

Management Plan for the Commercial Harvest of Kangaroos in Western Australia

2008 – 2012



Department of
Environment and Conservation

Our environment, our future



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DEFINITIONS

Carcass – the entire body (including the skin) of the *kangaroo*, excluding the head, distal portions of the limbs and tail, and viscera.

Code of Practice for the Humane Shooting of Kangaroos – the current nationally-endorsed Code, endorsed by the Council of Nature Conservation Ministers, last revised in 1990. A reference to this Code will also apply to any future nationally-endorsed subsequent codes.

Ecologically sustainable development – this plan employs the definition contained in the Environment Protection and Biodiversity Conservation Act 1999. In general this definition includes the precautionary principle, inter-generational equity, conservation of biological diversity and ecological integrity, and improved valuation of environmental factors.

Kangaroo – the kangaroo species that can be utilized in accordance with this management plan: the red kangaroo (*Macropus rufus*) and western grey kangaroo (*M. fuliginosus*).

Landholder – owner or occupier of specified lands.

Licensed Kangaroo Processor – the holder of a Licence to Process issued under Regulation 7 of the *Wildlife Conservation Regulations 1970*.

Licensed Kangaroo Shooter – the holder of a Licence to Take Kangaroos For Sale issued under Regulation 6 of the *Wildlife Conservation Regulations 1970*.

Licensed Skin Dealer – the holder of a Licence to Deal in Skins issued under Regulation 10 of the *Wildlife Conservation Regulations 1970*.

Registered Chiller Unit – a chiller unit that is owned by the holder of a Licence to Deal in Fauna Carcasses issued under Regulation 8 of the *Wildlife Conservation Regulations 1970*.

1. INTRODUCTION

This management plan has been developed to satisfy the requirements of the Commonwealth's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and to meet the legislative and other requirements of the Western Australian Government.

This management plan relates only to the commercial harvest of red (*Macropus rufus*) and western grey (*Macropus fuliginosus*) kangaroos within Western Australia. Where the term *kangaroo* is used in this document it refers to both the aforementioned macropod species and subspecies. The commercial harvest of euros (*Macropus robustus*) in Western Australia is the subject of a separate Wildlife Trade Operation application under provisions of the EPBC Act and is not subject to this management plan.

This management plan is current for a maximum five-year period from 1 January 2008 to 31 December 2012.

In Australia the export of *kangaroo* products requires Commonwealth Government approval under the EPBC Act.

In Western Australia, all native fauna are protected under the *Wildlife Conservation Act 1950* (WC Act), which is administered by the Department of Environment and Conservation (DEC). The utilization of protected fauna requires the issue of a licence under Regulation 6 of the *Wildlife Conservation Regulations 1970*. The commercial harvest of *kangaroos* in Western Australia is regulated via the issue of various licences and royalty tags under provisions of the Wildlife Conservation Act. This legislative framework applies to the entire State of Western Australia.

Pursuant to Section 35 of the *Agriculture and Related Resources Protection Act 1976* (ARRP Act), red and western grey kangaroos are listed by the Agriculture Protection Board as Category A7 declared animals throughout Western Australia. This declaration requires the development of a management program outlining areas and conditions under which controls may be applied. This management plan and regulation by the Wildlife Conservation Act satisfy the requirements of the A7 declaration under the ARRP Act.

This management plan does not provide the framework for the management of *kangaroos* on lands vested in the Conservation Commission of Western Australia under the *Conservation and Land Management Act 1984* (CALM Act) and managed by DEC e.g. national parks, nature reserves, State forest and timber reserves. *Kangaroos* cannot usually be taken for commercial purposes in such areas, which comprise a total area in excess of 24 million hectares or approximately 9.8 percent of the State.

This plan relates only to the commercial harvest of *kangaroos* within Western Australia. The non-commercial culling of *kangaroos* in Western Australia is not regulated by this plan. DEC regulates the non-commercial culling of *kangaroos* through provisions of the Wildlife Conservation Act.

The primary goal of the management plan is to ensure that the commercial harvest of *kangaroos* is ecologically sustainable. This will be achieved through the application of the best available scientific knowledge, best practice management and monitoring of outcomes to ensure the viability of *kangaroo* populations is not compromised by any action undertaken in accordance with this plan.

This management plan incorporates an adaptive approach to management. Adaptive management is the systematic acquisition and application of reliable information to improve management over time. The adaptive management provisions of this plan facilitate the investigation of different

strategies using scientifically rigorous experimentation to not only support appropriate adjustments to management practices, but to improve knowledge and inform future program reviews.

This plan will set the framework for the commercial harvest of *kangaroos* to provide for the management of *kangaroo* populations in accordance with the principles of *ecologically sustainable development*. Management in this context provides for the sustainable harvesting of *kangaroos* for products such as meat and leather to supply the Australian and international markets. Management also assists in balancing environmental, social and economic interests through the collaborative management of a sustainable resource.

2. LEGISLATIVE FRAMEWORK

2.1. Commonwealth

The relevant provisions under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) came into force on 11 January 2002, following the incorporation of the former *Wildlife Protection (Regulation of Exports and Imports) Act 1982*. The EPBC Act has legislative provisions requiring the development and approval of wildlife trade management plans in order for permits to be issued for the commercial export of wildlife products.

The EPBC Act states that the Commonwealth Minister for the Environment and Water Resources may approve a wildlife trade management plan for a maximum of five years. The EPBC Act specifies that such approval must only be given if the Minister is satisfied that:

- (a) the plan is consistent with the objects of Part 13A of the EPBC Act;
- (b) an assessment of the environmental impacts of the activities of the plan has been undertaken;
- (c) the plan includes management controls directed towards ensuring that the impacts of the activities covered by the plan are ecologically sustainable;
- (d) the activities in the plan are not detrimental to the species to which the plan relates or any relevant ecosystem; and
- (e) the plan includes measures to mitigate, monitor and respond to the environmental impacts of the activity covered by the plan.

In deciding whether to approve a plan, the Minister must also have regard to whether:

- (a) legislation relating to the protection, conservation or management of the specimens to which the plan relates is in force in the State or Territory concerned; and
- (b) the legislation applies throughout the State or Territory concerned; and
- (c) in the opinion of the Minister, the legislation is effective.

Finally, in resolving whether to approve a plan the Minister must also be satisfied that if an animal is killed, it is done in a way that is generally accepted to minimize pain and suffering. Animal welfare standards for the commercial harvesting of *kangaroos* are detailed in the *Code of Practice for the Humane Shooting of Kangaroos* (Appendix 1). All *kangaroos* must be taken in accordance with this Code or any subsequent relevant nationally-endorsed codes that replace that document. An assessment of how this plan meets the requirements of the EPBC Act is provided in Appendix 2.

2.2. Western Australia

In Western Australia, all native fauna, including all kangaroo species and subspecies, are protected by the *Wildlife Conservation Act 1950*. The *Wildlife Conservation Act 1950* and associated *Wildlife Conservation Regulations 1970* make provisions for the licensing of a range of activities relating to the commercial harvesting of native fauna including *kangaroos*.

Kangaroos can only be taken in accordance with this management plan under a licence issued by DEC. Moreover, under this management plan the commercial harvesting of *kangaroos* in Western Australia is presently restricted to the commercial Kangaroo Management Areas illustrated in Figure 1. However, within the life of this plan, new commercial *kangaroo* harvesting zones may be opened in areas of Western Australia where commercial harvesting of *kangaroos* is not currently occurring on the basis of *kangaroo* abundance.

The licensing process as it relates to *kangaroo* harvesting is summarized in a flow chart (Figure 2) and described in more detail below. The licensing process commences with a *kangaroo* shooter obtaining written permission from a landholder to shoot *kangaroos* on the landholder's property and then applying for a *Licence to Take Kangaroos for Sale*. Other activities associated with the commercial utilization of *kangaroos* require licences specific to those activities such as Processors' and Skin Dealers' licences.

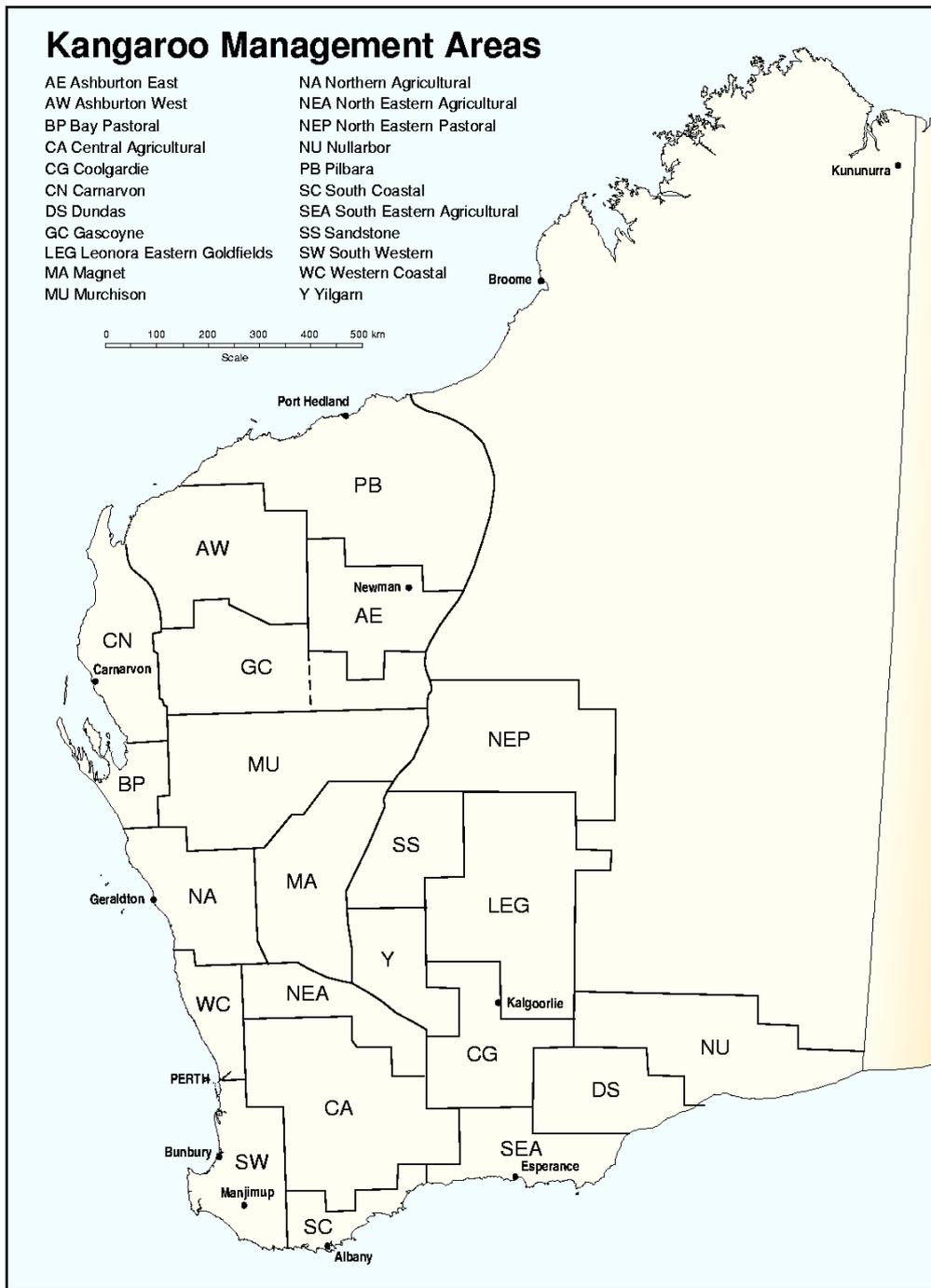


Figure 1. Kangaroo Management Areas in Western Australia.

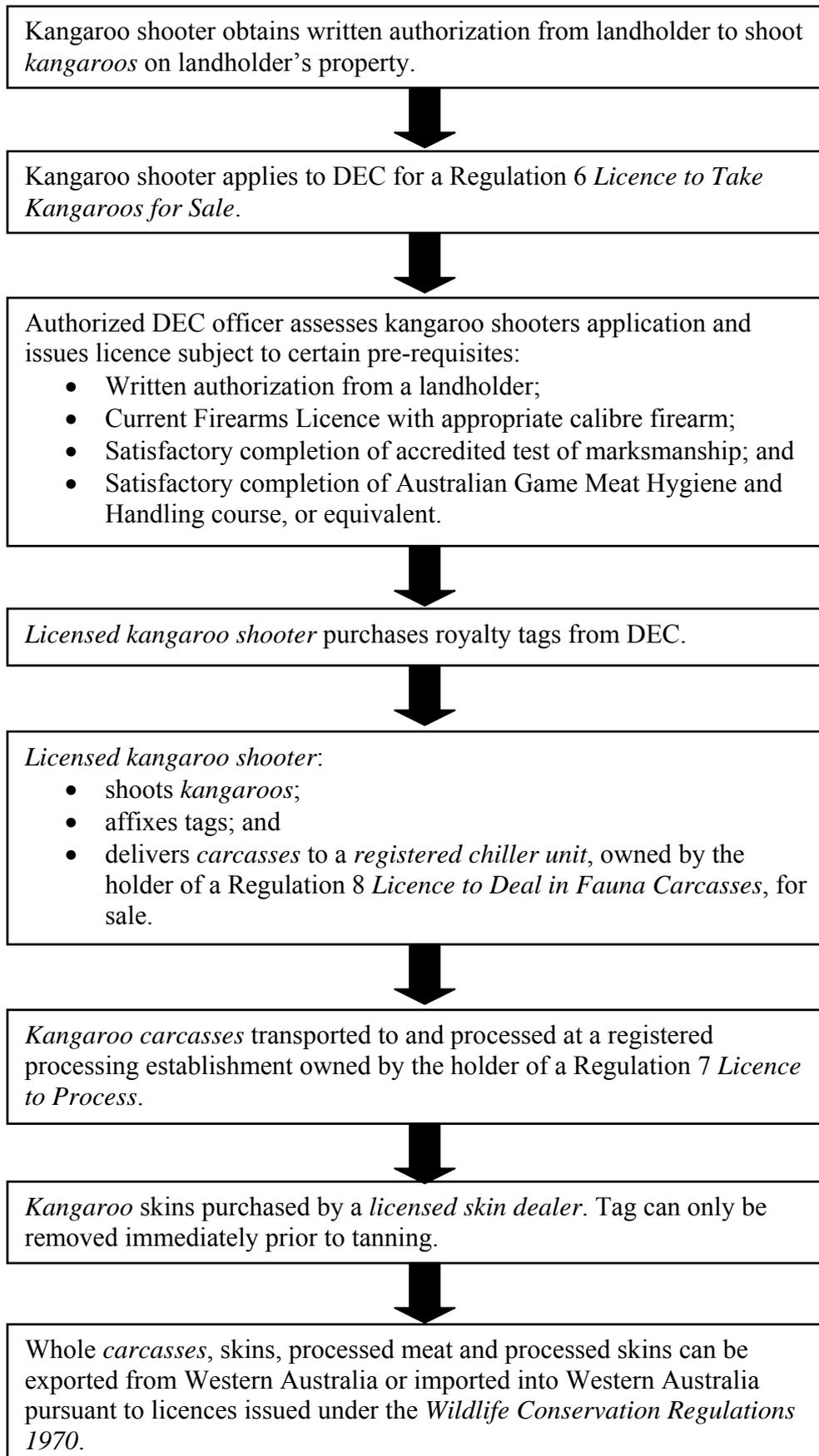


Figure 2. Western Australian licensing flowchart.

LICENCE TO TAKE KANGAROOS FOR SALE
(Kangaroo Shooter's Licence)

Issued under Regulation 6 of the *Wildlife Conservation Regulations 1970*

The licence holder may take *kangaroos* by means of a firearm on private or leasehold land that falls within the area described in an open season notice and sell the *carcasses* or skins to a *licensed kangaroo processor*.

Before approving an application for a *Kangaroo Shooter's Licence*, an authorized DEC officer will ensure that the applicant has the following pre-requisites:

- Written authorization from a landholder to take *kangaroos* on the landholder's property;
- Successful completion of accredited firearms competency testing in marksmanship; and
- Successful completion of NSW TAFE Course 5725: Australian Game Meat Hygiene and Handling, or equivalent.

Kangaroo Shooters' Licences are subject to conditions¹ that include, but are not limited to:

1. All shooting is to be carried out in accordance with the provisions of the *Code of Practice for the Humane Shooting of Kangaroos*.
2. Only *kangaroos* that have been killed by a single shot to the brain shall be delivered to a *licensed kangaroo processor*.
3. The licensee must possess a current Firearms Licence that has been issued pursuant to the *Firearms Act 1973* for a high-powered centrefire rifle of at least .222 calibre.
4. *Kangaroos* may only be taken in accordance with the conditions of the open season notices published in the Government Gazette.
5. The licensee is authorized to deliver kangaroo carcasses to the chiller(s) specified on this licence, registered as being located at the location also specified on this licence. No change to chiller location is to be made unless authorized by the Director General.
6. The licensee has approval to shoot on the stations and/or properties specified on or attached to this licence. All written station/property approvals must be submitted to the Director General.
7. Returns (Form 3) to be submitted monthly so as to reach the Department of Environment and Conservation no later than the fifteenth (15) day of the following month.
8. This licence must be carried by the licensee at all times for the purpose of proving their authority to take fauna when questioned as to their right to do so by a Wildlife Officer, any other State or Local Government Officer or any member of the public.
9. Only year-specific royalty tags applicable to the term of this licence and of the appropriate colour for the *kangaroo* species taken shall be attached to each *kangaroo carcass*.
10. *Kangaroo carcasses* held in a *registered chiller unit* or forwarded or consigned for sale shall have a royalty tag attached to each *carcass*. *Kangaroos* taken pursuant to this licence may only be consigned or sold to persons licensed as a dealer under the Wildlife Conservation Regulations.

¹ Note: any changes to licence conditions must be consistent with the requirements set out in this management plan.

LICENCE TO DEAL IN FAUNA CARCASSES
(Registered Chiller Unit)

Issued under Regulation 8 of the *Wildlife Conservation Regulations 1970*

The licence holder may purchase or receive *kangaroo carcasses* from a *licensed kangaroo shooter*.

Licences to Deal in Fauna Carcasses are subject to conditions¹ that include, but are not limited to:

1. The licensee shall comply with the provisions of the Wildlife Conservation Act and Regulations and any notices in force under this Act and Regulations.
2. No change of chiller location is to be made unless authorized by the Director General or the local District Wildlife Officer.
3. The Director General (through the local District Wildlife Officer) shall be notified immediately of any change of person in charge of a chiller.
4. Returns (Form 3) to be submitted monthly so as to reach the Department of Environment and Conservation no later than the fifteenth (15) day of the following month.
5. This licence shall be displayed in a prominent position in the premises at the property specified on this licence.
6. The licensee must comply with all relevant local authority by-laws.

¹ Note: any changes to licence conditions must be consistent with the requirements set out in this management plan.

LICENCE TO PROCESS
(Kangaroo Processor's Licence)

Issued under Regulation 7 of the *Wildlife Conservation Regulations 1970*

The licence holder may process *kangaroo carcasses*.

Licences to Process fauna are subject to conditions¹ that include, but are not limited to:

1. The licensee shall comply with the provisions of the Wildlife Conservation Act and Regulations and any notices in force under this Act and Regulations.
2. The licensee shall only accept the *carcasses* of *kangaroos* that were killed by a single shot to the brain².
3. The licensee must comply with all relevant local authority by-laws.
4. Processor returns (Form 2) to be submitted monthly so as to reach the Department of Environment and Conservation no later than the fifteenth (15) day of the following month.
5. Returns of *carcasses* received (Form 3), other than those from a *registered chiller unit* for which Forms 3 have already been completed, shall be submitted with the relevant Form 2.
6. Records of returns shall be maintained at the processing establishment and be available for inspection by officers of DEC.
7. This licence shall be displayed in a prominent position in the premises at the property specified on this licence.
8. Skins shall not be sold to other than *licensed skin dealers*.

¹ Note: any changes to licence conditions must be consistent with the requirements set out in this management plan.

² One of the ways that it will be determined that a kangaroo has not been shot in accordance with this condition is if the carcass contains a bullet hole in any region of the body other than the head.

LICENCE TO DEAL IN SKINS
(Skin Dealer's Licence)

Issued under Regulation 10 of the *Wildlife Conservation Regulations 1970*

The licence holder may receive, tan and sell *kangaroo* skins.

Licences to Deal in Skins are subject to conditions¹ that include, but are not limited to:

1. The licensee may purchase or receive skins of the specified species from persons licensed to take or to sell such skins under the *Wildlife Conservation Regulations 1970*.
2. This licence shall be displayed in a prominent position in the premises at the property specified on this licence.
3. The licensee shall comply with the provisions of the Wildlife Conservation Act and Regulations and any relevant health and local authority by-laws.
4. The licensee shall only accept the skins of *kangaroos* that were killed by a single shot to the brain².
5. Skin Dealer's returns (Forms 4 & 5) are to be submitted monthly so as to reach the Department of Environment and Conservation no later than the fifteenth (15) day of the following month
6. The royalty tag is to remain attached to, or in the case of the tag becoming detached, accompany the skin, until the tanning process has been completed.

¹ Note: any changes to licence conditions must be consistent with the requirements set out in this management plan.

² One of the ways that it will be determined that a kangaroo has not been shot in accordance with this condition is if the carcass contains a bullet hole in any region of the body other than the head.

LICENCE TO EXPORT OR IMPORT FAUNA

Issued under Regulation 18 (Export) and 19 (Import) of the *Wildlife Conservation Regulations 1970*

The licence holder may export or import *kangaroo* products.

Licences to Export or Import Fauna are subject to conditions¹ that include, but are not limited to:

1. Every consignment of *kangaroo* products must be accompanied by an export or import licence issued by DEC.
2. Licenses are valid only for single consignments and for the date(s) specified on the licence.
3. Licenses to export *kangaroo* products will be issued only if the relevant authority in the State or Territory to which the consignment is destined approves the importation of the fauna to that State or Territory.
4. The consignment specified in the licence is derived from fauna taken in accordance with an approved management program for the species specified.

NB: Export of *kangaroo* products from Australia requires a separate permit issued by the Commonwealth Department of the Environment and Water Resources.

¹ Note: any changes to licence conditions must be consistent with the requirements set out in this management plan.

TAGS

Under Regulation 50 of the *Wildlife Conservation Regulations 1970*, kangaroo skins or carcasses cannot be bought, sold, transported or held in possession unless a tag has been affixed to the skin or carcass.

Licensed kangaroo shooters must attached tags to the carcass of commercially harvested kangaroos as a condition of their licence. Tags are purchased from DEC in batches of 100.

Tags:

- Are colour-coded for the species being harvested – yellow for red kangaroos and white for western grey kangaroos;
- Are individually numbered with a year designation;
- Are issued to a specific *licensed kangaroo shooter* and are not transferable;
- Must be attached to the carcass of kangaroos that are commercially harvested;
- Have a self-locking mechanism and can only be removed by cutting the tag, skin or carcass; and
- May only be removed immediately prior to tanning.

3. BIOLOGY, ECOLOGY AND CONSERVATION OF KANGAROOS

3.1. Introduction

Kangaroos are among the most widely studied species in Australia, largely as a consequence of the commercial harvest. The biology, ecology, conservation status, threats and issues relating to the conservation and harvesting of the *kangaroo* species that are the subject of this plan have been comprehensively documented in a large number of widely available publications. It is beyond the scope of this plan to reiterate the contents of these publications as they relate to *kangaroos* and their management. Accordingly, the following sections provide only a summary of the variety of publications that address specific aspects of *kangaroo* biology, ecology, conservation, management and harvesting.

3.2. Biology and Ecology

The information in this section has largely been adapted from Pople and Grigg (1999). A comprehensive understanding of the biology and ecology of a harvested species is a pre-requisite for ensuring there is a sound basis for sustainable commercial use. In the case of the harvested *kangaroo* species there is a vast amount of information published pertaining to their biology and their ecology. An exhaustive review of this literature is not possible in the context of this plan, hence the following sections will only briefly summarise the key information relevant to commercial harvesting and provide references to more detailed information on specific aspects of *kangaroo* biology and ecology.

3.2.1. Introduction

The two *kangaroo* species that are the subject of this plan are common and abundant over a broad area of Western Australia as well as the Australian continent (Figures 3 and 4). Within the sheep and cattle grazing pastures of WA's rangelands, the provision of permanent watering points has meant that *kangaroos* are now more likely to be limited by food than water (Oliver 1986). This has had a profound effect on their distribution as well as their abundance (Newsome 1965a). It has been suggested that sheep and cattle also improved the habitat of *kangaroos* through facilitative grazing; creating a sub-climax pasture (Newsome 1975). These changes to the environment would have been most pronounced in the late 1800s when average sheep numbers in the rangelands of New South Wales and other parts of Australia were nearly twice what they are today (Caughley 1976). Other changes were also wrought upon Australia's rangelands following European settlement - numerous species of eutherian herbivores and predators were introduced and became established in the wild; at the same time numerous small native mammal species disappeared and many are now extinct. As Caughley (1987b) explained, not only was the habitat modified, but the ecological system was 'changed beyond recognition'. The current distribution and abundance of *kangaroos* may therefore bear only a vague resemblance to what it was prior to European settlement.

3.2.2. Red kangaroo (*Macropus rufus*)

The red kangaroo is the most abundant species of *kangaroo*. It is distributed over much of dry, inland Australia and is the only species exclusively restricted to the arid zone (Tyndale-Biscoe 2005). This distribution reflects the interaction between mean annual precipitation and mean annual temperature (Caughley *et al.* 1987). In Western Australia, red kangaroos occur

at varying densities over a range that occupies about 75% of the State (Figure 3) – an area of approximately 1.9 million km² (McNamara & Prince 1986).

Red kangaroos occupy a wide range of habitats including mulga and mallee scrub, shrubland, woodland, grassland and even desert (Caughley 1964; Russell 1974; Johnson & Bayliss 1981; Low *et al.* 1981; Short *et al.* 1983; Strahan 1995). However, Strahan (1995) and Russell (1974) describe a preference of this species for open plains habitat.

Many scientists consider that vegetation clearing, provision of artificial watering points and control of dingo (*Canis lupus dingo*) populations to facilitate the grazing of domestic stock in the pastoral zone have "improved" the habitat for red kangaroo and thus resulted in a general population increase from pre-European times (Russell 1974; Newsome 1975; Caughley *et al.* 1980; Squires 1982; Grigg 1982). Conversely, intensive agriculture is not regarded as beneficial to the species (Grigg 1982; Short & Grigg 1982). However, little red kangaroo habitat has been altered by intensive agriculture in Western Australia.

The red kangaroo is a herbivore; accordingly its role in the ecosystem can be defined as a primary consumer. Several detailed dietary studies have been undertaken on this species (Griffiths & Barker 1966; Chippendale 1968; Storr 1968; Bailey *et al.* 1971; Ellis 1976), with all indicating a preference for green herbage including grasses and dicotyledonous plants. Although they prefer to eat grasses and forbs, when these become scarce red kangaroos will switch to chenopods and black bluebush, and in some areas will even browse shrubs (Tyndale-Biscoe 2005).

The reproductive biology of red kangaroo has been thoroughly studied (Frith & Sharman 1964; Newsome 1964a, b, 1965b; Sharman 1964; Sharman & Pilton 1964). Females come into oestrus at approximately 35-day intervals and are therefore potentially fertile throughout the year. Periods of extreme drought, however, may lead to suppression of the oestrus cycle. Females can come into breeding condition almost immediately after drought-breaking rains. Pregnancy does not interrupt recurrence of oestrus. The female may give birth 33 days after mating and may mate again a day or two later. The embryo resulting from this post-partum mating remains a quiescent blastocyst until the previous young is about to leave the pouch or is lost prematurely – embryonic diapause (Pople & Grigg 1999).

Studies of behaviour and social organisation have been conducted by Caughley (1964) and Croft (1980). Red kangaroo is a gregarious species (Kirkpatrick 1967) and although relatively large groups may sometimes form, these groups are unstable in their composition (Croft 1980). The only enduring red kangaroo relationship is between the mother and her young. The mating system of the red kangaroo appears to be based on polygamy (Croft 1980).

Several studies have examined the movement patterns of red kangaroo (Frith 1964; Bailey 1971; Denny 1980; Croft 1980; Oliver 1986; Priddel 1987; Norbury & Norbury 1993; Norbury *et al.* 1994). These studies indicate that the majority of the population is relatively sedentary, moving distances of no more than 10 km, although a small proportion of animals may move tens or hundreds of kilometres. Individual home ranges have been found to overlap. In Western Australia Norbury *et al.* (1994) found that red kangaroos had very large home ranges and attributed this to the inherently poor vegetation production and the occurrence of drought during their study. These findings were quite different from those of Croft (1991) who studied red kangaroos during a non-drought period in better quality habitat.

The population dynamics of red kangaroo have been studied in detail with much of the information being derived from regular aerial surveys. These surveys provide a means of assessing the response of macropod populations to environmental conditions, particularly rainfall. Caughley *et al.* (1984),

working in New South Wales, found that the rate of increase in numbers was related to rainfall. Populations decreased when rainfall was approximately 90 millimetres below average and, except when rainfall was extremely high, increased when rainfall exceeded the 90 millimetres below average level. The maximum annual rate of increase was approximately 45 percent per annum, but under average rainfall, populations increased at 30-35 percent per annum. In poor conditions, populations declined at a maximum rate of 55 percent per annum. Robertson (1986) observed a 30 percent per annum decline in the red kangaroo population at Kinchega National Park in western New South Wales during the 1982-83 drought. Similar population changes have been observed in South Australia by Grigg (1982).

Red kangaroo is subject to predation by the dingo. Shepherd (1981) has made direct observations of dingo predation of red kangaroo, concluding that they prefer juveniles as prey and that the dingo might be able to limit the rate of increase of red kangaroo populations. Caughley *et al.* (1980) were more definite in their conclusions concerning dingo predation, and attribute the high densities of red kangaroo in the sheep country of South Australia, Queensland and New South Wales to the elimination of the dingo from these areas.

3.2.3. Western grey kangaroo (*Macropus fuliginosus*)

Eastern and western grey kangaroos have probably diverged from a common ancestor quite recently. Consequently, the biological and ecological differences between the two species are subtle. Indeed, the western grey kangaroo was only confirmed as a separate species from the eastern grey kangaroo in 1972 after detailed investigation of electrophoretic, serological, morphological and reproductive evidence (Kirsch & Poole 1967, 1972). Poole (in Strahan 1995) in reviewing information on western grey kangaroo commented that many aspects of the species' biology and ecology are so similar to the eastern grey kangaroo that they hardly needed to be described separately.

The western grey kangaroo is, perhaps, named inappropriately because the species actually occurs across the south of the continent, with a distribution extending northwards through western New South Wales and into a small area of southern central Queensland (Figure 4). This distribution corresponds to areas of aseasonal or winter rainfall (Caughley *et al.* 1987). Where the western grey kangaroo overlaps in its range with the eastern grey kangaroo, the latter is more abundant. Both species have similar habitat preferences and the western grey kangaroo has also benefited from pastoralism but been disadvantaged by intensive agriculture (Short & Grigg 1982).

Coulson and Norbury (1988) found that, like the eastern grey kangaroo, the western grey kangaroo feeds mainly on grasses. Norbury (1987), working in northwestern Victoria, found that they ate more than 75 per cent grass in a mixed pasture but, as pasture biomass declined, shifted to forbs and shrubs. Barker (1987) described a similar shift from forbs and grasses to shrubs for western greys feeding on pastures in western New South Wales and southern Queensland. This contrasted with red kangaroos and eastern grey kangaroos, which continued to feed on grasses and forbs as pasture biomass declined.

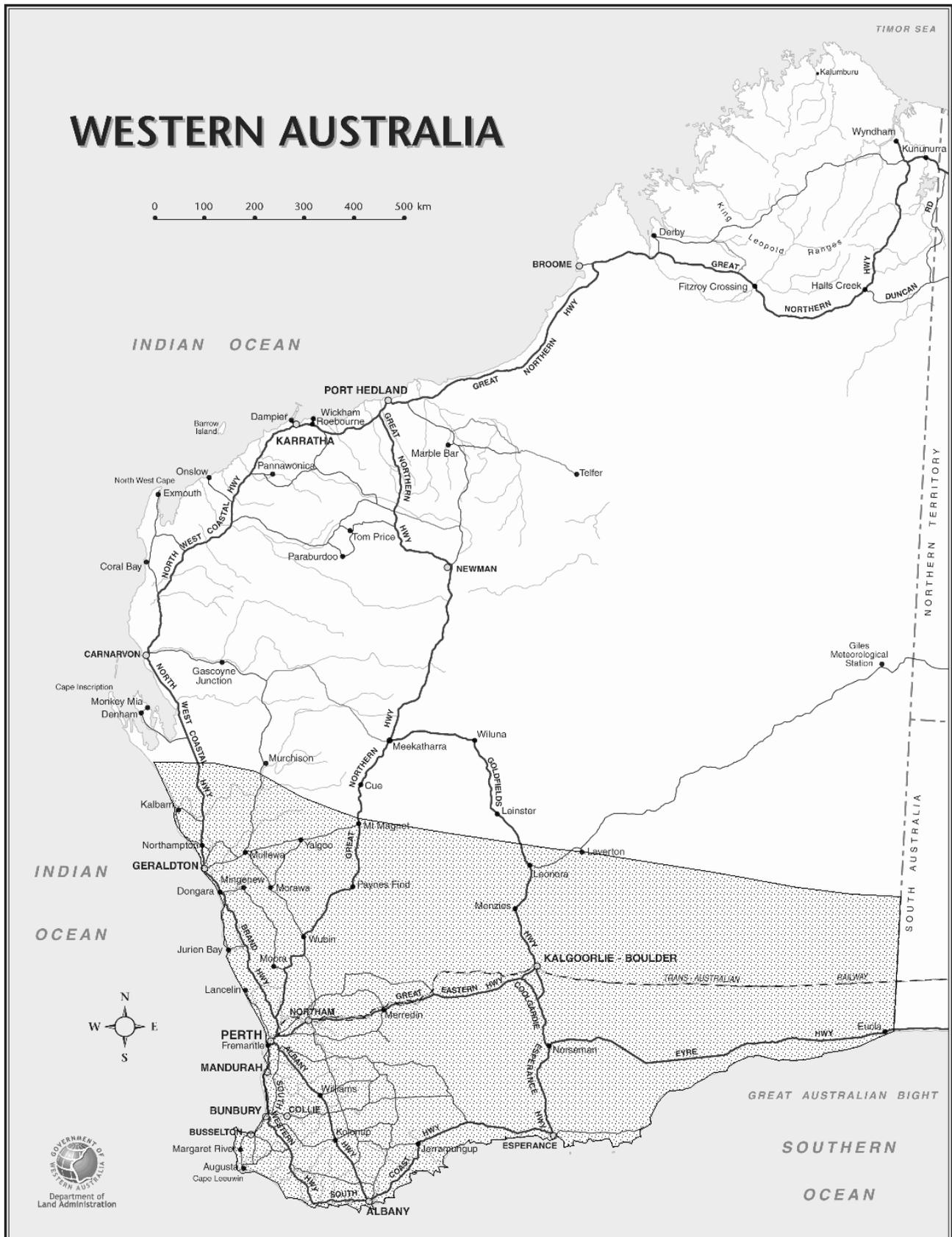


Figure 4. Distribution of the western grey kangaroo (*Macropus fuliginosus*) in Western Australia.

Reproductive biology of the western grey kangaroo shows some minor differences from eastern grey kangaroo: the mean lengths of oestrus cycle (35 days) and gestation period (30.5 days) are shorter, and the western grey kangaroo does not exhibit embryonic diapause (Poole, in Strahan 1995). Both eastern and western greys are less mobile than reds. Studies of eastern grey kangaroos by Jarman and Taylor (1983) and Jarman and Southwell (1986) indicate that the species occupies well-defined, highly overlapping home ranges. Few individuals have been shown to disperse, those that do being young males. Western greys were studied by Priddel (1987), Priddel *et al.* (1988a, b) and Arnold *et al.* (1989) and show the same general patterns, with individuals occupying relatively small home ranges that overlap extensively.

3.3. Conservation Status

The conservation status of the commercially harvested *kangaroo* species in Western Australia reflects their abundance and thus their utilization. No commercially harvested *kangaroo* species in Western Australia is listed as a threatened or endangered species under either State or Commonwealth legislation (Table 1). In addition, the World Conservation Union (IUCN) Red List of Threatened Species identifies all of the *kangaroo* species subject to commercial harvesting in Western Australia as Lower Risk, falling into the sub-category of Least Concern, which encompasses species that do not qualify for the conservation dependent and near threatened sub-categories (Table 1).

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is an international agreement between governments - including the Government of Australia - the aim of which is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES accords varying degrees of protection to more than 30,000 species of animals and plants, which are listed in the three CITES Appendixes. None of the *kangaroo* species commercially harvested in Western Australia is listed in the CITES Appendixes (Table 1).

Table 1. Conservation status of kangaroo species that are the subject of this management plan.

Instrument	<u>Kangaroo Species</u>	
	Red kangaroo	Western grey kangaroo
WA Government: <i>Wildlife Conservation Act 1950</i>	Not listed as <i>Specially Protected Fauna</i>	Not listed as <i>Specially Protected Fauna</i>
Australian Government: <i>Environment Protection and Biodiversity Conservation Act 1999</i>	Not listed as Threatened Fauna	Not listed as Threatened Fauna
2006 IUCN Red List of Threatened Species	Lower Risk/least concern	Lower Risk/least concern
Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Not listed	Not listed

3.4. Threats, Issues and Assessment of Impacts

In the context of commercial *kangaroo* harvesting in Western Australia:

- threats to the conservation status of harvested *kangaroo* species are limited;
- issues relating to the conservation and harvesting of *kangaroos* are well understood; and
- assessments of the impacts of harvesting on *kangaroos*, as well as other species, habitats and ecosystems, are comprehensive.

3.4.1. Threats and issues pertinent to the conservation status of *kangaroos*

The conservation of *kangaroos* in Western Australia is potentially threatened by a range of environmental and anthropogenic factors. Many of these potential threats – from drought and flood to disease and predation - are ecosystem and environmental processes beyond the control of DEC. Nevertheless, as evidenced by the scientific literature, these processes are not considered a long-term threat to the conservation of *kangaroos* (Table 2).

Potential anthropogenic threats to the conservation of *kangaroos* principally arise from the commercial harvest. However, in 36 years of commercial harvesting in WA, viable populations of the harvested *kangaroo* species have been maintained across their natural range and, moreover, the distributional ranges of red and western grey kangaroos have expanded. Accordingly, commercial harvesting is not considered a threat to the genetic integrity or conservation status of *kangaroos* in Western Australia (Table 2).

However, to ensure that the commercial *kangaroo* harvest in Western Australia remains sustainable and does not jeopardise the viability of *kangaroo* populations across their range in the future, DEC enacts a range of management controls, including:

(i). Undertaking regular and ongoing monitoring of kangaroo populations.

The strictly standardized survey techniques employed in Western Australia for the broad-scale monitoring and estimation of *kangaroo* populations are widely regarded as best practice, both in Australia and overseas (Caughley *et al.* 1976; Caughley & Grigg 1981; Anderson & Southwell 1995; Southwell *et al.* 1995; Pople 2004; Pople *et al.* 2006).

(ii). Managing the commercial harvest using a proportional harvesting strategy based on regular estimates of abundance.

Proportional harvesting strategies have been well studied and are considered safe and efficient for fluctuating populations (Caughley 1987a; Engen *et al.* 1997). Moreover, Western Australia's program of regularly monitoring and estimating abundance allows for any other agents of mortality acting on *kangaroo* populations to be detected and accounted for in the setting of annual commercial harvest quotas (e.g. animals lost through drought, disease, or road kill).

(iii). Using conservative and up-to-date species correction factors.

DEC employs correction factors - used in estimating *kangaroo* abundance from aerial survey data - which are generally regarded as conservative.

(iv). Setting commercial harvest quotas at levels that are considered ecologically sustainable for kangaroo populations.

Western Australia typically sets harvest quotas for red kangaroos at $\leq 20\%$ and for western grey kangaroos at $\leq 15\%$. These levels are regarded as ecologically sustainable (e.g. Caughley 1987a; Hacker *et al.* 2003, 2004), and have been demonstrably sustainable in practice. See Action 11 for additional information on quota setting.

(v). Providing refuge habitat.

In Western Australia, *kangaroos* usually cannot be commercially harvested in conservation reserves or State Forest, a total area in excess of 24 million hectares or approximately 9.8 percent of the State. The circumstances whereby *kangaroos* may be harvested from a conservation reserve or State Forest includes where such actions are deemed a *necessary operation* under the *Conservation and Land Management Act 1984* or where an area management plan specifies that the management of overabundant populations was warranted. A *necessary operation* would include such things as reducing overabundant populations to prevent environmental damage or unacceptable animal welfare outcomes such as starvation. Area management plans are approved by the Conservation Commission of WA, which is independent of DEC.

DEC also has limited management responsibilities for unallocated Crown land (UCL) and unmanaged reserves (UMR) outside the metropolitan area and townsites. The area of UCL and UMR for which DEC has limited management responsibilities totals about 90 million hectares. The commercial harvesting of *kangaroos* usually cannot be undertaken on UCL and UMR. Furthermore, the commercial *kangaroo* harvest is patchy within the Kangaroo Management Areas and individual properties leaving many other areas that are unharvested or provide refuge habitat (see Tenhumberg *et al.* 2004).

3.4.2. Assessment of the impacts of commercial *kangaroo* harvest on other species, habitats and ecosystems

Impacts on species, habitats and ecosystems resulting from actions detailed within this management plan are unlikely to be significant, and in many instances are expected to be positive (Table 3). The most notable issue identified in the assessment of impacts (Table 3) is the utilization of *kangaroo* harvest off-cuts by introduced predators, particularly foxes (*Vulpes vulpes*) and wild dogs. Read & Wilson (2004) suggested that *kangaroo* harvest off-cuts may sustain predator populations during periods of low prey availability. Maintenance of artificially high predator populations may in turn threaten prey populations, including endangered taxa (Saunders *et al.* 1995). However, in Western Australia the periods when natural prey populations are low usually corresponds with periods of below average rainfall. At such times *kangaroo* populations decline and *kangaroo* densities at the local scale decline dramatically. As a consequence, *kangaroo* harvesting also declines and the amount of *kangaroo* harvest off-cuts available to exotic predators declines reducing the likelihood of this food supply being able to sustain high densities of the predators.

Table 2. Threats and issues pertinent to the long-term conservation of kangaroos.

Threats	Comments	Selected References*
Drought	Rainfall via its impact on plant productivity is the single most important factor impacting on <i>kangaroo</i> populations and droughts can greatly reduce <i>kangaroo</i> numbers. However, <i>kangaroos</i> are well adapted to a dynamic environment and populations recover quickly after drought-driven population crashes, even with continued harvesting. Therefore drought is not considered a threat to the long-term conservation of <i>kangaroos</i> .	Bayliss (1987); Cairns & Grigg (1993); Cairns <i>et al.</i> (2000); Caughley <i>et al.</i> (1985); McCarthy (1996); Pople (2003); Pople <i>et al.</i> submitted; Robertson (1986).
Climate change	Shifts in climate regimes have the potential to significantly impact on all biodiversity including the commercially harvested species of <i>kangaroos</i> . How human-induced changes to the climate will manifest in the future is unknown at present. Modelling indicates that northern WA is likely to become warmer and wetter while south western WA warmer and drier. This will lead to variable responses across the landscape and is likely to benefit some populations and adversely impact on others. Since rainfall is the most significant factor influencing <i>kangaroo</i> densities, a persistent long-term drought caused by human-induced climate change has the potential to adversely impact on the long-term conservation of <i>kangaroos</i> . However, the methods used for setting harvest quotas are responsive to fluctuating densities of <i>kangaroos</i> and will alert managers to potential problems.	
Disease	A range of parasites and pathogens affect <i>kangaroo</i> populations. Epidemics have caused significant short-term reductions in <i>kangaroo</i> numbers in particular areas, however, these populations have recovered rapidly. Diseases do not appear to be important agents of mortality in <i>kangaroos</i> over the long-term and, therefore, are not considered to pose a threat to their conservation.	Caughley (1987a); Gilroy <i>et al.</i> (1999); Kirkpatrick (1985); Pople & Grigg (1999); Speare <i>et al.</i> (1989); Hooper <i>et al.</i> (1999); Reddacliff <i>et al.</i> (1999).
Flood	Flooding has been found to affect the short-term distribution and abundance of <i>kangaroos</i> and has been associated with occasional localized epizootics. Flooding is not considered a threat to the long-term conservation of <i>kangaroos</i> .	Choquenot (1991); Clancy <i>et al.</i> (1990).
Habitat loss and modification	The three largest species of <i>kangaroos</i> have benefited significantly from habitat modification, with numbers increasing and ranges extending due principally to the expansion of grasslands. Conversely, <i>kangaroo</i> numbers have generally declined where there is intensive agriculture, urbanisation or extensive clearing. However, despite more than 200 years of heavy exploitation and clearing of the land, the larger <i>kangaroos</i> have maintained their populations or increased in abundance and range. Accordingly, habitat loss and modification are not considered a threat to the long-term conservation of <i>kangaroos</i> .	Calaby & Grigg (1989); Dawson <i>et al.</i> (2004); Pople <i>et al.</i> submitted; Short & Grigg (1982).
Harvesting – general	In 36 years of managed harvest in Western Australia, viable populations of the harvested <i>kangaroo</i> species have been maintained across their natural range. Furthermore, the distributional ranges of red and western grey kangaroos have expanded. Therefore, harvesting is not considered a threat to the long-term conservation of <i>kangaroos</i> .	Cairns & Coombs (1992); Calaby & Grigg (1989); Dawson <i>et al.</i> (2004); Grigg & Pople (2001).

Table 2 (cont.). Threats and issues pertinent to the long-term conservation of kangaroos.		
Harvesting – genetic	Harvesting has the potential to alter the genetic structure and genetic diversity of a population. However, there is no empirical or modelled evidence of genetic impacts at current levels of <i>kangaroo</i> harvesting. Therefore harvesting is not considered a threat to the long-term genetic integrity of <i>kangaroo</i> populations.	Clegg <i>et al.</i> (1998); Hacker <i>et al.</i> (2003, 2004); Hacker & McLeod (2003); Hale (2001, 2004); Tenhumberg <i>et al.</i> (2002, 2004).
Predation	In some circumstances, dingoes (<i>Canis lupus dingo</i>) have been shown to limit <i>kangaroo</i> populations and there is increasing evidence for this species having a regulatory effect. Other predators such as European fox (<i>Vulpes vulpes</i>) and wedge-tailed eagle (<i>Aquila audax</i>) do not appear to exert much influence on the harvested species of <i>kangaroo</i> . Therefore, predation is not considered a threat to the long-term conservation of <i>kangaroos</i> .	Banks <i>et al.</i> (2000); Caughley <i>et al.</i> (1980); Corbert & Newsome (1987); Jarman & Denny (1976); Pople & Page (2001); Thompson (1992).

*Where applicable and/or available

Table 3. Impacts of the commercial kangaroo harvest on other species, habitat and ecosystems.

Potential Impacts	Comments	Selected References*
Land degradation caused by the erosion of soil	The commercial <i>kangaroo</i> harvest is unlikely to cause land degradation due to the erosion of soil. <i>Licensed kangaroo shooters</i> generally operate on pre-existing tracks and are reluctant to risk damage to their vehicles, especially punctured tyres, by traversing rough terrain. Moreover, <i>kangaroo</i> harvest off-cuts have been shown to contribute to soil nutrient retention and cycling, thereby improving soil quality.	Wilson & Read (2003).
Detrimental effects on water bodies, watercourses, wetlands and natural drainage systems	There is no evidence that suggests the commercial <i>kangaroo</i> harvest will have detrimental effects on water bodies, watercourses, wetlands and natural drainage systems.	
Vegetation clearing or modification	No vegetation is likely to be cleared or modified as a consequence of the commercial <i>kangaroo</i> harvest. The commercial harvest may however provide indirect benefits to vegetation by potentially contributing to an integrated approach to reducing total grazing pressure or facilitating the retention of vegetation that provides habitat for <i>kangaroos</i> by private landholders.	Fisher <i>et al.</i> (2004); Grigg (1988, 1995).
Detrimental effects on threatened flora species, populations or their habitats	There is no evidence that the commercial <i>kangaroo</i> harvest has a detrimental effect on threatened flora species, populations or their habitats.	
Endangering, displacing or disturbing native fauna, or creating a barrier to their movement	Native fauna is unlikely to be endangered, displaced or disturbed as a consequence of the commercial <i>kangaroo</i> harvest. Furthermore, the commercial harvest is unlikely to create a barrier to the movement of native fauna. Kangaroo harvest off-cuts are however utilized by species that scavenge such as birds of prey and corvids, thereby benefiting these species.	Read & Wilson (2004).
Detrimental effects on threatened fauna species, populations or their habitats	There is no evidence that the commercial <i>kangaroo</i> harvest has a direct detrimental effect on threatened fauna species, populations, or their habitats but there may be indirect effects on threatened fauna species and/or populations. However, such effects are not likely to be significant (see section on introduced predators below).	
Detrimental impacts on ecological communities of conservation significance	Ecological communities of conservation significance are unlikely to be impacted by the commercial <i>kangaroo</i> harvest.	
Positive effects on introduced predators	Kangaroo harvest off-cuts are utilized by introduced predators, particularly foxes (<i>Vulpes vulpes</i>) and may sustain populations of these predators during periods of low prey availability. Maintenance of artificially high predator populations may in turn threaten prey populations, including endangered taxa. However, given that harvest off-cuts are widely and randomly dispersed across the landscape and that predators such as foxes and wild dogs will typically consume the most abundant food source available, their impact on native fauna in areas subject to <i>kangaroo</i> harvesting is likely to be low..	Kay <i>et al.</i> (2000); Read & Wilson (2004); Saunders <i>et al.</i> (1995).

Table 3 (cont.). Impacts of the commercial kangaroo harvest on other species, habitat and ecosystems.

Potential Impacts	Comments	Selected References*
Positive effects on introduced herbivores	The commercial <i>kangaroo</i> harvest, by reducing <i>kangaroo</i> populations and thus competition, may allow populations of introduced herbivores such as goat (<i>Capra hircus</i>) and rabbit (<i>Oryctolagus cuniculus</i>) to increase. However, the limited magnitude of the reduction in <i>kangaroo</i> numbers coupled with ongoing pest animal control programs undertaken across Western Australia mitigates the potential positive effect on populations of introduced herbivores.	
Introduction and/or dispersal of invasive weeds	There is no evidence that the commercial <i>kangaroo</i> harvest contributes to the introduction and/or dispersal of invasive weeds more so than other land users.	

*Where applicable and/or available

4. GOALS AND AIMS

4.1. Goal

The overarching goal of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008 – 2012 is:

To maintain viable populations of *kangaroos* throughout their ranges in accordance with the principles of ecologically sustainable development.

The principles of *ecologically sustainable development* are defined in the *Environment Protection and Biodiversity Conservation Act 1999*.

In order to attain the overarching goal, this management plan has seven aims each of which encompasses a particular facet of *kangaroo* management. When the aims are combined, they set strategic directions for the management of the commercial *kangaroo* harvest in Western Australia.

Under each aim are one or more actions that detail both how the aim will be delivered and operational directions for *kangaroo* management. A range of performance indicators for each action have also been developed so that progress towards achieving the goal and aims of the management plan can be measured.

Throughout the life of this plan, performance indicators will be monitored annually with a major assessment and review at the end of the five-year term of the management plan.

4.2. Aims

The aims of this management plan are:

1. MANAGE THE COMMERCIAL KANGAROO INDUSTRY VIA LICENSING

Manage the utilization of *kangaroo* species in accordance with the provisions of the Wildlife Conservation Act and Regulations, Western Australian Government policies, the *Code of Practice for the Humane Shooting of Kangaroos* and this management plan.

2. ENSURE HUMANE TREATMENT OF KANGAROOS

Promote highest possible animal welfare outcomes and ensure that the commercial harvest of *kangaroos* under this plan is carried out in accordance with the *Code of Practice for the Humane Shooting of Kangaroos*.

3. MONITOR INDUSTRY COMPLIANCE

Monitor the *kangaroo* industry to ensure compliance with this management plan, licence conditions, the requirements of the Wildlife Conservation Act and Regulations and the *Code of Practice for the Humane Shooting of Kangaroos*.

4. MONITOR KANGAROO POPULATIONS

Monitor *kangaroo* populations and set commercial quotas to ensure *kangaroos* are utilized in accordance with the goal of the management plan. Direct and indirect monitoring will be undertaken in all areas where *kangaroos* are commercially harvested.

5. FACILITATE ADAPTIVE MANAGEMENT AND RESEARCH

Promote adaptive management experiments and studies using historical data from *kangaroo* industry returns and population data to improve our understanding of *kangaroos* and their interaction with environmental, social and economic systems. Facilitate research into other aspects of *kangaroo* ecology and/or harvest management as required to fill knowledge gaps.

6. UNDERTAKE PROGRAM REPORTING AND REVIEW

Undertake regular reporting and a final program review in consultation with relevant stakeholders to ensure that the management program is working as intended and that outcomes remain consistent with the goal of the management plan.

7. PROMOTE COMMUNITY AWARENESS AND PARTICIPATION

Promote greater understanding of the program through informed public and private sector participation in management of the commercial utilization of *kangaroos*.

5. MANAGEMENT ACTIONS AND PERFORMANCE INDICATORS

AIM 1: MANAGE THE COMMERCIAL KANGAROO INDUSTRY VIA LICENSING

In order to ensure that viable populations of *kangaroos* are maintained throughout their ranges, the commercial *kangaroo* industry in Western Australia is closely regulated via a range of licensing and tag procedures provided for under the Wildlife Conservation Act and Regulations. The legislative basis for licensing and licensing procedures is described in detail in Section 2.2.

ACTION 1: All relevant activities are licensed in accordance with the applicable Western Australian legislation and DEC policy.

All applications for licences relating to commercial *kangaroo* industry operations in Western Australia are to be assessed, processed and issued in accordance with the provisions of the *Wildlife Conservation Act 1950*, the *Wildlife Conservation Regulations 1970* and relevant DEC policy.

Performance Indicator 1: All licences relating to commercial *kangaroo* industry operations in Western Australia are assessed, processed and issued in accordance with Western Australian legislation and DEC policy.

2.5% of licences issued will be audited on an annual basis to ensure that:

- licences are being issued in accordance with the relevant legislation and policy;
- DEC procedures are being followed correctly;
- accurate information is being entered into appropriate databases; and
- licences are being assessed and issued appropriately.

The annual audits will be conducted randomly in DEC's central (and only) licensing office. This performance indicator is also a measure of success in the training of staff who approve and issue licences and the quality of application forms.

ACTION 2: Licence conditions are effective and reflect current Western Australian legislation, DEC policy and the goal and aims of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012.

To effectively and efficiently manage commercial *kangaroo* operations in Western Australia, licence conditions must be effective and consistent with Western Australian legislation, DEC policy and the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012. Accordingly, the standard licence conditions for each licence type will be reviewed, and where necessary amended, in response to changes in Western Australian legislation and/or DEC policy. Licensees will be advised of any changes to their licence conditions in writing.

Performance Indicator 2.1: Licence conditions are reviewed at least annually and where necessary amended.

Performance Indicator 2.2: Licensees are advised in writing of any changes to licence conditions within one month of such changes being approved by the Director of Nature Conservation or his delegate.

AIM 2: ENSURE HUMANE TREATMENT OF KANGAROOS

Animal welfare in *kangaroo* harvesting is of prime concern to DEC. The *Code of Practice for the Humane Shooting of Kangaroos* is the current nationally-endorsed animal welfare standard for the commercial harvest of *kangaroos*. Accordingly, compliance with this Code is required of the commercial *kangaroo* industry. Any approved subsequent code/s will similarly be adopted as the animal welfare standard for the commercial harvest of *kangaroos* in Western Australia. Conditions attached to *kangaroo* shooter's licences provide financial disincentives for shooting other than in accordance with the Code. Similar conditions apply to Processor's licences.

ACTION 3: DEC will work with the Western Australian Professional Kangaroo Shooters Association and any other shooter representative body to ensure that all *licensed kangaroo shooters* are competent to achieve standards of marksmanship consistent with the goal of the *Code of Practice for the Humane Shooting of Kangaroos*.

In order to ensure that the *kangaroo* harvest is humane, *licensed kangaroo shooters* are required to demonstrate they achieve a sufficient standard of marksmanship to meet the requirements of the *Code of Practice for the Humane Shooting of Kangaroos* prior to obtaining their licences. The accreditation program is a one-off practical test of marksmanship conducted by independent examiners who are registered with DEC. During the life of the plan, DEC will raise the matter of increasing the frequency of testing with the Kangaroo Management Advisory Committee.

Performance Indicator 3: All successful applicants for a *Licence to Take Kangaroos for Sale* must have completed the accredited test of marksmanship as a pre-requisite for being issued with a licence.

ACTION 4: DEC staff will monitor compliance with the *Code of Practice for the Humane Shooting of Kangaroos* by commercial *kangaroo* industry operators.

Authorized DEC officers undertake a mixture of targeted and opportunistic inspections of *licensed kangaroo shooters*, *registered chiller units* and all premises operated by *licensed kangaroo processors*. DEC does not tolerate breaches of the Code of Practice and, where *kangaroos* have been found to be taken other than in accordance with the Code, Caution Notices are issued or further prosecution action taken that may result in cancellation of licences and/or fines. This policy approach to animal welfare breaches demonstrates DEC's commitment to ensuring that the commercial harvest of *kangaroos* is humane.

Performance Indicator 4: All licensees who are found to have breached licence conditions relating to animal welfare are issued with Caution Notices or are prosecuted as appropriate.

ACTION 5: DEC will facilitate research into improving animal welfare outcomes associated with the commercial harvest of *kangaroos*.

DEC will work with external research organisations to identify and investigate animal welfare issues relevant to the commercial harvest of *kangaroos*. Such research may include aspects of the biology and ecology of *kangaroos* as they relate to the commercial harvest, or harvest techniques. Contributions by DEC may include funding and/or in-kind support such as the provision of harvest data.

Performance Indicator 5: Issues of significance associated with the animal welfare aspects of the commercial harvest are identified and where these are identified a research prospectus is prepared and distributed to universities and other research institutions during the life of this plan.

AIM 3: MONITOR INDUSTRY COMPLIANCE

Monitoring commercial *kangaroo* industry compliance with the provisions of Western Australian legislation, DEC policy, the goal and aims of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 and licence conditions is essential to effectively maintaining viable populations of *kangaroos* throughout their ranges and to ensure public confidence in the management of *kangaroos* in Western Australia.

ACTION 6: DEC staff will undertake a mixture of both targeted and opportunistic monitoring of compliance by commercial *kangaroo* industry licensees.

In order to assess industry compliance, authorized officers of DEC will, on both a regular and opportunistic basis, inspect *kangaroos* taken by *licensed kangaroo shooters* and all premises registered for processing *kangaroos*. The inspecting officers will check to ensure that the *kangaroos* have been taken in accordance with the Wildlife Conservation Act and Regulations, the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 and licence conditions. Assessments to ensure compliance with the current *Code of Practice for the Humane Shooting of Kangaroos* will be a priority.

Performance Indicator 6.1: On receipt of an application for a *Licence to Take Kangaroos for Sale*, the authorized DEC officer assessing the application will ensure that the applicant:

- has written permission from a landholder to shoot *kangaroos* on the landholder's property;
- holds a valid and current Western Australian Firearm Licence for a calibre of firearms prescribed in Schedule 1 of the *Code of Practice for the Humane Shooting of Kangaroos*;
- has completed an accredited test of marksmanship; and
- has completed the accredited course Australian Game Meat Hygiene and Handling run by New South Wales TAFE.

Performance Indicator 6.2: All *kangaroo* processing works in Western Australia are inspected at least annually during the life of this plan by authorized DEC officers to ensure compliance with Western Australian legislation and licence conditions.

Performance Indicator 6.3: All *registered chiller units* will be inspected over time in random inspections and all will be inspected at least once during the life of this management plan by authorized DEC officers to ensure compliance with Western Australian legislation

and licence conditions. A targeted investigation into all aspects of the kangaroo harvest and processing industry will be undertaken at least once every five years.

Performance Indicator 6.4: *Licensed kangaroo shooters' vehicles loaded with kangaroo carcasses* are inspected opportunistically during the life of this management plan to ensure compliance with Western Australian legislation and licence conditions, and the results of these inspections are documented.

ACTION 7: Activities not in accordance with the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 and Western Australian legislation will be investigated and, where an offence has been committed and it is appropriate, a Caution Notice issued or the offenders will be prosecuted as appropriate.

Investigation and prosecution of activities not in accordance with the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 and Western Australian legislation is essential for accountability and for maintaining public, industry and stakeholder confidence in the effectiveness of the plan as a mechanism for maintaining the viability of *kangaroo* populations, and thus the commercial *kangaroo* industry.

Performance Indicator 7: Reports of unlicensed activities and activities in breach of licence conditions are investigated to the fullest extent possible and, where sufficient evidence is available, offenders are issued with Caution Notices or prosecuted as appropriate.

ACTION 8: The accuracy of industry returns will be continually monitored during the life of this plan.

It is a licence condition that commercial *kangaroo* industry licensees submit monthly returns to DEC. The data obtained from these returns are essential for monitoring whether the industry is harvesting *kangaroos* within approved quotas and for reporting to the Commonwealth Government, industry and the public. In addition, the data from industry returns are utilized in indirect monitoring of *kangaroo* populations.

Performance Indicator 8: During the life of this plan, all incoming industry returns are scrutinized and discrepancies are investigated and resolved.

Auditing of industry returns encompasses manual assessment of returns, application of the customized licensing database utilized by DEC which includes numerous validation rules that assist in ensuring the integrity of data, and extensive verbal and written communication between DEC staff and industry operators.

ACTION 9: A compliance database will be maintained to support investigations, inspections and audits.

A compliance database for use in *kangaroo* management investigations, inspections and audits will be maintained for use by staff involved with *kangaroo* management. The database facilitates compliance reporting to the Commonwealth Government and other stakeholders and also easy access to information for relevant authorized DEC officers.

Performance Indicator 9: A compliance database is maintained.

Relevant compliance information stored in the customized database includes reports of alleged breaches of the Wildlife Conservation Act and/or licence conditions, investigation activities undertaken and outcomes of investigations. Data input is accurate and timely.

AIM 4: MONITOR KANGAROO POPULATIONS

Monitoring populations of commercially harvested *kangaroo* species, both directly and indirectly, is essential for maintaining viable populations of *kangaroos* throughout their ranges.

The two *kangaroo* species that are the subject of this management plan - *M. rufus* and *M. fuliginosus* - are widespread (see Figures 3 & 4) and abundant in their respective ranges in Western Australia. The combined 2006 population estimate in the commercial Kangaroo Management Areas for these two species was $\geq 1,163,000$ for red kangaroos and $\geq 1,473,000$ for western grey kangaroos.

A great deal is known about the biology of *kangaroos* including their habitats, distributions (Section 3), diets and reproduction, and this knowledge is continually improving. In particular, the reproductive biology of *kangaroos* has been researched extensively. While there are variations between the *kangaroo* species (e.g. gestation period, lactation period, interval between young and embryonic diapause), these are well understood and accounted for in the various quotas set for each species. In addition, there is abundant information from direct (periodic) and indirect (continuous both temporally and spatially) monitoring of *kangaroos*.

The commercial harvest of *kangaroos* is patchy throughout the Kangaroo Management Areas (see Figure 1). Even within a single property, the take can range from no harvesting in some areas to very high in others. In most circumstances *kangaroos* may move between areas that have different rates of harvesting. In densely vegetated country, the take can be restricted to established property tracks, resulting in the harvest being limited to relatively thin strips of land on the property. In other areas, the entire property may be accessible and subject to harvesting. Generally, commercial harvesting of *kangaroos* will be biased towards larger animals and therefore males. Historically, the commercial take in Western Australia has been male biased. Kangaroo mortality during drought is also male biased. Female-biased populations have been observed in unharvested areas. *Kangaroos* are polygamous and females will mate with available males. In a female-biased population, with favourable seasonal conditions, almost all females will have pouch young.

Results of aerial surveys conducted since the mid-1980s show that *kangaroo* populations fluctuate primarily in response to seasonal conditions, and in particular rainfall. However epidemic mortalities of *kangaroos* have been recorded, usually following flooding rain. Reports based on aerial surveys suggest significant short-term reductions in populations, greater than 50%, have occurred in some parts of Australia.

As illustrated in Section 3 of this plan, a wide range of literature relating to *kangaroos* and their management is currently available. Of particular relevance is a comprehensive review prepared for the Australian Government titled 'Commercial harvesting of kangaroos in

Australia'. This review is available on the Commonwealth Department of the Environment and Water Resources' website:

<http://www.deh.gov.au/biodiversity/trade-use/wild-harvest/kangaroo/harvesting/index.html>

It encompasses topics including the biology of the harvested *kangaroo* species, the effects of harvesting on *kangaroo* populations, animal welfare issues and the conservation status of the harvested *kangaroo* species.

ACTION 10: Aerial population surveys will be conducted annually, with each Population Monitoring Zone being surveyed on a triennial basis (see Figure 5).

There are three standard survey techniques that may be employed for direct monitoring of *kangaroo* populations.

1. Broad-scale aerial surveys from fixed-wing aircraft using strip transect sampling methodology (see Pople & Grigg 1999 for a description of standard aerial survey methods for estimating kangaroo populations). This technique is routinely used to obtain annual population estimates across Western Australia.
2. Medium/small-scale aerial surveys from a helicopter using strip transect sampling methodology. This technique is not routinely used in Western Australia because of the considerable area involved and the associated costs.
3. Small-scale terrestrial surveys using strip transect sampling methodology (see Buckland *et al.* 2001). This technique is rarely employed anywhere in Australia in this context due to the high associated costs.

Kangaroo population estimates obtained from aerial surveys (direct monitoring) will be used as the basis of setting commercial quotas following the procedures set out in this management plan.

Fixed-wing aircraft will be used to survey *kangaroo* populations. Survey lines have been established at regular intervals across the harvest region and the same lines are surveyed during the same season each survey period to allow comparison of results between years (Figures 5).

Each Population Monitoring Zone will be surveyed in full on a triennial basis. In the intervening years, a minimum of 6 standard monitoring blocks (one degree latitude by one degree longitude) will be surveyed in each of the other Population Monitoring Zones to provide an indication of trends in the populations of *M. rufus* and *M. fuliginosus*. The *M. fuliginosus* population in the south-western section of the southern Population Monitoring Zone will be surveyed annually to provide more detail on the trend in the population in this zone given the high degree of alienation this region has experienced as well as the greatly increased potential for the *M. fuliginosus* population to adversely affect high value primary production activities in the region.

For the two species that are the subject of this management plan - *M. rufus* and *M. fuliginosus* - the quota will be adjusted based on the most recent aerial survey population estimate (with adjustments for intervening rainfall and climatic conditions) that will inherently account for

all *kangaroo* mortality, including those unrelated to commercial use (i.e. disease, drought, flood, road mortality and non-commercial culling).

The annual population estimates will be calculated in the following manner:

1. For Population Monitoring Zones where broad scale aerial survey has been undertaken, the population estimate is calculated from the survey results using standard methodology. (2008 – Southern Zone; 2009 – Central Zone; 2010 – Northern Zone; 2011 – Southern Zone; 2012 – Central Zone.)
2. For Population Monitoring Zones where only monitor blocks have been surveyed, the population estimates will be calculated using the most recent broad scale survey results and corrected using a conservative adjustment for each year since the last broad scale survey. The conservative adjustment will be calculated according to the following schedule.

If the population estimate for a monitor block:	And annual regional rainfall for a zone is:	Then the adjustment to the previous population estimate for a population monitoring zone will be:
Increases	Above average	Increased by up to 50% of the indicated monitor block increase
Increases	Below average	Increased by up to 20% of the indicated monitor block increase
Decreases	Above average	Decreased from 100% to 50% of the indicated monitor block decrease
Decreases	Below average	Decreased by the same percentage as the monitor block decrease

Performance Indicator 10: Aerial surveys are undertaken annually in accordance with this plan.

ACTION 11: Commercial *kangaroo* harvest quotas will be set in accordance with the provisions of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012.

The commercial quota for a species is the maximum number of individuals that can be commercially harvested in a calendar year. Quotas will be set for each commercially harvested *kangaroo* species and allocated to each Population Monitoring Zone (Figure 5) based on the most current population estimate for that zone and using survey correction factors accepted at that time. The Commonwealth Government will be advised of the annual quotas prior to implementation, in order to obtain approval for the proposed level of harvesting and allow export of product. Any changes to Kangaroo Management Area boundaries (Figure 1) will be detailed in the quota submission to the Australian Government. The DEC retains the capacity to manage quotas at the Kangaroo Management Area level if required through the allocation of royalty tags and spatial and temporal closures in specific management areas and monitoring zones, without the need to prescribe set quotas for each Kangaroo Management Area each year.

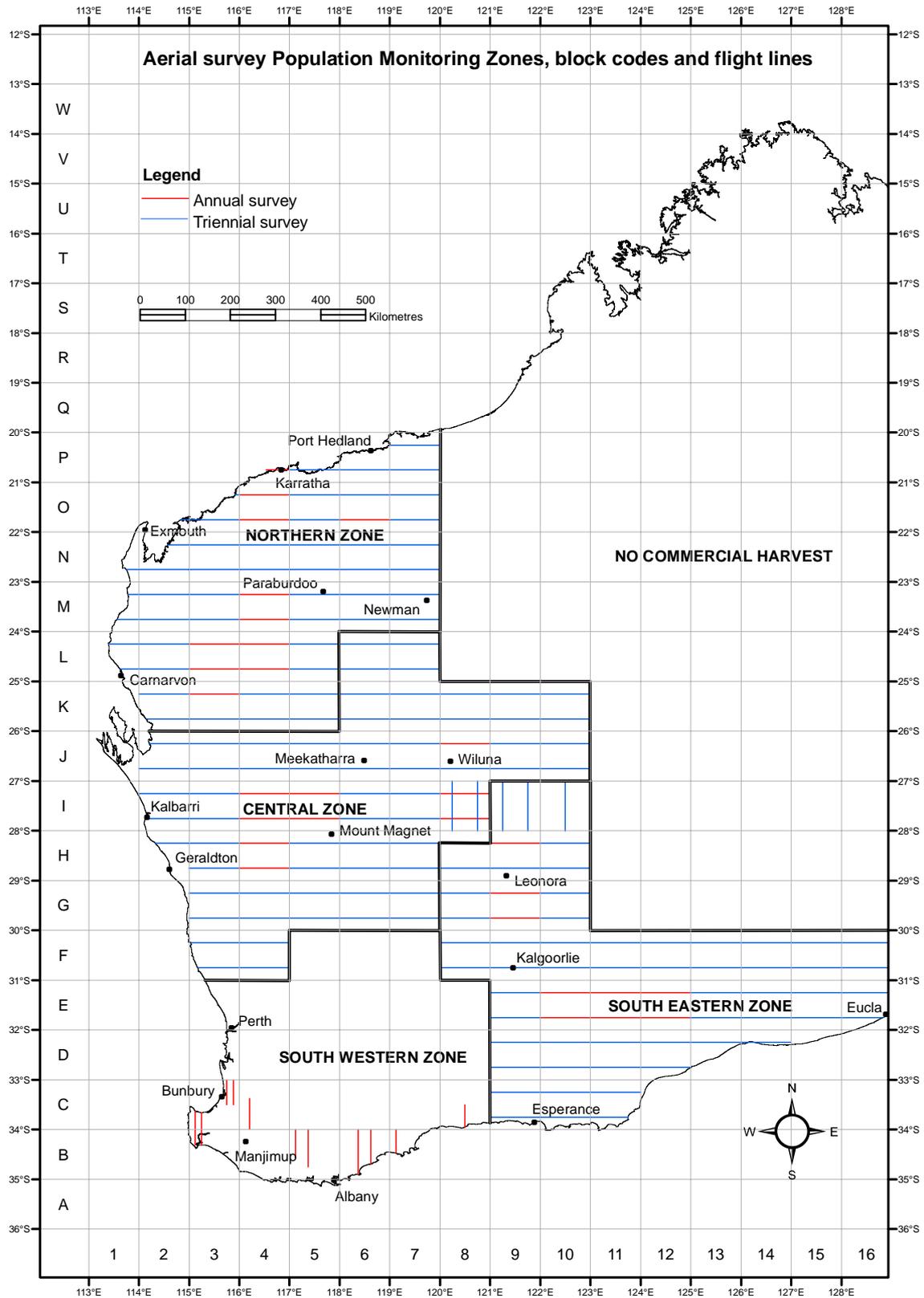


Figure 5. Aerial survey Population Monitoring Zones, block codes and flight lines in Western Australia. The Northern, Central and South Eastern Zones are surveyed on a triennial basis while the South Western Zone is surveyed annually. Blue flight lines are flown triennially and red flight lines are flown annually.

Table 4. Relationship between Population Monitoring Zones and Kangaroo Management Areas.

Northern Zone Management Areas	Central Zone Management Areas	South Eastern Zone Management Areas	South Western Zone Management Areas
Pilbara Ashburton East Ashburton West Carnarvon Gascoyne (west)	Murchison North Eastern Pastoral Gascoyne (east) Magnet Northern Agricultural Bay Pastoral Sandstone Yilgarn Western Coastal	Leonora Eastern Goldfields Coolgardie Dundas Nullarbor South Eastern Agricultural	North Eastern Agricultural Central Agricultural South Coastal South Western

Royalty tags are purchased from DEC each year by *licensed kangaroo shooters*. They are colour coded for each species of commercially harvested *kangaroo* – yellow for *M. rufus* and white for *M. fuliginosus*. Each tag has a year stamp and is individually numbered. The number of tags manufactured for any particular year will be sufficient to cover the quota for a particular species in that particular year. When the annual quota for a species has been reached in a Population Monitoring Zone, no additional royalty tags will be issued to kangaroo shooters operating in that Monitoring Zone until the following year.

Unless undertaken as part of an adaptive management experiment approved by the Commonwealth (see Action 15) or Special Quota (see Action 12), commercial quotas will be set at $\leq 20\%$ of the population estimate for red kangaroos and $\leq 15\%$ for western grey kangaroos. Not all *kangaroo* species are harvested in each Kangaroo Management Area (Figure 1). It is important to note that the most recent scientific information available is considered when determining annual quotas and that analysis of this information may result in quotas being decreased in order to maintain the viability of *kangaroo* populations and to meet the other objectives of this plan.

Performance Indicator 11.1: All commercial *kangaroo* harvest quotas are set in accordance with the provisions of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 throughout the life of the plan.

Performance Indicator 11.2: The Commonwealth Government is advised of commercial harvest quotas for the following calendar year by 30 November.

The Quota Submission will contain the following information:

- population estimates for each species in each Population Monitoring Zone and the method of survey used;
- quotas calculated as a proportion of the population estimate as per the approved Management Plan (including any Special Quota);
- any proposed changes to quotas; and
- charts showing trends in annual rainfall and population/quota/take.

Performance Indicator 11.3: If Commonwealth approval is required for quotas set above the rates specified in the plan as part of an adaptive management experiment, such approval is obtained before the additional quota is implemented.

Performance Indicator 11.4: Following approval by the Commonwealth, the quota submission will be made available to the public via DEC's website.

ACTION 12: Special kangaroo harvest quotas will be set in accordance with the provisions of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012.

A Special Quota for each species may be set annually at a maximum of 1.5% of the population estimate for that species. The special quota for a specific region can be higher but the total special quota for that species cannot exceed 1.5% of the population estimate for the commercial harvesting zone.

The sole purpose of the Special Quota allocations is to provide for commercial utilization of *kangaroos* that would otherwise be shot and left in the field under the normal non-commercial licensing system. The Special Quota will therefore minimize the number of *kangaroos* shot under non-commercial licences. The Special Quota can only be considered for release when the commercial quota for a particular Population Monitoring Zone has been fully issued. The use of the Special Quota will depend on one or more of the following:

- Climatic trends and conditions;
- Exceptional circumstance declarations; and
- *Kangaroo* population trends.

The decision on whether or not to make the Special Quota available at any particular time will be made by DEC in consultation with the Kangaroo Management Advisory Committee and the Commonwealth and consideration of these factors.

Special Quota allocations and the use of the Special Quota will be reported to the Commonwealth in the annual report and final review.

Performance Indicator 12: Special kangaroo harvest quotas are set and utilized in accordance with the provisions of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012.

ACTION 13: Kangaroo populations will be continually monitored indirectly throughout the life of this plan.

Indirect data on *kangaroo* populations will be obtained continuously throughout the life of this plan from *licensed kangaroo shooter* returns. Licensee returns detail the number of each species taken and data on average carcase weights, sex and location of take.

Ongoing monitoring of licence returns by DEC's Nature Protection Branch will identify significant changes in the average weights and sex ratios of harvested *kangaroos*, that can provide an indication of population health or selective harvesting.

Performance Indicator 13.1: Sudden or acute changes in the average weights of harvested *kangaroos*, as ascertained from licence returns, are investigated to determine where practicable the cause of the change.

If mean weights for any species (male and female separately) fall below the long-term mean by more than one standard deviation in any calendar year, or decadal means show a decreasing trend, weights will then be monitored quarterly in the following year and possible contributing factors examined. If necessary, management action will be taken to ensure the viability of the *kangaroo* population is maintained over the long term. Actions may include reducing or suspending the commercial harvest for that species in that zone, or increasing survey intensity at next survey.

Performance Indicator 13.2: Sudden or acute changes in the sex ratios of harvested *kangaroos*, as ascertained from licence returns, are investigated to determine where practicable the cause of the change.

The sex ratio of the harvest for each species is usually maintained at $\geq 50\%$ male for each calendar year. Where the sex ratio falls below 50% male, possible contributing factors will be examined. If necessary, management action will be taken to ensure the sustainability of the *kangaroo* population. Actions may include reducing or suspending the commercial harvest for that species in that zone, or increasing survey intensity at next survey.

AIM 5: FACILITATE ADAPTIVE MANAGEMENT AND RESEARCH

Adaptive management experiments and studies using historical data from *kangaroo* industry returns and population data are essential to improving our understanding of *kangaroos* and their interaction with environmental, social and economic systems and thereby effectively maintaining viable populations of *kangaroos* throughout their ranges. Research into particular aspects of *kangaroo* ecology or harvest management can also assist in ensuring that the commercial harvest is sustainable over the long term. While there has been a large body of research on the ecology and management of *kangaroos*, there are information gaps which, when filled, may lead to improved management of the commercial harvest.

ACTION 14: Historical data relating to the commercial *kangaroo* harvest in Western Australia will be analysed during the life of this plan to identify trends; this analysis will be considered in future *kangaroo* management programs.

Previous *kangaroo* management programs have generated a wide range of information relating to the commercial harvesting of *kangaroos* in Western Australia. This information will be analysed to provide data on trends in *kangaroo* populations, utilization rates, average weights and other specific information relating to either the commercial harvest or *kangaroo* populations generally.

The analysis of historical data relating to the commercial *kangaroo* harvest in Western Australia may be undertaken by a range of individuals or organisations including tertiary students, university professionals, consultants or DEC staff.

Performance Indicator 14.1: Analysis of historical *kangaroo* harvest and management data is undertaken during the life of this plan.

Data analysis research proposals must be accompanied by a project plan that clearly identifies the goals and objectives of the proposed research and outlines performance indicators that enable an assessment of the success (or otherwise) of the research.

Performance Indicator 14.2: The results of analysis and research using historical *kangaroo* harvest and management data are published in an appropriate forum.

Consideration of research findings and the results of any analysis are essential not only for the development of future management plans, but also for facilitating the adaptive management of *kangaroo* populations, which in turn will aid in maintaining viable populations of *kangaroos* throughout their ranges. The appropriate forum will vary according to the type of research or analysis. At a minimum, the results of any research undertaken using DEC data should be provided to DEC and, ideally, be made publicly available on DEC's website.

ACTION 15: Where practicable, management experiments will be performed to test deliberate management interventions during the life of this plan.

Under such active adaptive management, management activities are conducted as a deliberate experiment. Alternative strategies are viewed as treatments and are implemented through statistically valid experimental design; monitoring is the data-collection step of the experiment. Active adaptive management can establish cause-and-effect relationships between activities and changes in ecological conditions.

All proposals to undertake active adaptive management experiments will be reviewed by the Kangaroo Management Advisory Committee and will be critically assessed by DEC with reference to the following criteria:

- the proponents' awareness of relevant background information;
- whether the proposal considers alternative models and hypotheses;
- whether the proposal is scientifically rigorous and statistically valid;
- whether the proposal incorporates a monitoring program;
- that there is substantial evidence that the risk of permanent damage to *kangaroo* populations is low;
- that the proposal is consistent with the goal of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 and relevant Western Australian legislation; and
- that the proposal includes consideration of how management may be modified to accommodate the new knowledge gathered from the intervention.

All experiments that affect the commercial utilization of *kangaroos* must also demonstrate how the experiment provides for reasonable business planning and investment.

Performance Indicator 15.1: All proposals to undertake active adaptive management experiments are reviewed and assessed by DEC in accordance with the criteria outlined in this plan.

Performance Indicator 15.2: All necessary approvals are obtained prior to experiments testing deliberate management interventions commence.

In situations where experiments will impact on the overall commercial harvest quota DEC will seek approval from the Commonwealth Department of the Environment and Water Resources.

Performance Indicator 15.3: All adaptive management experiments are continuously monitored and conducted according to approval conditions.

As per the criteria outlined above, all active adaptive management experiment proposals must have monitoring programs incorporated. Monitoring programs must be maintained during the life of the experiment. All monitoring must be conducted in accordance with any conditions imposed with the approval.

Performance Indicator 15.4: Results of all experiments testing deliberate management interventions are published in an appropriate forum.

The appropriate forum for dissemination will vary according to the type of research and the target audience. However, it is expected that any research conducted as an active adaptive management experiment in accordance with the provisions of this plan will be made available to the Kangaroo Management Advisory Committee (KMAC – see Aim 6) and DEC for inclusion on DEC’s website.

ACTION 16: DEC will facilitate research into the ecology and harvest management of *kangaroos*.

DEC will work with external research organisations to identify and investigate issues relevant to the commercial harvest of *kangaroos*. Such research may include aspects of the biology and ecology of *kangaroos* as they relate to the commercial harvest, or harvest techniques. Contributions by DEC may include funding and/or in-kind support such as the provision of harvest data. During the life of this plan, priorities for research will include the relationship between the commercial harvest and *kangaroo* population structure in fenced environments.

Performance Indicator 16.1: During the life of this plan, significant issues associated with the ecology of harvested species and the management of the commercial harvest that are identified will be incorporated into a research prospectus and distributed, if required.

AIM 6: UNDERTAKE PROGRAM REPORTING AND REVIEW

Good management of the commercial *kangaroo* industry is essential for maintaining viable populations of *kangaroos* throughout their ranges. A program review and concomitant reporting is vital to evaluate the success of the plan in achieving its stated goal and aims as well as ensuring that managers remain fully informed.

ACTION 17: An annual report will be submitted to the Commonwealth.

An annual report detailing the operation of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 will be prepared and submitted to the Commonwealth. The report will provide information on the previous year’s harvest statistics, including the use of any Special Quota, and industry compliance.

Performance Indicator 17: An annual report will be provided to the Commonwealth by 31 March of the following year.

The annual report will include the following information:

1. Harvest statistics for each species taken in each Kangaroo Management Area (Figure 1) and then summarized by Population Monitoring Zone (Figure 5) including:
 - Numbers of *kangaroos* taken;
 - Sex ratio of the harvest;
 - Average body weights of harvested animals for each sex taken; and
 - Harvest effort.
2. Use of Special Quota including:
 - Whether or not any Special Quota was used;
 - Rationale for implementation of any Special Quota; and
 - Harvest statistics for any Special Quota utilized including numbers of *kangaroos* of each species taken for each Kangaroo Management Area and then summarized by Population Monitoring Zone.
3. Industry compliance statistics including:
 - number of premises inspected;
 - number of Caution Notices issued and reason for issue;
 - number of alleged offences investigated and outcomes;
 - number of prosecutions undertaken (offence and outcome); and
 - any joint surveillance/enforcement activities completed with other agencies.
4. Any unusual situations that arose (e.g. disease outbreaks, drought conditions, market factors, etc).

ACTION 18: A final review of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 will be undertaken at the end of the life of the Plan and a report submitted to the Commonwealth.

A review of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 will commence no later than twelve months prior to the expiry of the Plan and will assess the success of the Plan in achieving its goal. The review will also assist in the development and improvement of any subsequent plan. A final report detailing the operation of the Plan will be prepared and submitted to the Commonwealth. The report will provide information on quotas, harvest rates and surveys conducted during the term of the Plan. The report will also identify whether any adaptive management experiments were undertaken during the term of this plan. Finally, the review will audit plan aims against performance indicators so that progress towards achieving the goal of the management plan can be measured.

Performance Indicator 18.1: A final report on the operation of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 will be prepared during 2012, submitted to the Commonwealth by 31 March 2013 and posted on DEC’s website by 30 June 2013.

- The final report will include the following information for each year in the life of the Plan:
- Actual harvest for each species compared to quota;
 - Sex ratio and average weights for each species in each Kangaroo Management Area (Figure 1);

- Damage mitigation statistics for close season areas;
- Any research undertaken or sponsored by DEC; and
- An audit of plan aims against performance indicators;

AIM 7: PROMOTE COMMUNITY AWARENESS AND PARTICIPATION

The public profile of *kangaroo* management in Western Australia is high, in part due to the sometimes contentious nature of the commercial harvest, but also due to the large number of stakeholders involved in the commercial *kangaroo* industry. Consequently community awareness of and participation in *kangaroo* management is considered a key component to the success of the program, and thus the maintenance of viable populations of *kangaroos*.

ACTION 19: Members of the Kangaroo Management Advisory Committee will be provided with relevant information and afforded the opportunity to advise DEC on key *kangaroo* management issues throughout the life of this plan.

The Kangaroo Management Advisory Committee (KMAC), which is convened by DEC, is the main forum through which stakeholder group representatives can raise issues for discussion, as well as communicate their group's positions and interests to Government on a regular basis. Stakeholder groups presently represented on KMAC encompass the *kangaroo* industry, landholder groups, primary producers and government. Member organisations hold their appointed positions indefinitely. KMAC provides an opportunity for all stakeholder organizations to actively participate in directing the future development of the commercial *kangaroo* industry in Western Australia. During the life of the plan, DEC will raise the matter of including an animal welfare representative on KMAC for discussion.

Performance Indicator 19.1: KMAC meets at least once per year to review progress of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia 2008–2012 in relation to the goal and aims of the plan.

Performance Indicator 19.2: KMAC is provided with annual updates on commercial harvest and tag issue throughout the life of this plan.

Performance Indicator 19.3: KMAC is provided with other relevant information as required or as necessary throughout the life of this plan.

ACTION 20: Relevant public documents will be made available on DEC's website.

The provision of information to members of the public promotes understanding of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia and allows members of the community to form better-educated opinions regarding *kangaroo* management issues.

Performance Indicator 20: Throughout the life of this plan, DEC's website will contain the following information as a minimum standard:

- The current management plan;
- the current quota submission document;
- the current annual report submitted to the Commonwealth;
- information sheets on *kangaroo* biology and management; and

- relevant contact information.

Additional relevant information will be posted on DEC's website as available and appropriate.

ACTION 21: Publicly available information will be provided to interested parties on request.

The provision of information to members of the public promotes understanding of the Management Plan for the Commercial Harvest of Kangaroos in Western Australia and allows members of the community to form better-educated opinions regarding *kangaroo* management issues.

Performance Indicator 21: Publicly available *kangaroo* management information is distributed to interested parties as soon as practicable after such a request via:

- copies of this management plan
- Fauna Notes 29 and 31

ACTION 22: Where appropriate, relevant DEC staff will participate in media interviews and prepare media releases.

Participation in media interviews and the preparation of media releases can be an effective mechanism for communicating information regarding *kangaroo* management to a broad audience and, moreover, improves program transparency and accountability, and therefore public confidence.

Performance Indicator 22.1: Relevant DEC staff participate in interviews with the media where appropriate.

Performance Indicator 22.2: Media releases are prepared for issues of interest to the community when appropriate.

ACTION 23: Relevant information regarding licensing arrangements will be developed as required and distributed to all licensees.

Licensees and operators will be provided with written information relevant to their licensing arrangements to assist in achieving a high level of compliance with the licensing framework.

Performance Indicator 23: As a minimum, all *kangaroo* shooters who are issued with a *Licence to Take Kangaroos for Sale* for the first time, or who have not held a valid licence during the term of the current management plan, will be provided with written information on the following:

- pre-requisites for obtaining a licence
- licence conditions;
- regulations for taking *kangaroos* for damage mitigation;
- open and close season areas for red and western grey kangaroos;
- a copy of the *Code of Practice for the Humane Shooting of Kangaroos*; and
- Fauna Notes 29 (western grey kangaroo) and 31 (red kangaroo) and any revisions thereof that are available on the DEC website.

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APPENDIX 1:

Code of Practice for the Humane Shooting of Kangaroos

Endorsed by the Council of Nature Conservation Ministers

The Council of Nature Conservation Ministers (CONCOM) was composed of all Commonwealth, State and Territory Ministers having responsibility for national parks and wildlife. In July 1991 the CONCOM was amalgamated with the Australian and New Zealand Environment Council to form the Australian and New Zealand Environment and Conservation Council (ANZECC).

Addresses of government nature conservation agencies are found on page 5.



Department of the Environment and Heritage

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The Council of Nature Conservation Ministers (CONCOM) is composed of all Commonwealth, State and Territory Ministers having responsibility for national parks and wildlife. CONCOM is advised by a Standing Committee consisting of the Heads of Commonwealth, State and Territory Authorities responsible for national parks and wildlife matters.

This 'Code of Practice for the Humane Shooting of Kangaroos' has been prepared by the CONCOM Special Working Group on Cruelty Aspects of the Taking and Holding of Native Fauna. During the course of its preparation, drafts of the Code were circulated widely for public comment.

The Code sets an achievable standard of humane conduct and is the minimum required of persons shooting kangaroos.

Endorsed in principle by Council on 30 May 1985, the Code is intended to be implemented through education and State and Territory legislation as appropriate. This Code is based on the knowledge and technology available at the time of publication and may need to be varied in the light of new knowledge.

Since the code was originally published, there have been numerous comments on its value and suggestions on its improvement. In particular, the RSPCA and the National Advisory Committee on Kangaroos have recommended a number of changes. An ad hoc Working Group on the Code of Practice for the Humane Shooting of Kangaroos was formed to consider these suggestions and revise the code. The revised code was endorsed by CONCOM on 20 September 1990. Further comments are welcome, and should be forwarded to the Wildlife Management Section, Environment Australia - Biodiversity Group, GPO Box 787, CANBERRA ACT 2601.

INTRODUCTION

This Code of Practice has been produced to ensure that all persons intending to shoot a free-living kangaroo are aware of the welfare aspects pertinent to that activity. In this Code the term 'kangaroo' means all species of the family Macropodidae within the superfamily Macropodoidea and so applies to kangaroos, wallaroos or euros, wallabies and pademelons.

All shooting of kangaroos, whether on public or private land, is subject to law. The laws may differ between localities and the Government Wildlife Authority in the state or territory in which the shooting will occur can advise on the relevant provisions. Except where specifically exempted by law, states and territories will require the shooter to have a licence or permit issued by the Government Wildlife Authority and this Authority will specify any conditions or restrictions applying to that licence or permit.

When shooting a kangaroo the primary objective must be to achieve instantaneous loss of consciousness and rapid death without regaining consciousness. For the purposes of this Code, this is regarded as a sudden and painless death. Commonsense is required to assess the prevailing conditions. Where the conditions are such as to raise doubts about achieving a sudden and painless kill, shooting must not be attempted.

The Code is divided into three sections covering the method of shooting, despatch of injured kangaroos and pouch young and shooting for scientific purposes, and has three schedules specifying firearms, ammunition and points of aim. In each section an introduction provides background to the conditions which must be adhered to by all persons shooting kangaroos.

METHOD OF SHOOTING

The species of kangaroos which are shot differ in size and there is enormous variation in the terrain and prevailing weather conditions at the time of shooting. The combinations of firearms and ammunition are considered adequate to ensure a sudden and painless death for the target animal under most environmental conditions, provided that the shooting is done in accordance with the other conditions set out in this Code. However, it is the shooter's responsibility to ensure a sudden and painless death for target animals, and under unusual conditions firearms and ammunition that exceed the minimum requirements may have to be used.

With a centrefire rifle a sudden and painless death is consistently achieved by the projectile striking the brain of the target animal. Thus the brain is the required point of aim for this class of weapon. Centrefire rifles are specified for all kangaroo shooting except where the smaller wallabies are to be shot in or adjacent to forest or scrub. Such shooting is often carried out in daylight; the animals are flushed at close quarters and are unlikely to be stationary. In these cases the licence or permit issued by the Government Wildlife Authority may authorise the use of shotguns. At ranges up to the maximum specified in Schedule 1 a shotgun will cause a sudden and painless death if the pattern is centred on the head, neck or chest of the target animal. The shooter must be able to place a clear shot into one of these target areas whether the animal is moving or stationary.

Firearms

Conditions

- (i) The minimum specifications for firearms and ammunition are set out in Schedule 1. Kangaroos shall only be shot with a combination of firearms and ammunition that complies with or exceeds those minimum specifications.
- (ii) In the environmental conditions in which the shooter operates the combination of firearm and ammunition selected must ensure the sudden and painless death of each target animal. Evidence of compliance with the minimum specifications in Schedule 1 is no defence in administrative and/or legal proceedings concerning a breach of this Code if the combination used by the shooter has not achieved a consistently sudden and painless kill.
- (iii) Kangaroos must be shot using a centrefire rifle unless use of a shotgun is specifically allowed by the licensing authority.
- (iv) A rifle must be sighted in against an inanimate target before commencing each day's shooting.

Shooting platform

Conditions

- (i) Kangaroos must not be shot from a moving vehicle or other moving platform.

Target animal

Conditions

- (i) The target kangaroo must be clearly visible.
- (ii) When a rifle is used the target kangaroo must be stationary and within a range that permits accurate placement of the shot.
- (iii) When a shotgun is used the target kangaroo must be within the range specified in Schedule 1 and in a position where a clear shot can be fired at the head, neck or chest.

Point of aim

Conditions

- (i) A shooter using a rifle must aim so as to hit the target kangaroo in the brain (see diagram in Schedule 2), except in the case of an injured or wounded animal where a brain shot may be impractical.
- (ii) A shooter using a shotgun must aim so that, whether the target kangaroo is stationary or mobile, it will be hit in the head, neck or chest by the centre of the pattern.

INJURED KANGAROOS AND POUCH YOUNG

No matter how carefully the shooter aims, some kangaroos will not be killed outright. Wounded kangaroos must be dispatched as quickly and humanely as possible.

When killing a wounded animal a brain shot may be impractical. For example, the accurate placement of a shot in the brain may require capture and restraint of the animal; this would increase suffering and be inconsistent with the objective of sudden and painless death. In such circumstances a heart shot may be the most humane means of dispatch. In some special circumstances, where a wounded kangaroo is encountered, it may not be practicable to shoot the animal, as at a practical range the acceptable points of aim may be obscured, and at a close range the use of a high powered rifle may be unsafe. In these special circumstances a heavy blow to the skull to destroy the brain may be the most appropriate and humane means of dispatch.

Kangaroo shooters often shoot more than one kangaroo out of a group before driving to the carcasses to retrieve them. This is acceptable provided that where an individual kangaroo is wounded no further kangaroos are shot until all reasonable efforts have been made to dispatch the wounded animal.

Shot females must be examined for pouch young and if one is present it must also be killed. Decapitation with a sharp instrument in very small hairless young or a properly executed heavy blow to destroy the brain in larger young are effective means of causing sudden and painless death.

Larger young can also be dispatched humanely by a shot to the brain, where this can be delivered accurately and in safety.

Conditions

- (i) The shooter must be certain that each animal is shot dead before another is targeted.
- (ii) If a kangaroo is thought to be alive after being shot, every reasonable effort shall be made immediately to locate and kill it before any attempt is made to shoot another animal.
- (iii) When located, wounded animals must be killed by a method that will achieve a rapid and humane death, where practical by a shot to the brain.
- (iv) Under circumstances where a shot to the brain of an injured animal is impractical or unsafe, a shot to the heart is permissible (see Schedule 3).
- (v) In circumstances where, for dispatch of a wounded kangaroo, a shot to either the brain or heart is impractical or unsafe, a very heavy blow to the rear of the skull to destroy the brain (see Schedule 2) is permissible. To ensure a humane kill, a suitably hard and heavy blunt instrument must be used (e.g., metal pipe, billet of wood etc., carried for this purpose).
- (vi) If a female has been killed, the pouch must be searched for young as soon as the shooter reaches the carcass.
- (vii) The pouch young of a killed female must also be killed immediately, by decapitation or a heavy blow to the skull to destroy the brain, or shooting.

SHOOTING FOR SCIENTIFIC PURPOSES

Permits to shoot kangaroos for scientific purposes are sometimes requested. Because of the circumstances and locations in which such shooting may take place, and because of specific research requirements (e.g. to obtain anatomical items such as intact skulls for diagnostic examination and museum reference collections), it may be necessary to allow exemptions from the general conditions such as point of aim and shooting platform.

Such variations must never detract from the primary responsibility of the shooter to provide a sudden and painless death for the target animals.

Conditions

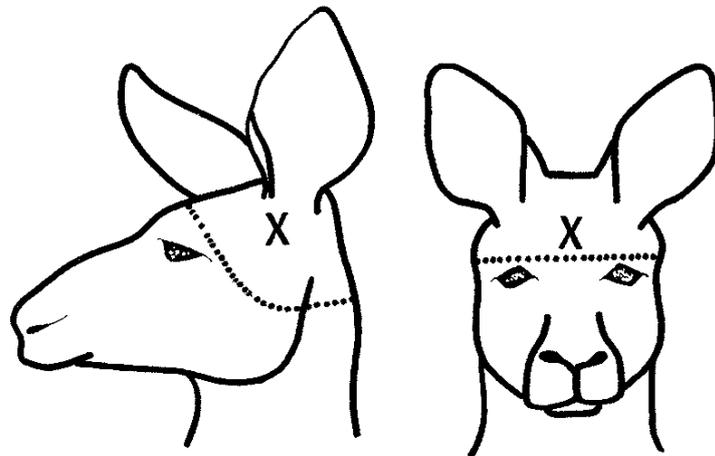
- (i) The provisions of this Code shall apply to the shooting of kangaroos for scientific purposes except where express provision to the contrary is included in the permit/licence under which the animals are shot.
- (ii) The licensing authority should only issue such a permit/licence if it is satisfied that;
 - (a) the Animal Care and Ethics Committee (or equivalent) at the relevant institution has examined and approved the proposal; and
 - (b) the method of shooting will result in sudden and painless deaths for the animals authorised to be killed.
- (iii) The waiving of any requirements of this code shall not relieve the shooter of the absolute requirement to provide a sudden and painless death for the target kangaroos.

SCHEDULE 1: Minimum Specifications for Firearms and Ammunition

(Note: Ammunition must be loaded to at least the specifications shown to ensure a sudden and painless death for the target animals)

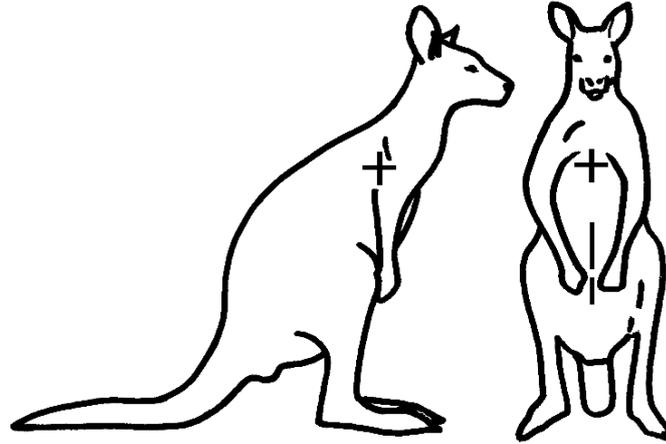
Species	Prescribed firearm and firearm/ammunition combinations
Group 1 Red kangaroo (<i>Macropus rufus</i>), Eastern grey kangaroo (<i>M. giganteus</i>), Western grey kangaroo (<i>M. fuliginosus</i>), Euro or wallaroo (<i>M. robustus</i>), Agile wallaby (<i>M. agilis</i>), Whiptail wallaby (<i>M. parryi</i>)	A centrefire rifle, fitted with a telescopic sight. Nominal bore size 0.569cm (0.224") and centrefire case capacity of at least .222 Remington. Ammunition shall have an expanding projectile (soft or hollow point) of not less than 324 mg (50 grains) and provide a minimum muzzle energy of 1542 Joules (1137 foot-pounds). [.222 Remington with 50 grain projectile must be loaded to achieve a muzzle velocity of 975 m/sec (3200 ft/sec) to achieve this minimum muzzle energy].
Group 2 All members of the family Macropidae other than those listed in Group 1.	a) A centrefire rifle fitted with a telescopic sight. Calibre and ammunition sufficient to achieve at least a minimum muzzle energy of 975 Joules (720 foot-pounds) {e.g. .22 Hornet; 45 grain projectile and loaded to achieve muzzle velocity (m.v.) of at least 2690 ft/sec, or .17 Remington; 25 grain projectile loaded to achieve m.v. of at least 3610 ft/sec}. or b) Shotguns of 12 gauge or larger, using No.2, 1, BB or larger shot. Maximum range for shotguns of 30 metres. Shotgun cartridges must be loaded to provide a dense and random pattern (e.g. 12 gauge cartridge requires a shot load no less than 36g = 1.25 oz = 63 BB shot pellets).

SCHEDULE 2: Point of Aim (X) for a Shot to the Brain and Location of the Brain. (All kangaroos)



Note: A shot to the side of the head is preferred as it is a larger target area.

SCHEDULE 3: Point of Aim (+) for a Shot to the Heart. (Applicable only as described for injured kangaroos and specified shotguns)



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APPENDIX 2: Assessment of the Management Plan for the Commercial Harvest of kangaroos in Western Australia 2008–2012 against the requirements of the Environment Protection and Biodiversity Conservation Act 1999.

SECTION 303BA: OBJECTS OF PART

(1) The objects of the Part are as follows:

(a) to ensure that Australia complies with its obligations under CITES and the Biodiversity Convention

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) implements Australia's obligations under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). CITES aims to ensure that trade in wildlife and wildlife products is ecologically sustainable. The EPBC Act requires that CITES specimens may only be imported or exported in line with CITES requirements.

No species subject to this management plan are listed under CITES. Additionally, none of the *kangaroo* species harvested in Western Australia (WA) is listed as threatened or endangered under WA or Commonwealth legislation or by the International Union for Conservation of Nature and Natural Resources (IUCN).

This management plan is consistent with Australia's obligations under the Convention on Biological Diversity as ecological sustainability is a primary aim of the plan. Further, ecological sustainability of commercial harvest is promoted via regular monitoring, the setting of harvest quotas at sustainable levels, and effectively monitoring take and people involved in the industry (e.g. through permit and tag procedures).

(b) to protect wildlife that may be adversely affected by trade

This management plan is consistent with this object as all *kangaroo* species covered by this plan are listed as common and there is sufficient regulation to ensure that trade will not adversely affect the species. In particular, there are permit and tag procedures in place to ensure that the commercial harvest of *kangaroos* is effectively regulated and enforced, and therefore will not be adversely affected by trade. For example, there is a compliance program (investigations, checks, inspections, returns) in place to ensure that the potential illegal take of *kangaroos* can be detected (Aim 3 of the plan).

(c) to promote the conservation of biodiversity in Australia and other countries

This management plan is consistent with the object as allowing for and managing a sustainable harvest of *kangaroos* will not impact on the conservation status of *kangaroos*. Reducing the grazing impact of these species is likely to assist in the conservation of biodiversity in WA.

(d) to ensure that any commercial utilization of Australian native wildlife for the purposes of export is managed in an ecologically sustainable way

This management plan is consistent with this object as the commercial harvest of *kangaroos* in WA will be conducted in an ecologically sustainable way by setting commercial quotas at levels considered sustainable for *kangaroo* populations. These quotas will be based on direct monitoring of *kangaroo* populations. The management of the commercial harvest has identified management controls and performance measures to ensure harvest levels remain sustainable and maintain *kangaroo* populations across

their entire range in WA. There are also management controls to ensure that harvest does not have irreversible negative impacts on the sex or size structure of *kangaroo* populations. There is a system of permits and enforcement in place for all involved in the commercial industry, from landholders through to processors, to minimise the amount of illegal take or non-compliance with permit conditions.

Further details on how the harvest is managed in an ecologically sustainable way are included in the advice on section 303FO(3)(c).

(e) to promote the humane treatment of wildlife

This management plan is consistent with this object as it requires shooters to comply with the *Code of Practice for the Humane Shooting of Kangaroos* (the Code) or any subsequent relevant nationally-endorsed Codes that replace that document. An Aim of the Plan is dedicated to animal welfare (Aim 2: Ensure humane treatment of kangaroos). Adherence to the Code is an enforceable condition under the licensing system.

Further details on how the management plan meets the animal welfare requirements of the EPBC Act are included in the advice on section 303FO(3)(f).

(f) to ensure ethical conduct during any research associated with the utilization of wildlife

This management plan deals with the commercial utilization of *kangaroos* and most *kangaroo* research falls outside the scope of this management plan. However the plan does refer to research that relates to the commercial harvest.

Action 16 of the management plan states that the WA Department of Environment and Conservation (DEC) will facilitate research by external research organisations into issues relevant to the commercial harvest of *kangaroos*. Areas of research may include aspects of the biology and ecology of *kangaroos* as they relate to the commercial harvest, or harvest techniques. Priorities for research will include the relationship between the commercial harvest and introduced and native animals. Necessary approvals by DEC, including animal care and ethics, are required prior to commencing any research.

(g) there is no subsection (g).

(h) to ensure that the precautionary principle is taken into account in making decisions relating to the utilization of wildlife

The precautionary principle as defined in the EPBC Act is that:

A lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible damage.

The management plan contains a range of measures that require a precautionary approach to be taken when decisions are made in relation to the harvest of *kangaroos*. These measures include:

- Conducting regular monitoring prior to the setting of commercial quotas.
- Setting quotas at levels considered sustainable for *kangaroo* populations.

- Collecting and analysing harvest returns to detect changes to sex bias or harvest rate, and conducting additional population surveys, and/or restricting or closing harvest when this is detected.
- Incorporating adaptive management into the commercial harvest of *kangaroos*.

(Aims 4, 5 and 6 of the plan).

SECTION 303FO: APPROVED WILDLIFE TRADE MANAGEMENT PLAN

(3) The Minister must not declare a plan under subsection (2) unless the Minister is satisfied that:

(a) the plan is consistent with the objects of this Part

The management plan is consistent with the objects of Part 13A of the EPBC Act. The details outlining this are presented in the previous section – Section 303BA: Objects of Part.

(b) there has been an assessment of the environmental impact of the activities covered by the plan, including (but not limited to) an assessment of:

(i) the status of the species to which the plan relates in the wild

This management plan includes an assessment of the status of the species covered in the plan. All species to which this plan relates are common and widespread in WA, and are not listed on State or Commonwealth threatened species schedules. (Sections 3.2 and 3.3 of the plan)

(ii) the extent of the habitat of the species to which the plan relates

This management plan includes an assessment of the extent of the habitat of the species. The extent of the habitat is represented by the current distribution of each species which is discussed in Section 3.2 of this plan. This management plan includes distribution maps for each species (Figures 3 and 4 of the plan).

(iii) the threats to the species to which the plan relates

This management plan includes an assessment of the threats to the long-term conservation of *kangaroos*. Threats to *kangaroos* are addressed in Section 3.4 and listed in Table 2 of the plan. These include: environmental impacts (particularly drought), habitat loss and modification, disease, predation and harvesting. Of these threats, drought is considered to be the most significant.

(iv) the impacts of the activities covered by the plan on the habitat or relevant ecosystems

This management plan includes an assessment of the impacts of the commercial harvest on habitat and ecosystems. The impacts are listed in Table 3 of the management plan. Impacts on habitat through commercial harvest are more likely to be positive than negative, due to a reduction in *kangaroo* grazing impacts. Reduction of grazing pressure is likely to lead to vegetation recovery, and/or conservation of biodiversity, although the extent to which *kangaroo* grazing impacts on vegetation is yet to be clearly quantified. Other impacts to ecosystems are considered unlikely due to the position of *kangaroos* in the food chain, and the low numbers of natural predators (particularly dingoes) in the main harvest area. There are potential impacts on feral populations such as foxes, through the provision of offcuts left in the field as a food resource. Maintenance of

artificially high predator populations may in turn threaten prey populations, including endangered taxa. However, given that the offcuts are widely and randomly dispersed across the landscape, it is unlikely that the commercial *kangaroo* harvest will significantly increase populations of introduced predators.

(c) the plan includes management controls directed towards ensuring that the impacts of the activities covered by the plan on:

- (i) a taxon to which the plan relates**
- (ii) any taxa that may be affected by activities covered by the plan**
- (iii) any relevant ecosystem (for example, impacts on habitat or biodiversity)**

are ecologically sustainable

There are management controls within this management plan to ensure that the impacts of commercial harvesting are ecologically sustainable to *kangaroos*, other species, habitats and biodiversity.

The commercial harvesting of *kangaroos* is presently restricted to the commercial Kangaroo Management Areas illustrated in Figure 1 of the plan. However, within the life of this plan, new commercial kangaroo harvesting areas may be opened following the completion of population surveys (Aim 4 of the plan).

The commercial harvest is controlled through the use of quotas. The commercial quotas represent an upper limit and are set at levels that are considered ecologically sustainable for *kangaroo* populations. Quotas are set on a regional basis and are based on a fixed percentage of the population estimate. Unless undertaken as part of an approved adaptive management experiment, commercial quotas will be set at $\leq 15\%$ of the population estimate for western grey kangaroos and $\leq 20\%$ of the population estimate for red kangaroos. Based on the population dynamics of the kangaroos, these quotas are considered sustainable over the long-term (Aim 4, Action 11).

The management plan includes provision for a Special Quota. Special quotas are set annually at a maximum of 1.5% of the population estimate for the commercial harvesting zone. The sole purpose of the Special Quota is to provide for the commercial utilization of *kangaroos* that would have otherwise been shot and left in the field under the normal non-commercial licensing system. The Special Quota can only be used when the commercial quota for a particular *kangaroo* management area has been fully issued. DEC will only use this option if there is a damage mitigation problem. The decision on whether to use the Special Quota will be made by DEC following consultation with the Kangaroo Management Advisory Committee and consideration of climatic trends and local conditions, exceptional circumstance declarations, and *kangaroo* population trends. See Aim 4, Action 12.

If within the commercial harvesting zone the Special Quota is fully utilized, then the total commercial harvest would be 16.5% of the population estimate for western grey kangaroos and 21.5% of the population estimate for red kangaroos. These harvest rates are not considered sustainable in the long-term but would not be detrimental in the short-term. Harvests at this level would be one-off to deal with a particular damage mitigation problem.

Special quota allocation and use of the Special Quota will be reported to DEH in the Quota Report and the Annual Report (Aim 4, Action 12).

This management plan includes provision for undertaking adaptive management experiments. All proposals to undertake active adaptive management experiments will be reviewed by the Kangaroo Management Advisory Committee and will be assessed by DEC. If the adaptive management experiment involves harvesting over the quota specified in the management plan then DEC will seek approval from DEW (Aim 5).

Licensed kangaroo shooters are issued with sequentially numbered lockable tags which must be attached to the *kangaroo carcass* before it is removed from the property (Section 2 and Aim 1). The tags enable accurate harvest monitoring.

Licensed kangaroo shooters and *licensed kangaroo processors* are required to submit monthly returns (Section 2.2). These returns will be audited and cross checked to monitor industry compliance with the management plan. DEC staff will undertake regular and opportunistic inspections of *registered chiller units*, *carcasses* and processing establishments. Reports of unlicensed activities or activities in breach of licence conditions will be investigated and appropriate action taken where there is sufficient evidence (Aim 3).

(d) the activities covered by the plan will not be detrimental to:

- (i) the survival of a taxon to which the plan relates;***
- (ii) or the conservation status of a taxon to which the plan relates; or***
- (iii) any relevant ecosystem (for example, detriment to habitat or biodiversity)***

The activities covered by this management plan will not be detrimental to the survival or the conservation status of the taxon to which the plan relates. The overarching goal of the WA management plan is to maintain viable populations of *kangaroos* throughout their ranges in accordance with the principles of ecologically sustainable development. This plan aims to ensure that the activities covered by the plan are not detrimental to the survival or conservation status of *kangaroos*.

Commercial quotas are set at a sustainable level and the harvest will not be detrimental. Refer to the discussion on the setting of quotas in the previous section.

The impacts of the harvest and other causes of mortality (e.g. road kill, disease) are determined regularly through direct monitoring of *kangaroo* populations. Results of direct monitoring are used as a basis for setting future quotas. For further details on direct monitoring refer to the discussion on section 303FO(3)(e).

Concerns have been raised by non-government organisations and members of the public that *kangaroos* are being over-harvested due to the increased mortality caused by the ongoing drought. The impact of the drought is taken into account as the quotas are based on population estimates which take into account total mortality.

During the years in which *kangaroos* have been harvested and monitored, *kangaroo* populations throughout Australia have demonstrated a strong capacity to recover from the regular occurrence of drought. For example, the drought of 1981-3 drove *kangaroo* populations in harvested areas down to almost half of the estimated pre-drought population, after which they recovered to exceed pre-drought figures within seven years. In response to the drought of the early 1990s in Queensland, *kangaroo*

populations also went through a period of decline, before recovering following good rainfall. Throughout this period, *kangaroos* in Queensland were harvested at rates close to 20%, demonstrating that the harvest did not impact on the *kangaroos*' natural ability to recover quickly following drought. It is anticipated that *kangaroo* numbers will increase again following the end to drought conditions across much of Australia.

Harvesting may reduce kangaroo numbers further than if no harvesting occurred during drought, however historical data clearly demonstrates that this does not impact on the long-term viability of *kangaroo* populations within the harvested areas of Australia.

As an added precaution, harvest returns are collected and analysed to identify significant changes in the average weights of harvested *kangaroos*. *Carcass* weights can provide an indication of population health as *licensed kangaroo shooters* generally target the larger animals and a significant decrease in average carcass weights could indicate a population under stress. Analysis of this data can detect potential changes earlier than the population surveys and can ensure that appropriate action is taken on a timely basis (Action 13 of the plan). For details on the actions to be taken in the event of a significant change refer to the discussion on section 303FO(3)(e)(iii).

Genetic impacts of harvest have been assessed briefly in Table 2 of the management plan and are not considered likely due to the size and extent of the harvest in WA compared to the size and extent of *kangaroo* populations. Illegal take and non-compliance with permit conditions is minimized through the presence of permit and tag procedures for the industry, and the presence of a compliance program to enforce the management plan.

The activities covered under this management plan will not be detrimental to the ecosystem. Potential negative impacts to habitat or ecosystems are considered unlikely and have been considered in the discussion on section 303FO(3)(b)(iv) and also in Table 3 of the plan.

(e) the plan includes measures:

(i) to mitigate and/or minimize the environmental impact of the activities covered by the plan

This management plan contains measures to mitigate and minimize the environmental impact of the activities covered by the plan. Refer to discussion under section 303FO(3)(c).

(ii) to monitor the environmental impact of the activities covered by the plan

Aim 4 of the plan addresses the requirement to monitor the environmental impact of the activities through a program of direct and indirect monitoring of the commercial harvest.

Action 10 states that there are three standard survey techniques that may be employed for direct monitoring of *kangaroo* populations.

1. Broad-scale aerial surveys from fixed-wing aircraft using strip transect sampling methodology (see Pople & Grigg 1999 for a description of standard aerial survey methods for estimating *kangaroo* populations). This technique is routinely used to obtain annual population estimates across Western Australia.

2. Medium/small-scale aerial surveys from a helicopter using strip transect sampling methodology. This technique is not routinely used in Western Australia because of the considerable area involved and the associated costs.
3. Small-scale terrestrial surveys using strip transect sampling methodology (see Buckland *et al.* 2001). This technique is rarely employed anywhere in Australia in this context due to the high associated costs.

Action 13 of the plan states that *kangaroo* populations will be continually monitored indirectly throughout the life of this plan. Ongoing monitoring of licence returns will identify significant changes in the average weights of harvested *kangaroos*, which, for example, can provide an indication of population health. If mean weights for any species (male and female separately) fall below the long-term mean by more than one standard deviation in any calendar year, or decadal means show a decreasing trend, weights will then be monitored quarterly in the following year and possible contributing factors examined. If necessary, management action will be taken to ensure the viability of the *kangaroo* population is maintained over the long term. Actions may include reducing or suspending the commercial harvest for that species in that zone, or increasing survey intensity at next survey.

(iii) to respond to changes in the environmental impact of the activities covered by the plan

This management plan is able to respond to changes in the environmental impact of the activities covered by the plan.

Quotas are set as a fixed percentage of the population estimate and will change when the population changes (Action 11 of the management plan). The Special Quota enables DEC to respond to specific damage mitigation needs of landholders (Action 12 of the management plan).

Ongoing monitoring of licence returns will identify significant changes in the average weights of harvested *kangaroos*, which can provide an indication of population health. If necessary, management action will be taken to ensure the viability of the *kangaroo* population over the long term. Actions may include reducing or suspending the commercial harvest for that species in that zone, or increasing survey intensity at next survey (Action 13 of the management plan).

(f) if the plan relates to the taking of live specimens that belong to a taxon specified in the regulations - the conditions that, under the regulations, are applicable to the welfare of the specimens are likely to be complied with.

Regulation 9A.05(2) limits this subsection to mammals, amphibians, reptiles and birds. *Kangaroos* are mammals and therefore the management plan must meet any applicable animal welfare requirement.

Regulation 9A.05(4) set out the conditions that are to be complied with:

(a) the animal is taken, transported and held in a way that is known to result in minimal stress and risk of injury to the animal; and

Regulation 9A.05(4)(a) is not applicable, as the *kangaroos* are killed in the field.

(b) if the animal is killed, it is done in a way that is generally accepted to minimize pain and suffering.

Section 2.2 of the management plan describes the WA licensing framework and Aims 2 and 3 detail animal welfare and compliance requirements. Compliance with the current *Code of Practice for the Humane Shooting of Kangaroos* (the Code) or any subsequent such code is a licence condition for *licensed kangaroo shooters*. The Code requires that *kangaroos* should be shot in the head and *licensed kangaroo processors* are prohibited from purchasing the *carcass* of a *kangaroo* that has been shot elsewhere as a condition of their licence (section 2.2).

The Code was developed co-operatively by the State, Territory and Federal environmental agencies, and sets out a minimum achievable standard of animal welfare. A working Group of the Natural Resource Management Ministerial Council (NRMMC) is conducting a review of the Code. There are been delays in progressing the review but it is hoped that a revised Code will be finalized in 2007.

The Code is referred to in a Note to Regulation 9A.05, implying that Parliament accepts that *kangaroos* killed in accordance with the Code have been killed in a way that is generally accepted to minimize pain and suffering.

In addition, the EPBC Act must also be satisfied that the welfare conditions are likely to be complied with. This management plan includes controls/measures that make this likely. All commercial shooters must have successfully completed accredited competency testing in marksmanship. If a *licensed kangaroo shooter* has not previously done so, they must successfully complete the NSW TAFE course 5725 – Australian Game Meat Hygiene and Handling or equivalent before being issued with a licence. *Licensed kangaroo shooters* are skilled and it is in their interest to ensure that *kangaroos* are killed quickly and humanely.

Licensed kangaroo processors are prohibited from buying the *carcasses* of *kangaroos* that have not being killed with a single shot to the brain and are periodically inspected by Wildlife Officers to check for compliance with the Code and Western Australian legislation. The tagging system enables DEC to track a *carcass* back to the individual shooter. All breaches of licence conditions relating to animal welfare result in the issuing of a written caution or prosecution.

(g) such other conditions (if any) as are specified in the regulations have been, or are likely to be, satisfied.

This subsection is not applicable for the approval of this management plan. No other conditions are specified in the *Environment Protection and Biodiversity Conservation Amendment Regulations 2001*.

(4) In deciding whether to declare a plan under subsection (2), the Minister must have regard to:

(a) whether legislation relating to the protection, conservation or management of the specimens to which the plan relates is in force in the State or Territory concerned; and

(b) whether the legislation applies throughout the State or Territory concerned; and

(c) whether, in the opinion of the Minister, the legislation is effective.

In Western Australia all native fauna, including the commercially harvested species of *kangaroos*, are protected under the *Wildlife Conservation Act 1950*, which is administered by the Department of Environment and Conservation (DEC). The commercial utilization of protected fauna requires the issue of a licence under Regulation 6 of the *Wildlife Conservation Regulations 1970*. The commercial harvest of kangaroos in WA is regulated via the issue of various licences and royalty tags under provisions of the *Wildlife Conservation Act 1950* (Section 2.2 of the plan). This legislative framework applies to the entire State of Western Australia.

DEW considers the State legislation to be effective in protecting, conserving and managing *kangaroo* populations in WA.