2019 Quota Submissions for Commercially Harvested Macropods in Queensland

Queensland Government

Prepared by: Macropod Management Program, Energy, Extractive and South West Queensland Compliance, Environmental Services and Regulation, Department of Environment and Science

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Executive summary

The commercial macropod harvest in Queensland is focused on three species (red kangaroo *Macropus rufus*, eastern grey kangaroo *Macropus giganteus*, and common wallaroo *Macropus 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 and 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.

Population estimates for 2018 and proposed sustainable use quotas for the 2019 commercial harvest

Species	Harvest zone	2018 estimated population (rounded to the nearest 50)	2019 sustainable use quota (rounded to the nearest 50)	Proportion of population (% rounded to the nearest whole number)
Red kangaroo	Central	4,668,750	933,700	20
	Eastern	188,300	18,850	10
	Western	434,400	43,450	10
	Combined	5,291,450	996,050	19
Eastern grey kangaroo	Central	8,293,350	1,099,800	13
	Eastern	4,171,500	417,150	10
	Western	13,800	0	0
	Combined	12,478,650	1,516,950	12
Common wallaroo	Central	1,414,600	212,200	15
	Eastern	1,565,850	156,600	10
	Western	321,350	32,150	10
	Combined	3,301,800	400,950	12

The 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 2018, aerial surveys were conducted at 12 monitor blocks across Queensland. 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.

Population estimates have decreased marginally for eastern grey kangaroos in the eastern and central zone but increased significantly in the western zone at the edge of its distributional range in 2018. In the central zone north and central zone south the eastern grey population estimates are below a predetermined trigger point and the quota for these regions has been halved for 2019. The red kangaroo population estimate for the central and western zones decreased slightly but increased in the eastern zone since the 2017 surveys. Common wallaroo population estimates decreased in the central and eastern zone but increased significantly in the western zone. Overall combined totals for all three species declined marginally across the state.

Examination of long-term trends in population and block density estimates indicates that the 2018 estimates are comparable to fluctuations of previous years. Population estimates for all three commercially harvested species consistently number over 1,000,000 in Queensland.

In the 2017 harvest period, only 26.4% of the commercial harvest quota was utilised, with the highest percentage of quota used being 37% for common wallaroo and 36% for eastern grey kangaroos in the central zone. The overall harvest was male biased, with females comprising less than 4% of the overall harvest.

Figures available on 31 August 2018 show that 17% of the available quota for red kangaroos in the western zone had been harvested with 14% and 8% of the quota was harvested in the central and eastern zones respectively. For eastern grey kangaroos, 22% and 8% of the quota was harvested in the central and eastern zones respectively. For common wallaroos, 19% and 14% of the quota was harvested in the central and western zone, whilst only 2% of the quota was harvested in the eastern zone. Given these figures, it is unlikely that quotas will be met for each species in each zone in 2018.

Non-commercial take under damage mitigation permits (DMPs) were below quota for the 2017 harvest period. This trend is likely to be repeated in 2018.

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.

2017 was the warmest year on record for Queensland with many areas of the harvest zones recording the highest mean temparatures. Below average rainfall was recorded for most of central and western parts of Queensland in 2017. The majority of the harvest zones are still drought declared at 4 September 2018.

Contents

Executive summary iii
Introduction 1
Proposed quotas 2
Long-term population trends 4
Trigger points 11
Comparison between 2017 and 2018 population estimates 14
Review of the 2017 harvest 20
Sex ratio by species and zone 21
Harvest update for 2018 23
The extent of non-commercial harvest mortality 23
Proportion of the population not subject to harvesting 25
Rainfall trends 29
References 33
Appendixes 34
Appendix 1 Summary of the methodology for population monitoring and quota derivation for Queensland 34
Appendix 2 Densities per km^2 of the commercially harvested macropod species 2004–2018 37

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 (Administration) Regulation 2017
  - Nature Conservation (Wildlife Management) Regulation 2006
  - Nature Conservation (Wildlife) Regulation 2006
  - 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 2012).

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 2019. Additionally, the submission outlines the basis of how these quotas were determined.

The Nature Conservation (Macropod Harvest Period 2019) Notice 2018 is due for release in December 2019. The release of this notice will allow the harvest period to be declared open on 1 January 2019. The notice will outline specific conditions for the 2019 harvest period including, but not limited to, harvest zone boundaries and minimum allowable weights.

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 Department of the Environment and Energy for determining state quota limits.

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

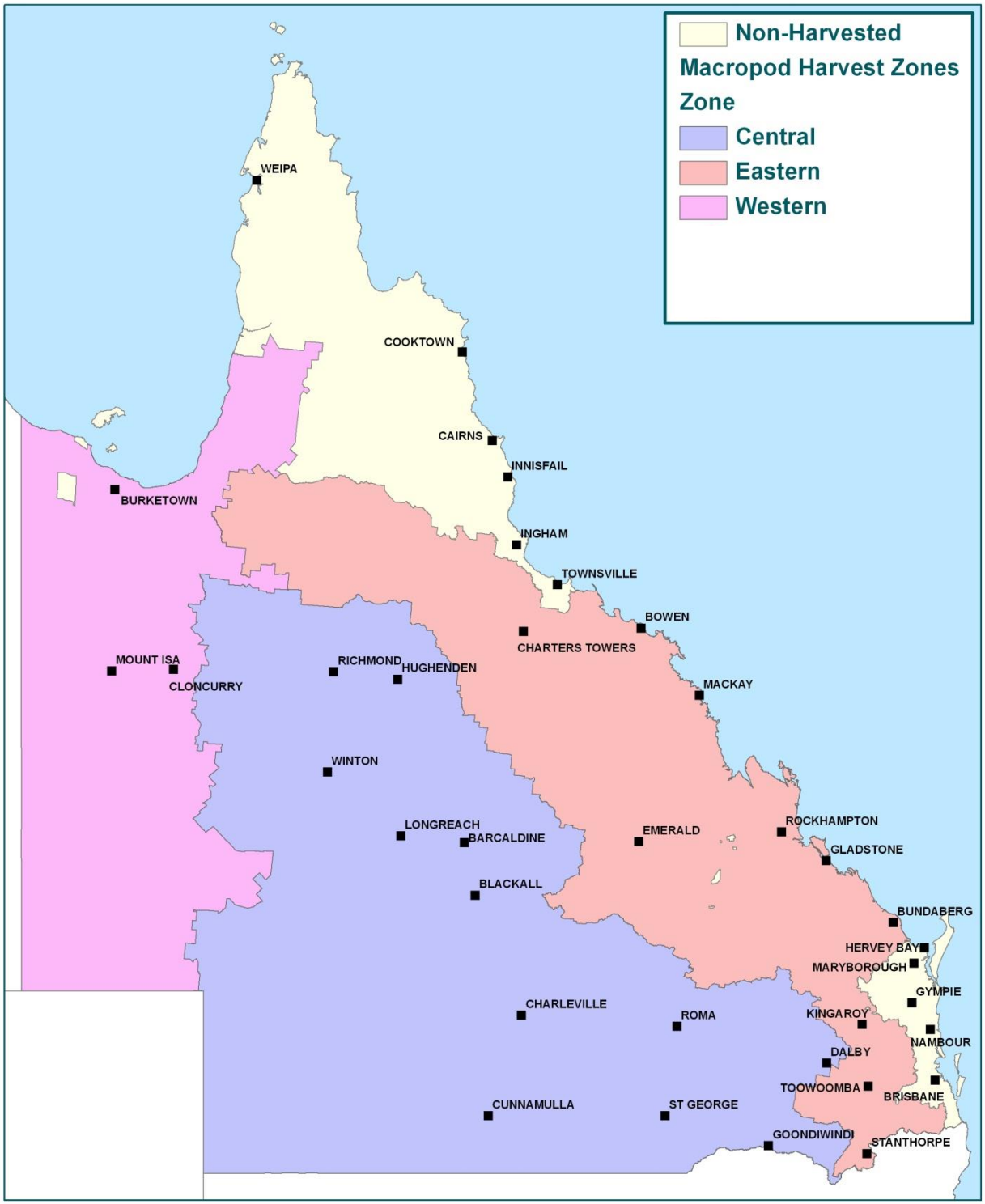
- population trends (estimates obtained through aerial surveys)
- review of previous harvests
- the extent of non-commercial harvest mortality
- the extent of areas not subject to any harvest
- rainfall trends.

Proposed quotas

Table 1 – 2018 estimated populations and 2019 proposed quotas for each macropod species in each harvest zone

Species	Harvest zone	2018 estimated population	2019 sustainable use quota (rounded to the nearest 50)	Proportion of population (% rounded to the nearest whole number)
Red kangaroo	Central	4,668,750	933,700	20
	Eastern	188,300	18,850	10
	Western	434,400	43,450	10
	Combined	5,291,450	996,050	19
Eastern grey kangaroo	Central	8,293,350	1,099,800	13
	Eastern	4,171,500	417,150	10
	Western	13,800	0	0
	Combined	12,478,650	1, 516,950	12
Common wallaroo	Central	1,414,600	212,200	15
	Eastern	1,565,850	156,600	10
	Western	321,350	32,150	10
	Combined	3,301,800	400,950	12

Figure 1 – Queensland macropod harvest zones



The central harvest zone is divided into three regions central north, central south, and central east as displayed in figure 6.

The shires in the central north harvest region are Barcaldine, Barcoo, Blackall-Tambo, Flinders, Longreach, McKinlay, Richmond and Winton.

The shires in the central south harvest region are Bulloo, Murweh, Paroo and Quilpie.

The shires in the central east harvest 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 shires.

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

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.

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).

Figure 2 – Macropod population trends—1992–2018

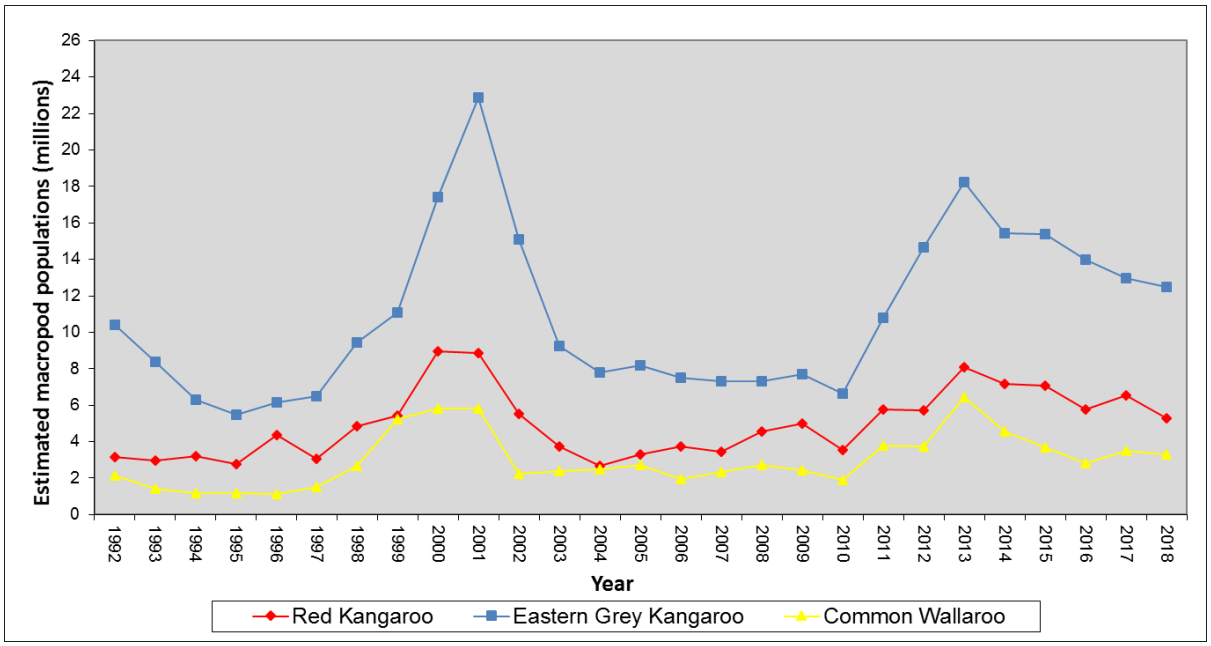


Figure 3 – Red kangaroo population estimates (with one standard error) since 1992

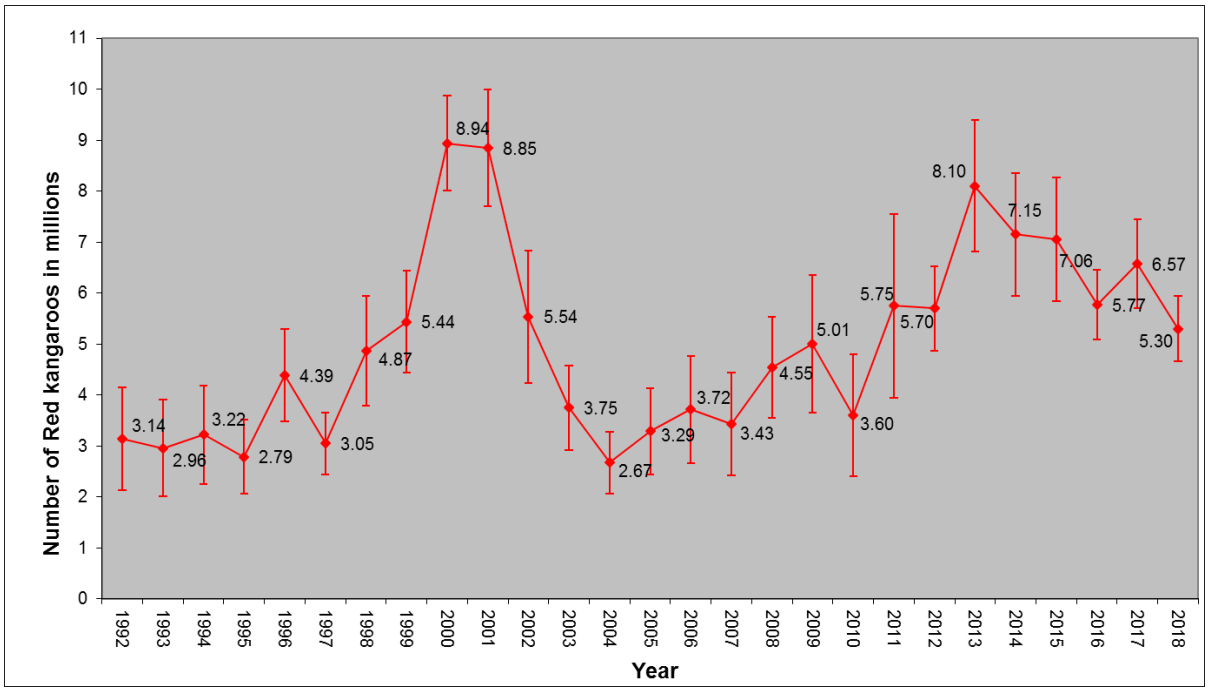


Figure 4 – Eastern grey kangaroo population estimates (with one standard error) since 1992

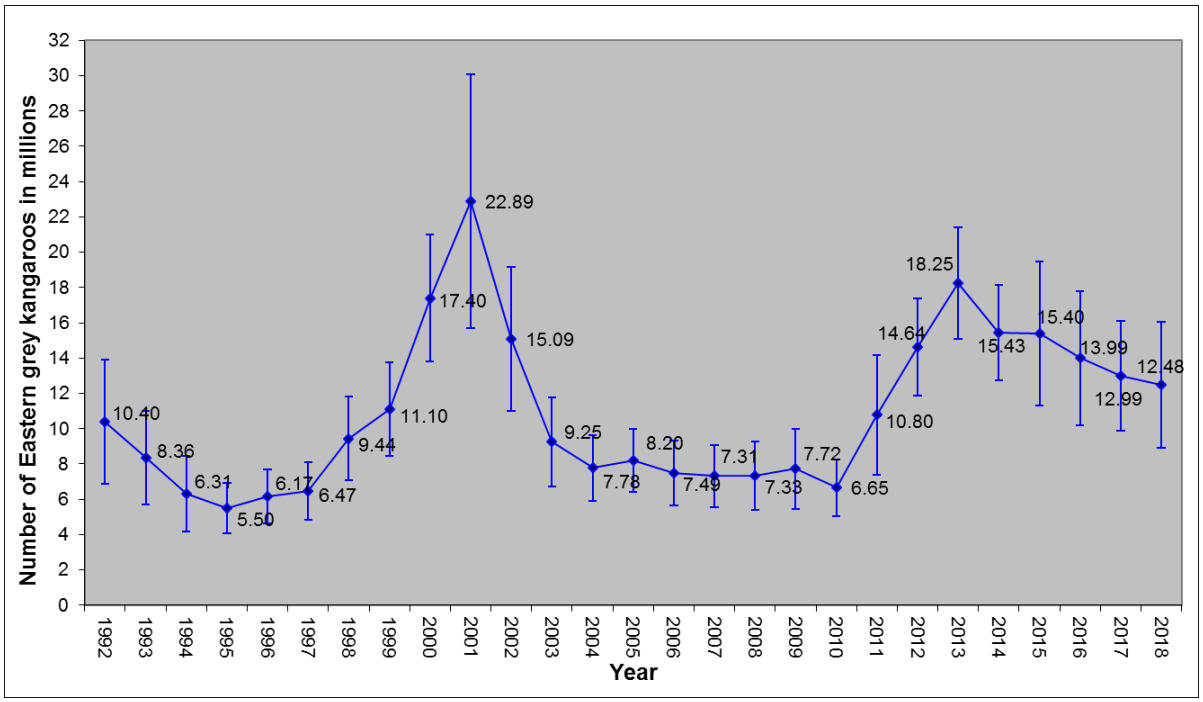


Figure 5 – Common wallaroo population estimates (with one standard error) since 1992. Estimates include a 1.85 correction factor for 2011 to 2018 and a 1.2 correction factor all other years

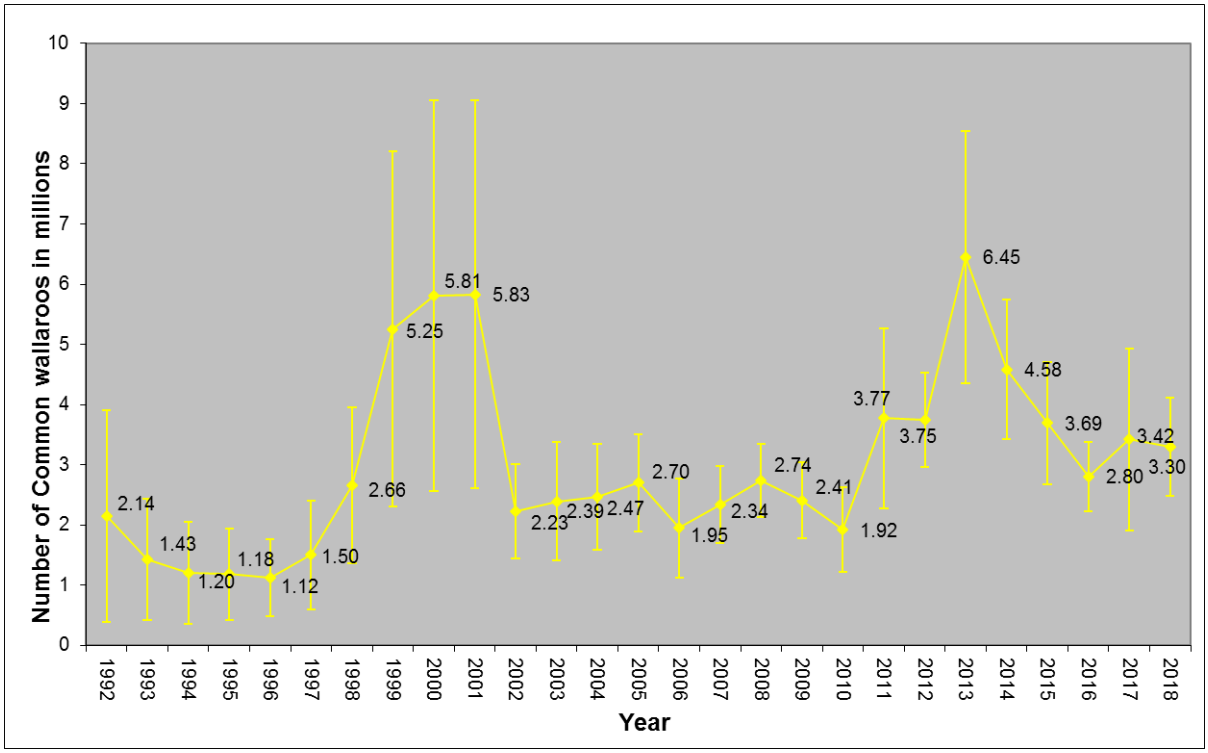
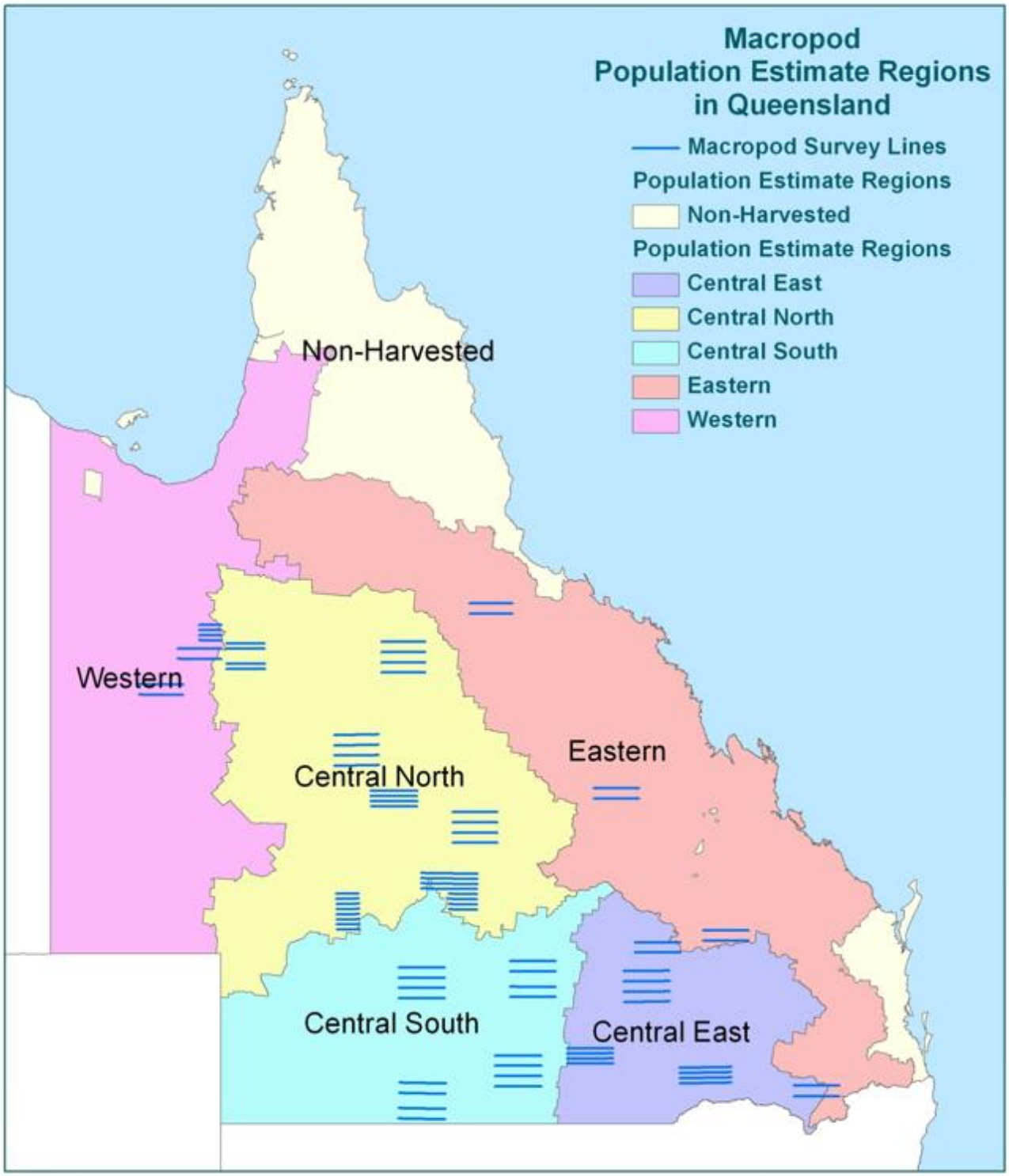


Figure 6 – Regions used to calculate population estimates of commercially harvested macropods



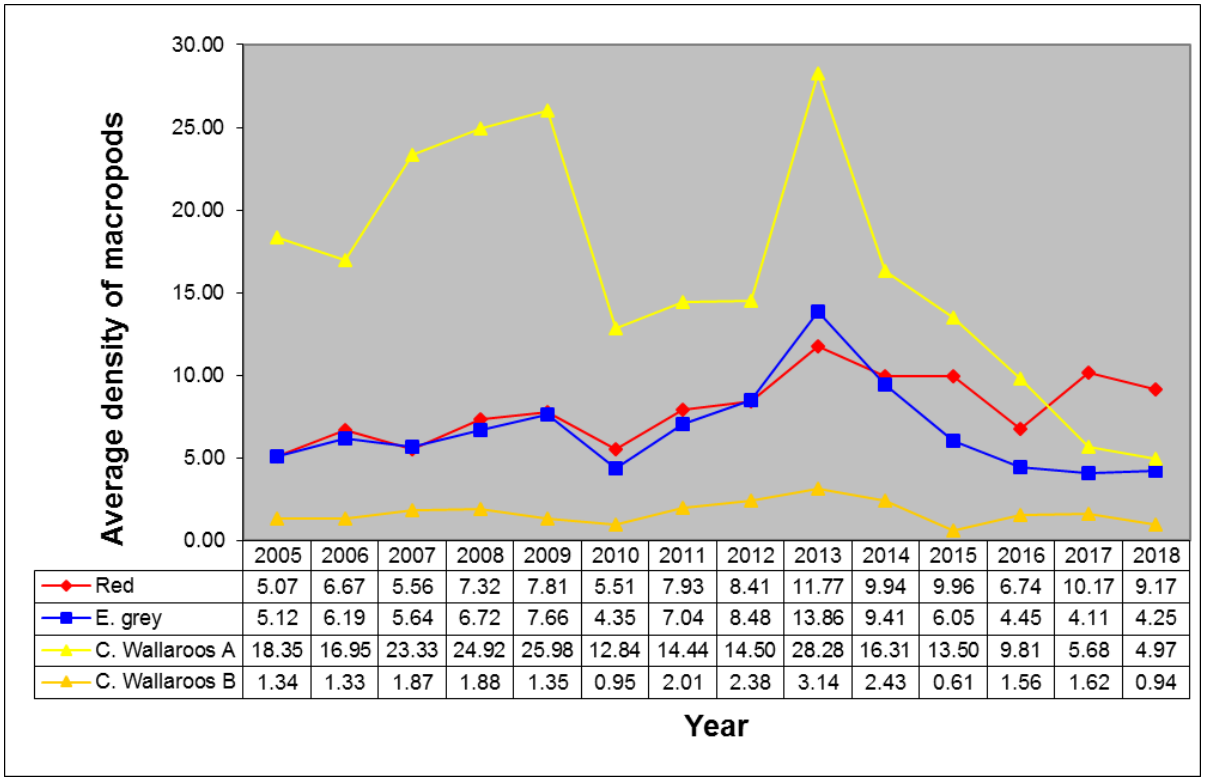
This data is monitored for any significant decreases in densities. This approach is possible for all data collected since 2005. Examination of trends in density for the three commercially harvested macropod species in the areas outlined above for the period 2005–2018 demonstrates densities do fluctuate over time (figures 7–11).

For red kangaroos densities are greatest in the central zone north and central zone south, 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). 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).

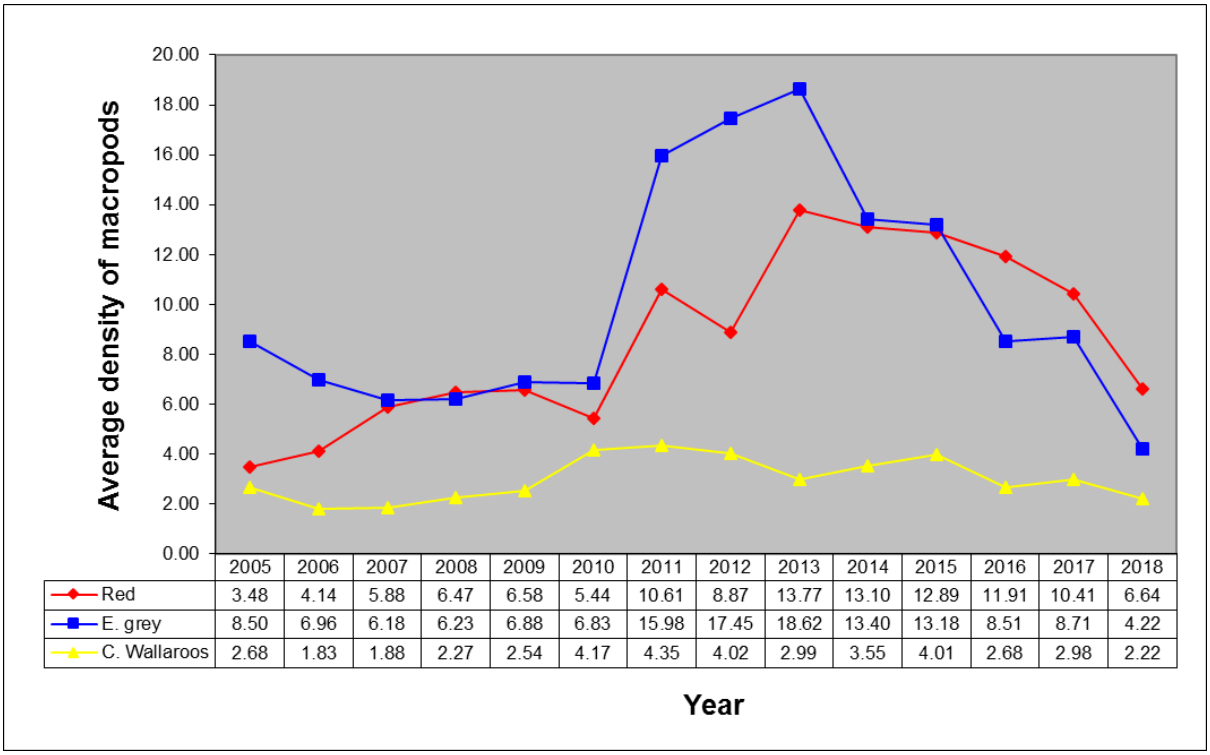
Common wallaroos occur in highest densities in the central zone north. This area is further divided into two regions for the purposes of estimating populations due to the considerably higher densities recorded around Blackall, Tambo and Longreach when compared to the rest of the zone (figure 7 and Appendix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

Figure 7 – Average density per km^2 of commercially harvested macropods in the Central North population estimate region from 2005 to 2018 (Common wallaroos are represented by two areas in the Central North zone)



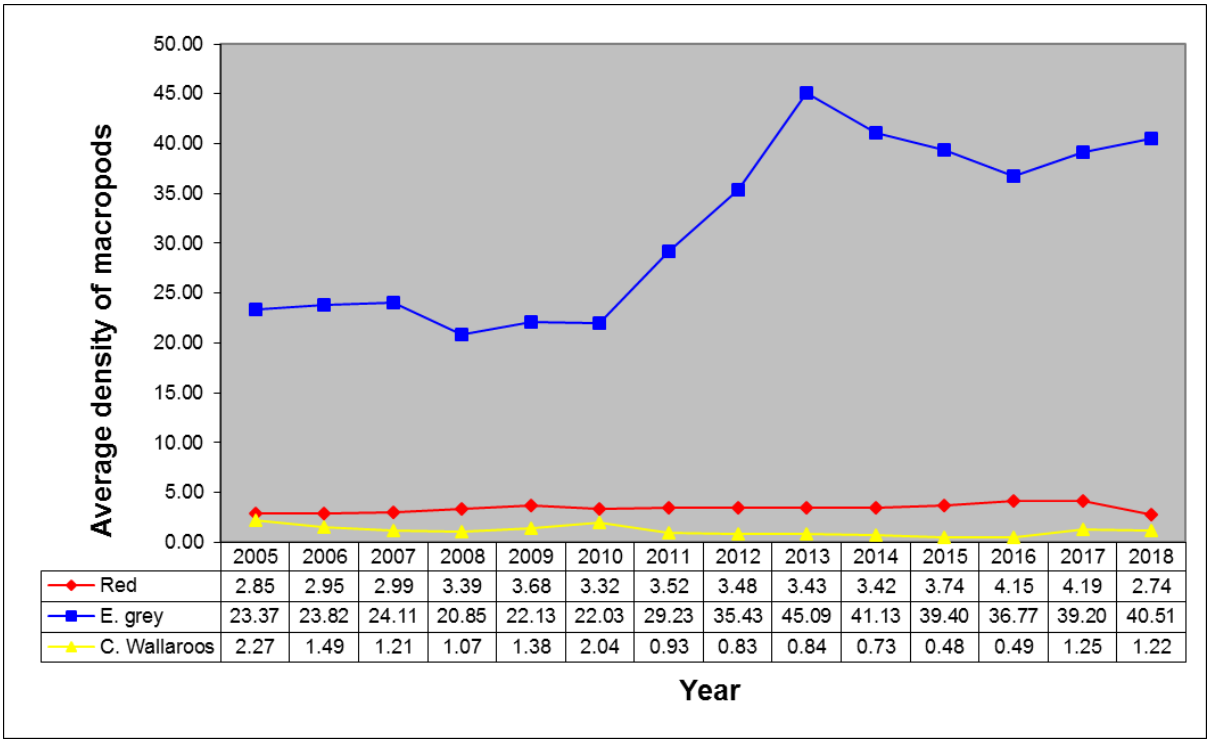
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Red	5.07	6.67	5.56	7.32	7.81	5.51	7.93	8.41	11.77	9.94	9.96	6.74	10.17	9.17
E. grey	5.12	6.19	5.64	6.72	7.66	4.35	7.04	8.48	13.86	9.41	6.05	4.45	4.11	4.25
C. Wallaroos A	18.35	16.95	23.33	24.92	25.98	12.84	14.44	14.50	28.28	16.31	13.50	9.81	5.68	4.97
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

Figure 8 – Average density per km^2 of commercially harvested macropods in the Central South population estimate region from 2005 to 2018



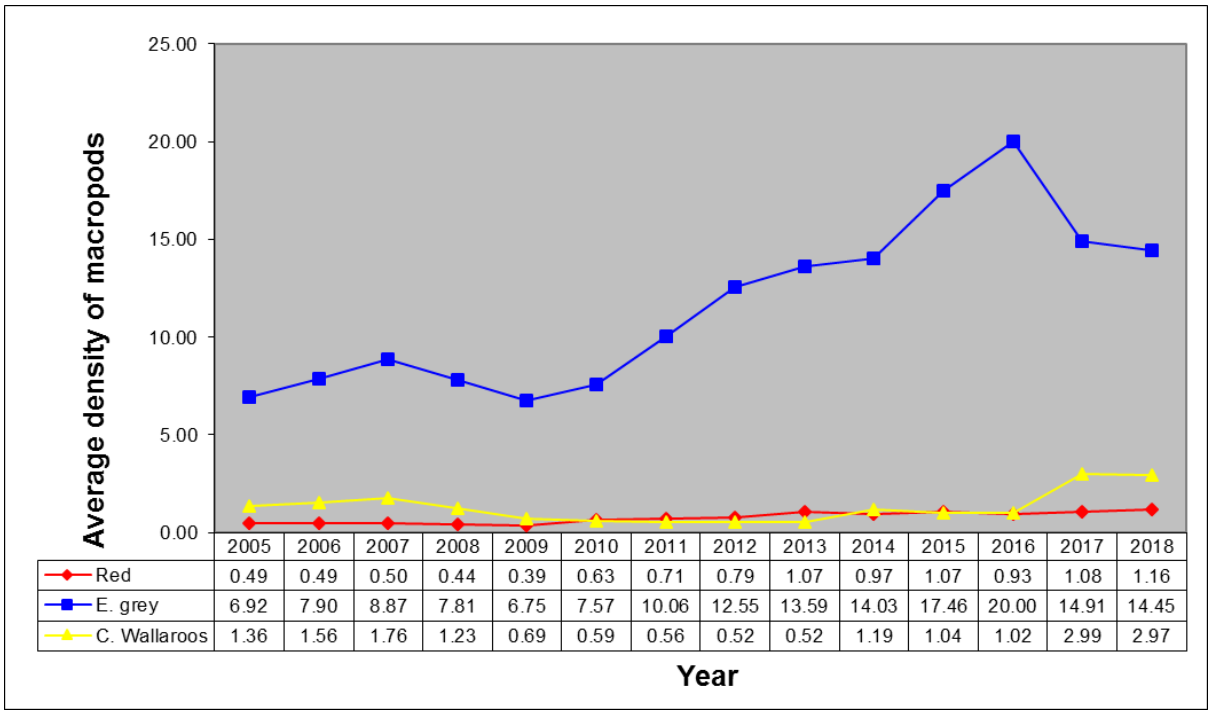
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Red	3.48	4.14	5.88	6.47	6.58	5.44	10.61	8.87	13.77	13.10	12.89	11.91	10.41	6.64
E. grey	8.50	6.96	6.18	6.23	6.88	6.83	15.98	17.45	18.62	13.40	13.18	8.51	8.71	4.22
C. Wallaroos	2.68	1.83	1.88	2.27	2.54	4.17	4.35	4.02	2.99	3.55	4.01	2.68	2.98	2.22

Figure 9 – Average density per km^2 of commercially harvested macropods in the Central East population estimate region from 2005 to 2018



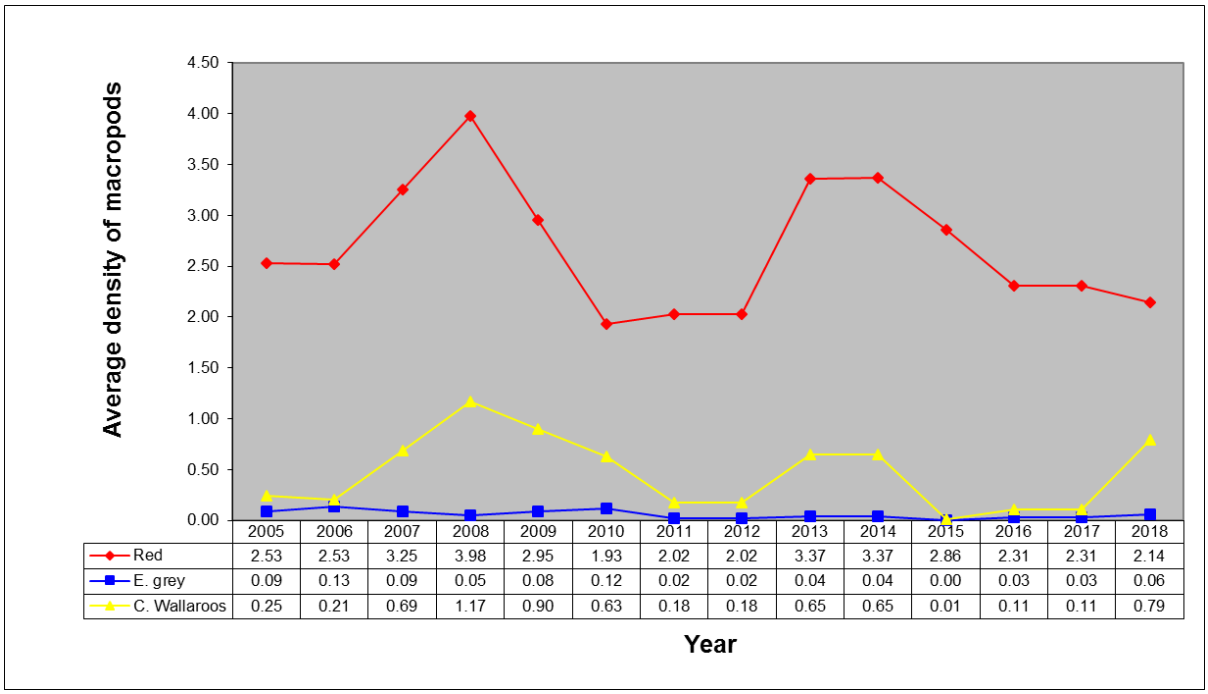
	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Red	2.85	2.95	2.99	3.39	3.68	3.32	3.52	3.48	3.43	3.42	3.74	4.15	4.19	2.74
E. grey	23.37	23.82	24.11	20.85	22.13	22.03	29.23	35.43	45.09	41.13	39.40	36.77	39.20	40.51
C. Wallaroos	2.27	1.49	1.21	1.07	1.38	2.04	0.93	0.83	0.84	0.73	0.48	0.49	1.25	1.22

Figure 10 – Average density per km^2 of commercially harvested macropods in the Eastern population estimate region from 2005 to 2018



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

Figure 11 – Average density per km^2 of commercially harvested macropods in the Western population estimate region from 2005 to 2018



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

Trigger points

Pre-determined trigger points for each of the commercial harvest quotas was introduced to the Queensland Wildlife Trade Management Plan for Export (Commercially Harvested Macropods 2013–17) and is 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 2019 for each species in each region compared with the population estimates for those regions. The estimated population for eastern grey kangaroos in the central north and central south region is below 1.5 SD trigger point. Consistent with the Wildlife Trade Management Plan for Export—Commercially Harvested Macropods 2018–22 the harvest quota for this species has been halved for 2019 in the central zone north and central zone south regions. The harvest of eastern grey kangaroos will be limited to a maximum of 87,700 in the central north region and 56,500 in the central south region for 2019. (figure 12). All other species are above the calculated trigger points and quotas have been allocated accordingly (figure 12). As the western zone is on the very limit of the eastern grey kangaroo range no quota is set for this species in this zone. Consequently there are no trigger points calculated for this species in this zone.

Table 2 – Calculated trigger points for 2019 and estimated populations of commercially harvested macropod species in each region for 2018

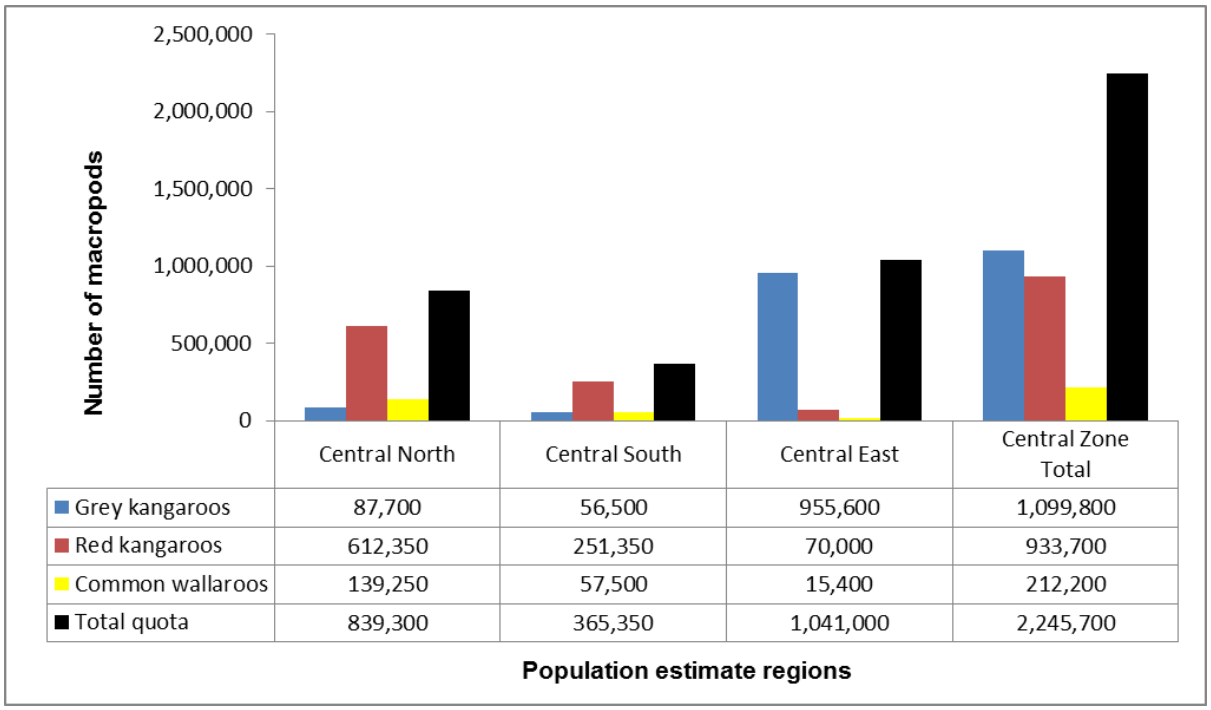
Note: There is no quota set for eastern grey kangaroos in the western region. The quota for this species will be halved for the central north and central south region in 2019 as the estimated population is below the 1.5 SD trigger point.

Species	Population estimate region	2018 estimated population	2019 1.5 SD trigger point	2019 2 SD trigger point
Red kangaroo	Central North	3,061,844	1,829,053	1,613,900
	Central South	1,256,828	695,306	564,721
	Central East	350,058	97,694	73,852
	Eastern	188,322	74,289	63,668
	Western	434,406	186,370	148,406
Eastern grey kangaroo	Central North	1,169,410	1,199,902	983,316
	Central South	753,159	826,042	659,973
	Central East	6,370,804	2,473,788	2,088,002
	Eastern	4,171,503	1,196,267	921,611
	Western	13,819	NA	NA
Common wallaroo	Central North	928,419	794,509	595,215
	Central South	383,396	173,463	126,483
	Central East	102,775	29,483	22,494
	Eastern	1,565,830	228,440	179,439
	Western	321,356	22,065	13,353

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

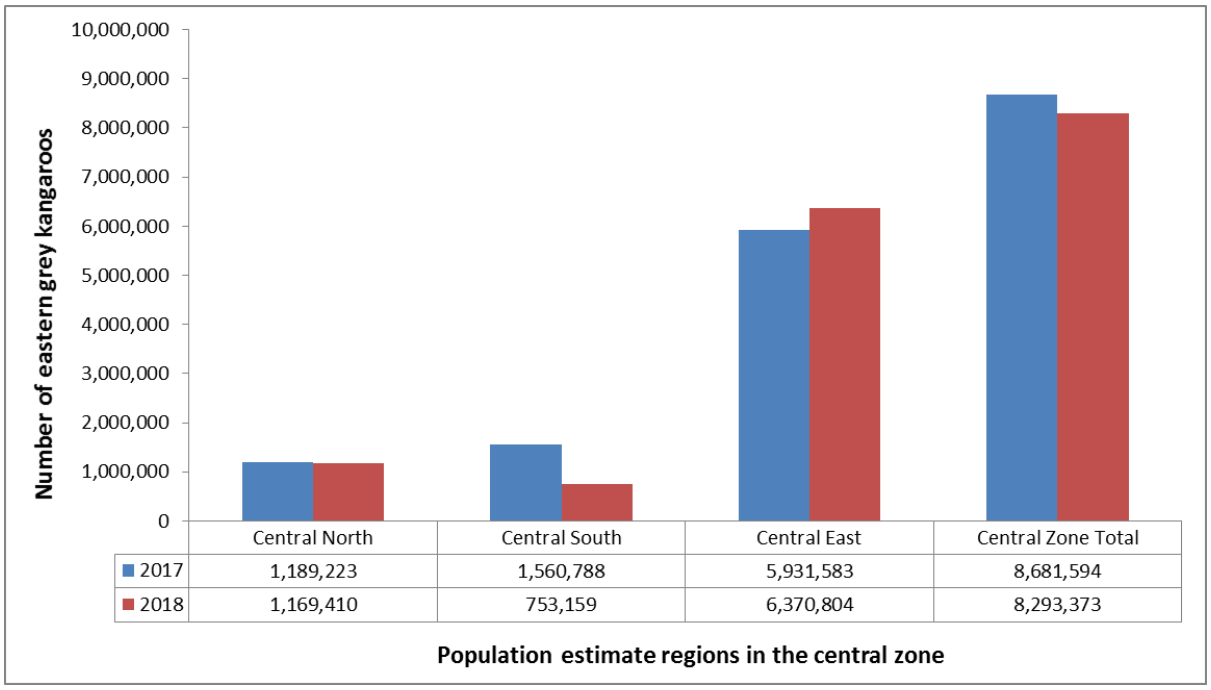
Whilst the effect of halving the harvest quota for eastern greys in the central north and central south reduces the available harvest for this species this effect is unlikely to impact the industry. The overall availability of harvest macropods in the central north and central south is 839,300 and 365,350, respectively, whilst the overall availability of eastern greys in the entire central zone is 1,099,800 (figure 12). Although the estimated population for eastern greys decreased in the central south region it remained very similar to 2017 in the central north, central east and over the combined central harvest zone (figure 13).

Figure 12- Detail of the calculated harvest quotas for the central zone including the reduction of eastern grey kangaroos in the central north and central south



	Central North	Central South	Central East	Central Zone Total
Grey kangaroos	87,700	56,500	955,600	1,099,800
Red kangaroos	612,350	251,350	70,000	933,700
Common wallaroos	139,250	57,500	15,400	212,200
Total quota	839,300	365,350	1,041,000	2,245,700

Figure 13- Comparison of eastern grey kangaroo estimated populations between 2017 and 2018 in the central harvest zone



	Central North	Central South	Central East	Central Zone Total
2017	1,189,223	1,560,788	5,931,583	8,681,594
2018	1,169,410	753,159	6,370,804	8,293,373

Comparison between 2017 and 2018 population estimates

The total population estimates combined across all three harvest zones has decreased slightly for all species in 2018 compared with 2017 (figure 14). However whilst some population estimates have decreased for specific zones others have increased (table 3). Red kangaroo population estimates increased in the eastern zone and marginally decreased in the central and western zones (figure 15). Common wallaroo population estimates increased significantly in the western zone. However common wallaroos decreased in the central zone (figure 15). The increase of common wallaroos in the western zone is comparable to fluctuations in previous years The eastern grey population estimates decreased in the eastern zones and central zone and increased significantly in the western zone (figure 15). As was the case for the 2018 quota, no quota will be proposed for eastern grey kangaroos in the western Zone because the population size in this harvest zone, despite the observed recent increase, remains small (figure 15 and figure 16).

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 16). This model was updated in 2012 to incorporate almost a decade of survey data and to generate trigger points for the commercial quota allocation.

Figure 14 – Comparison of overall macropod populations in the commercial harvest zones 2017 and 2018 (with one standard error)

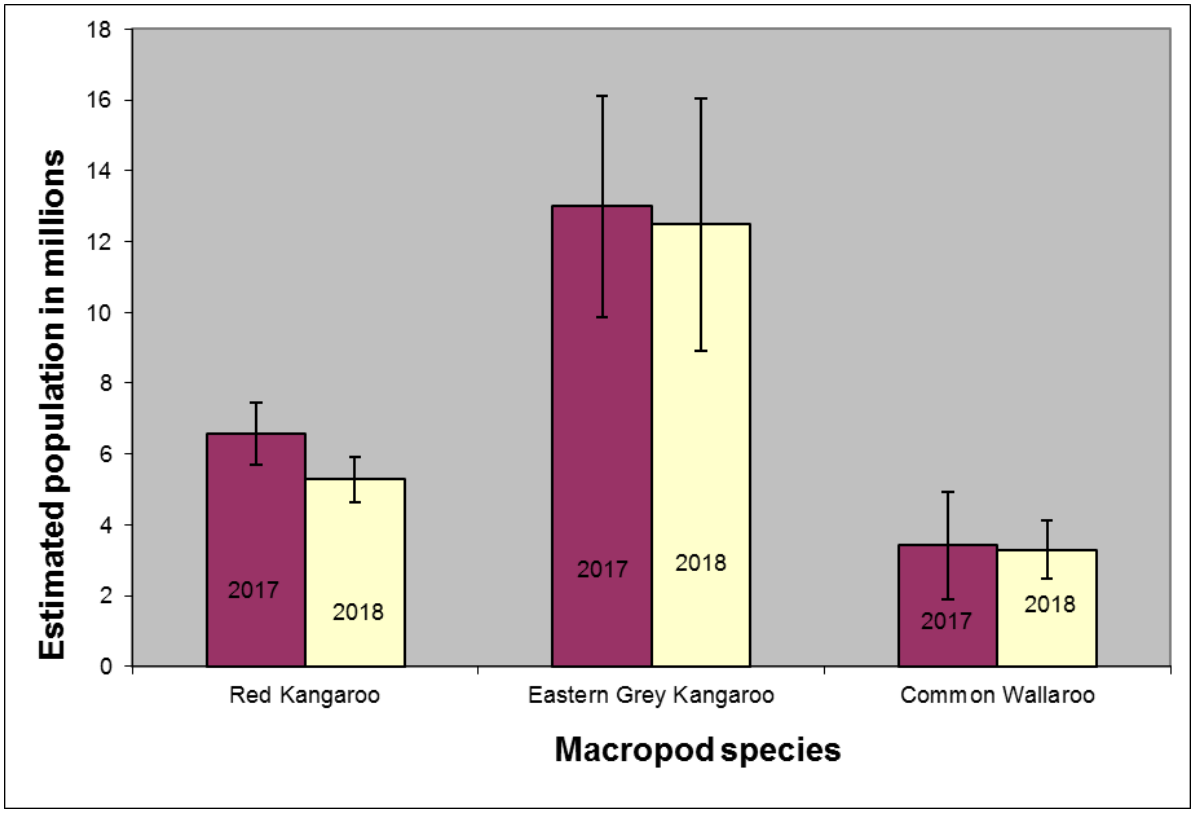


Table 3 – Comparison between 2017 and 2018 macropod population estimates

Species	Harvest zone	2017 population estimate (rounded to the nearest 50)	2018 population estimate (rounded to the nearest 50)
Red kangaroo	Central	5,866,450	4,668,750
	Eastern	174,400	188,300
	Western	485,850	434,400
	Combined	6,526,700	5,291,450
Eastern grey kangaroo	Central	8,681,600	8,293,350
	Eastern	4,303,300	4,171,500
	Western	7,250	13,800
	Combined	12,992,150	12,478,650
Common wallaroo	Central	1,790,200	1,414,600
	Eastern	1,579,850	1,565,850
	Western	47,050	321,350
	Combined	3,417,100	3,301,800

Figure 15 – Comparison of macropod populations from 2017 to 2018 by species and zone

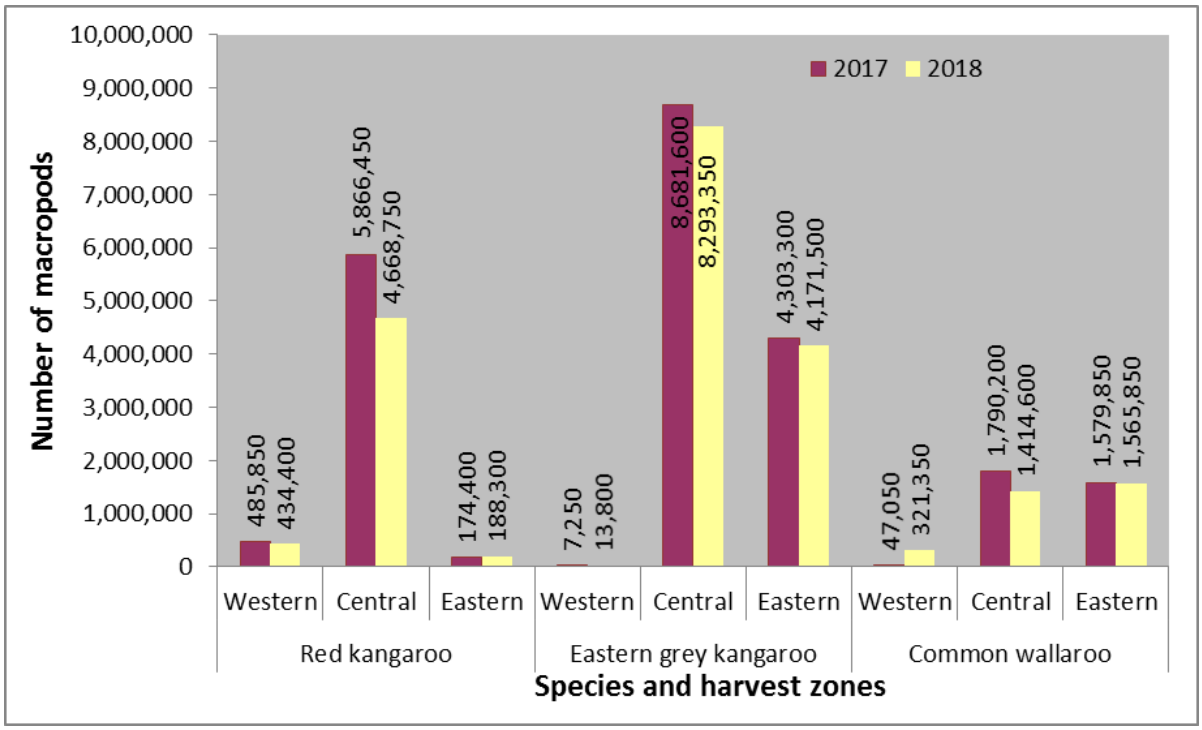
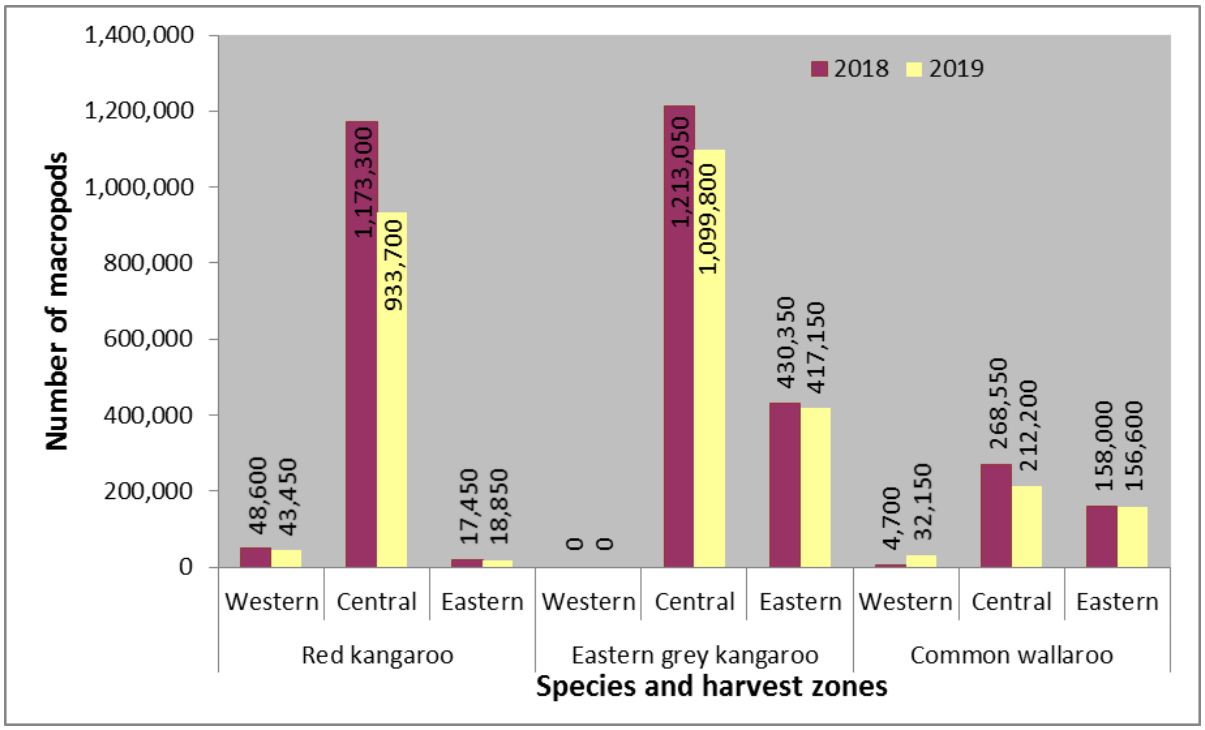


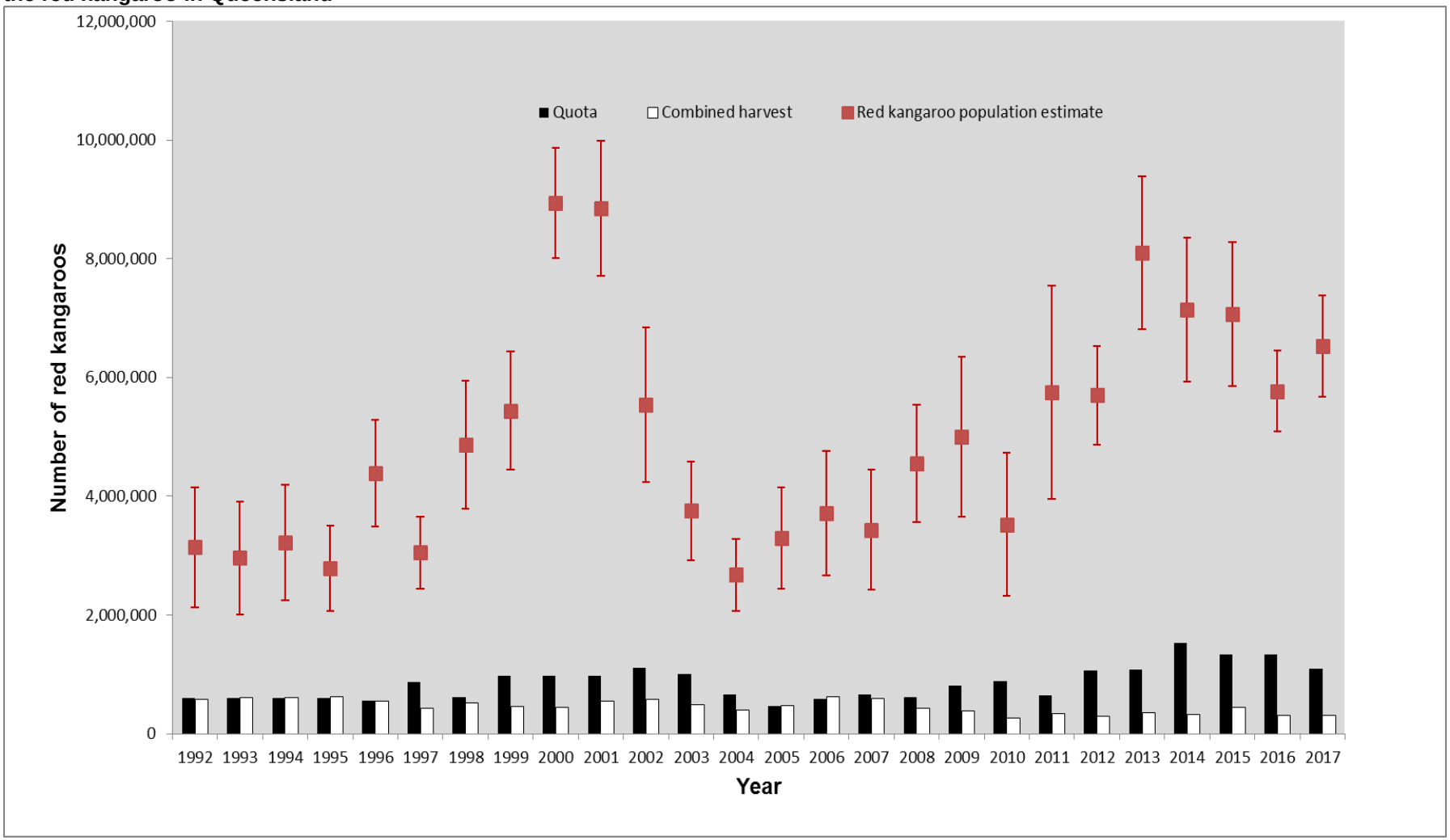
Figure 16 – Comparison of 2018 actual and 2019 proposed harvest quotas



Long-term quota and harvest trends

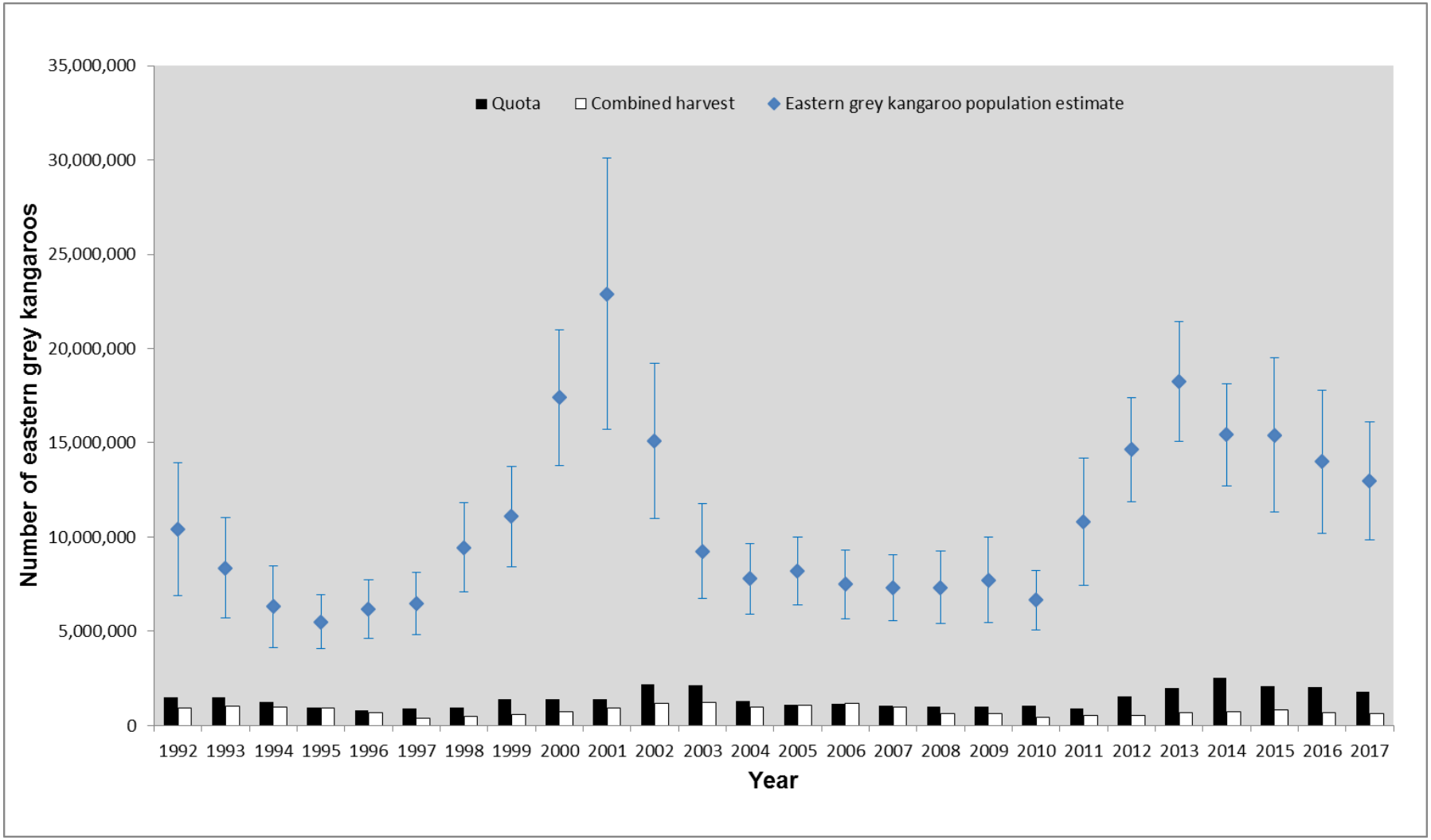
Figures 17 to 19 outline data on the three commercially harvested macropod species pertaining to estimated population, quota and harvest for the years 1992 to 2017. Please note that population estimates are based on aerial surveys conducted in the previous year to the quota and harvest. Combined population 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 17 – Long-term population estimates (± one standard error), quota and harvest data (commercial harvest + damage mitigation permits) for the red kangaroo in Queensland



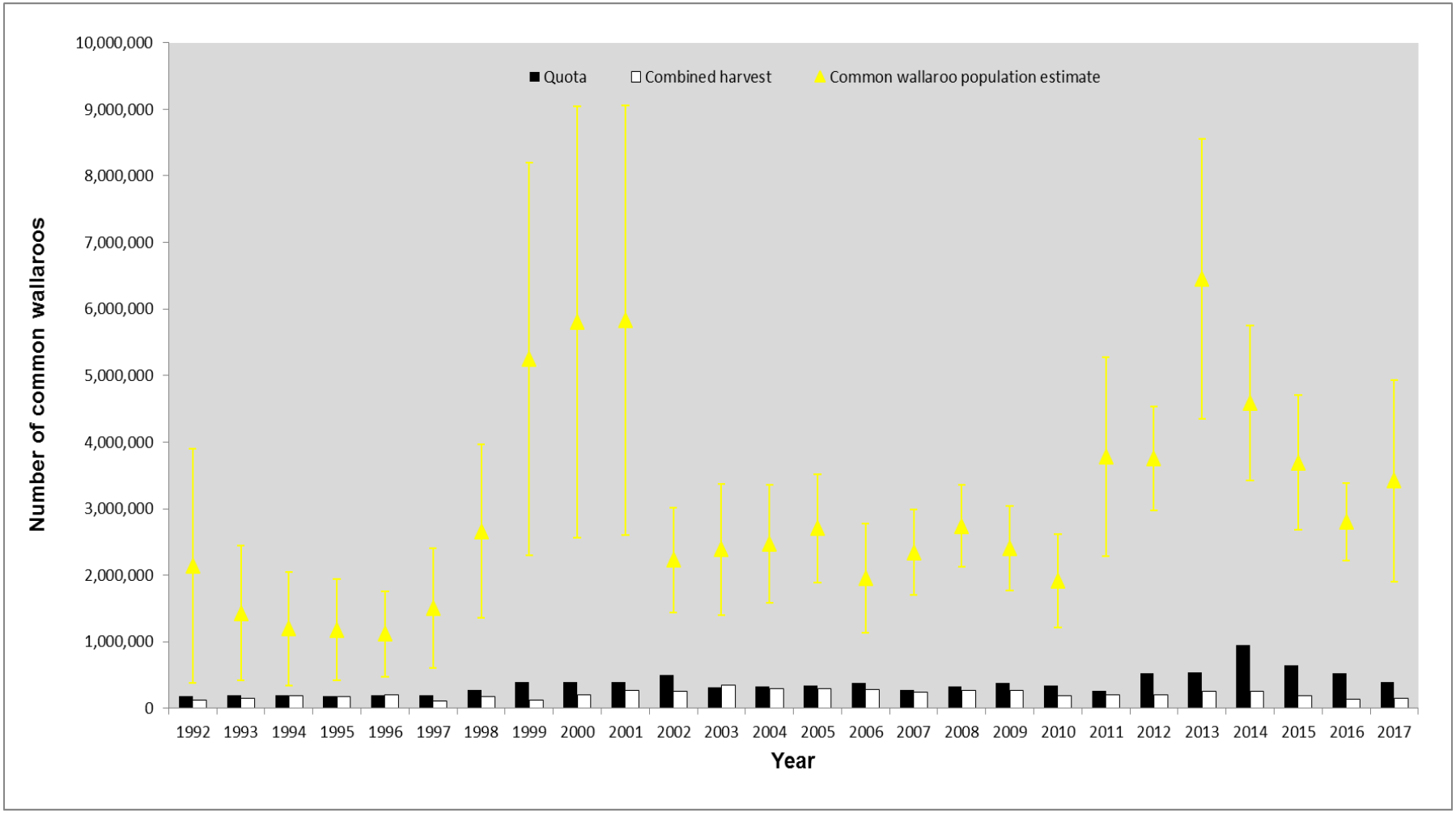
Note: population estimates are based on aerial surveys conducted the year before the harvest was taken.

Figure 18 – Long-term population estimates (± one standard error), quota and harvest data (commercial harvest + damage mitigation permits) for the eastern grey kangaroo in Queensland



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

Figure 19 – Long-term population estimates (± one standard error), quota and harvest data (commercial harvest + damage mitigation permits) 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 17 to 19). 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 17 to 19). 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 2017 harvest

Dealer returns for the year 2017 indicate that there were 868,129 macropods taken in Queensland, which represents 26.4% of the overall combined quota. Of the 868,129 animals harvested, there were 257,646 red kangaroos, 482,544 eastern grey kangaroos and 127,939 common wallaroos harvested (table 4). Quotas for individual species in each harvest zone were not exceeded in 2017, the maximum commercial take as a percentage of the approved quota was 37% for common wallaroo and 36% for eastern grey kangaroos in the central zone (tables 4 to 7).

Table 4 – Total harvest in 2017

Species	Population estimate 2016	Quota 2017	Harvest take 2017	% quota used 2017	% population harvested 2017
Red kangaroo	5,768,650	1,090,600	257,646	23.6%	4.5%
Eastern grey kangaroo	13,992,950	1,804,200	482,544	26.7%	3.4%
Common wallaroo	2,805,150	390,800	127,939	32.7%	4.6%
Total	22,566,750	3,285,600	868,129	26.4%	3.8%

Note: population estimates are based on aerial surveys conducted in 2016, which were used to set the 2017 quota.

Table 5 – Harvest of red kangaroos in 2017

Zone	Population estimate 2016	Quota 2017	Harvest take 2017	% quota utilised 2017	% population harvested 2017
Central	5,137,600	1,027,500	248,000	24.1%	4.8%
Eastern	145,200	14,500	1,735	12%	1.2%
Western	485,850	48,600	7,911	16.3%	1.6%
Total	5,768,650	1,090,600	257,646	23.6%	4.5%

Note: population estimates are based on aerial surveys conducted in 2016, which were used to set the 2017 quota.

Table 6 – Harvest of eastern grey kangaroos in 2017

Zone	Population estimate 2016	Quota 2017	Harvest take 2017	% quota utilised 2017	% population harvested 2017
Central	8,111,850	1,216,800	438,222	36.0%	5.4%
Eastern	5,873,850	587,400	44,322	7.5%	0.8%
Western	7,250	NA	NA	NA	NA
Total	13,992,950	1,804,200	482,544	26.7%	3.4%

Note: population estimates are based on aerial surveys conducted in 2016, which were used to set the 2017 quota.

Table 7 – Harvest of common wallaroos in 2017

Zone	Population estimate 2016	Quota 2017	Harvest take 2017	% quota utilised 2017	% population harvested 2017
Central	2,205,600	330,850	122,815	37.1%	5.6%
Eastern	552,500	55,250	3,815	6.9%	0.7%
Western	47,050	4,700	1,309	27.9%	2.8%
Total	2,805,150	390,800	127,939	32.7%	4.6%

Note: population estimates are based on aerial surveys conducted in 2016, which were used to set the 2017 quota.

Sex ratio by species and zone

Commercial harvest is typically biased towards males (figure 20) as they are usually larger and heavier than females. In 2017, the total harvest for each species was biased towards males by 94% or greater. Data gathered throughout 2017 indicates 3.5% of the overall harvest was female (figure 21).

Figure 20 – Overall sex ratio from 2006 to 2017 (percentages rounded to the nearest whole number)

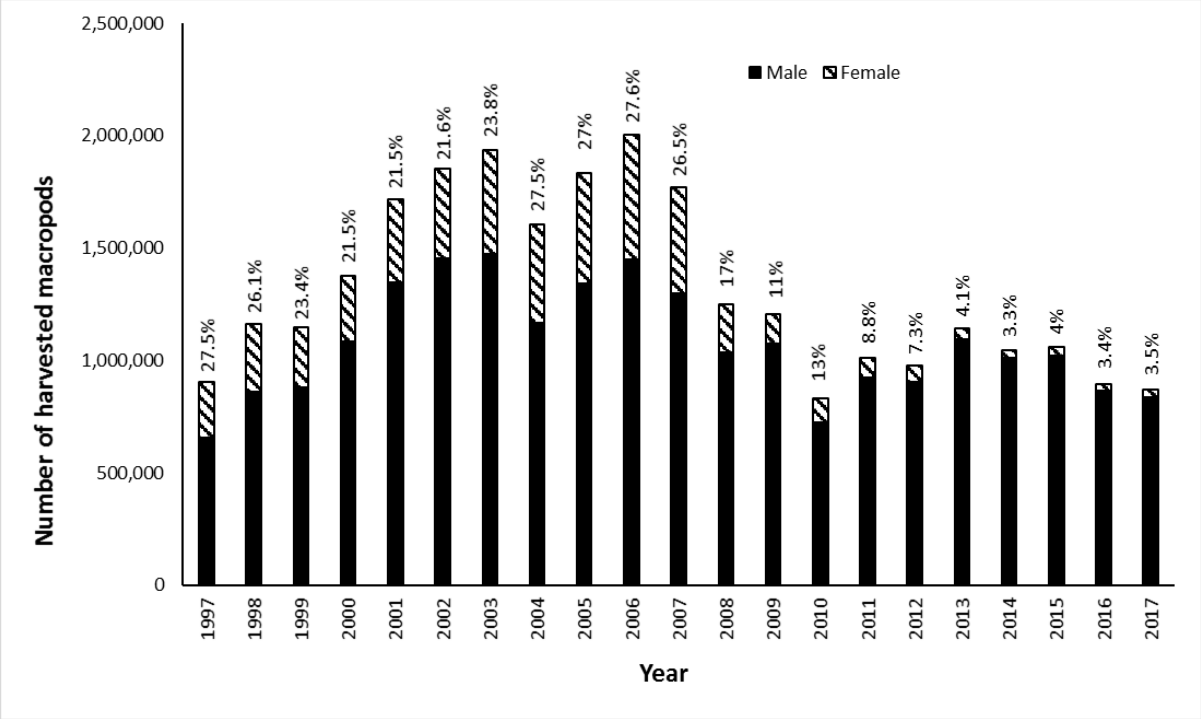
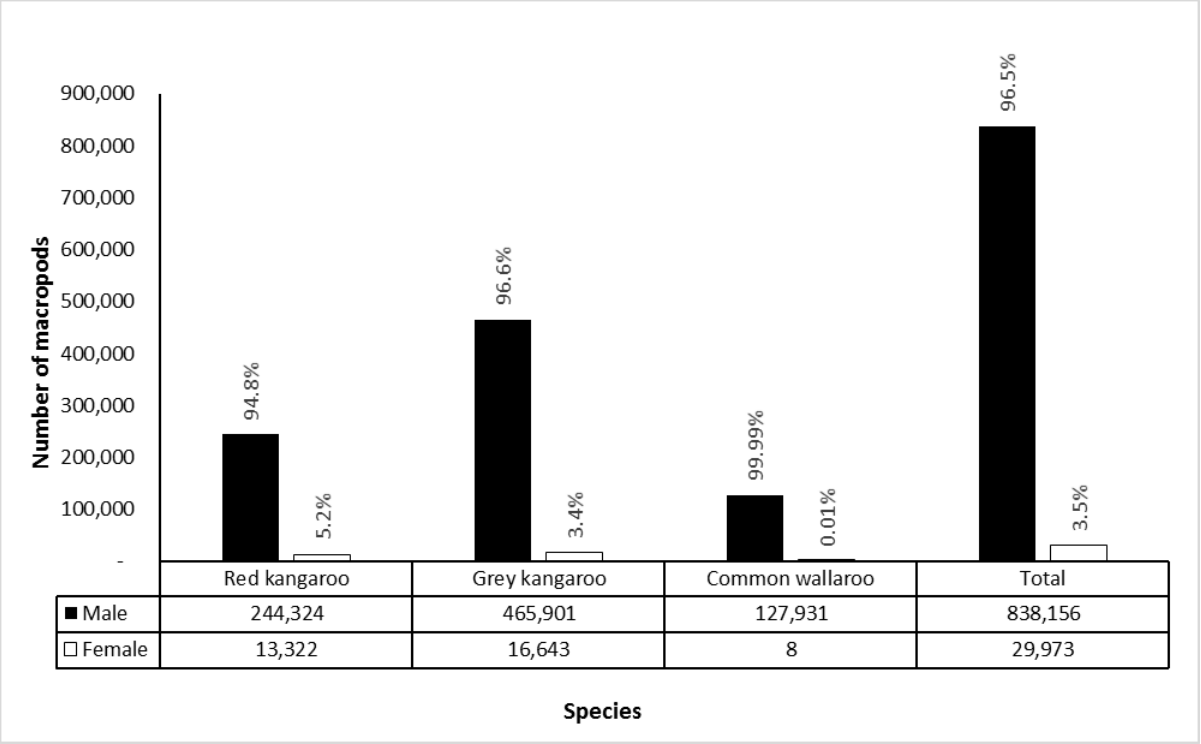


Figure 21 - Proportion of 2017 harvest, male and female by species



Harvest update for 2018

The total number of tags issued up to 31 August 2018 was 778,400. A comparison of tag sales and harvest returns in relation to quotas in each zone is given 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. Given the low percentage of the quota that has currently been issued in tags, it is unlikely quotas will be met for any species in any zone. The 2018 harvest will be comprehensively reported on in the 2018 annual report, due for release in March 2019.

Table 8 – Tags issued and reported harvest for 2018 at 31 August

Species	Harvest zone	2018 sustainable use quota (rounded to the nearest 50)	Tags issued to 31 August 2018	Reported harvest to 31 August 2018
Red kangaroo	Central	1,173,300	245.600	166,648
	Eastern	17,450	4,550	1,445
	Western	48,600	11,400	8,498
Eastern grey kangaroo	Central	1,213,050	363,600	270,339
	Eastern	430,350	58,400	35,960
	Western	NA	NA	NA
Common wallaroo	Central	268,550	85,350	51,433
	Eastern	158,000	7,850	3,458
	Western	4,700	1,650	651

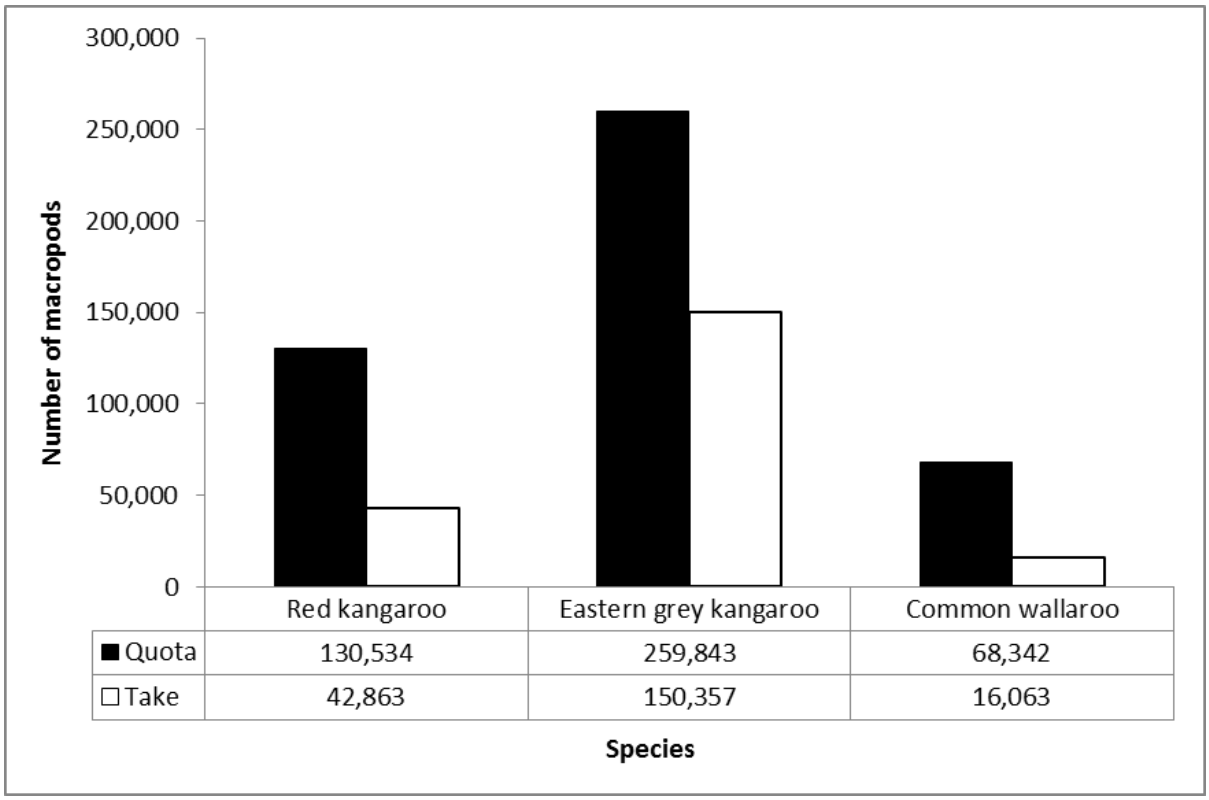
The extent of non-commercial harvest mortality

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

Damage mitigation permit

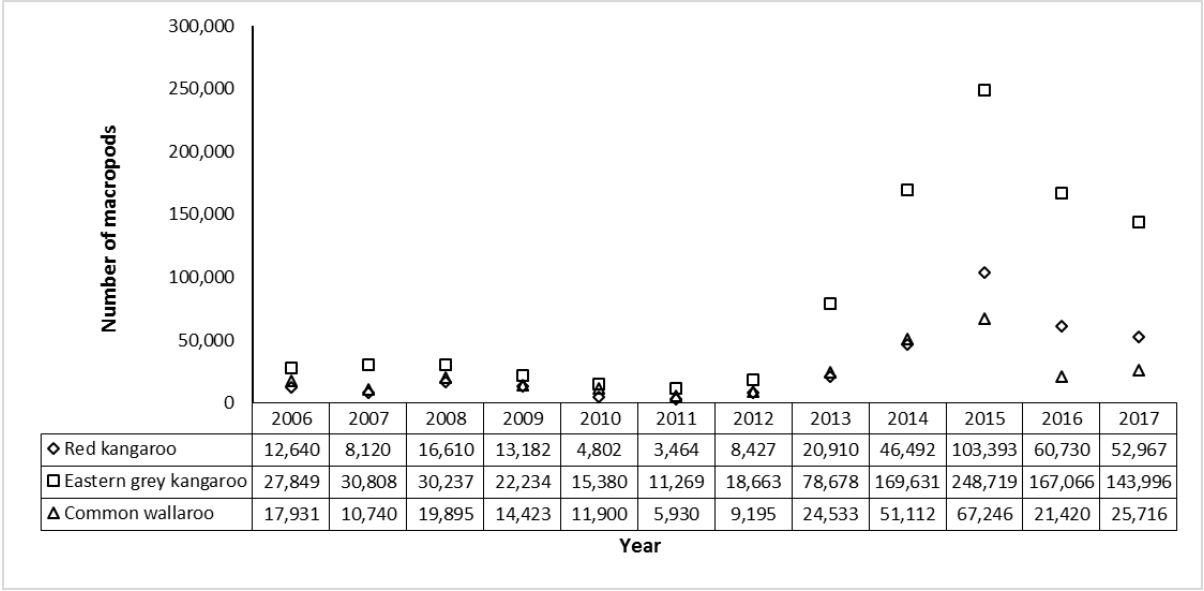
DMPs are issued by DES where macropods are causing demonstrable damage to property or person. The total number allowed to be taken under these permits are limited to a maximum of 2% of the estimated population for each species in each zone. It is a condition of the permit that macropods are taken in accordance with the requirements of the National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Non-commercial Purposes. Uptake of DMPs is below the available quota (figure 22) and has decreased since 2015 (figure 23).

Figure 22 – DMP macropod quota and take for 2018 at 5 September



Note: Figures are as recorded on 5 September 2018

Figure 23 – Macropods approved to be taken under a DMP 2006–2017



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
◇ Red kangaroo	12,640	8,120	16,610	13,182	4,802	3,464	8,427	20,910	46,492	103,393	60,730	52,967
□ Eastern grey kangaroo	27,849	30,808	30,237	22,234	15,380	11,269	18,663	78,678	169,631	248,719	167,066	143,996
△ Common wallaroo	17,931	10,740	19,895	14,423	11,900	5,930	9,195	24,533	51,112	67,246	21,420	25,716

Disease outbreak mortality and its significance

No incidence of significant disease mortalities have been recorded for macropod populations in Queensland during 2018. Whilst the winter of 2016 was wetter than average above average temperatures, extremely dry conditions, have continued across majority of the commercial harvest zones in 2018. Most of the local government areas within the harvest zones have been drought declared for over three years. These conditions reduce the available feed for all grazing species including macropods. The main areas to experience a reduction in macropod numbers is common wallaroos in the central north.

Recreational wildlife harvesting licence (macropods)

2017 was the last year Recreational Wildlife Harvesting Licences (macropods) were issued as they have been combined with the Commercial Wildlife Harvesting Licence (macropods) in the Nature Conservation (Macropod) Conservation Plan 2017. Since 2018 a Macropod Harvesting Licence is required to harvest macropods for either commercial or personal use.

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 24). Within the three commercial harvest zones macropods cannot be harvested within National Parks, States Forests, Conservationl Parks, Resources Reserves, Timber Reserves and Forest Reserves. Table 9 outlines the size of these land tenures within the commercial harvest zones (current in 2017).

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 the western and central harvest zones and in the north of the eastern harvest zone (figure 24). Eastern grey kangaroos are only harvested in the eastern and western harvest zones (figure 25). Common wallaroos have the broadest distribution (figure 26) throughout Queensland and can be harvested in the central, eastern and western zones.

Table 9 – Area of land tenures (at 26 September 2018) within the Queensland commercial harvest zones where harvesting of macropods is not permitted

	Western harvest zone km²	Central harvest zone km²	Eastern harvest zone km²	Total km²
National Park	21,448	11,771	16,627	49,846
State Forest	NA	10,788	15,937	26,725
Conservation Park	79	30	320	429
Resources Recserves	969	137	1,047	2,153
Forest Reserve	NA	NA	225	225
Timber Reserve	77	451	121	649
Total km²	22,573	23,177	34,277	80,027

Figure 24 – Red kangaroo *Macropus rufus* distribution

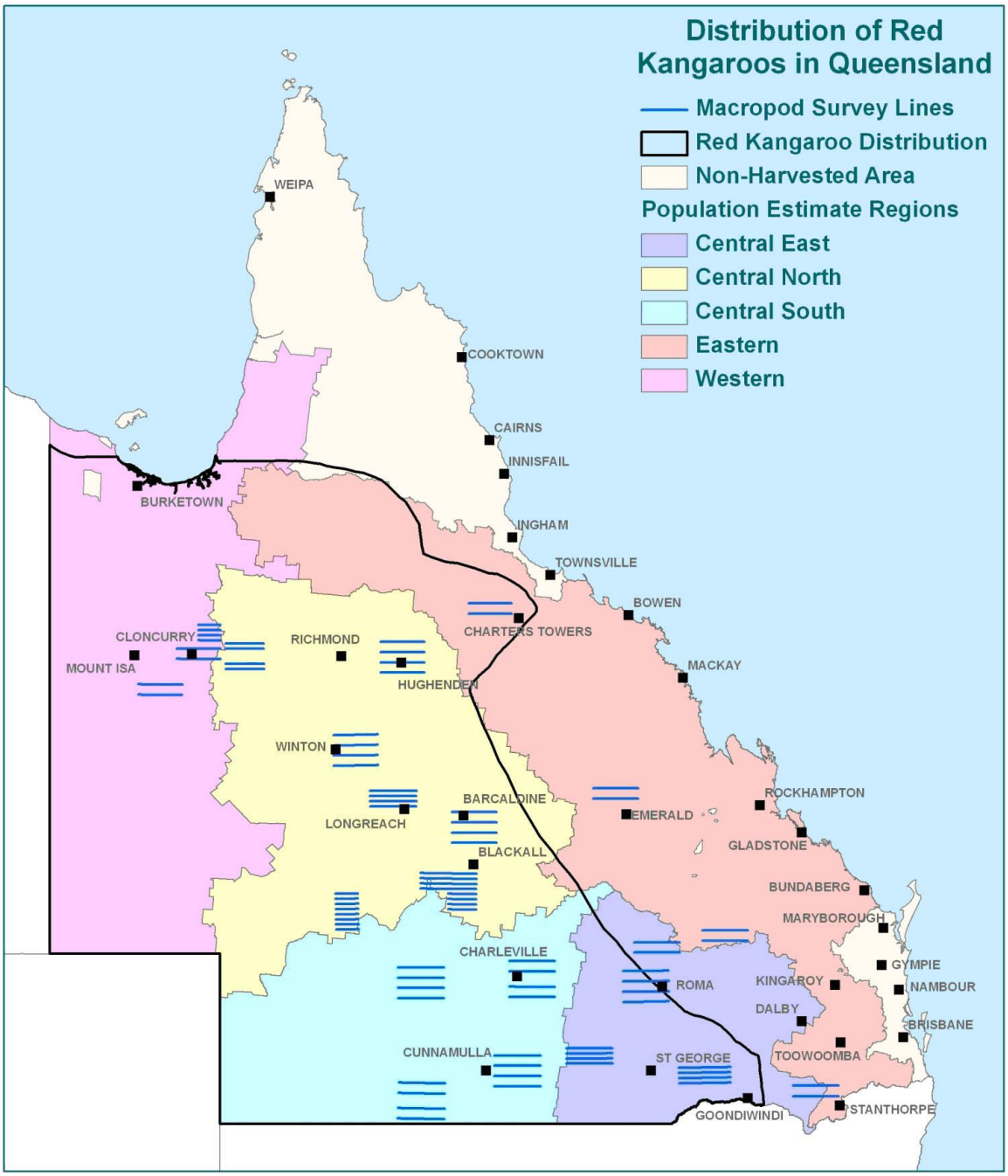


Figure 25 – Eastern grey kangaroo *Macropus giganteus* distribution

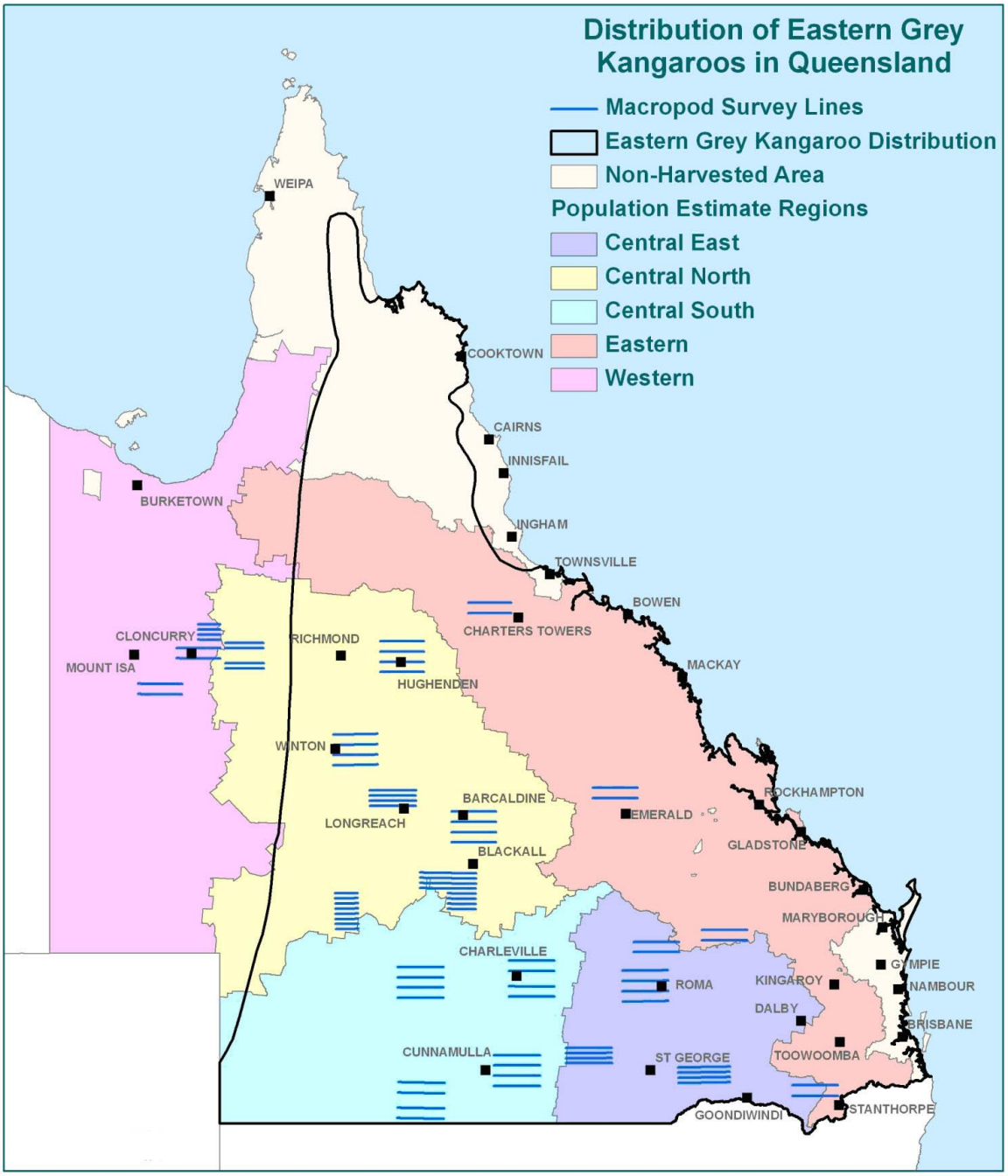
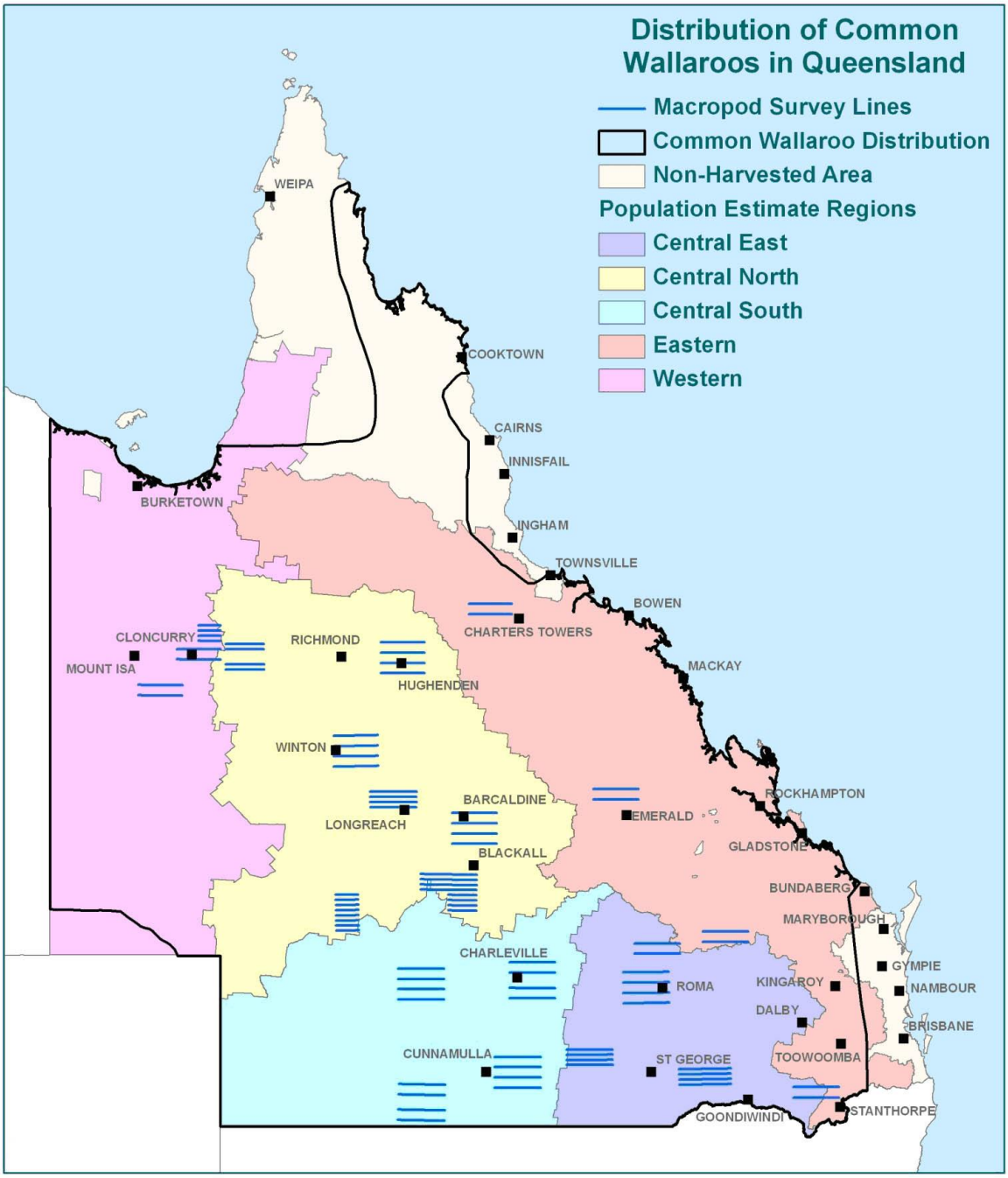


Figure 26 – Common wallaroo *(Macropus robustus)* distribution



Rainfall trends

2017 was the warmest year on record for Queensland with many areas of the harvest zones recording the highest mean temperatures. Minimum temperatures through winter were also the highest on record for many areas. Below average rainfall was recorded for most of central and western parts of the state (figure 28). Parts of the northern interior, the Gulf Country and east coast south of Bowen received above average rainfall. Drought declarations continue across the majority of areas where macropod harvesting occurs (figure 29).

Much of the commercial harvest zones have now been drought declared for five consecutive years. Despite the ongoing drought conditions sufficient rainfall has occurred in some parts of the harvest zones over the last 12 months to produce feed for macropods. The population estimate for eastern grey kangaroos in the central north and central south region was below the 1.5 SD trigger point in 2018. However the overall population estimates are similar to 2017 with no significant decline or increase observed in any of the harvest zones. Given the continued dry conditions the potential exists for macropod densities to decrease significantly like they did in 2002 (figure 27) across the harvest zones.

Figure 27 Estimated macropod populations plotted with annual rainfall totals from Queensland from 1992 to 2017

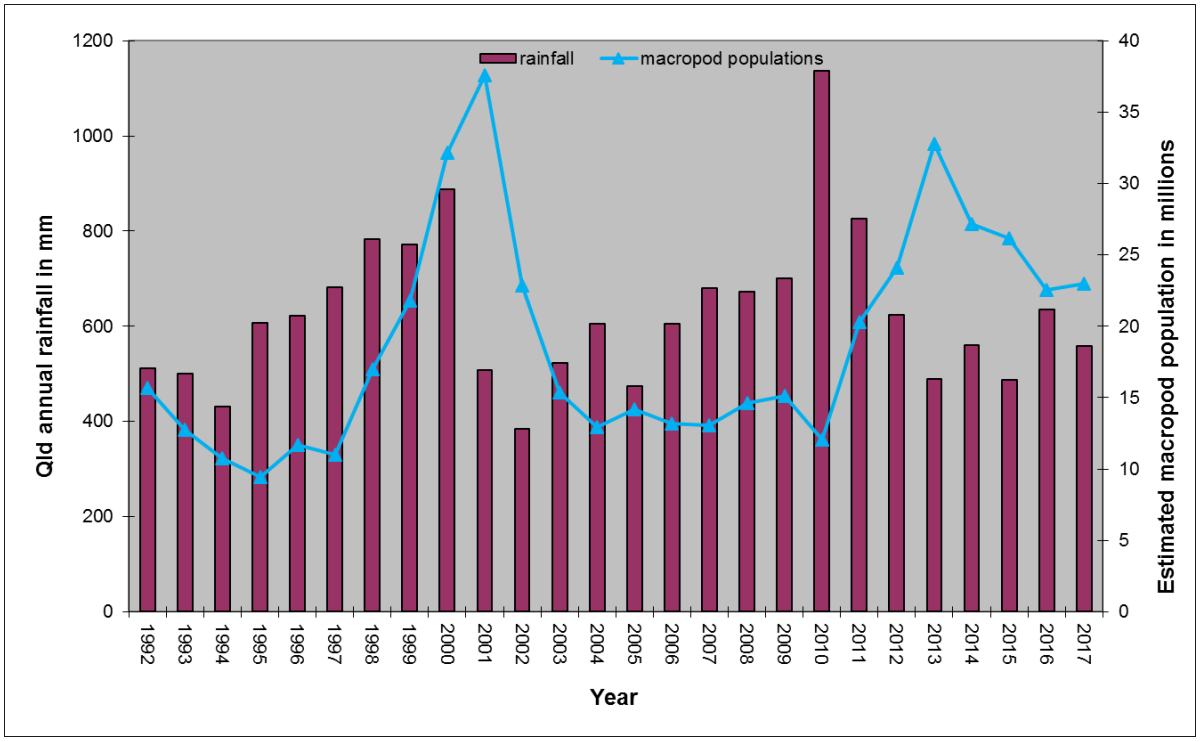


Figure 28 – Queensland rainfall totals (mm) from 1 August 2017 to 31 July 2018

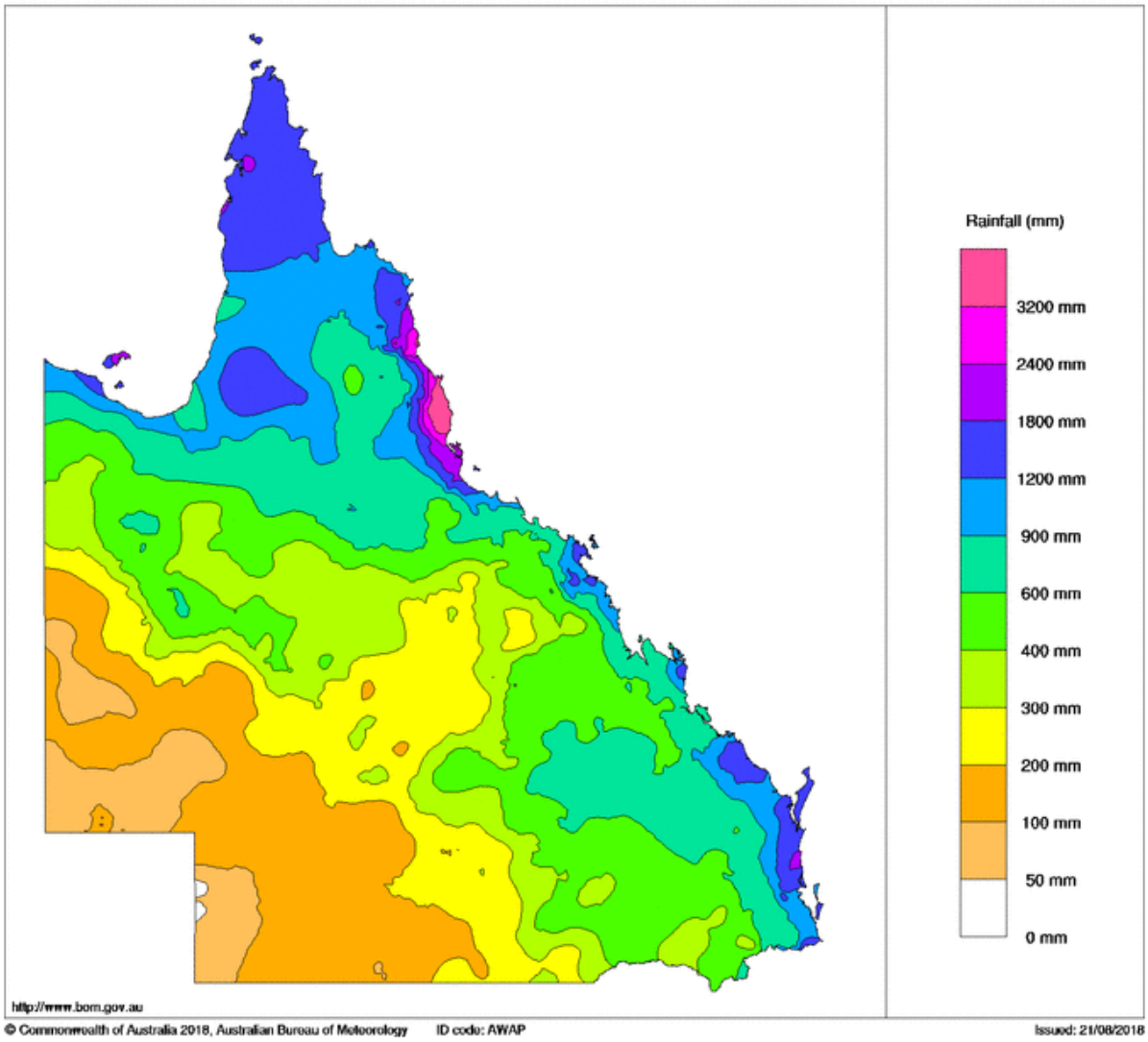
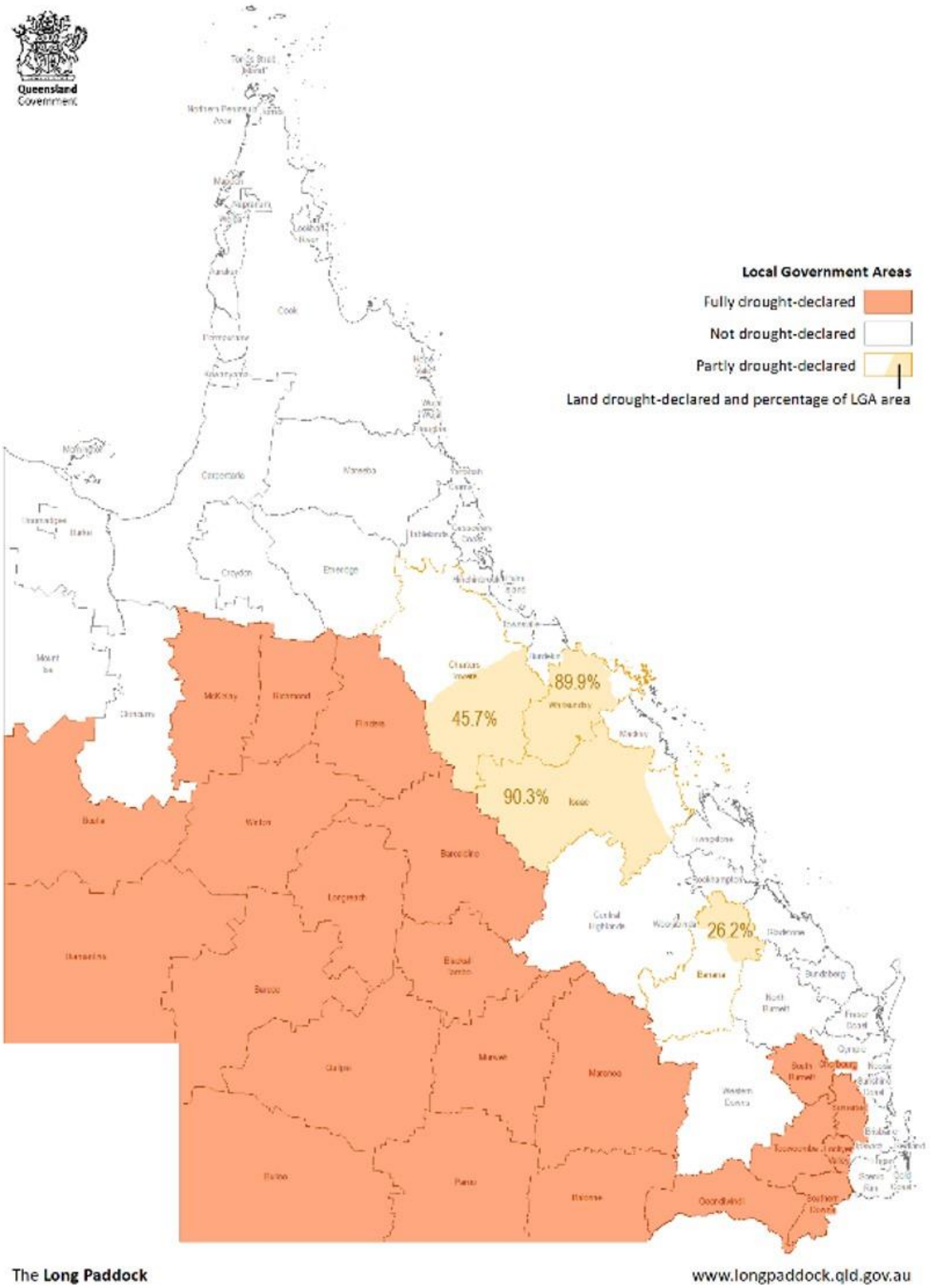


Figure 29 – Queensland drought declarations at 4 September 2018



Summary and conclusion

The proposed quotas for the 2019 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 for all species indicate that numbers over 1,000,000 occur in the harvest area. 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 2018.

Population estimates have decreased marginally for eastern grey kangaroos in the eastern and central zone but increased significantly in the western zone in 2018. In the central zone north and central zone south the eastern grey population estimate is below a predetermined trigger point and the quota for these regions has been halved for 2019. The red kangaroo population estimate for the central and western zone decreased slightly but increased in the eastern zone since the 2017 surveys. Common wallaroo population estimates decreased in the central and eastern zone but increased significantly in the western zone. Overall combined totals for all three species declined marginally across the state.

For the 2017 commercial harvest no quotas were exceeded, with the maximum percentage of quota utilised, being 37% for common wallaroo and 36% for eastern kangaroos in the central zone. Sex ratios from harvest data continue to be biased towards males with the overall percentage of females harvested below 4%. Thus, the last completed harvest period provides no indication of adverse pressure on populations that would influence proposed quotas.

For the 2018 harvest period up to 31 August, 17% of the available quota for red kangaroos in the western zone had been harvested with 14% and 8% of the quota harvested in the central and eastern zones respectively. For eastern grey kangaroos, 22% of the quota was harvested in the central zone and 8% harvested in the eastern zone. For common wallaroos, the highest percentage of quota harvested was 19% in the central zone, with 2% harvested in the eastern zone and 14% in the western zone. Given these figures, it is unlikely that quotas will be met for each species in each zone in 2018.

Usage of DMPs in 2017 were below the 2% of the population estimate quota for all species for all zones. The current percentages for usage of DMP quotas for 2018 are 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 has remained relatively stable over the last 12 months. The majority of the harvest zones are drought declared and macropod numbers overall have decreased slightly. Should the widespread dry conditions continue throughout the state it is possible that observed macropod numbers will decrease again in 2019.

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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 2013–2017. 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 are still close correspondences 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 2004–2018

	Eastern grey kangaroo														
Block	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Barcaldine	20.61	13.17	22.77	17.65	23.15	29.50	12.871	23.92	24.09	44.10	24.96	19.31	14.71	13.65	15.19
Blackall	7.57	7.10	6.22	7.51	8.28	11.19	7.082	6.08	9.87	19.41	10.59	8.75	5.29	4.97	3.16
Bollon	25.66	25.31		30.53		31.74	30.143		47.2		32.01	24.95		27.58	
Charleville	17.51	19.91	15.96	12.05	11.20	12.95	12.229	28.11	25.12	26.77	11.77	8.4	10.47	9.32	5.25
Charters		1.63		5.02		5.33	5.568		3.37		3.14	2.01		1.53	
Cloncurry	0.01		0.16		0.02		0.214	0.012		0.07		0.00	0.06		0.12
Cunnamulla	13.20		9.97		11.44		11.642	32.82		41.04		35.87	18.73		9.15
Duchess	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	5.035		2.75		7.01	5.29		7.88	
Hughenden	0.77	0.58		1.16		0.97	0.795		0.53		1.17	1.41		1.01	
Hungerford	1.16	1.10		0.77		0.94	0.651		2.20		4.00	3.79		3.36	
Inglewood		8.72		18.62		9.75	12.326		29.10		32.73	49.88		42.02	
Injune	13.53	18.85		18.62	6.82		16.599	17.75		31.32		22.52	40.62		25.97
Julia Creek	1.08	0.87	1.05		0.76		0.276	0.28		0.84		0.84	0.2		0.49
Longreach	9.05	8.48		6.63		6.61	6.129		18.07		20.17	5.25		3.85	
Quilpie	1.86		0.97		1.42		2.795	1.57		3.61		4.65	2.66		0.87
Roma	25.05	24.98	25.46	25.12		23.43	19.298		27.16		40.56	32.23		31.74	
Taroom	8.12	13.37		8.44		7.87	7.362		14.98		13.24	12.65		8.19	
Westmar	25.53		23.17		21.18		22.083	37.25		62.54		77.9	66.07		82.67
Windorah	1.58	2.69	1.14	1.39	2.39	1.26	0.858	2.68	1.24	1.80	0.79	1.02	2.13	1.34	0.29
Winton	4.86	2.98	3.74		4.78		2.432	3.57		6.61		5.79	4.46		5.11

	Red kangaroo														
Block	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
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
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
Bollon	4.13	8.87		8.35		11.16	9.90		7.78		7.27	9.83		8.87	
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
Charters		0.02		0.05		0.00	0.70		0.24		0.21	0.62		0.59	
Cloncurry	2.14		4.18		6.17		3.01	3.34		5.91		4.06	3.45		2.97
Cunnamulla	3.54		4.59		9.02		10.65	18.27		28.76		27.29	16.54		6.94
Duchess	2.92		0.87		1.78		0.85	0.71		0.82		1.66	1.61		1.32
Emerald		0.00		0.00		0.00	0.02		0.05		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	
Hungerford	1.04	2.57		3.90		4.41	2.60		7.01		8.75	9.7		9.83	
Inglewood		0.00		0.00		0.00	0.50		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
Julia Creek	4.08	5.13	4.91		5.39		3.16	3.30		8.10		5.6	4.58		5.54
Longreach	9.53	11.86		11.33		14.71	12.24		14.43		19.26	4.79		15.90	
Quilpie	2.19		1.39		5.13		2.06	4.70		9.80		9.51	12.27		7.87
Roma	2.19	1.62	2.54	2.66		2.37	2.26		3.47		5.02	2.83		2.96	
Taroom	0.02	0.37		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
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
Winton	3.69	5.02	5.62		6.05		3.32	4.44		9.73		16.98	8.57		10.86

	Common wallaroo														
Block	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Barcaldine	6.59	12.30	8.63	16.42	19.98	16.20	5.521	8.306	5.53	9.02	4.69	6.79	4.89	3.57	3.57
Blackall	18.02	21.17	22.15	34.98	39.14	49.05	23.819	21.549	20.2	54.43	28.58	24.86	11.29	9.32	6.89
Bollon	4.72	2.64		1.55		1.67	0.363		2.44		0.7	0.31		2.38	
Charleville	7.21	6.20	5.79	4.66	4.70	5.36	11.803	13.439	10.65	5.09	4.47	4.07	3.81	1.24	0.60
Charters		0.30		2.84		0.61	1.069		0.51		1.03	0.22		0.23	
Cloncurry	0.00		0.30		0.64		0.507	0.260		0.14		0.02	0.21		1.32
Cunnamulla	1.68		0.45		0.64		1.951	0.611		0.70		2.53	2.60		2.10
Duchess	0.57		0.11		1.69		0.743	0.093		1.16		0.00	0.00		0.26
Emerald		0.02		0.00		0.78	0.024		0.33		0.19	0.32		0.25	
Hughenden	1.65	1.28		2.28		0.24	0.411		0.94		0.93	0.22		1.59	
Hungerford	1.19	0.36		0.24		0.48	0.254		0.47		1.27	1.93		2.33	
Inglewood		3.08		4.03		0.34	1.013		1.22		3.18	3.42		11.16	
Injune	0.01	2.30	1.34		0.91		4.053	0.00		0.63		0.84	0.60		0.33
Julia Creek	2.74	0.00	0.04		0.11		0.013	0.00		0.00		0.00	0.03		0.00
Longreach	17.96	21.57		18.59		12.69	9.185		17.77		15.67	8.84		4.17	
Quilpie	5.41		0.78		3.36		2.686	3.007		5.58		7.51	3.42		3.76
Roma	1.35	3.74	2.49	2.08		1.16	3.447		0.87		1.01	0.75		1.45	
Taroom	0.22	2.04		0.17		1.05	0.253		0.02		0.38	0.18		0.35	
Westmar	0.74		0.02		0.13		0.299	0.00		0.01		0.00	0.28		0.54
Windorah	2.14	2.30	1.81	2.72	3.03	3.07	2.422	3.185	3.32	5.29	2.82	1.46	4.86	4.12	2.47
Winton	1.73	1.78	1.70		3.14		0.955	4.191		6.35		0.76	1.14		1.30