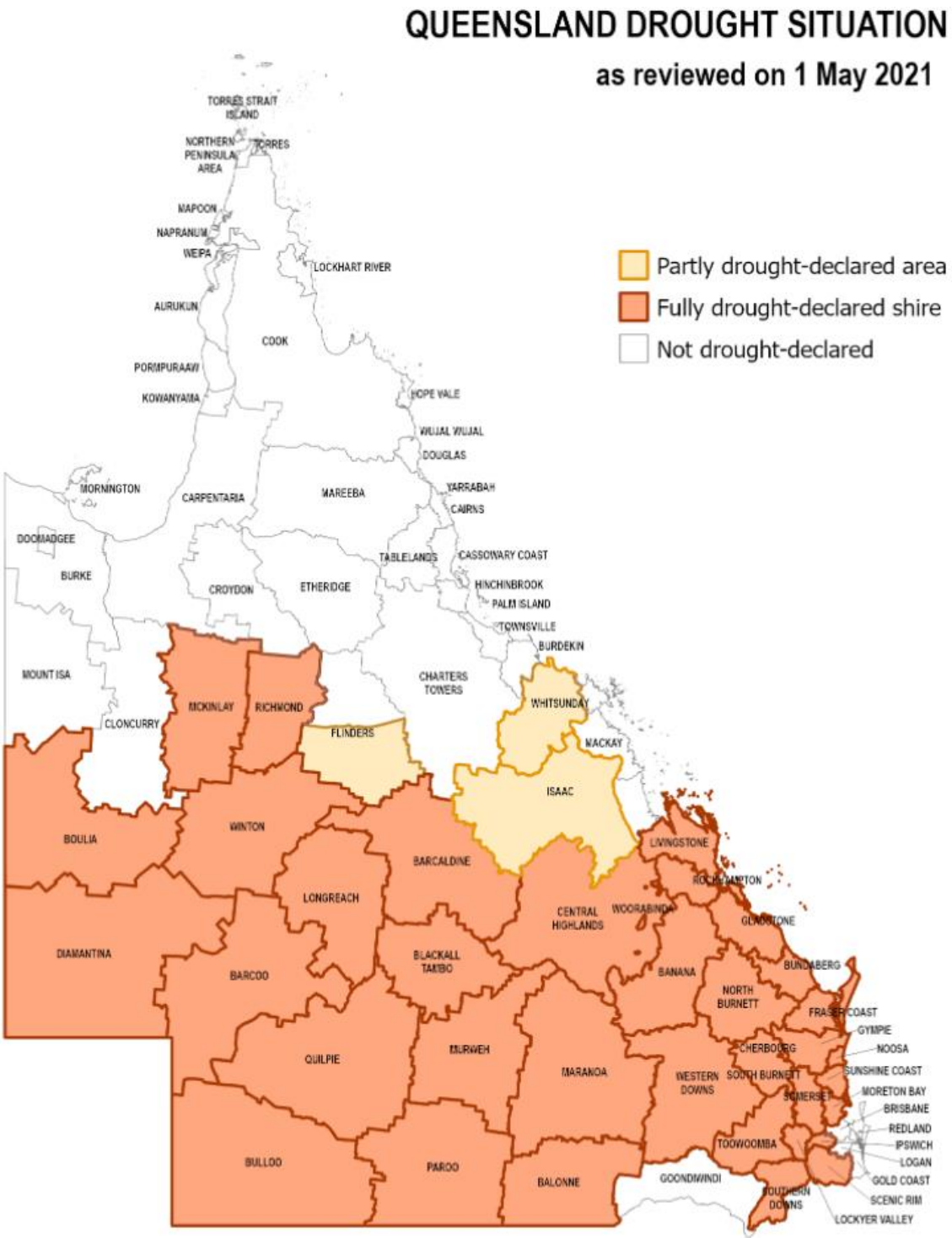


Figure 27. Queensland drought declarations at 1 May 2021



Summary and conclusion

The proposed quotas for the 2022 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 the eastern and western zones are a function of both the new model and the survey data for 2021. All survey monitor blocks were surveyed in 2021,

Population estimates have decreased for eastern grey kangaroos in the eastern zones in 2021. In the central zone north and central zone south the eastern grey population estimate is below a predetermined trigger point and there is no quota for this species in these regions in 2022.

The red kangaroo population estimate for the overall central zone increased slightly as well as in the western zone but decreased in the central zone east.

Common wallaroo population estimates increased in the central zone but decreased in the eastern zone. Although overall combined population estimates for all three species declined across the state there were only 2 trigger points reached in 2021 compared to the five trigger points in 2020.

For the 2020 commercial harvest period no quotas were exceeded, with the maximum percentage of quota utilised being 77.9% 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 21%. Thus, the last completed harvest period provides no indication of adverse pressure on populations that would influence proposed quotas.

For the 2021 harvest period as at 31 July, tag sales are well below quota for all species in all zones, except for central zone common wallaroo tags which has the quota issued. Although the tag quota has been issued for this species and zone only 34% of the quota has been harvested and it is therefore unlikely that quotas will be met for any species in any zone in 2021.

Usage of DMPs in 2020 were below the 2% of the population estimate quota for all species for all zones. The current percentages for usage of DMP quotas for 2021 are also below the quota limit of 2%.

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.

Overall numbers of commercially harvested macropods in Queensland harvest zones have remained relatively stable over the past 12 months although significant declines were observed in the eastern zone. Much of the harvest zones remain drought declared as many of them have for the past seven years. Should the widespread dry conditions continue throughout the state it is possible that observed macropod numbers will decrease in 2022.

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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 2004–2020

	Eastern grey kangaroo																	
Block	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
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
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
Bollon	25.6	25.3		30.53		31.74	30.14		47.2		32.01	24.9		27.58		29.50		12.95
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
Charters		1.63		5.02		5.33	5.57		3.37		3.14	2.01		1.53		1.32		2.45
Cloncurry	0.01		0.16		0.02		0.21	0.012		0.07		0.00	0.06		0.12			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
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
Hughenden	0.77	0.58		1.16		0.97	0.79		0.53		1.17	1.41		1.01		1.43		1.47
Hungerford	1.16	1.10		0.77		0.94	0.65		2.20		4.00	3.79		3.36		0.13		0.08
Inglewood		8.72		18.62		9.75	12.33		29.10		32.73	49.8		42.02		66.87		23.77
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
Longreach	9.05	8.48		6.63		6.61	6.13		18.07		20.17	5.25		3.85		4.67		3.60
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
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
Taroom	8.12	13.3		8.44		7.87	7.36		14.98		13.24	12.6		8.19		13.00		9.74
Westmar	25.5		23.1		21.1		22.08	37.25		62.54		77.9	66.07		82.67		30.64	24.76
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
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

	Red kangaroo																	
Block	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
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
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
Bollon	4.13	8.87		8.35		11.16	9.90		7.78		7.27	9.83		8.87		7.18		6.68
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
Charters		0.02		0.05		0.00	0.70		0.24		0.21	0.62		0.59		0.28		0.20
Cloncurry	2.14		4.18		6.17		3.01	3.34		5.91		4.06	3.45		2.97			2.86
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
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
Hughenden	1.97	1.59		1.59		1.29	0.92		2.22		2.67	1.52		2.62		3.54		3.92
Hungerford	1.04	2.57		3.90		4.41	2.60		7.01		8.75	9.7		9.83		0.65		2.94
Inglewood		0.00		0.00		0.00	0.50		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
Longreach	9.53	11.86		11.33		14.71	12.24		14.43		19.26	4.79		15.90		25.72		25.75
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
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
Taroom	0.02	0.37		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
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
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

	Common wallaroo																	
Block	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**
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
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
Bollon	4.72	2.64		1.55		1.67	0.36		2.44		0.7	0.31		2.38		1.01		1.42
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
Charters		0.30		2.84		0.61	1.07		0.51		1.03	0.22		0.23		0.63		0.41
Cloncurry	0.00		0.30		0.64		0.51	0.260		0.14		0.02	0.21		1.32			0.73
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
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
Hughenden	1.65	1.28		2.28		0.24	0.41		0.94		0.93	0.22		1.59		0.55		1.21
Hungerford	1.19	0.36		0.24		0.48	0.25		0.47		1.27	1.93		2.33		0.08		0.28
Inglewood		3.08		4.03		0.34	1.01		1.22		3.18	3.42		11.16		11.60		4.47
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
Longreach	17.96	21.57		18.59		12.69	9.18		17.77		15.67	8.84		4.17		6.05		8.40
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
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
Taroom	0.22	2.04		0.17		1.05	0.25		0.02		0.38	0.18		0.35		0.20		0.10
Westmar	0.74		0.02		0.13		0.30	0.00		0.01		0.00	0.28		0.54		0.38	0.75
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
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