NSW SCIENTIFIC COMMITTEE

Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to REJECT a proposal to list the Red Kangaroo *Macropus rufus* (Desmarest 1817) as a Vulnerable species in Part 1 of Schedule 2 of the Act. Rejection of nominations is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. *Macropus rufus* (Desmarest 1817) (family Macropodidae), known as the Red Kangaroo, is a large, highly sexually dimorphic macropod. Head-body to 1400 mm (males), 1100 mm (females); tail to 1000 mm (males), 900 mm (females); weight to 92 kg (males), 39 kg (females). The fur is dense and short. Males typically brick red and females blue-grey dorsally; both sexes off-white to cream ventrally and on lower limbs and tail. However, blue-grey males, red females and intermediate individuals also occur. Head blue-grey, with black and white markings on side of short square muzzle, broad pale cheek stripe to the base of the long pointed ears. Forepaws and toes dark brown to black (Menkhorst and Knight 2001; Johnson 2006; Croft and Clancy 2008).

2. *Macropus rufus* is endemic to Australia and is widely distributed across the continent, from the Western Australian coast to western New South Wales (NSW) and Queensland. No subspecies are recognised (Menkhorst and Knight 2001; Johnson 2006; Croft and Clancy 2008). *Macropus rufus* occurs in arid and semi-arid areas (annual rainfall < 500 mm; Caughley *et al.* 1987b) inhabiting grassland, shrubland, woodland and dry open forest. Individuals typically avoid steep and rocky areas (Menkhorst and Knight 2001; Johnson 2006; Croft and Clancy 2008; Dawson 2012).

3. *Macropus rufus* is mostly nocturnal or crepuscular, spending the day resting in a shallow scrape dug in the shade of vegetation (usually a shrub or small tree). Individuals become active in the late afternoon or early evening and feed throughout the night (Croft 1981; Croft and Clancy 2008; Dawson 2012). *Macropus rufus* is a specialist grazer, with short green grass or forbs preferred but in periods of low rainfall dry grass and forbs and some browse is consumed (Bailey *et al*. 1971; Ellis *et al.* 1977; Croft and Clancy 2008). Red Kangaroos are efficient in their use of water and typically only need to drink every 1-2 weeks in summer. Individuals often travel 10-20 km to access water and may venture outside their normal home range to drink (Croft and Clancy 2008; Dawson 2012).

4. *Macropus rufus* is gregarious, typically occurring in small fluid groups of 3-5 individuals (Croft 1981; Dawson 2012). However, individuals will also aggregate into larger mobs (>20) where food is abundant, at water sources or during drought (Pople *et al.* 2007; Dawson 2012). Home ranges are large, averaging 774-2,614 ha (Priddel *et al.* 1988a; McCullough and McCullough 2000), with males having larger home ranges than females. Although many individuals are largely sedentary, local movements of 10-15 km are common and some individuals make larger movements of 50 to over 300 km in response to changes in resource abundance (Priddel *et al.* 1988b; Pople *et al*. 2007; Dawson 2012). Local population sizes are known to fluctuate widely with seasonal conditions,

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with densities reaching as high as 30 per km^2 (Caughley *et al.* 1984; Bayliss 1985a, b; Croft and Clancy 2008).

5. *Macropus rufus* breeds continuously, with females monovular and polyoestrus (Tyndale-Biscoe and Renfree 1987). A single young, born after a gestation period of about 33 days, spends around 8 months in the pouch and is weaned at about 12 months (Sharman and Calaby 1964). Females come into oestrus and mate shortly after giving birth (post-partum oestrus)o0 with the resultant blastocyst held in suspended animation (i.e. embryonic diapause) until the suckling stimulus of the incumbent young is reduced (Tyndale-Biscoe and Renfree 1987). Development of the blastocyst then recommences with a young being born about the time the incumbent young is permanently evicted from the pouch (Sharman and Calaby 1964). Breeding may be reduced or paused during prolonged drought (Newsome 1965). Females reach sexual maturity from 15 months and males from 24 months (Sharman and Calaby 1964). The generation time is estimated to be 7-10 years (Dawson 2012).

6. *Macropus rufus* is not listed as threatened under the Commonwealth *Environmental Protection and Biodiversity Conservation Act* 1999 and is listed as 'least concern' by the IUCN (2013) due to its wide distribution, large population, occurrence in protected areas and lack of major threats. In some areas *M. rufus* is regarded as an agricultural pest and periodic local culling is undertaken (Calaby and Grigg 1989; DOE 2012). The species is also commercially harvested in NSW, Queensland, South Australia and Western Australia (DOE 2012).

7. In assessing potential changes in the number of *Macropus rufus* in NSW over the last three generations (21-30 years), survey data from the NSW Office of Environment and Heritage (OEH) Kangaroo Management Program (KMP) (Payne 2013) has been used as an index of abundance. Aerial surveys (light plane) for *M. rufus* are conducted annually for the KMP and cover almost the entire range of the species in NSW (Croft and Clancy 2008). There are a number of limitations associated with the interpretation of these data including changes in both methodology and areas surveyed (Payne 2013). Directly comparable data exist for 0.4-0.6 of the three generation (21-30 years) length, from 2001 to 2012 (Payne 2013). From 2001 to 2012 these data show a decline and then an increase in *M. rufus* abundance (Payne 2013). It is well established that numbers of large kangaroos fluctuate widely primarily in response to seasonal conditions but also as a consequence of animal movements and other factors (Caughley *et al.* 1984; Bayliss 1985a, b; Caughley *et al.* 1987a; Cairns and Grigg 1995; Pople 2006; Pople *et al.* 2007, 2010a; Dawson 2012; Letnic and Crowther 2013). For example, at a site in western NSW the density of *M. rufus* varied between 1 and 37 per km^2 (Bilton and Croft 2004). After the previous decade (2001-2010) there has been drought conditions throughout most of NSW, it is unsurprising that the index of abundance of *M. rufus* has declined during that period. With the breaking of the drought in 2010/11 a subsequent increase in *M. rufus* abundance has occurred (Payne 2013). As there is no consistent long-term trend in the index of abundance of *M. rufus* in NSW, there is currently no evidence of an ongoing decline of *M. rufus* in NSW.

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8. Location records for *Macropus rufus* from the Atlas of Living Australia (ALA May 2013) may give a guide to change in geographic distribution over the last three generations. However, for *M. rufus*, some 30% of records are pre-1982 and these records only cover a subset of the current distribution. 70% of records are post-1982 and these cover the full extent of the distribution of *M. rufus* in NSW. Consequently, there are not sufficient records to form a baseline for inferring any change in the last three generations. Hence no inference about changes in geographic distribution of *M. rufus* can be made from these data. However, data collected between 1992 and 2001 from annual aerial surveys indicate that *M. rufus* has expanded its range eastward into more mesic areas of NSW, mostly likely in response to land clearing (Pople *et al.* 2010).

9. There have been changes to the habitat quality for *Macropus rufus* in NSW since European settlement of Australia (reviewed in Calaby and Grigg 1989; Olsen and Braysher 2000). Some habitat is likely to have been lost to cropping, urbanisation and other infrastructure. However, large areas have been converted from woodland/open forest to more open and grassy habitat favoured by *M. rufus* (Pople *et al.* 2010a). The addition of water points for domestic stock and the suppression of dingoes is also likely to have increased the carrying capacity of western NSW for *M. rufus* (Olsen and Braysher 2000; Letnic and Crowther 2013); with the NSW sheep rangelands now supporting the highest densities of *M. rufus* in Australia (Caughley *et al.* 1987a; Croft and Clancy 2008). In contrast, heavy grazing by domestic stock around watering points (i.e. piospheres) and other areas will have decreased local habitat quality in some parts of the arid and semi-arid zones (James *et al.* 1999). There are insufficient data for the last three generations to infer an overall reduction in habitat quality across the range of *M. rufus* in NSW.

10. There is no evidence of a reduction in genetic diversity in *Macropus rufus* in NSW. Hale (2004) found no evidence kangaroo harvesting resulted in loss of diversity in *M. rufus*, although this study did not include sampling in NSW and examined a small number of loci. Another population genetic study of *M. rufus* identified high levels of diversity throughout its range (Clegg *et al.* 1998). This study was not directly designed to test the impact of harvesting but samples were collected from harvested populations.

11. The geographic distribution of *Macropus rufus* in NSW is not considered to be moderately restricted. Based on records in Atlas of Living Australia (May 2013), the extent of occurrence (EOO) for *M. rufus* was estimated to be approximately 469,000 km^2 covering the distribution of the species in NSW, while excluding records east of the following Bioregions: Riverina, Cobar peneplain and Darling Riverine Plain SEWPaC (2012). The EEO is based on a minimum convex polygon enclosing all mapped occurrences of the species, the method of assessment recommended by IUCN (2011), and extending this to the Queensland and South Australia borders in line with a continuation of the distribution into those states. The area of occupancy (AOO) of *M. rufus* was estimated to be at least 3192 km^2, based on 798 2 x 2 km grid cells, the scale recommended for assessing AOO by the IUCN (2011). This estimate only included cells placed over known ALA records and is hence an underestimate of actual AOO as the species will also occur in areas between known records.

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12. The estimated total number of mature individuals of *Macropus rufus* in NSW is not considered to be low or moderately low. The annual aerial surveys conducted by the OEH for the KMP have estimated that in each year from 2001-2012 the *M. rufus* population size exceeded 80,000 (mostly over 100,000) in each of the eight Kangaroo Management Zones surveyed in western NSW (Payne 2013). Even allowing for the presence of immature individuals, sampling uncertainty and experimental error, it is highly likely that the total number of mature *M. rufus* individuals is not low or moderately low.

13. In view of the above the Scientific Committee is of the opinion that the Red Kangaroo *Macropus rufus* (Desmarest 1817) does not meet any of the criteria for listing of Vulnerable species in the *Threatened Species Conservation Regulation* 2010, and therefore is not eligible to be listed as a Vulnerable species in Schedule 2 of the Act.

Dr Mark Eldridge
Chairperson
Scientific Committee

Exhibition period: 01/05/15 – 26/06/15 Proposed Gazettal date: 01/05/15

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