

2012 Quota Submission for Commercially Harvested Macropods in Queensland



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Executive summary

The commercial macropod harvest in Queensland is focused on three species:

- red kangaroo *Macropus rufus*
- eastern grey kangaroo *M. giganteus*
- common wallaroo *M. robustus*.

The harvest is divided into four zones:

- no harvest zone
- eastern harvest zone
- central harvest zone
- western harvest zone.

The harvest is administered through a quota and a quota submission is released annually that outlines proposed quotas for each species in each zone for the following calendar year. Quotas are set between 10 and 20 per cent 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 2011 and proposed sustainable use quotas for the 2012 commercial harvest are:

Species	Harvest zone	2011 estimated population	2012 sustainable use quota (rounded to the nearest 50)	Proportion of population (% rounded to the nearest whole number)
Red kangaroo	Central	5 371 081	1 020 500	19 %
	Eastern	109 141	10 900	10 %
	Western	265 368	26 550	10 %
	Combined	5 745 591	1 057 950	18 %
Eastern grey kangaroo	Central	8 842 729	1 326 400	15 %
	Eastern	1 954 533	195 450	10 %
	Western	2 418	0	0 %
	Combined	10 799 679	1 521 850	14 %
Common wallaroo (2011 population estimate based on 1.85 correction factor)	Central	2 922 313	438 350	15 %
	Eastern	553 818	55 400	10 %
	Western	303 842	30 400	10 %
	Combined	3 779 973	524 150	14 %

The formation of quotas is informed by criteria including:

- 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.

This quota submission outlines in detail the aspects of these criteria that pertain to the 2012 proposed quota.

For 2011, aerial surveys were conducted at 12 monitor blocks across the state. Density estimates for common wallaroos have been multiplied by a 1.85 correction factor in 2011 as a result of additional studies and a review of the scientific literature. Population estimates derived from the surveys have increased when compared to 2010 for each species in each zone, with the exception of eastern grey kangaroos in the western zone. Consequently, quotas have increased for each species in each zone except eastern grey kangaroos in the western zone. No quota will be issued for eastern grey kangaroos in the western zone as the population of this species in this zone remains small.

Examination of long-term trends in population and block density estimates indicates that the 2011 estimates are within the realm of fluctuations in previous years and above the low of the mid 1990s. Estimates for all three commercially harvested species consistently number over 1 000 000 in Queensland.

In the 2010 harvest period, 36.24 per cent of the commercial harvest quota was utilised, with the highest percentage of quota used being 56.97 per cent for common wallaroos in the central zone. The overall harvest was male biased, with females comprising 12 per cent of the overall harvest.

Figures available on 31 August 2011 show that 41 per cent of the available quota for red kangaroos in the western zone had been harvested with 33 per cent and 29 per cent of the quota harvested in the eastern and central zones respectively. For eastern grey kangaroos, 38 per cent and 16 per cent of the quota was harvested in the central and eastern zones respectively. For common wallaroos, the highest percentage of quota harvested was 62 per cent in the central zone, whilst only three per cent of the quota was harvested in the western zone with 10 per cent harvested in the eastern zone. Given these figures, it is unlikely that quotas will be met for each species in each zone in 2011, with the possible exception of common wallaroos in the central zone.

Non-commercial take under damage mitigation permits were below quota for the 2010 harvest period with 21 per cent of the quota used. This trend is likely to be repeated in 2011 with only 15 per cent of the damage mitigation quota utilised by 31 August 2011.

Minor changes to the harvest zones were approved by the former Minister for Environment and Resource Management in 2011 to align harvest zone boundaries with local government areas. 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 new harvest zones increased by 688 km² to a total of 76 812 km². This increase includes declaration of new protected areas in 2011. Macropods are further protected from harvest in Queensland within the non-harvest zones. The total area of the non-harvest zones is 236 408 km².

Annual rainfall was exceptional during the second half of 2010 with the year being the wettest ever recorded. The months of September and December were the wettest on record, as was the 2010 spring. Wet conditions continued widespread during the summer of 2010–11 with heavy rainfall over northern, central and eastern Queensland. Widespread major flooding occurred throughout much of the harvest zones with many of the rivers of southern inland Queensland experiencing record flood heights.

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Introduction

The commercial macropod harvest industry in Queensland is centred on three species:

- red kangaroo *Macropus rufus*
- eastern grey kangaroo *M. giganteus*
- common wallaroo *M. robustus*.

The harvesting of these macropods is regulated through:

- *Environment Protection and Biodiversity Conservation Act 1999*
- Queensland Wildlife Trade Management Plan for Export—Commercially Harvested Macropods 2008–2012
- *Nature Conservation Act 1992*
 - Nature Conservation (Administration) Regulation 2006
 - Nature Conservation (Wildlife Management) Regulation 2006
 - Nature Conservation (Wildlife) Regulation 2006
 - Nature Conservation (Macropod) Conservation Plan 2005
 - Nature Conservation (Macropod Harvest Period) Notice
- *Animal Care and Protection Act 2001*
- *Food Production (Safety) Act 2000*.

The Department of Environment and Resource Management (DERM) administers the harvest of macropods in Queensland in accordance with 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 2008–2012, ‘to provide sustainable use, conservation of the species and their habitats in accordance with the principles of ecologically sustainable development’ (Anon 2008).

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 utilised in Queensland since 1975. The Director-General of DERM 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 – 2008–2012*. Quotas are provided to the Commonwealth Minister for Sustainability, Environment, Water, Population and Communities for endorsement.

Quotas in Queensland are set between 10 and 20 per cent 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.

Minor changes to the harvest zones were approved by the former Minister for Environment and Resource Management in 2011 to align harvest zone boundaries with local government areas. Previous boundaries were set prior to amalgamation of local government areas. The new boundaries allow for improved administration and enforcement relating to harvest and a simpler system for industry. Changes to boundaries were made after consultation with stakeholders. Old and new harvest boundaries are given in Figure 1.

This quota submission contains a summary of the recommended quotas for each of the species in each of the harvest zones for 2012. Additionally, the submission outlines the basis of how these quotas were determined.

The method used to estimate common wallaroo population densities has changed for 2011. Since 1998 the estimated population densities for common wallaroos in Queensland have been based on a conservative correction factor of 1.2. In 2010 the department conducted ground surveys to fine-tune the calibration of aerial surveys, especially for common wallaroos. Previous work on the relationship between aerial and ground surveys in Queensland (Clancy et al. 1997) found that density estimates were largely comparable between the two methods for eastern grey kangaroos and red kangaroos but helicopter surveys consistently underestimated densities of common wallaroos by a factor of 2–3. The 2010 ground survey results support the work by Clancy et al. (1997) and Cairns et al. (2008) that a correction factor of 1.85 should be applied to densities of common wallaroos when calculated from helicopter surveys. Density estimates for common wallaroos used in this quota submission are based on a correction factor of 1.85. This correction factor is also used in New South Wales for the estimation of common wallaroo population densities.

The Nature Conservation (Macropod Harvest Period 2012) Notice 2012 is due for release in December 2011. The release of this notice will allow the harvest period to be declared open on the 1 January 2012. The notice will outline specific conditions for the 2012 harvest period including, but not limited to, harvest zone boundaries, weights and more.

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 per cent of the populations for eastern grey kangaroos and common wallaroos and 20 per cent 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 per cent 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, DERM and the Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSWEPC) for determining state quota limits.

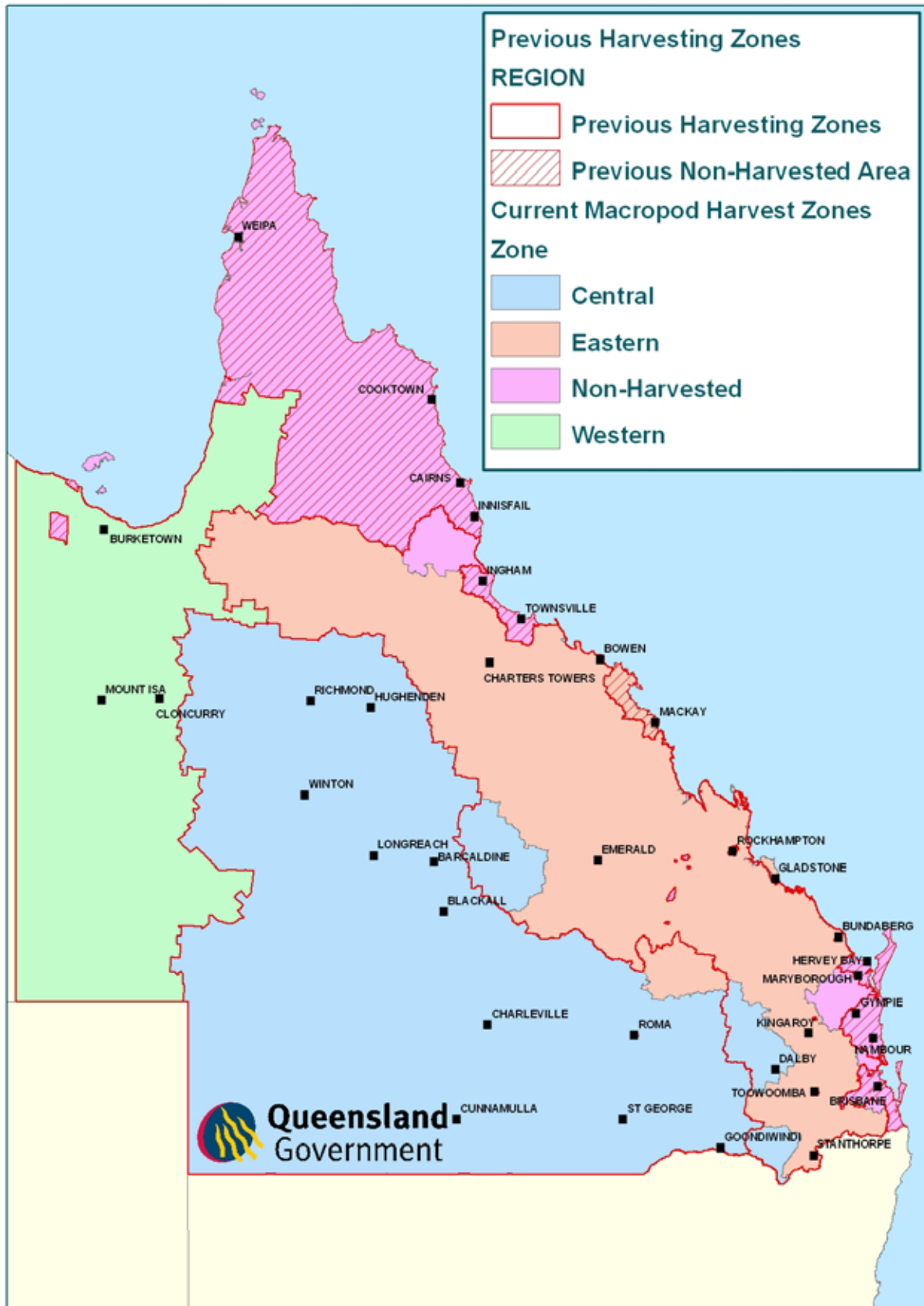
Proposed quotas

The 2011 estimated population sizes and proposed sustainable use quotas for 2012 for the commercially harvested species in each zone are outlined in Table 1.

Species	Harvest zone	2011 estimated population	2012 sustainable use quota (rounded to the nearest 50)	Proportion of population (% rounded to the nearest whole number)
Red kangaroo	Central	5 371 081	1 020 500	19 %
	Eastern	109 141	10 900	10 %
	Western	265 368	26 550	10 %
	Combined	5 745 591	1 057 950	18 %
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	Eastern	553 818	55 400	10 %
	Western	303 842	30 400	10 %
	Combined	3 779 973	524 150	14 %

Table 1. 2011 estimated populations and 2012 proposed quotas for each species in each zone (2011 population estimates for common wallaroo are based on 1.85 correction factor)

Figure 1. Queensland harvest zones showing old and new boundaries for 2012



Criteria considered in quota determination

The following criteria were considered in determining the quotas for each macropod species:

- 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.

Each of these criteria will be outlined in detail in this quota submission.

Long-term population trends

Population estimates

Since 1991, 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. 2011 marks the first year that a correction factor of 1.85 has been applied to population estimates for common wallaroo in Queensland.

Current harvesting rates (quotas ranging from 10 to 20 per cent of population estimates) are considered sustainable. None of the three commercially harvested species has shown a consistent decline in abundance since 1992 (figures 2 and 3), 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. Macropod population estimates increased in 2011 compared with 2010.

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 eastern and western zone, with the central zone divided into three regions, central zone north (Mitchell Grass dominant), central zone south (Mulga Lands dominant) and central zone east (Brigalow Belt dominant) (figures 4–6).

Figure 2. Macropod population trends—1992–2011 (2011 population estimate for common wallaroo is based on 1.85 correction factor)

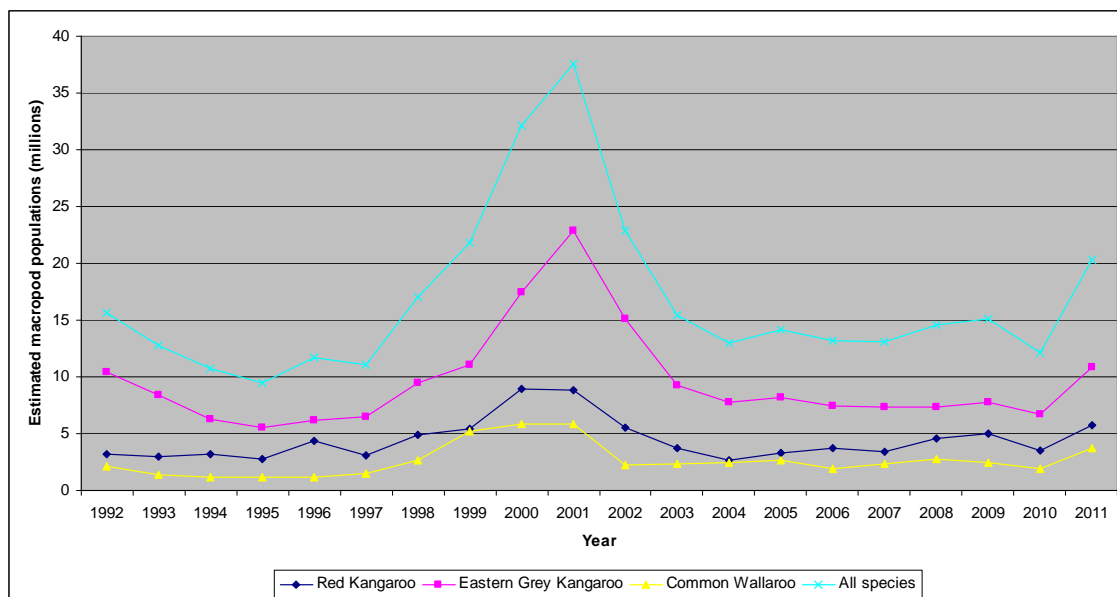
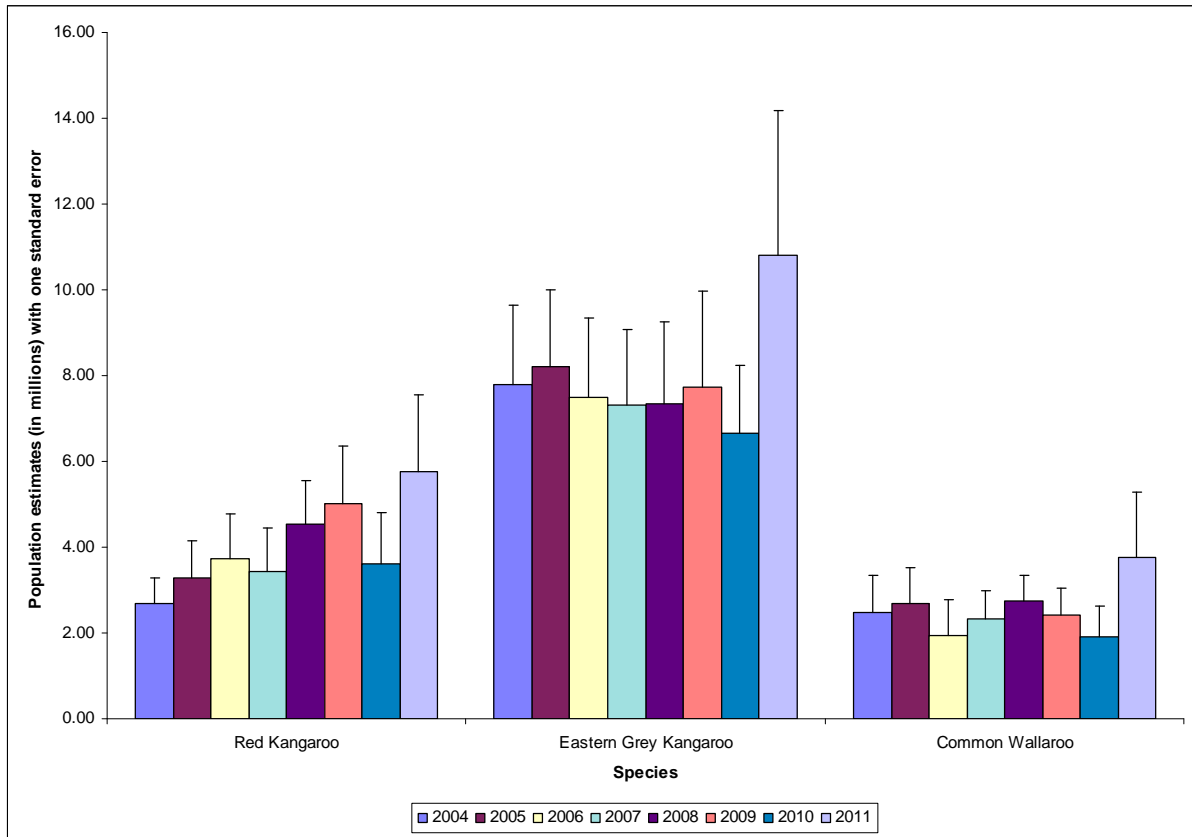


Figure 3. Macropod population estimates (with one standard error) since 2003 regionalisation (2011 population estimate for common wallaroo is based on 1.85 correction factor)



This data is monitored for any significant decreases in densities. This approach is possible for all data collected since regionalisation of the macropod commercial harvest management in 2003. Examination of trends in density for the three commercially harvested macropod species in the areas outlined above for the period 2003–2011 demonstrates densities do fluctuate over time (figures 4–6).

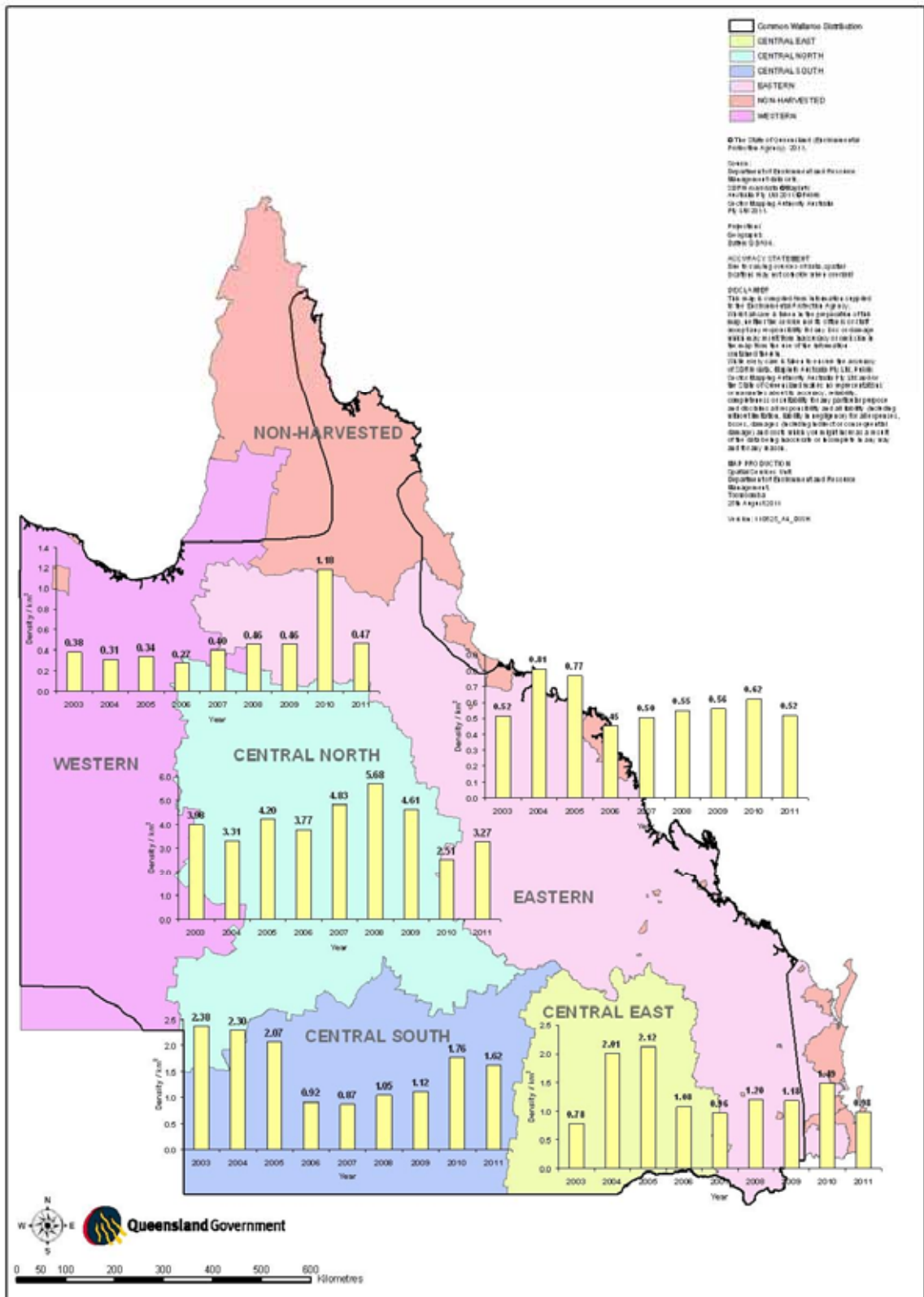
For red kangaroos densities are greatest in the central zone north and central zone south, with densities lowest in the eastern zone (Figure 4). Low densities in the eastern zone are expected as this area incorporates the edge of the distributional range for this species (Figure 4).

For eastern grey kangaroos highest densities are recorded in the central zone east (Figure 5). Eastern grey kangaroos occur in consistently low densities in the western zone at the edge of their distributional range (Figure 5). 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 and lowest densities in the western zone (Figure 6). Densities fluctuations for this species do not follow the same patterns as those exhibited by red and eastern grey kangaroos (figures 4–5).

Although population estimates have increased in 2011 for each species in each zone, with the exception of eastern grey kangaroos in the western zone, the block density estimates for 2011 are consistent with the fluctuations in densities observed through time (Appendix 2).

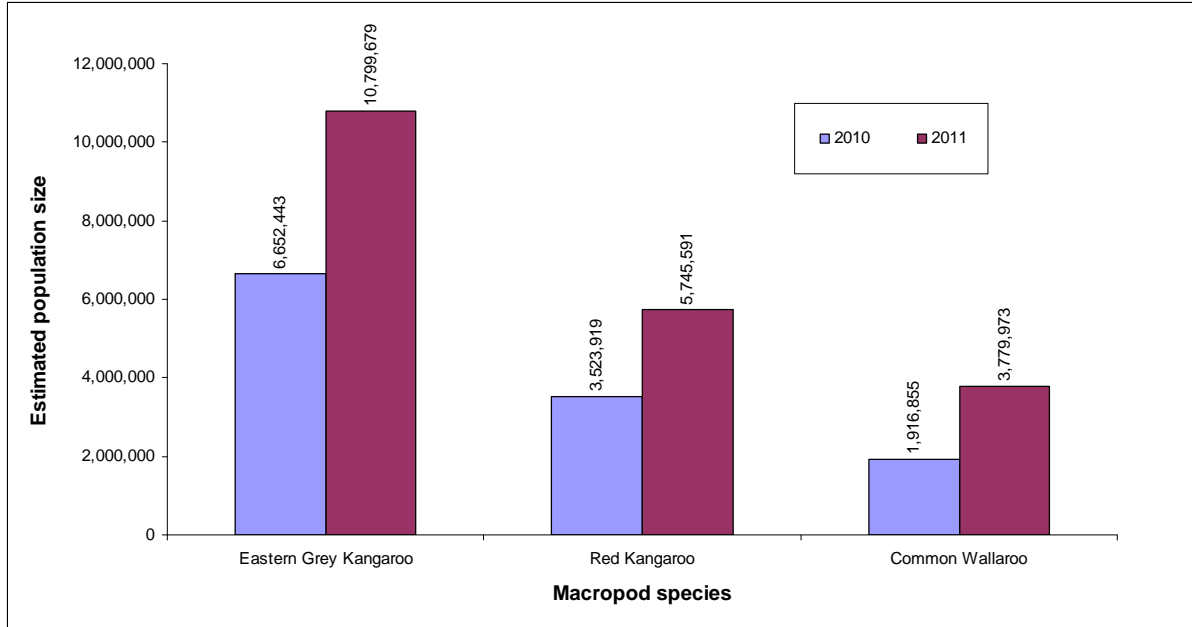
Figure 6. Density of the common wallaroo (per km²) 2003–2011



Comparison between 2010 and 2011 population estimates

Overall population estimates of eastern grey kangaroos, red kangaroos and common wallaroos increased in 2011 when compared to 2010 (Figure 7). Eastern grey kangaroos increased by 62.3 per cent, whilst red kangaroos increased by 59.4 per cent and common wallaroos increased by 97.2 per cent (Table 2). Note 2011 population estimates for common wallaroo is based on 1.85 correction factor.

Figure 7. Comparison of overall macropod populations 2010 and 2011 (2011 population estimate for common wallaroo is based on 1.85 correction factor)



Species	Harvest zone	2010 population estimate	2011 population estimate	% population change 2010–11
Red kangaroo	Central	3 352 823	5 371 081	60.2 %
	Eastern	85 548	109 141	27.6 %
	Western	165 138	265 368	60.7 %
	Combined	3 603 509	5 745 591	59.4 %
Eastern grey kangaroo	Central	5 160 736	8 842 729	71.3 %
	Eastern	1 483 247	1 954 533	31.8 %
	Western	8 460	2 417	-71.4 %
	Combined	6 652 443	10 799 679	62.3 %
Common wallaroo (2011 population estimate based on 1.85 correction factor)	Central	1 433 632	2 922 313	103.4 %
	Eastern	358 640	553 818	54.4 %
	Western	124 582	303 842	143.9 %
	Combined	1 916 855	3 779 973	97.2 %

Table 2. Comparison between 2010 and 2011 macropod population estimates (note: common wallaroo estimates for 2011 are based on a 1.85 correction factor)

The population estimates for red kangaroos and common wallaroos increased in each of the harvest zones since 2010 consequently there is an increase in the proposed quota for these species for each of these zones (Table 2 and figures 8–9). Note: 2011 population estimates for common wallaroo is based on 1.85 correction factor.

Eastern grey kangaroo population estimates increased in the central and eastern harvest zones. However, there was a decrease in estimated numbers in the western zone. (Table 2 and Figure 8). The western zone covers the western boundary of the eastern grey kangaroo’s natural distribution. Estimated population size for this species in this zone fluctuates around 0.1 per cent of the estimated total population size in Queensland. Consequently there is no quota proposed for eastern grey kangaroos in the western zone for 2012 (Figure 9).

Figure 8. Comparison of macropod populations 2010–11 by species and zone

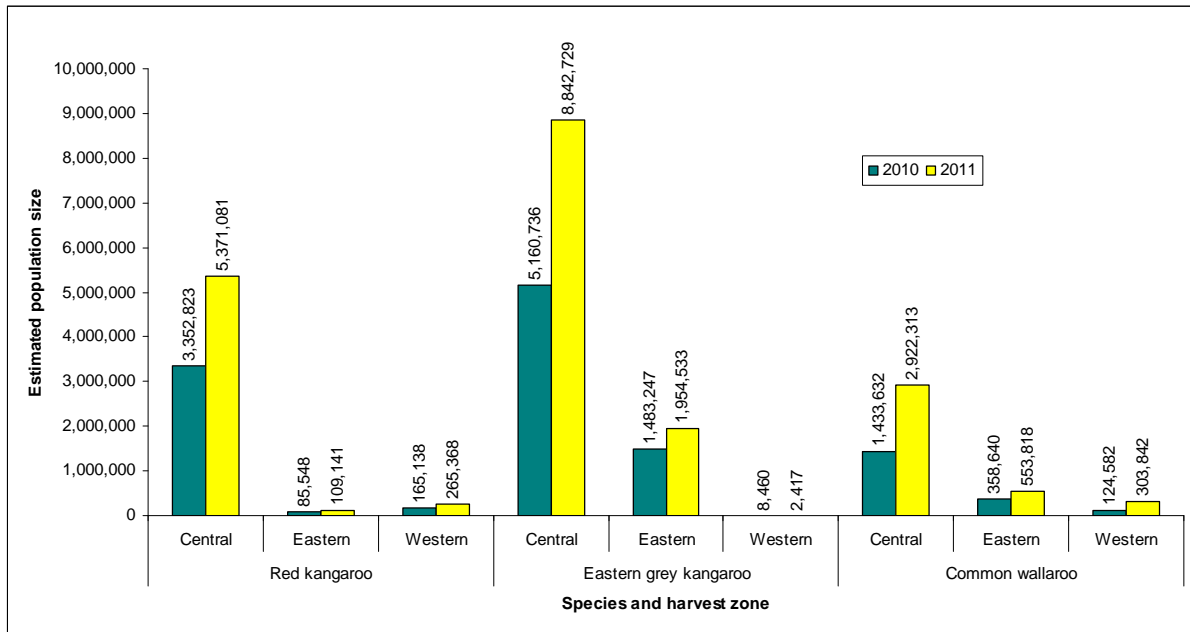
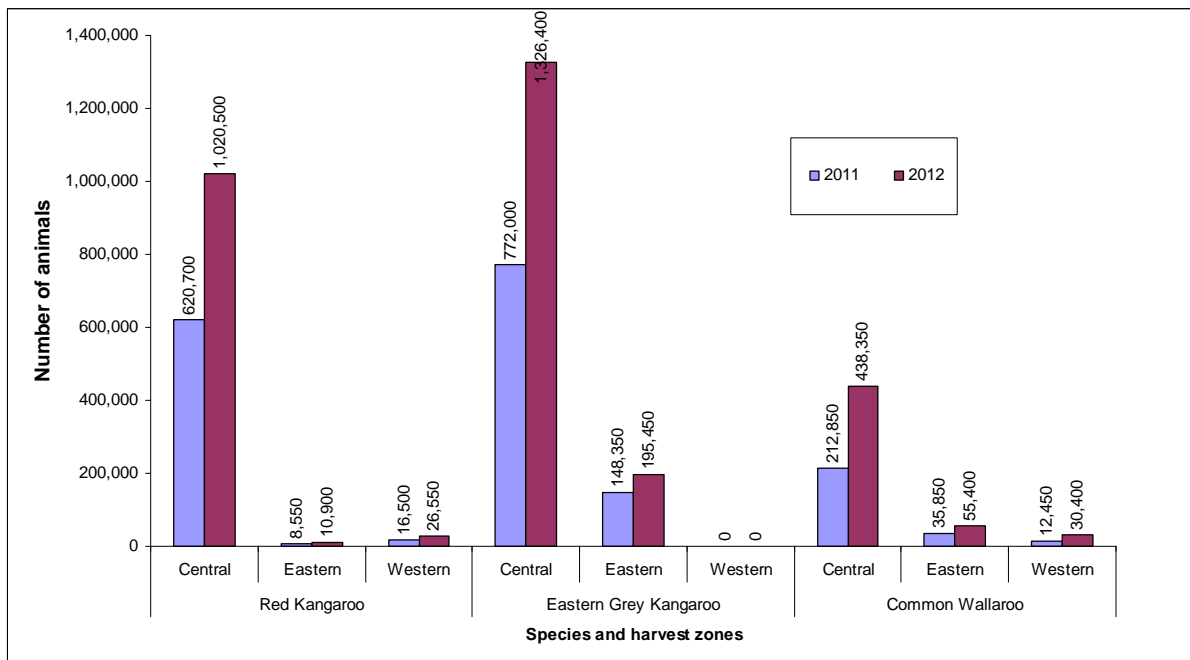


Figure 9. Comparison of 2011–12 actual and proposed quotas



Long-term quota and harvest trends

Figures 10–12 outline data on the three commercially harvested macropod species pertaining to estimated population, quota and harvest for the years 1993–2011. 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 (2003) to enable comparison with data collated prior to this period. Note 2011 population estimates for common wallaroo is based on 1.85 correction factor.

Figure 10. Long-term population, quota and harvest data for the red kangaroo

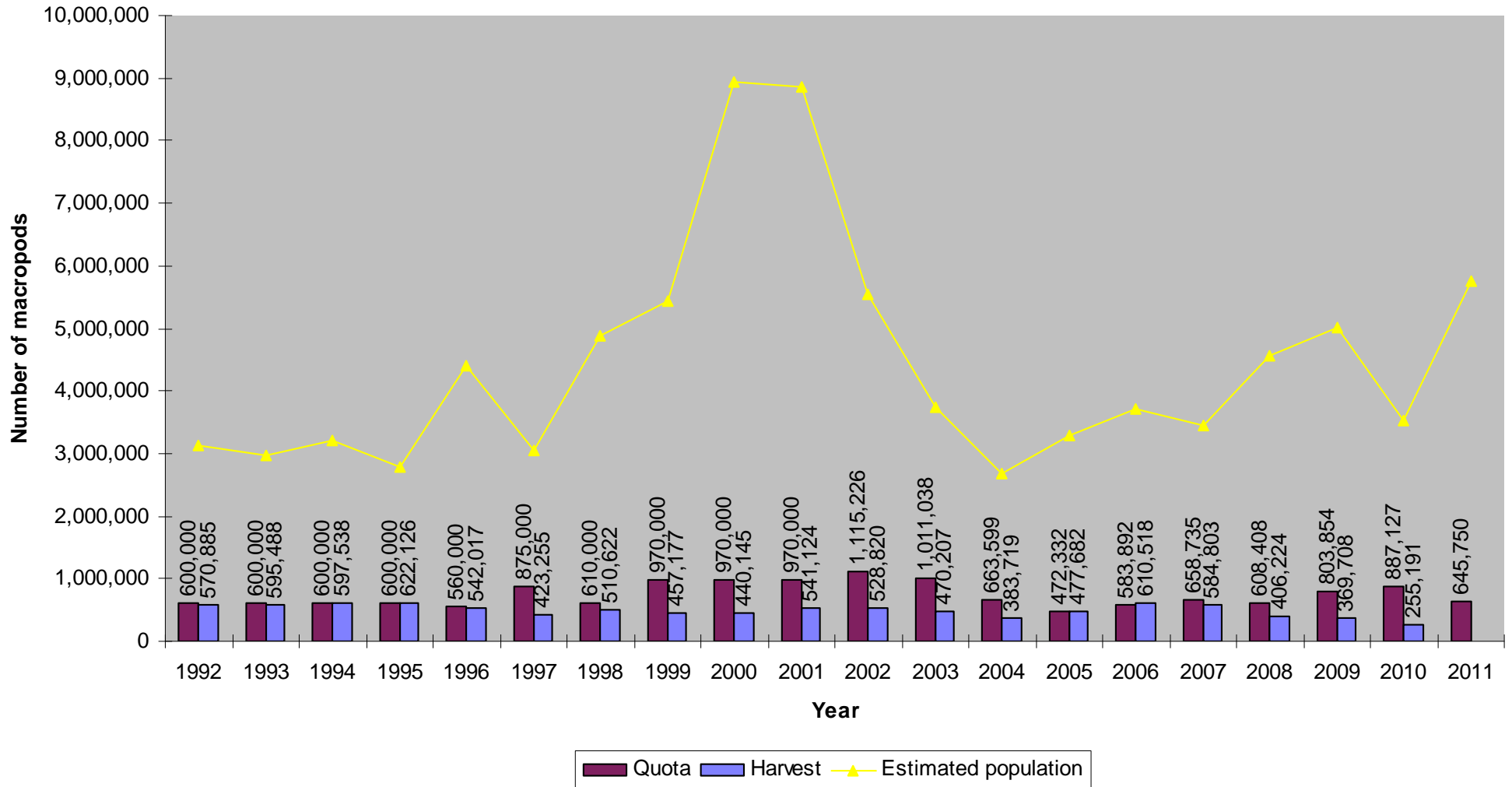


Figure 11. Long-term population, commercial quota and harvest data for the eastern grey kangaroo

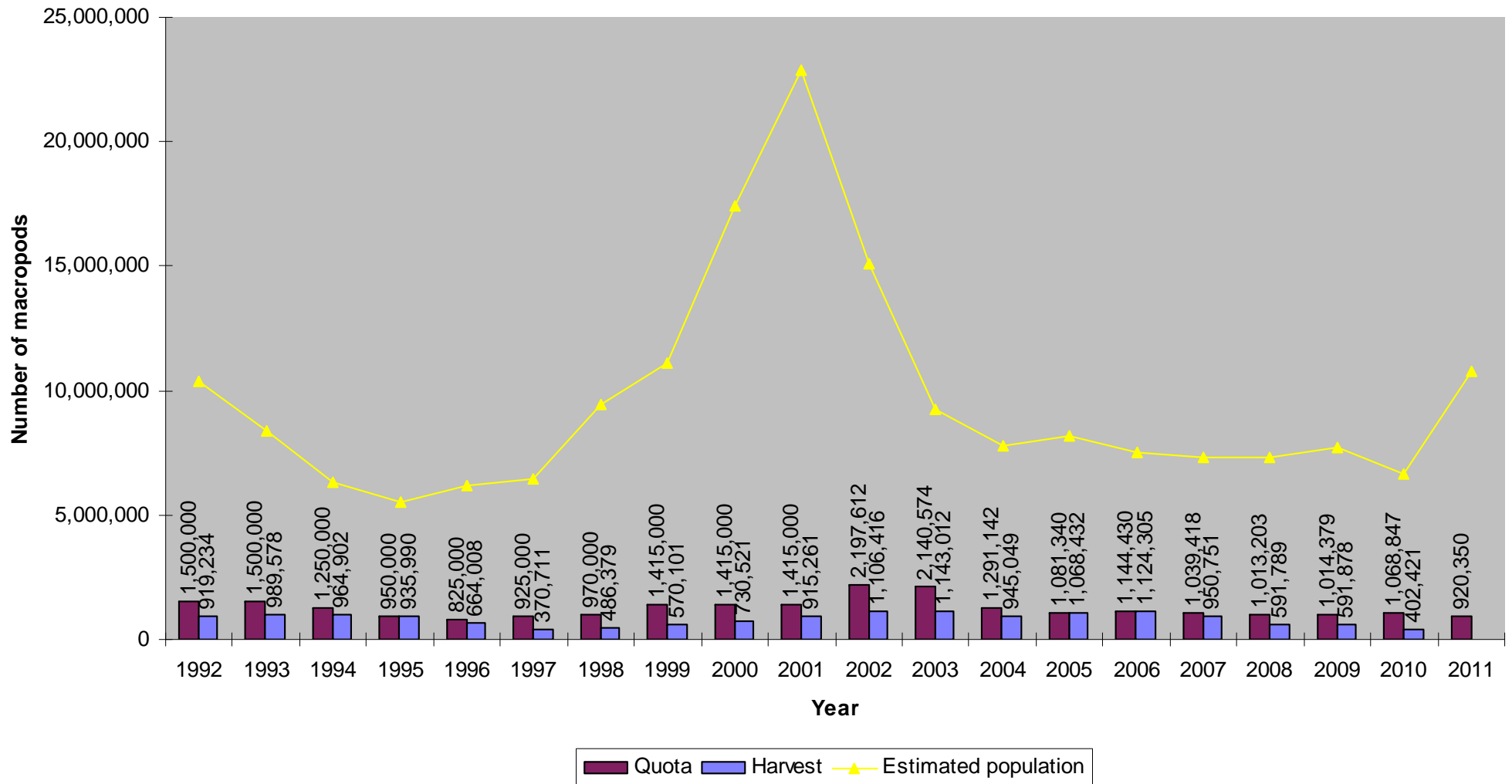
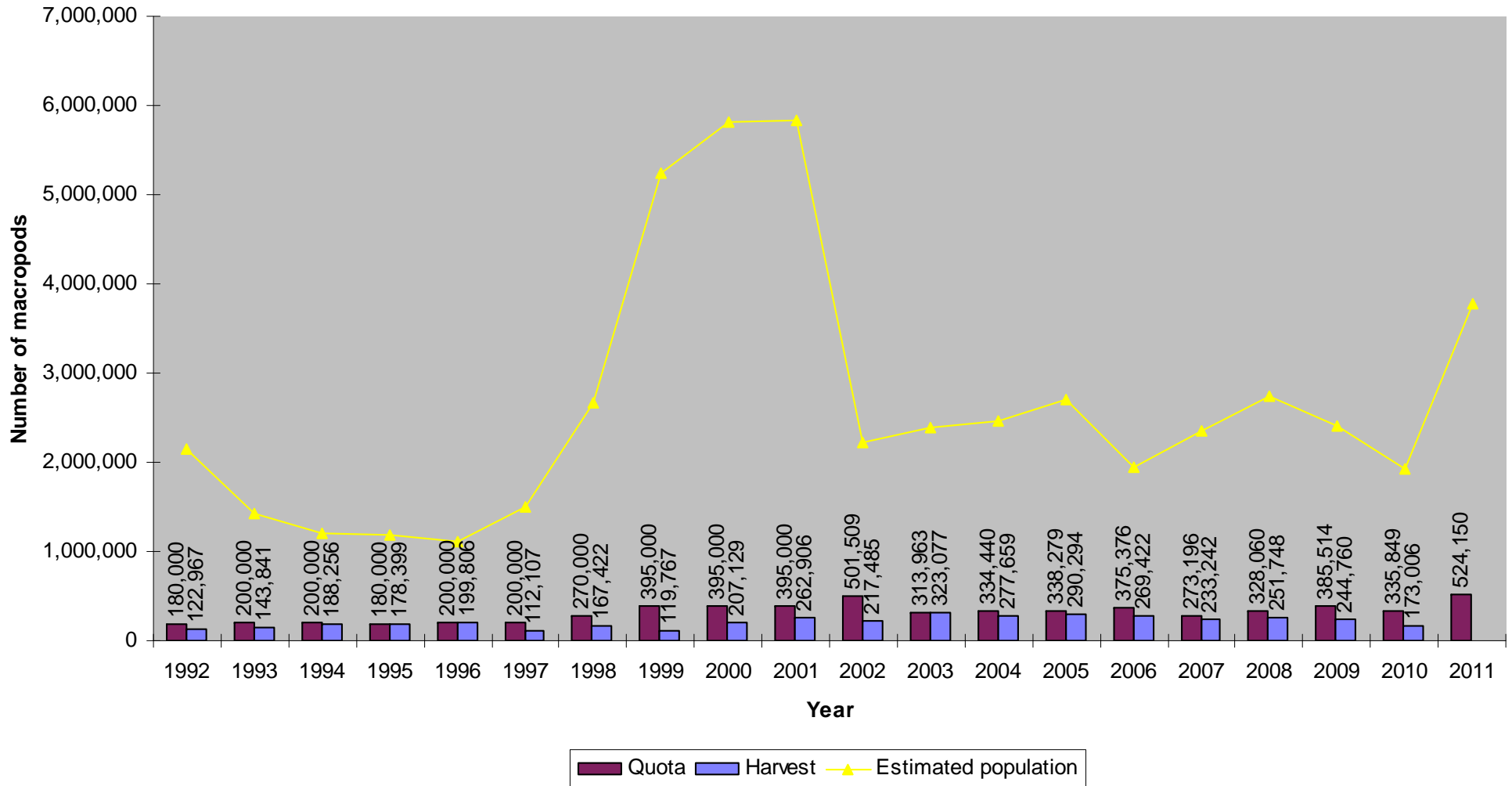


Figure 12. Long-term population, quota and harvest data for the common wallaroo (Note 2011 population estimates for common wallaroo is based on 1.85 correction factor)



As previously outlined, there has been no consistent decline in the populations of the three commercially harvested species since 1993 (figures 10–12). 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 1 000 000 across the harvest zones.

As quotas are set as a constant proportion of the populations, they fluctuate as population estimates fluctuate (figures 10–12). 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 1993.

Red kangaroo quotas have fluctuated between 472 332 and 1 115 226 since 1993 whilst commercial harvest take has fluctuated between 255 191 and 622 126. For eastern grey kangaroos quotas have fluctuated between 825 000 and 2 197 612 and harvests have varied between the range of 370 711 and 1 143 012. For common wallaroos quotas have ranged between 180 000 and 524 150 and harvests have fluctuated between 112 107 and 323 077.

Review of the 2010 harvest

Dealer returns for the year 2010 indicate that there were 830 618 macropods taken in Queensland, which represents 36.2 per cent of the overall combined quota. Of the 830 618 animals taken there were 255 191 red kangaroos, 402 421 eastern grey kangaroos and 173 006 common wallaroos (Table 3).

Quotas for individual species in each harvest zone were not exceeded in 2010, the maximum commercial take as a percentage of the approved quota of 57 per cent being for the common wallaroo in the central zone (tables 4–6).

Species	Population estimate 2009	Quota 2010	Harvest take 2010	% Q	% P	% male	% female
Red kangaroo	5 004 684	887 127	255 191	28.8	5.1	83.5	16.5
Eastern grey kangaroo	7 714 654	1 068 847	402 421	37.7	5.2	85.8	14.2
Common wallaroo	2 405 729	335 849	173 006	51.5	7.2	99.9	0.1
Total	15 125 067	2 291 823	830 618	36.2	5.5	87.9	12.1

Table 3. Total harvest in 2010 Note: Population estimates are based on the aerial surveys conducted in 2009, which were used to set the 2010 quota. % Q = commercial take as percentage of approved quota; % P = commercial take as percentage of population estimate

Zone	Population estimate 2009	Quota 2010	Harvest take	% Q	% P	% male	% female
Central	4 532 104	839 869	236 471	28.2	5.2	83.9	16.1
Eastern	110 397	11 040	5 629	51.0	5.1	75.1	24.9
Western	362 183	36 218	13 091	36.1	3.6	78.0	22.0
Total	5 004 684	887 127	255 191	28.8	5.1	83.4	16.6

Table 4. Harvest of red kangaroos by zone in 2010. Note: Population estimates are based on the aerial surveys conducted in 2009, which were used to set the 2010 quota. % Q = commercial take as percentage of approved quota; % P = commercial take as percentage of population estimate

Zone	Population estimate 2009	Quota 2010	Harvest take	% Q	% P	% male	% female
Central	6 015 263	899 444	348 171	38.7	5.8	87.3	12.7
Eastern	1 694 031	169 403	54 250	32.0	3.2	75.6	24.4
Western	5 360	0	0	n/a	n/a	n/a	n/a
Total	7 714 654	1 068 847	402 421	37.6	5.2	85.7	14.3

Table 5. Harvest of eastern grey kangaroos by zone in 2010. Note: Population estimates are based on the aerial surveys conducted in 2009, which were used to set the 2010 quota. % Q = commercial take as percentage of approved quota; % P = commercial take as percentage of population estimate

Zone	Population estimate 2009	Quota 2010	Harvest take	% Q	% P	% male	% female
Central	1 921 657	287 442	163 746	57.0	8.5	99.9	0.1
Eastern	321 221	32 122	8 205	25.5	2.5	99.9	0.1
Western	162 851	16 285	1 055	6.5	0.6	99.8	0.2
Total	2 405 729	335 849	173 006	51.5	7.2	99.9	0.1

Table 6. Harvest of common wallaroos by zone in 2010. Note: Population estimates are based on the aerial surveys conducted in 2009, which were used to set the 2010 quota. % Q = commercial take as percentage of approved quota; % P = commercial take as percentage of population estimate

Sex ratio by species and zone

Commercial harvest is typically biased towards males (Figure 14) as they are usually larger and heavier than females. In 2010, the total harvest for each species comprised between approximately 83.4 per cent and 99.8 per cent males (Figure 13). Data gathered throughout 2010 indicates 12 per cent of the overall harvest was female (Figure 13).

Figure 13. Proportion of 2010 harvest, male and female by species

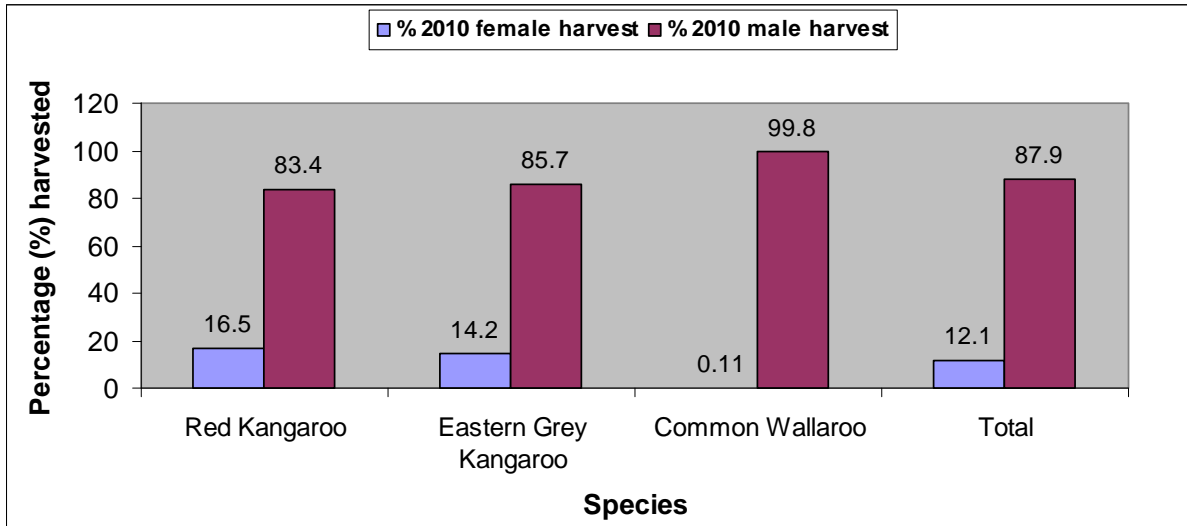
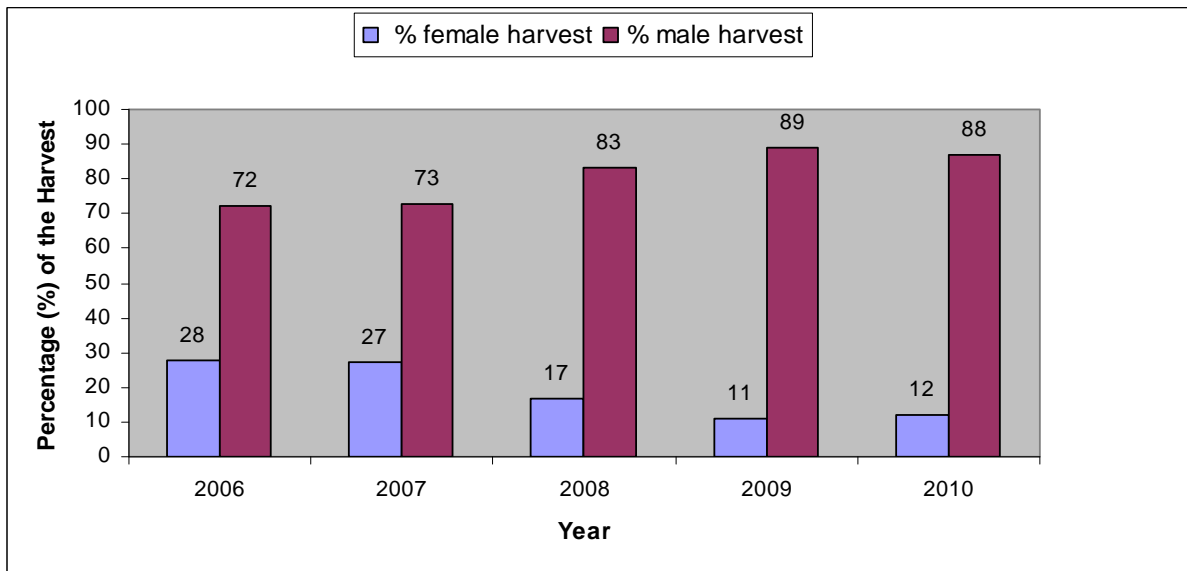


Figure 14. Overall sex ratio 2006–2010



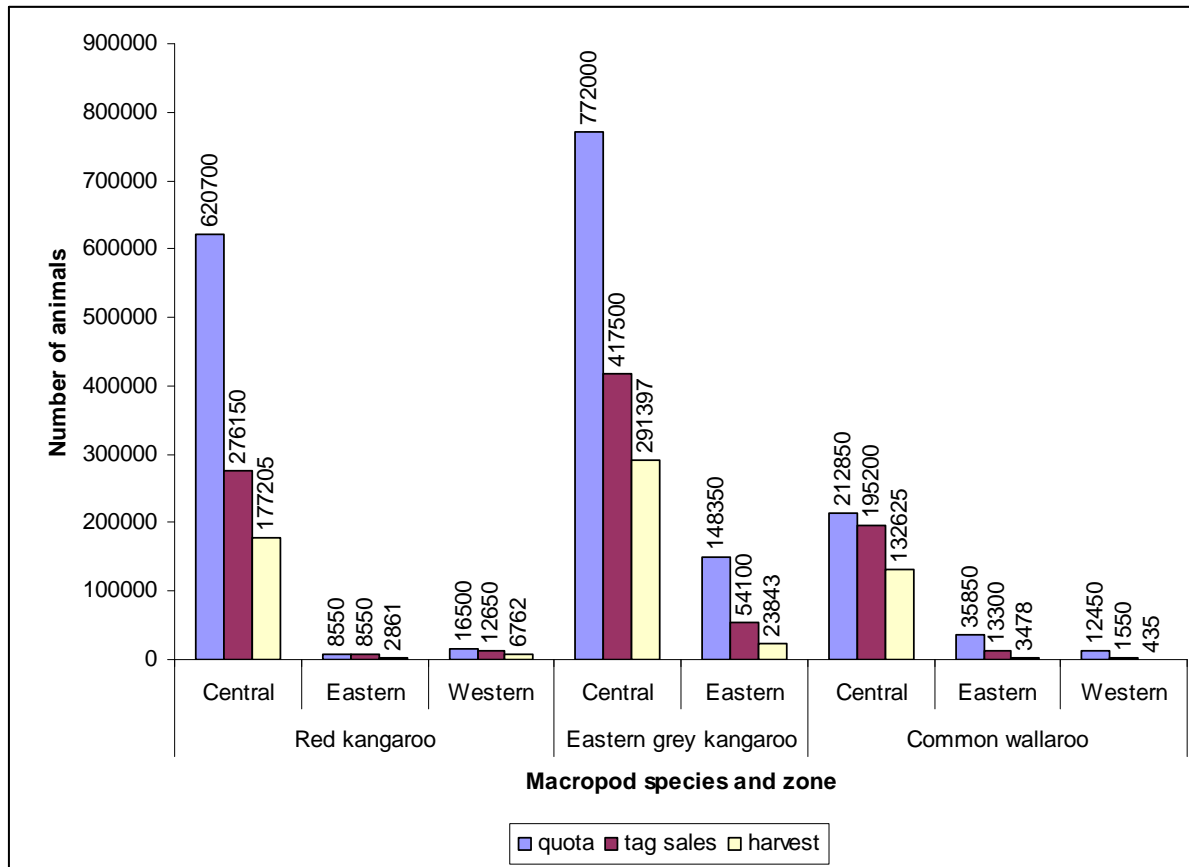
Harvest update for 2011

The total number of tags issued up to the 31 August 2011 for red kangaroos was 297 350, for eastern grey kangaroos 471 600 and for common wallaroos 210 050. Total reported harvest from dealer returns up to 31 August 2011 for red kangaroos was 186 828 and for eastern grey kangaroos 315 240 and for common wallaroos 136 538 (Table 7). A comparison of tag sales and harvest returns in relation to quotas in each zone is given in Figure 15.

Under the new system introduced into Queensland for the 2010 harvest period, where the number of tags produced matches the maximum quota for each species in each zone, it is not possible for the commercial harvest quotas to be exceeded. Given the percentage of the quota that has currently been issued in tags, it is unlikely quotas will be met for most species in most harvest zones, with the obvious exception of red kangaroos in the eastern zone and potentially common wallaroos in the central zone.

The 2011 harvest will be comprehensively reported on in the Annual Report 2011, due for release in March 2012.

Figure 15. Harvest update for 2011 (data derived from tag sales and harvest returns as of 31 August 2011)



Species	Harvest sone	2011 Sustainable Use Quota (rounded to the nearest 50)	Tags Issued to 31 August 2011	Reported Harvest to 31 August 2011
Red kangaroo	Central	620 700	276 150	177 205
	Eastern	8550	8550	2861
	Western	16 500	12 650	6762
	Combined	645 750	297 350	186 828
Eastern grey kangaroo	Central	772 000	417 500	291 397
	Eastern	148 350	54 100	23 843
	Western	0	na	na
	Combined	920 350	471 600	315 240
Common wallaroo	Central	212 850	195 200	132 625
	Eastern	35 850	13 300	3478
	Western	12 450	1550	435
	Combined	261 150	210 050	136 538

Table 7. Tags issued and reported harvest for 2011

The extent of non-commercial harvest mortality

There are many forms of macropod mortality outside of the commercial harvest. It is possible for DERM 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 (DMP), licensed recreational harvest and disease outbreak mortality.

Damage to primary production

DMPs are issued by DERM where macropods are causing demonstrable damage to primary production. The issuing of these permits is limited to a maximum of one per cent of the population estimate 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*.

For comparative purposes, a summary of the macropods taken under DMPs for each species for each zone for 2006–2010 is outlined in Figure 16. Since 2006, the greatest number of macropods taken under DMPs are from the central zone, with the lowest number of DMP take recorded in the western zone. A total of 82 DMPs were issued for macropods in Queensland in 2010 which is down from 125 in 2009. Totals for macropod DMP quota and take 2009–10 are given in Figure 17. For 2011 there have been 46 permits issued as of 31 August 2011. The current percentages of quota issued for 2011 are below the quota limit, as at 28 August (Table 8). The highest percentage of quota used is for the common wallaroos in the central zone at 35.57 per cent.

Figure 16. Macropods taken under damage mitigation permits 2006–2010

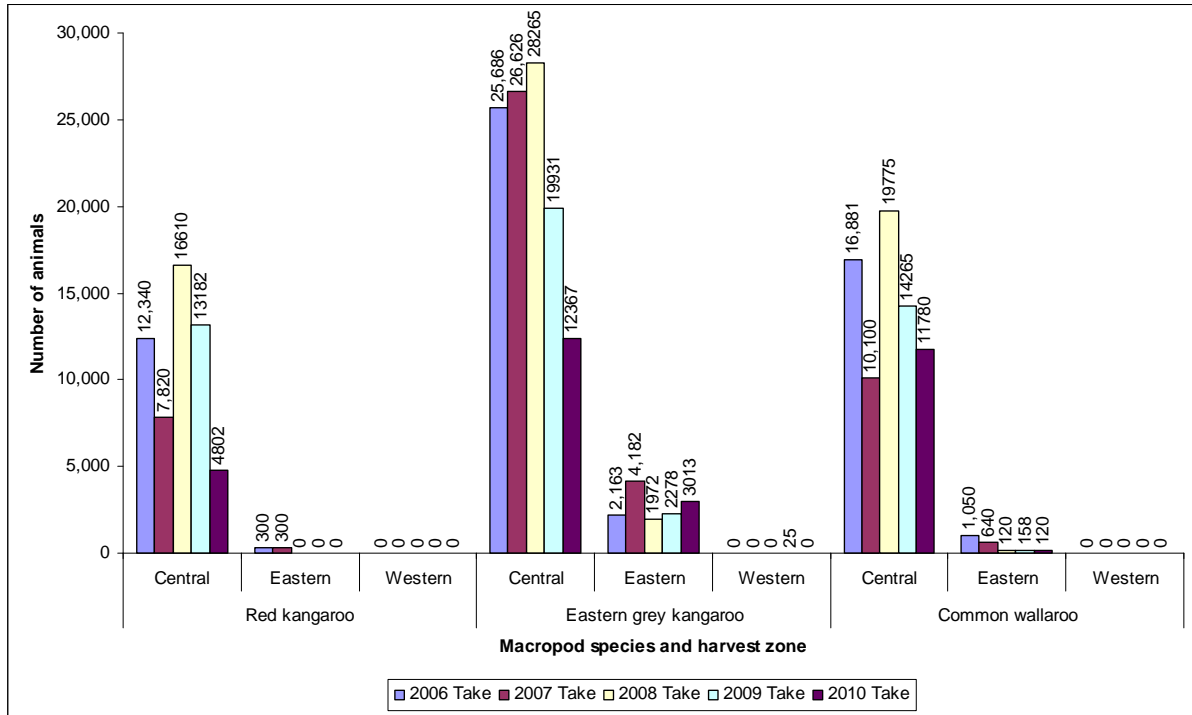
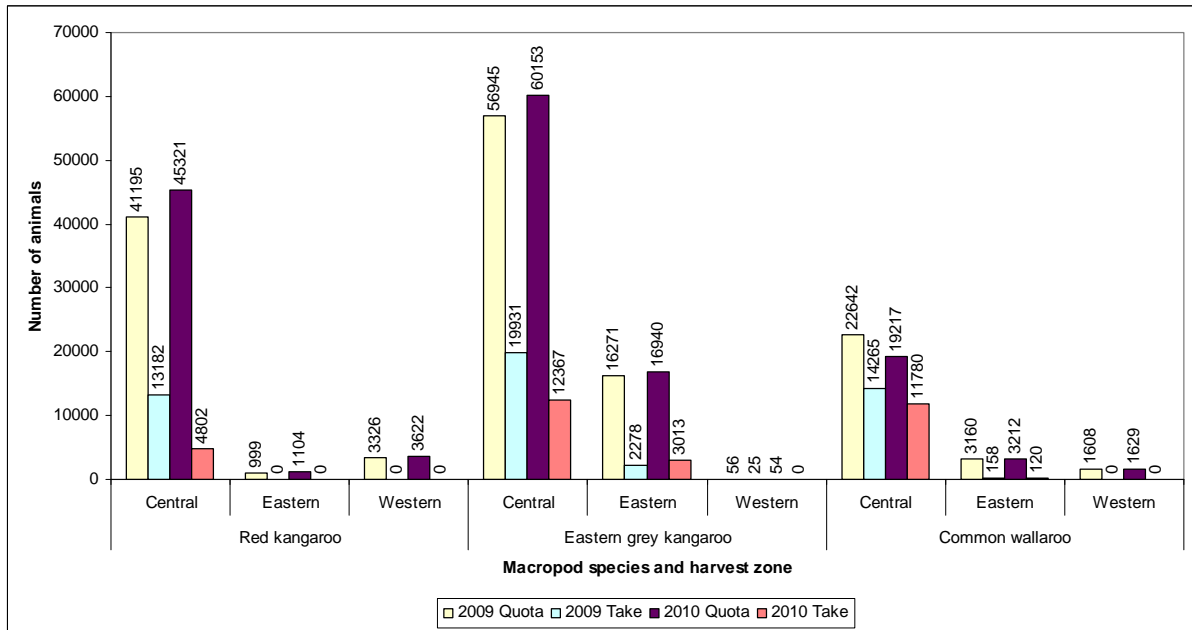


Figure 17. Macropod quota and take for damage mitigation permits 2009–10



Species	Harvest zone	2011 DMP quota	2011 DMP take	% of quota used
Red kangaroo	Central	33 528	2662	7.94 %
	Eastern	855	0	0.00 %
	Western	1651	0	0.00 %
	Combined	36 035	2662	7.39 %
Eastern grey kangaroo	Central	51 607	9892	19.17 %
	Eastern	14 832	585	3.94 %
	Western	85	5	5.91 %
	Combined	66 524	10 482	15.76 %
Common wallaroo	Central	14 336	5100	35.57 %
	Eastern	3586	40	1.12 %
	Western	1246	0	0.00 %
	Combined	19 169	5140	26.81 %

Table 8. Damage mitigation permit quota and percentage of quota utilised for macropods for 2011. Note: figures are as recorded on 31 August 2011

Disease outbreak mortality and its significance

No incidence of significant disease outbreak mortalities have been recorded for macropod populations in Queensland during the past 12 months. Extremely high rainfall totals were recorded across Queensland during spring and summer 2010 and the summer of 2011. This resulted in widespread flooding in many areas. Whilst these conditions almost certainly had some impact on local kangaroo populations there were no reports of either significant direct mortalities or any increased incidence of disease related deaths in kangaroo populations from these regions. The annual Queensland aerial survey program took place between May and July 2011 and hence would reflect any changes in the populations in these areas as a result of the flooding.

The last recorded non-harvest mortality event recorded in Queensland macropod populations was in March 2010. Localised non-harvest mortalities for some commercially harvested species were recorded in the south-west of the state from the New South Wales border to just north of Quilpie in the Paroo and Bulloo river systems. Investigation and surveillance over the weeks following the reports established that the deaths were very limited (between 200 to 600 animals) and restricted to small areas only. This was documented in the 2011 Quota Submission for Queensland. The aerial surveys conducted in 2011 showed that in the year following the reported mortalities, macropod populations have increased indicating that the reported mortalities in 2010 did not have a significant effect on macropod populations in the area.

Licensed recreational wildlife harvesting licence (macropods)

The recreational macropod harvest in Queensland is centred on the same three species as the commercial harvest and runs for the same harvest period. The recreational harvesting of these macropods is regulated through:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Nature Conservation Act 1992*
 - Nature Conservation (Administration) Regulation 2006

- Nature Conservation (Wildlife Management) Regulation 2006
- Nature Conservation (Wildlife) Regulation 2006
- Nature Conservation (Macropod) Conservation Plan 2005
- Nature Conservation (Macropod Harvest Period) Notice
- *Animal Care and Protection Act 2001.*

A person holding a Commercial Wildlife Harvesting Licence (macropods) cannot hold a Recreational Wildlife Harvesting Licence (macropods). The harvest is restricted to a maximum of 50 tags per licence holder during a harvest period. The recreational harvest of macropods in Queensland is small with a total of 1220 tags issued in 2010. Only 15 Recreational Wildlife Harvesting Licence (macropods) had been issued by August 2011 (Table 9).

	2008	2009	2010	2011
Total number of permits issued	19	20	25	15
Total quantity which can be taken	673	910	1220	660

Table 9. Number of Recreational Wildlife Harvesting Licences (macropods) issued per year since 2008. Note: 2011 figures are year to date at August 2011

Proportion of the population not subject to harvesting

The range of the red kangaroo in Queensland covers approximately 1 105 587km² (Figure 18). Red kangaroos are harvested over the entirety of their Queensland distribution (Figure 18). The area within the red kangaroo range in Queensland in which they are protected within national parks and state forests increased slightly in 2011 to around 44 691km², or approximately four per cent of their total distribution (Figure 18).

The range of the eastern grey kangaroo in Queensland covers approximately 1 253 710 km² (Figure 19). Eastern grey kangaroos are harvested over approximately 1 097 410 km², or 88 per cent of their Queensland distribution (Figure 19). The area within the active harvest zones within which they are protected in national parks and state forests increased in 2011. Together with the area of range outside the harvest zones, the total protected area for eastern grey kangaroos is 282 499 km² or approximately 21 per cent of their total distribution (Figure 19).

The range of the common wallaroo in Queensland covers approximately 1 239 921 km² (Figure 20). Common wallaroos are harvested over approximately 1 104 222 km², or 89 per cent of their Queensland distribution (Figure 20). The area within the active harvest zones where common wallaroos are protected within national parks and state forests increased in 2011. Together with the area of range outside the harvest zones the total protected area for common wallaroos is 164 876 km² or around 13 per cent of their total distribution area (Figure 20).

Figure 18. Red kangaroo distribution, harvest area and protected areas in Queensland (distribution maps sourced from Johnson 2003)

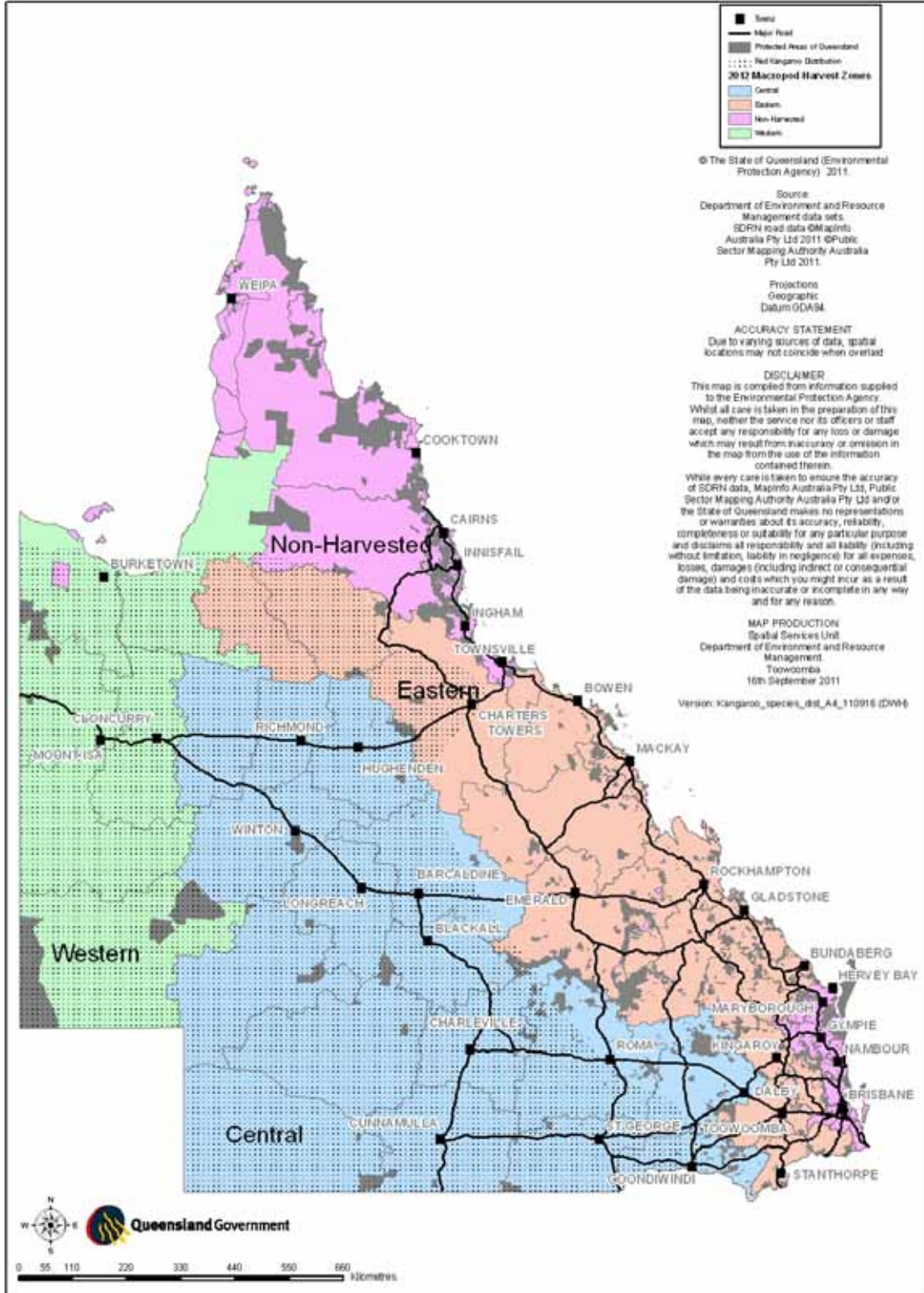


Figure 19. Eastern grey kangaroo distribution, harvest area and protected areas in Queensland (distribution maps sourced from Johnson 2003)

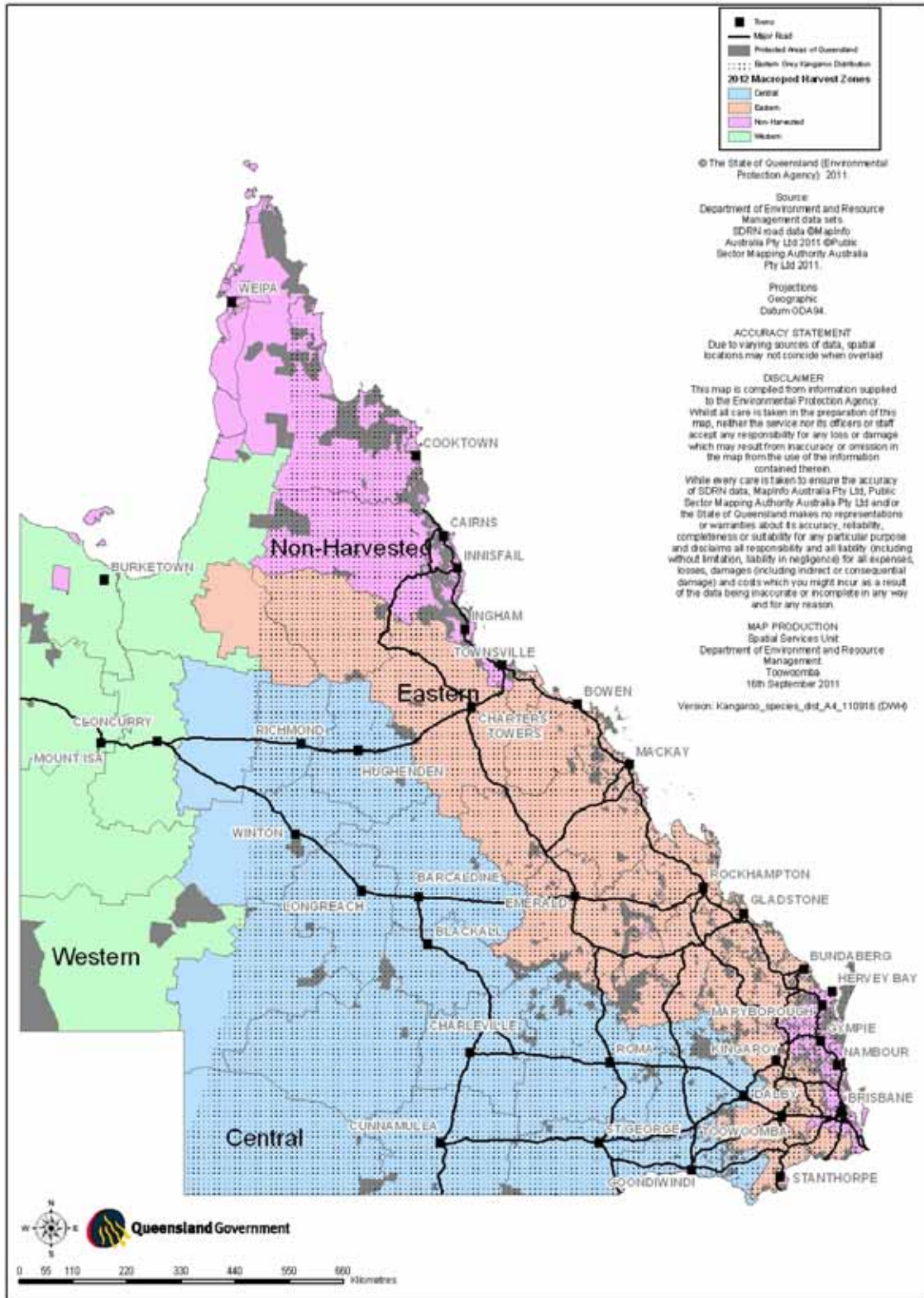
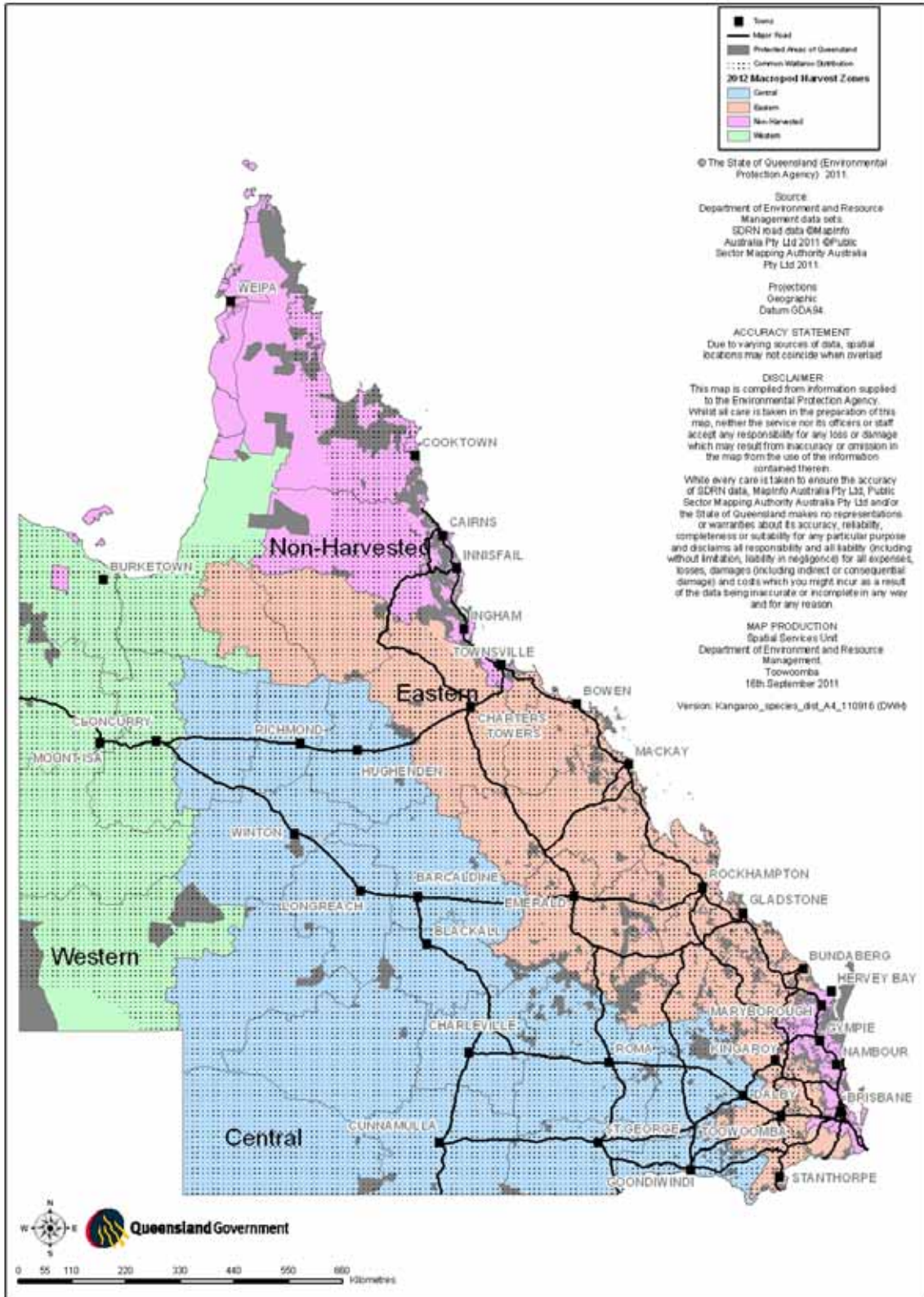


Figure 20. Common wallaroo distribution, harvest area and protected areas in Queensland (distribution maps sourced from Johnson 2003)



Rainfall trends

Recorded rainfall deciles for Queensland are outlined in figures 22–24 for July to December 2010 and from January to August 2011. These figures and the categorisation of deciles ranges within these figures are derived from the Australian Bureau of Meteorology <www.bom.gov.au>.

Annual rainfall was exceptional in 2010, despite a dry May and June, with the year being the wettest ever recorded. The months of September and December were the wettest on record, as was the 2010 spring. Widespread major flooding occurred throughout much of the harvest zones with many of the rivers of southern inland Queensland experiencing record flood heights.

Active monsoonal conditions and upper instability continued widespread during the summer of 2010–11 with heavy rainfall over northern, central and eastern Queensland. These higher than average rainfall events culminated in one of the most significant flooding events in Queensland's history. Wet conditions continued during autumn with most areas within the harvest zones receiving average or above average rainfall. A small area around the Culgoa Floodplain National Park received below average rainfall whilst heavy rain in April caused flooding around Roma.

The increase in macropod numbers predicted in the 2010 quota submission for 2011 was observed in the 2011 aerial surveys. Historically, macropod numbers increase or decrease in response to rainfall after a one to two year lag period as demonstrated in Figure 21. Many areas of the Queensland harvest zones received below average rainfall in 2007, 2008 and 2009. All these areas have now received higher than average rainfall and it is possible that macropod numbers throughout the harvest zones will continue to increase during 2012.

Figure 21. Estimated macropod populations plotted with annual rainfall totals from Queensland 1992–2010

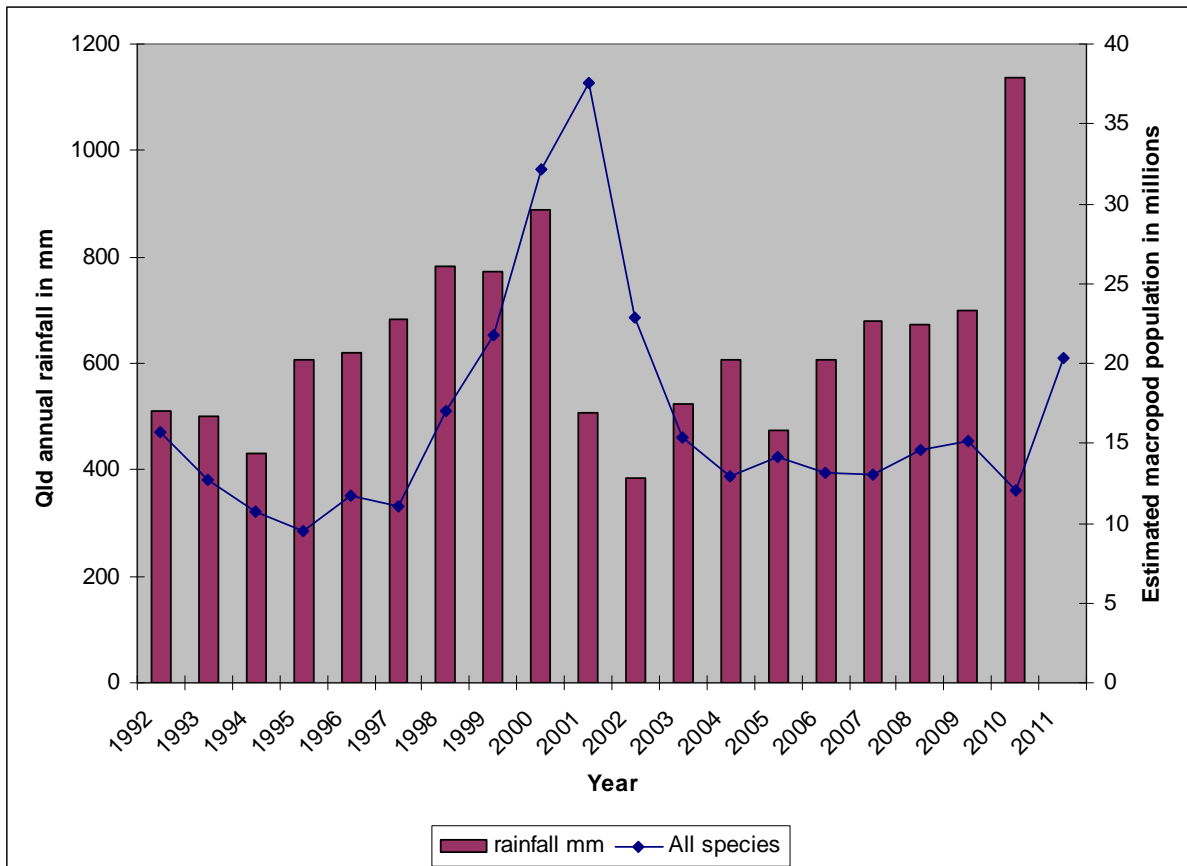


Figure 22. Queensland rainfall deciles July to December 2010

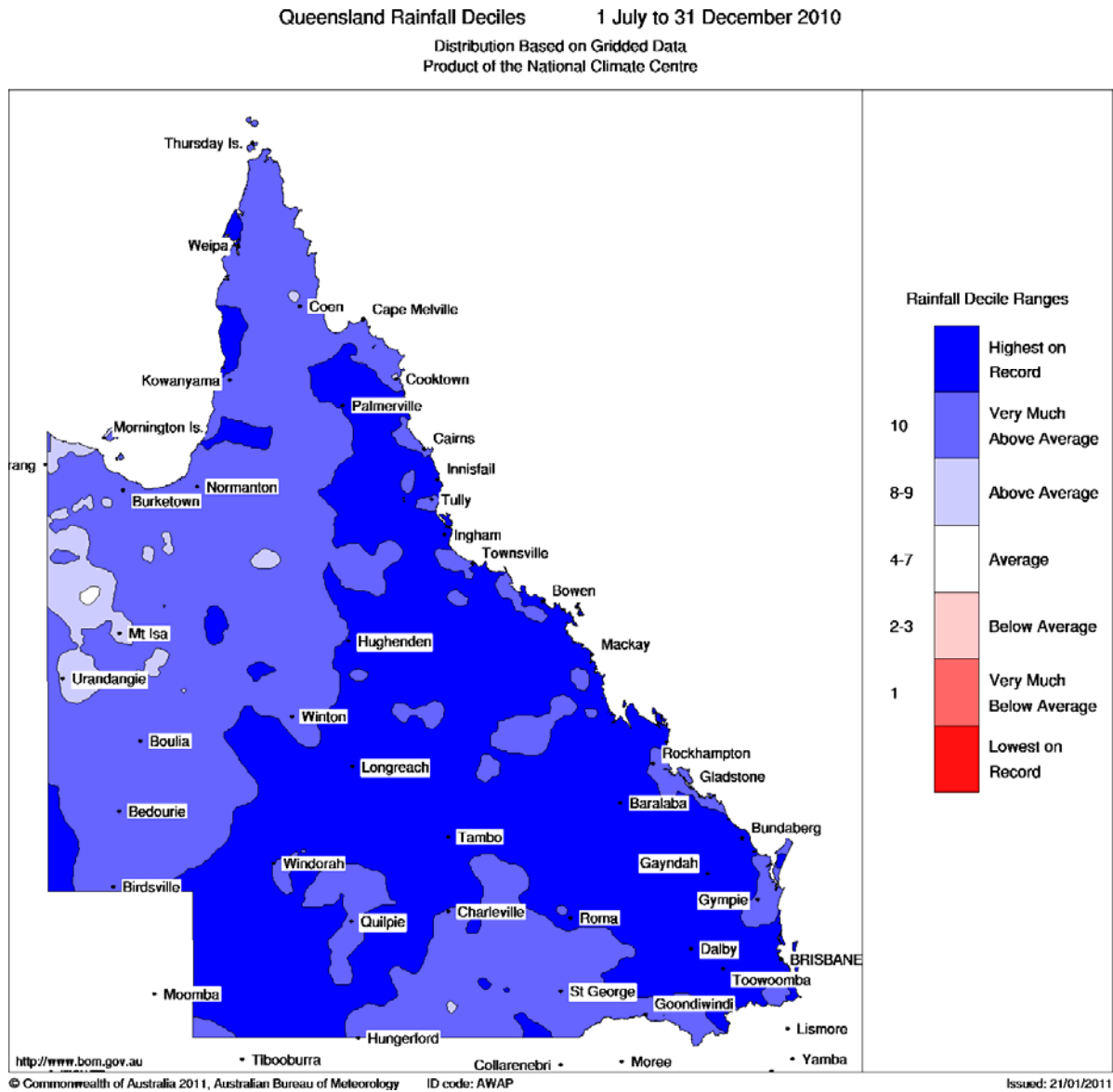


Figure 23. Queensland rainfall deciles January to June 2011

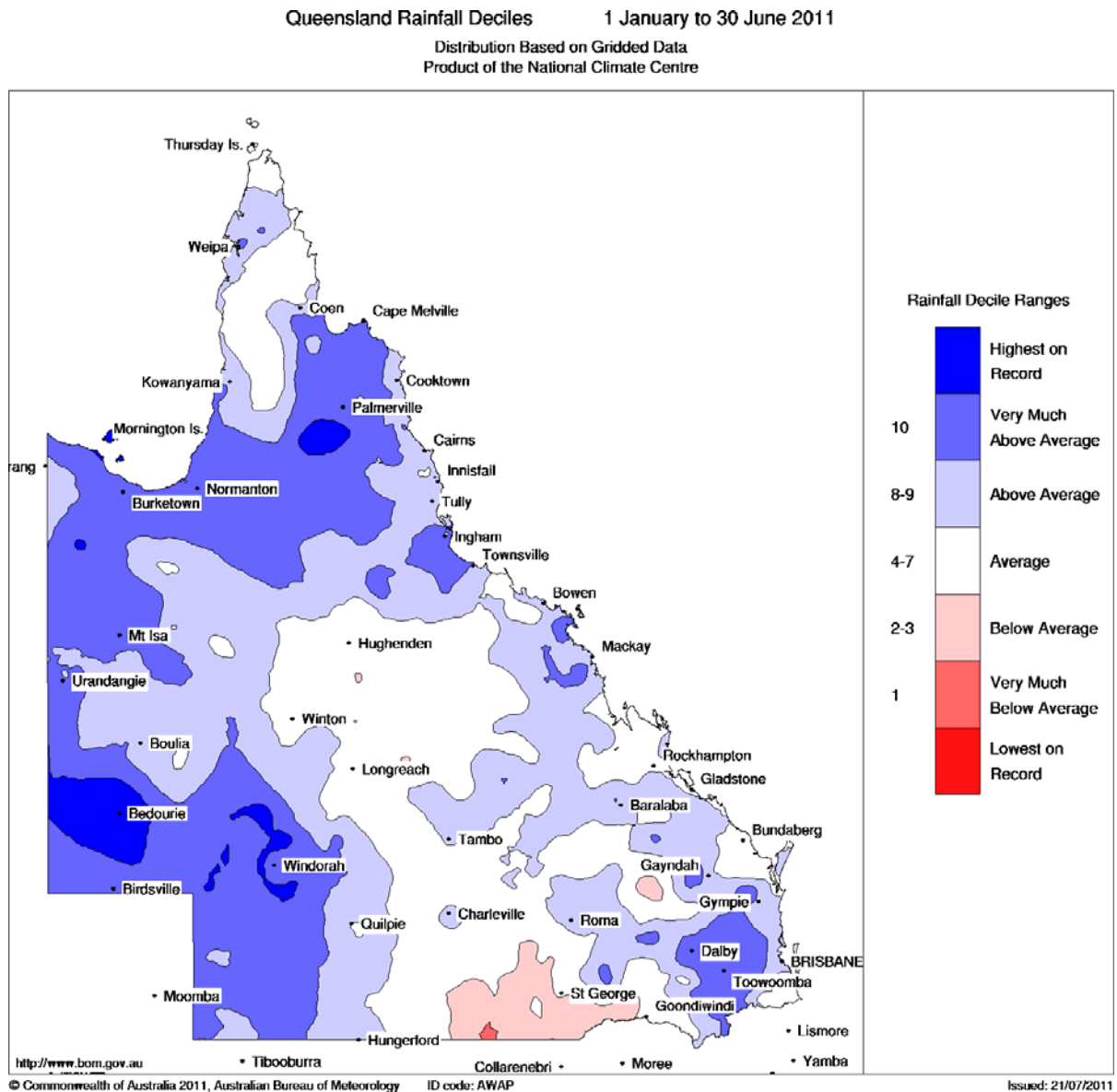
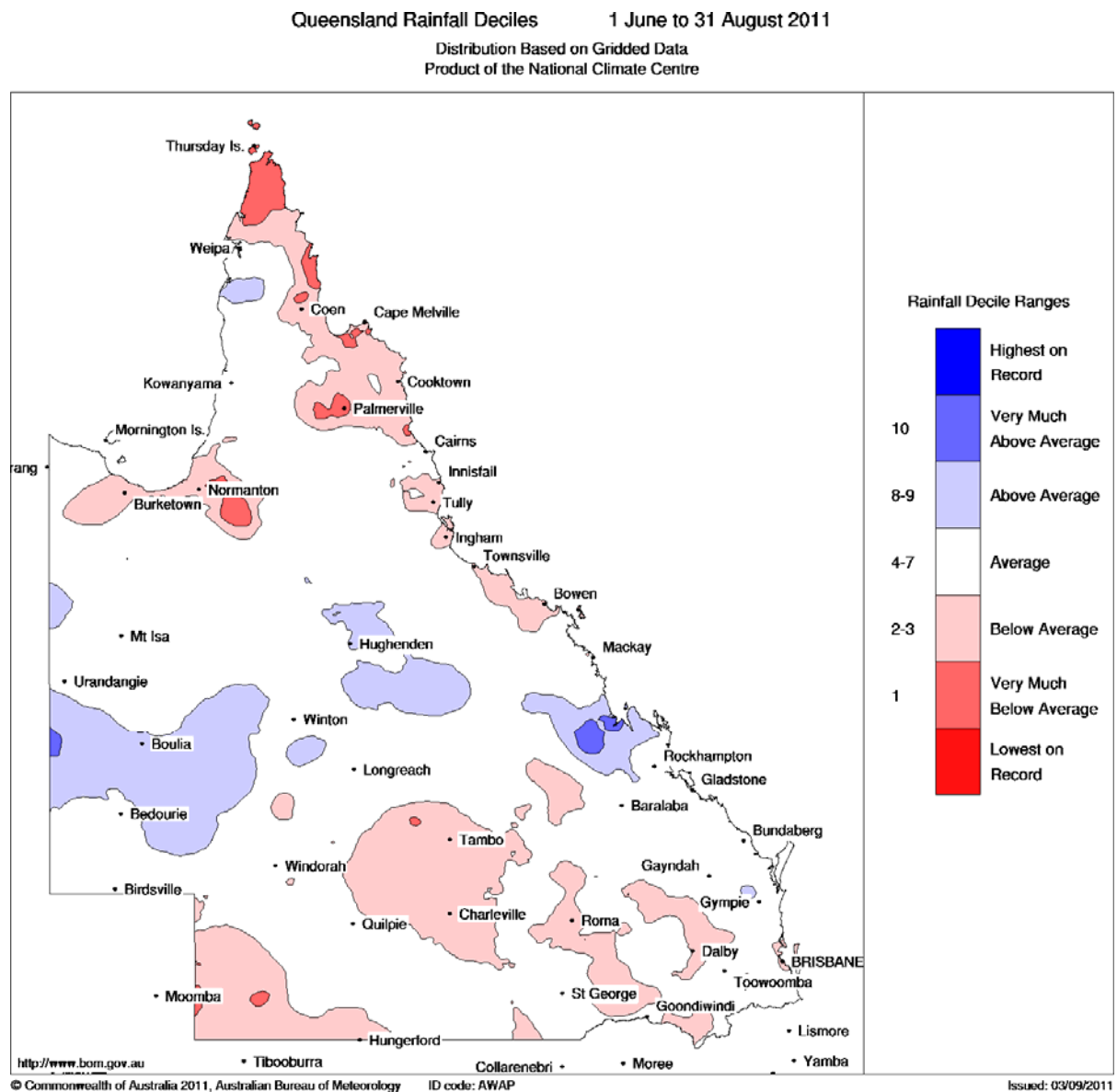


Figure 24. Queensland rainfall deciles June to August 2010



Summary and conclusion

The proposed quotas for the 2012 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. Other factors considered in the setting of the 2012 commercial harvest quotas include a review of previous harvests, extent of non-commercial harvest, proportion of the population not subject to harvesting, non-commercial harvest mortality and its significance, and rainfall trends.

Long-term trend data relating to population size since 1993, when Queensland began an annual program of helicopter surveys, demonstrates there has been no consistent 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 occur over 1 000 000 in the harvest area. Thus, current harvest rates can be viewed as not having a long-term detrimental impact on populations.

Population estimates for red kangaroos, eastern grey kangaroos and common wallaroos increased in 2011 in most harvest zones, with the exception of eastern grey kangaroos in the western zone and common wallaroos in the eastern zone. As for 2010, no quota will be set for eastern grey kangaroos in the western zone. This species continues to be recorded in low densities in this zone which is at the limit of its distributional range. Proposed quotas are inherently linked to population fluctuations by the manner in which they are determined.

For the 2010 commercial harvest no quotas were exceeded, with the maximum percentage of quota utilised being 57 per cent 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 recorded at 12 per cent. Thus, the last completed harvest period provides no indication of adverse pressure on populations that would influence proposed quotas.

For the 2011 harvest period up to 31 August, 41 per cent of the available quota for red kangaroos in the western zone had been harvested with 33 per cent and 29 per cent of the quota harvested in the eastern and central zones respectively. For eastern grey kangaroos, 38 per cent and 16 per cent of the quota was harvested in the central and eastern zones respectively. For common wallaroos, the highest percentage of quota harvested was 62 per cent in the central zone, whilst only three per cent of the quota was harvested in the western zone with 10 per cent harvested in the eastern zone. Given these figures, it is unlikely that quotas will be met for each species in each zone in 2011, with the possible exception of common wallaroos in the central zone.

Non-commercial quotas for DMPs for 2010 were below the one per cent of the population estimate quota for all species for all zones. The current percentages for utilisation of DMP quotas for 2011 are well below the quota limits, with the highest percentage of use recorded for common wallaroos in the central zone totalling 45 per cent. DMP take will continue to be monitored to ensure adherence to quotas.

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 and increased slightly in 2011. Macropods are further protected from harvest in Queensland within the non-harvest zones. The total area of the non-harvest zones is 236 408 km².

Rainfall in the second half of 2010 and beginning of the 2011 harvest period was extreme, with many areas receiving above average rainfall and widespread flooding. This rainfall may result in increased numbers of macropods in the 2012 aerial surveys. An increase in macropod numbers was observed in 2011 when compared to 2010.

Examination of the long-term population and density estimate trends indicates that the decrease in numbers observed in 2010 was within the realms of fluctuations in previous years and above the low of the mid 1990s.

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Appendices

Appendix 1

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

Aerial surveys

Since 1991, 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 – 2008–2012. 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 136 000 km² (Figure 1) or 25 per cent 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 50–90 km transect lines have been placed systematically 10 km apart. Sampling intensity within each block is approximately 2.5 per cent.

The placement of the original ten 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 630 000 km² (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 2 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 1 097 410 km² for eastern grey kangaroos, 1 105 587 km² for red kangaroos and 1 104 222 km² 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 per cent of populations for eastern grey kangaroos and common wallaroos and 20 per cent 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 per cent 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 Resource Management and the Commonwealth Department of Sustainability, Environment, Water, Population and Communities for determining state quota limits.

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 Cloncurry	✓ ✓ ✓		✓ ✓ ✓

Table 10. Stratification, pairing and sampling frequency for fixed aerial survey monitor blocks in Queensland

Appendix 2. Densities per km² of the commercially harvested macropod species 2004–2011

	Eastern grey kangaroo							
Block	2004	2005	2006	2007	2008	2009	2010	2011
Barcaldine	20.61	13.17	22.77	17.65	23.15	29.50	12.871	23.921
Blackall	7.57	7.10	6.22	7.51	8.28	11.19	7.082	6.082
Bollon	25.66	25.31		30.53		31.74	30.143	
Charleville	17.51	19.91	15.96	12.05	11.20	12.95	12.229	28.112
Charters Towers		1.63		5.02		5.33	5.568	
Cloncurry	0.01		0.16		0.02		0.214	0.012
Cunnamulla	13.20		9.97		11.44		11.642	32.823
Duchess	0.00		0.00		0.00		0	0
Emerald		3.95		3.41		4.05	5.035	
Hughenden	0.77	0.58		1.16		0.97	0.795	
Hungerford	1.16	1.10		0.77		0.94	0.651	
Inglewood		8.72		18.62		9.75	12.326	
Injune	13.53	18.85		18.62	6.82		16.599	17.753
Julia Creek	1.08	0.87	1.05		0.76		0.276	0.276
Longreach	9.05	8.48		6.63		6.61	6.129	
Quilpie	1.86		0.97		1.42		2.795	1.57
Roma	25.05	24.98	25.46	25.12		23.43	19.298	
Taroom	8.12	13.37		8.44		7.87	7.362	
Westmar	25.53		23.17		21.18		22.083	37.252
Windsorah	1.58	2.69	1.14	1.39	2.39	1.26	0.858	2.676
Winton	4.86	2.98	3.74		4.78		2.432	3.574

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Red kangaroo								
Block	2004	2005	2006	2007	2008	2009	2010	2011
Barcaldine	6.07	4.07	11.07	6.72	9.03	9.83	7.58	10.047
Blackall	3.99	3.29	4.55	3.78	6.45	7.24	4.701	12.367
Bollon	4.13	8.87		8.35		11.16	9.895	
Charleville	4.55	5.48	7.36	9.57	7.58	8.47	6.459	14.686
Charters Towers		0.02		0.05		0.00	0.7	
Cloncurry	2.14		4.18		6.17		3.013	3.337
Cunnamulla	3.54		4.59		9.02		10.646	18.269
Duchess	2.92		0.87		1.78		0.846	0.712
Emerald		0.00		0.00		0.00	0.024	
Hughenden	1.97	1.59		1.59		1.29	0.922	
Hungerford	1.04	2.57		3.90		4.41	2.598	
Inglewood		0.00		0.00		0.00	0.496	
Injune	1.02	0.14	0.05		0.72		0	0.862
Julia Creek	4.08	5.13	4.91		5.39		3.156	3.304
Longreach	9.53	11.86		11.33		14.71	12.236	
Quilpie	2.19		1.39		5.13		2.056	4.697
Roma	2.19	1.62	2.54	2.66		2.37	2.261	
Taroom	0.02	0.37		0.00		0.00	0	
Westmar	0.97		0.59		0.55		1.139	1.494
Windorah	4.42	4.52	7.32	4.48	9.85	12.62	6.668	10.472
Winton	3.69	5.02	5.62		6.05		3.315	4.441

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Common wallaroo								
Block	2004	2005	2006	2007	2008	2009	2010	2011
Barcaldine	6.59	12.30	8.63	16.42	19.98	16.20	5.521	8.306
Blackall	18.02	21.17	22.15	34.98	39.14	49.05	23.819	21.549
Bollon	4.72	2.64		1.55		1.67	0.363	
Charleville	7.21	6.20	5.79	4.66	4.70	5.36	11.803	13.439
Charters Towers		0.30		2.84		0.61	1.069	
Cloncurry	0.00		0.30		0.64		0.507	0.260
Cunnamulla	1.68		0.45		0.64		1.951	0.611
Duchess	0.57		0.11		1.69		0.743	0.093
Emerald		0.02		0.00		0.78	0.024	
Hughenden	1.65	1.28		2.28		0.24	0.411	
Hungerford	1.19	0.36		0.24		0.48	0.254	
Inglewood		3.08		4.03		0.34	1.013	
Injune	0.01	2.30	1.34		0.91		4.053	0
Julia Creek	2.74	0.00	0.04		0.11		0.013	0
Longreach	17.96	21.57		18.59		12.69	9.185	
Quilpie	5.41		0.78		3.36		2.686	3.007
Roma	1.35	3.74	2.49	2.08		1.16	3.447	
Taroom	0.22	2.04		0.17		1.05	0.253	
Westmar	0.74		0.02		0.13		0.299	0
Windsorah	2.14	2.30	1.81	2.72	3.03	3.07	2.422	3.185
Winton	1.73	1.78	1.70		3.14		0.955	4.191