National Recovery Plan for the Regent Parrot (eastern subspecies) *Polytelis anthopeplus monarchoides*

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Summary

The eastern subspecies of the Regent Parrot *Polytelis anthopeplus monarchoides* (herein referred to as the eastern Regent Parrot) is restricted to a single population occurring in inland south-eastern Australia, in the lower Murray-Darling basin region of South Australia, New South Wales and Victoria. Within this range, the eastern Regent Parrot occurs in riverine and mallee woodlands and forests.

The eastern Regent Parrot has suffered a decline in range and abundance over the last 100 years. Major threats include clearing and degradation of nesting and foraging habitat, disturbance around nesting sites, competition for nest hollows, deliberate killing of birds, road kills and accidental poisoning. The population is estimated to be no more than 1,500 adult breeding pairs.

The eastern Regent Parrot is currently listed as Vulnerable under the Australian Government *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Within its range states, the Regent Parrot is listed as Vulnerable under the South Australian *National Parks and Wildlife Act 1972*, Threatened under the Victorian *Flora and Fauna Guarantee Act 1988* and Endangered under the NSW *Threatened Species Conservation Act 1995*. This national Recovery Plan for the eastern Regent Parrot is the first national recovery plan prepared for the species. The Plan details the species' distribution and biology, conservation status, threats, and recovery objectives and actions necessary to ensure its long-term survival. This is the first national recovery plan for this subspecies. However, previous research and management activities have been conducted by State conservation agencies and Catchment Authorities. A national recovery team was established in 2009 which acts as a forum to share information between people working on this species and its' first task has been to completion of this plan.

Species Information

Description

The eastern Regent Parrot is a medium-sized, slender, long-tailed parrot from 37–42 cm in length and 160–190 g in weight. Adult males are bright yellowish with an olive green back, bluish-black wings and tail and red patches on the inner wings. Adult females and juveniles are mostly olive-green, with bluish-green wings and tail and less extensive red wing patches (description from Higgins 1999). The Regent Parrot has two subspecies, nominate *P. a. anthopeplus* (western Regent Parrot) occurring in south-western Australia, and *P. a. monarchoides* occurring in the interior of south-eastern Australia (Higgins 1999). The western Regent Parrot is currently not considered threatened (Garnett & Crowley 2000).

Biology and Ecology

Regent Parrots nest in loose colonies of up to 61 pairs (Webster 2006), though most colonies are smaller (2–10 pairs). Colony areas range from 0.5 ha–90 ha (av. 20 ha: (Higgins 1999; Webster 2002), depending on the numbers of birds involved and the distribution of suitable habitat. Breeding pairs in colonies usually use different nest trees, although occasionally two or more active nests may be found in hollows in the same tree. Away from colonies, home range size is not known.

Breeding occurs from August to December (Tarr 1964; Smith 1992; Webster 1993). Up to six eggs are laid, incubated for about 21 days by the female alone, and the young fledge about 42 days later (Forshaw & Cooper 1981). During this time males feed their mate near the nest hollow by regurgitation, and females do most of the feeding of young. In Western Australia, three young were fledged per active nest (Long & Mawson 1994). Regent Parrots may live 15–20 years (Burbidge 1985), with perhaps about five years between generations (Garnett & Crowley 2000).

Eastern Regent Parrots feed in pairs and small parties, occasionally in large flocks, usually on the ground, but also in trees (Beardsell 1985; Burbidge 1985). For the first half of the breeding season, feeding flocks consist only of males. When not breeding, eastern Regent Parrots spend much of the day on the ground searching for food or resting in large trees along rivers, and may travel long distances between roost sites and feeding grounds (Forshaw & Cooper 1981). They drink in the early morning and again in the evening (Forshaw & Cooper 1981).

Eastern Regent Parrots feed mostly on plant seeds, and will also eat buds, flowers, and occasionally insect larvae, psyllids and lerps (Higgins 1999). Most foraging occurs on the ground in mallee, with some in mallee trees, vineyards, orchards, cereal crops and riparian woodlands (Burbidge 1985). Spilt grain is also eaten along roadsides (Forshaw & Cooper 1981).

In mallee woodlands, a wide range of seeds from grasses, chenopods, daisies and eucalypts are consumed, including Bluebushes *Maireana eriocladа*, *Marieana gracilis* and *Maireana pentatropis*, Climbing Twinleaf *Zygophyllum eremaeum*, Red Mallee *Eucalyptus oleosa* subsp. *oleosa*, Yorrell *Eucalyptus gracilis* and White Mallee *Eucalyptus dumosa* (Burbidge 1985; Higgins 1999; Webster 2001; Webster & Belcher 2008a, b). In riparian woodlands, seeds of daisies, grasses, Bladder Saltbush *Atriplex vesicaria*, Babaggia *Osteocarpum acropterum* and Cats Ear *Hypochaeris radicata* are eaten (Burbidge 1985; Webster 1993; Webster & Leslie 1997), as well as River Red Gum *Eucalyptus camaldulensis* and Black Box *Eucalyptus largiflorens* flower buds (Webster 2001; Webster & Belcher 2008a, b).

Eastern Regent Parrots also feed on cereal crops including Oats *Avena sativa*, Triticale *Triticale* sp., Barley *Hordeum vulgare*, Rye *Secale cereale* and Wheat *Triticum aestivum*. Oats are eaten in November when the seed is still in the 'milky' stage. In December birds move on to Triticale and in January move on to Barley. Within irrigated horticultural areas, birds also feed on seeds from various small weeds, overripe fallen Olives *Olea europaea*, fragments of Almond *Prunus dulcis* kernels (Burbidge 1985).

Distribution

The eastern Regent Parrot occurs in the lower Murray-Darling basin region of South Australia, New South Wales and Victoria, in an area roughly bounded by Murray Bridge (South Australia), Pooncarie (NSW), Swan Hill and Dimboola (Vic) (Figure 1), in the Murray Darling Depression and Riverina IBRA bioregions (*sensu* DEH 2000).

Within this broad distribution, there are three separate breeding areas:

1. The Wimmera River drainage system in Victoria, predominantly in Wyperfeld National Park (F. Noelker *in* Garnett 1992), Lake Albacutya and Lake Hindmarsh (Hurley 2011).

2. The lower Murray River, upstream from Swan Reach in South Australia to north-western Victoria (Lindsay Island) (Harper 1989; Smith 2001, 2004).
3. The mid Murray River in Victoria and NSW, between Red Cliffs (south-east of Mildura) and Piangil, including the lower Murrumbidgee and Wakool Rivers in NSW (Webster & Leslie 1997; Webster 2005).

The Wimmera drainage population, as in most locations, breeds along water courses and wetlands in River Red Gums (Higgins 1999; Garnett & Crowley 2000). However, beyond the northern end of this drainage system a small outlying colony (~six pairs) was recently discovered breeding in Semi-arid Woodlands in both live and dead hollow-bearing Slender Cypress Pine (*Callitris gracilis*) (Hurley 2011).

The lower Murray River populations in South Australia have been well surveyed with detailed counts of colonies and the number of active nets within each being made every two years (Smith 2001, 2004, 2009 & 2011).

Within the distribution in NSW, knowledge of the location of breeding colonies varies greatly. Some areas, especially where timber harvesting occurs, have been surveyed extensively (Webster 1993, 1995, 2003a, b, 2004; Webster & Leslie 1997; Webster & Belcher 2008c), while other areas, particularly on leasehold land, are poorly surveyed. The areas that have been surveyed provide primarily data on the presence/absence of breeding colonies and very little information on the number of nests in these colonies.

There is a gap of about 150 km between the lower and mid-Murray River breeding areas (between Lindsay Island and Mildura). Whether birds once bred in this area is not known, although Burbidge (1985) noted that this area was probably always relatively sparsely populated by Regent Parrots because it contains large areas of unsuitable saltbush plains rather than mallee near the river.

The mid Murray population in Victoria has been surveyed primarily for the presence/absence of breeding colonies in proposal logging coupes (Webster 2002, 2003a, 2004, 2005b).

Historically the breeding range of the eastern Regent Parrot has declined over the past one hundred years (Burbidge 1985). Whilst there were reports of breeding on the Avoca River just upstream from Kerang (Campbell 1901), they no longer breed there. The junction of the Avoca River is 100 km upstream from the Wakool junction with the Murray River and some 140 km upstream from Boundary Bend. They were reported breeding in the Lake Boga district but becoming very scarce early last century (Stone 1912) and they no longer are reported breeding there now. They declined in numbers on the Wakool River, particularly since the 1967 drought and no birds were sighted during a brief survey in 1985 (Burbidge 1985). Reports of breeding on Pentel Island, opposite Swan Hill ceased by the early 1960s (Burbidge 1985). They were reported nesting in the mid 1960s on the edge of the Sunset Country and they are not known to breed there now (Burbidge 1985). There are reports of Regent Parrots breeding along the Darling River near Pooncarie during the 1960s (Burbidge 1985). However, targeted surveys for breeding activity conducted in spring 2008 did not locate any eastern Regent Parrots (Forests NSW 2009). Whilst suitable nesting habitat was found (suitable large hollow-bearing River Red Gums), the distance of this habitat from potential foraging habitat (mallee woodland) may limit the breeding capability along the Darling River (Forests NSW 2009).

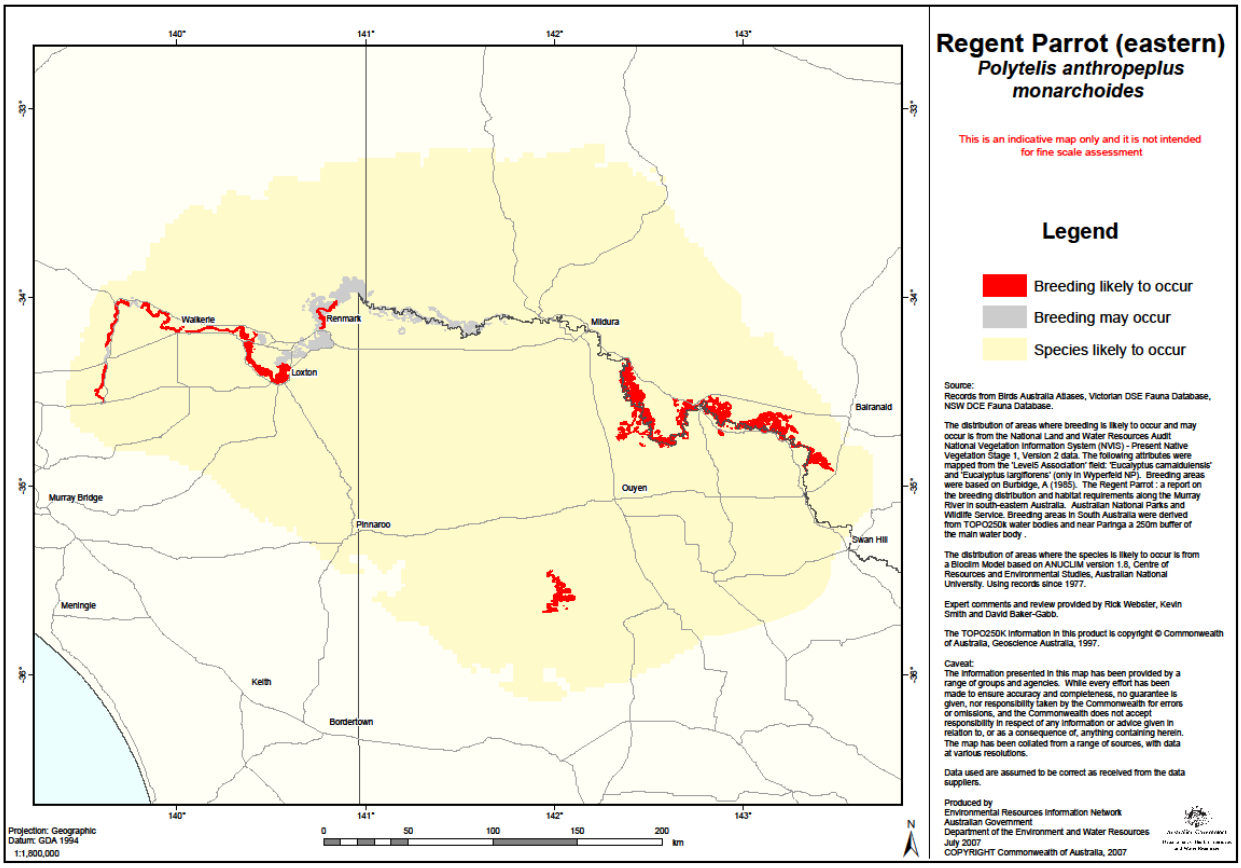

Figure 1. Distribution of the eastern Regent Parrot

Habitat

The habitat critical to the survival of the eastern Regent Parrot contains all known sites for nesting, food resources, water, shelter, essential travel routes, dispersal, and buffer areas, and is defined in this Recovery Plan as all potential eastern Regent Parrot habitat within its 'current normal range'. Much of this habitat is on public land, in parks, conservation reserves and state forest, but some is on freehold and leasehold land, especially in NSW. Habitat can be divided into those areas used during the breeding and non-breeding seasons, and is described as follows:

Breeding season requirements: The eastern Regent Parrot breeds almost entirely in River Red Gum forest and woodland, and all known breeding colonies are located along the Murray River, lower Wakool River, lower Murrumbidgee and Wimmera River floodplains or associated anabranch creeks and lakes. A small colony in Wyperfeld National Park (Victoria) nests in Slender Cypress Pine *Callitris gracilis* ssp. *gracilis* (Hurley 2011).

Nest trees are typically large (mean 160 cm DBH), tall (mean 28 m), mature, healthy River Red Gums with many hollows, usually close to water. Growth rates indicate nest trees are a minimum of 160 years of age and most are probably significantly older. Most nests are in hollow branches, with a few in holes in the tree trunk, and are usually high (av. 18 m, range 6–36 m) above the ground (Beardsell 1985; Burbidge 1985; Webster & Leslie 1997; Higgins 1999; Smith 2001; Webster & Belcher 2008c).

In South Australia, large dead River Red Gums are also used for nesting (Smith 2001). Along the Wimmera River, nest trees are smaller (down to 95 cm DBH), and some nests occurred in old stumps (F. Noelker *in* Garnett 1992). Historical records suggest that birds also bred infrequently in Black Box, mallee eucalypts, and in cavities in cliffs along the Murray River (Burbidge 1985; Higgins 1999).

During the breeding season, eastern Regent Parrots feed mostly in large blocks of intact mallee woodlands within 20 km (usually 5–10 km) of nest sites, with areas containing Red/Grey Mallee *Eucalyptus socialis*, or Ridge-fruited/Yellow Mallee *Eucalyptus incrassata* apparently favoured (Burbidge 1985; Webster & Leslie 1997). Foraging within riverine forests and other woodlands containing Black Box, Buloke *Allocasuarina leuhmanii*, Belah/Black Oak *Casuarina pauper* or Slender Cypress Pine has also been observed (Burbidge 1985; Emison *et al.* 1987; Webster 1993; Webster & Leslie 1997). Nesting is restricted to stretches of mature riverine forest within 20 km of suitable feeding habitat, because male Regent Parrots are limited by their need to make at least 2–3 return trips per day to feed nesting females (Forshaw & Cooper 1981). A recent study found males returning to feed nesting females every two hours, with 80% of feeding visits recorded between 7:00 am and midday (Hurley 2009).

Eastern Regent Parrots are reluctant to fly over open areas where they are vulnerable to predation by raptors (Webster & Leslie 1997), particularly during the breeding season. Corridors of vegetation between nesting and foraging sites are therefore essential for bird movement (Webster & Leslie 1997). Birds will use remnant woodlands along roadsides or in farm paddocks for movement and occasionally foraging, and rarely use more extensively cleared areas (Higgins 1999).

In summary, breeding eastern Regent Parrots require:

1. Large River Red Gums, generally within 120 m of water, for nesting;
2. Mallee woodlands within 20 km and ideally within 5 km of nest sites for foraging;
3. Treed flight corridors between these two habitats.

Non-breeding requirements: Relatively little is known about the habitat utilised by eastern Regent Parrots during the non-breeding season, though they are known to remain within the Murray-Darling Basin all year round. Some birds appear to move away from their riverine breeding areas, and will use mallee woodlands for foraging up to 100 km from the river (Joseph 1978; Burbidge 1985; Baker-Gabb 1997), although other birds remain closer to the river throughout the year (V. Hurley unpubl. data 2008). Some birds in South Australia disperse into the mallee in and around the Bookmark Biosphere Reserve, north-west of Renmark (Higgins 1999). Some birds that breed along the Wimmera River remain there after breeding (Webster 1991), while others move north into the Murray-Sunset National Park, coincident with at least some birds from the mid-Murray breeding area moving south-west into the park (Burbidge 1985). Surveys in April 2008 in NSW recorded large numbers of birds roosting in mallee near the Murray River and then returning to River Red Gums for most of the day, for feeding and inspecting prospective nest hollows. Importantly, the birds used the same flight paths that had been utilised during the breeding season (Webster & Belcher 2008b).

Population Information

The total adult breeding population of eastern Regent Parrots is estimated at 1,500 pairs, with 600 in NSW (Sluiter *et al*. 2006), 500 in Victoria (Sluiter *et al*. 2006 and Hurley, DSE unpublished data 2011) and 400 in South Australia (Smith 2011). These population estimates are based on the only survey data collected to date and do not include counts of juveniles or non-breeding adults.

Large aggregations of adult and juvenile birds during the non-breeding season have been seen at several locations often away from the river. A total of 576 birds in groups of 3–41 were counted as they flew to one roost near Berri in 1991 (Smith 2001), and up to 200 birds in a single flock have been observed at a watering point on Gluepot Reserve north-west of Renmark (Smith 2004). Other large aggregations seen recently include about 460 birds in the Manie State Forest area (NSW) in April 2008 (Webster & Belcher 2008b), 500 birds in mallee near Speed (Vic) in 2004 and 700–900 birds near Lake Hindmarsh (Vic) in 2006 (DSE unpubl. data).

Decline and Threats

The eastern Regent Parrot has suffered a decline in range (and is now restricted to three sub-populations) and a probable decline in abundance over the last 100 years (Burbidge 1985; Garnett & Crowley 2000). In the mid Murray region, there has been a major contraction in range from the east along the Murray River, with birds no longer found in the Wangaratta (Cheney 1915), Mooroopna (Bedgood 1958), Kerang (Campbell 1901), Lake Boga (Stone 1912) and Swan Hill (Burbidge 1985) districts. The breeding population along the Wimmera River and Outlet Creek systems in Victoria once extended as far south as Dimboola (Blakers *et al.* 1984), but birds are now seldom sighted south of Jeparit (V.G. Hurley, DSE unpubl. data). Eastern Regent Parrots once occurred along the lower Darling River in NSW (Beardsell 1985, Burbidge 1985 and Webster 2002), although there are no recent records. In South Australia, the Regent Parrot was once common along the lower reaches of the Murray River, but became scarce there by 1913 (White 1914). Suggestions of ongoing population decline (Garnett & Crowley 2000) are supported by an apparent 43% decline in the number of breeding pairs in the lower Murray River upstream of Lock 3 between 1991 and 2003 (Smith 2001, 2004). This decline has continued in 2010 with a further 22% decline in the number of breeding pairs since 1991 (Smith 2011). This brings the total decline from 10 colonies comprising 76 nests in 1991 to 4 colonies and only 26 nests by 2010 in the breeding population in the lower Murray River upstream of Lock 3. These declines equate to a 60% loss in the number of colonies and a 66% loss in the total number of breeding pairs from this area of South Australia.

Factors implicated in this decline include clearing of mallee foraging habitat within 20 km of nesting colonies along the Murray and other major rivers (Burbidge 1985), removal and degradation of remnant treelines used as flight corridors (Burbidge 1985; Webster & Leslie 1997), destruction of nesting habitat through clearing, logging for timber, salinisation and waterlogging (Burbidge 1985), declining health and death of River Red Gums due to extended drought and current watering regimes (Cunningham *et al*. 2007), trapping for the cage bird trade (Burbidge 1985), deliberate killing to reduce agricultural damage (Condon 1947; Burbidge 1985), accidental killing through collisions with vehicles and ingestion of poison bait (Burbidge 1985) and competition for nest hollows from other birds and feral Honey Bees *Apis mellifera* (Garnett 1992; Smith 2001).

Several elements of the eastern Regent Parrot's biology make it particularly vulnerable to a range of threats. The species concentrates in colonies to breed, has an absolute requirement for mallee foraging areas within 20 km (usually 5–10 km) of nest sites, and requires vegetated corridors between breeding and feeding areas. Feeding and movement corridor areas have been extensively cleared. It breeds in large, mature River Red Gums that were targeted for timber harvesting, and that take decades or centuries to replace. Feeding in flocks makes large numbers of birds vulnerable to poisoning, road-kills and trapping for the cage bird trade.

Key threats are summarized as follows:

Clearing and degradation of mallee woodland

River Red Gums containing suitable hollows for nesting occur along major rivers throughout the Regent Parrot's range, but there is no nesting where there is a natural absence of mallee or where there has been extensive clearing of mallee (Burbidge 1985). The only known exception to a colony breeding in River Red Gum is four nests located in Slender Callitris Pine (*Callitris gracilis*) in Wyperfeld NP, Vic (Hurley 2011). Despite this the major threat to the eastern Regent Parrot is the decline and loss of mallee woodland particularly within 20 km of nesting colonies (Burbidge 1985), both as feeding habitat and as flyways linking feeding habitat with breeding and non-breeding habitat. Further, during the non-breeding period of the year eastern Regent Parrots forage considerable distances away from the floodplain and are dependent upon mallee remnants and vegetated roadside corridors to access these (Sluiter *et al*. 2008 & 2009, Webster and Belcher 2008b).

There are several causes of the decline and loss of this habitat. Much was cleared decades ago leading to an extinction debt in the mallee (Tilman *et al*. 2002; Hurley and Cheers 2007) and so the threat from past clearing remains an ongoing threat. Over 1,200 ha of mallee was cleared without a permit in one incident in South Australia's Riverland in 2002. In NSW, over 19,000 ha of mallee was cleared under permit in the three years to December 2002 (DLWC 2002). More recently in NSW from March to April 2011 18,179 ha was legally cleared on private and leasehold lands within the Lower Murray/Darling CMA (OEH 2011).

Eastern Regent Parrots frequently forage on the ground, and heavy grazing by stock, feral and native herbivores is likely to reduce an area's value for these parrots. In mallee grazed by Sheep *Ovis aries*, Frith (1962) showed that breeding densities of ground-foraging Malleefowl *Leipoa ocellata* were reduced by 85–90% compared to similar ungrazed habitats. Grazing continues across vast areas of mallee woodland, with about 90% of public land with mallee in New South Wales and 20% in South Australia under pastoral lease (Choate 1989). Feral Goat *Capra hircus* numbers can also be very high in mallee, particularly north of the Murray River (Benshemesh 2009). Some known foraging sites in NSW were severely degraded by stock and introduced herbivores such as European Rabbit *Oryctolagus cuniculus* (Webster 1991).

Decommissioning artificial water points in mallee can help reduce overgrazing and have considerable biodiversity benefits (Landsberg *et al*. 1997; Harrington 2002). Within the eastern Regent Parrot's range, this has probably occurred to the greatest extent in parks and reserves in north-western Victoria. However, birds still need access to water, and Smith (2001) noted that the removal of all water points over a large area could make it difficult for the species to forage effectively there. Recent

drought dried up most water points in South Australian mallee pastoral areas and eastern Regent Parrots were forced to forage closer to the Murray River, where they came into greater conflict with fruit growers (Smith 2004).

The removal of regularly-used flight paths that follow tracts of natural woodland between foraging and nesting sites (Webster & Leslie 1997) might also lead to the abandonment of nesting areas. Strip-mining of mineral sands is occurring in Victoria and South Australia within the range of eastern Regent Parrots, and sand mining is proposed within the New South Wales range of the species. In Victoria, existing sand mines and those approved have or will involve clearance of native vegetation along road reserves and linear corridors. This has the potential to disrupt eastern Regent Parrot movement patterns (Sluiter & Robertson 2006). Careful planning along with targeted revegetation prior to cutting any flight path corridors is required to minimise disturbance to eastern Regent Parrots.

Loss of habitat – loss of flyways

A critical component of the eastern Regent Parrot's habitat is the vegetation between the mallee woodland feeding and roosting areas and the River Red Gum nesting areas. Due to extensive clearing of lands within 20 km of the Murray River, this component now largely comprises vegetated corridors (or flyways) linking the other two habitats. These flyways are now often limited to one or two trees in width along roadsides and have been further degraded through road widening activities to accommodate larger irrigation machinery and infrastructure. There is considerable evidence to show eastern Regent Parrots use these flyways to commute between the nest sites and feeding grounds several times a day during the breeding season (Hurley 2009, Robertson and Hurley 2010; Sluiter 2006; Webster 1991, 2005b). One study in particular (Sluiter 2006) illustrated changes in flight path following the destruction of part of one of these corridors and a reluctance on the part of eastern Regent Parrots to cross gaps or open areas greater than 200 m.

Timber harvesting of River Red Gums

Nest trees are lost due to variety of causes including timber harvesting (of both living and dead trees), altered flooding regimes, drought, fires and natural falling of dead standing trees. Timber harvesting and silvicultural operations such as thinning and ring-barking occurs in state forests in NSW containing eastern Regent Parrot colonies. At least six known nest trees were ring-barked in recent years during such operations (R. Webster pers. comm. 2006). The successive removal of large trees that were approaching a size where they would have been suitable for nesting has been taking place over many decades. On private property logging is generally not controlled as rigorously as on public land, and so nest sites there are more likely to be lost. In South Australia, many eastern Regent Parrot nests are in dead trees, and decline and loss of these trees is occurring. During a nine-year period, 25% of 101 nest trees suffered extensive damage reducing their suitability for nesting, and 7% fell or were removed completely (Smith 2001), so availability of nesting hollows is becoming increasingly limited.

Altered hydrological regimes

River Red Gum forests and woodlands throughout the range of the Eastern Regent Parrot are under great stress, and many living nest trees are likely to die because of prolonged immersion, reduced flooding and ongoing drought (Smith 2004). In Victoria, a survey of the condition of River Red Gums along the Murray River floodplain found only 30% of stands to be in good condition (Cunningham *et al.*

2007). A survey of 520 Black Box and 1,890 River Red Gum trees across seven wetlands in Wyperfeld National Park (Vic) known to be used by eastern Regent Parrots recorded 53% of Black Box and 49% of River Red Gums to be stressed or dead (Hurley 2006). In New South Wales, a rise in groundwater levels east of Euston Weir (Salotti & Williams 1996) threatens three known breeding sites (R. Webster pers. comm. 2006).

Fires

Extensive wildfires may be a threat to eastern Regent Parrots by reducing the availability of seeds over large areas of mallee for many years after a fire (Clarke *et al* 2008). Fires have also caused the loss of nest trees (DSE 2008).

Disturbance around nesting colonies

Eastern Regent Parrots are reluctant to enter their nest hollows when people are nearby, and nesting sites accessible by people do appear to suffer from human disturbance (Smith 2001), such as through timber harvesting operations and recreational activities. Access to some riverine nest locations is difficult due to flooding when the birds are breeding, and so human disturbance is likely to be less of a problem at these sites.

Competition for nest hollows

Competition for nest hollows is likely to be occurring with feral birds such as Common Starling *Sturnus vulgaris* and Rock Dove (pigeon) *Columba livia*, and with native birds including Little Corella *Cacatua sanguinea* and Yellow Rosella *Platycercus elegans flaveolus* (Smith 2001, 2004). Feral Honey Bees have excluded eastern Regent Parrots from hollows around Lake Albacutya, with 11 of 12 nests used in 1985 occupied by bees in 1988 (F. Noelker *in* Garnett 1992). Bees also occupied some hollows that were suitable for Regent Parrots in Wyperfeld National Park, although overall hollow availability there may not be limiting (Oldroyd *et al.* 1994). Surveys of hollow-bearing trees at Wyperfeld found three hollows occupied by feral bee hives in 2006 (Hurley 2006) and four hollows in 2009 (Robertson & Hurley 2010). Long-billed Corellas raised four young in 2010 in a nest site occupied by Regent Parrots in 2008 and 2009 in Wyperfeld NP (Hurley unpublished data, DSE, 2010).

Competition from invasive plants

Recruitment of River Red Gum is being inhibited in some areas by the continuing spread of the invasive European Weeping Willow *Salix babylonica* (Smith 2001). This may reduce the future availability of nest trees. The highly invasive Ward's Weed (*Carrichtera annua*) has been identified as a very high risk to ground-dwelling reptiles in wetlands along the Outlet Creek system and in the Murray Scroll Belt (west of Mildura to the SA/Vic border) (Robertson & Ahern 2006) due to covering habitat. The risk to Regent Parrots is the simplification of mallee chenopod shrubland vegetation systems, such that it reduces available food resources over a large area for this species.

Human-caused mortality

Human actions, both deliberate and inadvertent, have killed and continue to kill significant numbers of eastern Regent Parrots. The birds are readily attracted to spilt grain and where this occurs along roadsides the birds may be struck and killed by passing vehicles (Higgins 1999). Many birds may be killed in this way, with about

160 birds killed along the Calder Highway in one incident in Victoria (Anon 1980). In 2009, about 40 eastern Regent Parrots were killed near Robinvale, Victoria by a passing truck when flushed from drinking at a roadside drain on a sweeping bend following heavy rains (Hurley DSE unpublished data). Many other similar incidents are likely to go unobserved or unreported. The laying of poisoned grain to control rabbits and mice has probably had a substantial impact on eastern Regent Parrot populations when this practice was more common (Burbidge 1985).

Eastern Regent Parrots are thought by some orchardists to damage fruit crops, even though their impact is minor compared to several other species (Burbidge 1985). Many birds have been deliberately killed, with 500 culled under permit in South Australia in 1944 alone (Condon 1947). Despite the birds now being fully protected in all range States, this persecution still persists. In one incident in northern Victoria in November 2006, 41 Regent Parrots, including 38 breeding males, were killed in an almond orchard (Sluiter *et al*. 2007). The loss of so many males during the breeding season means that many nesting females were facing starvation and would have abandoned eggs and chicks in the nest. Major expansion of almond plantations in recent years has brought the species into conflict with more orchardists.

Take from the wild

Many eastern Regent Parrots were captured for the cage bird trade, which has almost certainly had an impact of wild populations (Burbidge 1985). As late as 1957–58, 455 birds were legally trapped and taken into captivity in South Australia, and there was thought to be considerable illegal trapping then (Beruldsen 1960). There are now more than 10,000 Regent Parrots in captivity (Garnett 1992). There is suspected to still be a low level of illegal removal of birds, especially nestlings, from the wild, as evidenced by some easily climbed nest trees in South Australia being marked by persons unknown (Smith 2004).

Predation

The impact of predation, especially that by raptors, on the eastern Regent Parrot is unknown. Much of the eastern Regent Parrot's behaviours during the breeding season indicate predator avoidance strategies, especially the commuter feeding flights of males in groups provisioning nesting females and the reliance on vegetated corridors by males commuting between nests and feeding sites (Sluiter 2006, 2007, 2008, & 2009). Regent Parrots prefer to nest high up in River Red Gums (above 12 m) and using in deep hollows (up to 1.8 m) with narrow entrances (10.1 cm) (Hurley 2010) making access to nests by terrestrial predators difficult. However, Australian Ravens (*Corvus coronoides*) have been seen taking eggs and chicks (Burbidge 1985; Smith 2001) and Lace Monitors *Varanus varius* have been seen taking eggs (R. Dayman pers. obs. 1995). Also ground-foraging leaves birds vulnerable to introduced predators.

Recovery Information

Current Conservation Actions

The history of the mallee since settlement has been one of large-scale clearing in many areas. In the Victorian mallee only 6% of the extent of native vegetation

remains (Mallee CMA 2008). The eastern Regent Parrot has benefited from several broad-scale actions such as native vegetation clearance controls in all three range States. Native vegetation clearance controls were first introduced in 1985 (SA *Native Vegetation Management Act*) which were updated in 1991, in 1988 (Vic *Flora and Fauna Guarantee Act*) with vegetation clearance controls introduced in 1989 and the *Native Vegetation Act 2003* in NSW had its Regulations proclaimed in 2005. This has been particularly important for the retention of mallee woodlands (in which the majority of foraging takes place) within 20 km of nesting sites in River Red Gum forests and woodlands (Burbidge 1985).

A range of other measures such as 'Codes of Forest Practice', controls on the use of poisoned grain, improved grain handling and wildlife education programs have also benefited eastern Regent Parrots. Substantial areas of eastern Regent Parrot habitat are already protected in parks and reserves since the Burbidge report on Regent Parrots (1985). In Victoria the Land Council and Conservation Council's final recommendations from the Mallee Area Review 1989 converted much of the large mallee leasehold lands in Victoria to National Parks which steadily phased-out stock grazing by 1996 (LCC 1989) (e.g. Hattah Kulkyne, Murray-Sunset, Wyperfeld National Parks). In South Australia the Billiat Conservation Park, originally proclaimed in 1972, was expanded to become the Wilderness Protection Area in 2008; Chowilla Regional Reserve was proclaimed in 1993; and the Dangalli Conservation Park, originally proclaimed in 1976, was expanded with the northern section proclaimed Wilderness Protection Area in 2009. Also the private purchase and reservation of Gluepot Station by Birds Australia in 1997 and Taylorville Station by the Commonwealth Government and the Australian Landscape Trust (in the 1990s) has protected more than 150,000 ha of non-breeding foraging habitat for eastern Regent Parrots in South Australia. In NSW Mallee Cliffs National Park (NP) (1977) was then declared Kemendoc Nature Reserve (NR) in 1988, which was expanded and been upgraded to Kemendoc National Park in 2010, incorporating Tarawi NR and Euston Regional Park (2010). The 3 Yanga Reserves have been amalgamated and expanded into the Murrumbidgee Valley Reserves (2010). An additional area of Murray Valley RP (formerly Kyalite SF) was also gazetted in 2010.

The decline of the eastern Regent Parrot has also been the impetus for a number of specific actions aimed at establishing its status and implementing protection measures, including:

- Establishing a Regent Parrot Steering Committee in the early 1980s to oversee investigations into ecology and threats, and a national Recovery Team in 2009 to coordinate implementation of recovery actions.
- Surveys along the Murray River in all three range States (Beardsell 1985 and Burbidge 1985) that confirmed the decline in range and abundance, defined breeding habitat and the location of several breeding colonies, and identified the need for large blocks of intact mallee within 20 km (ideally within five km) for nesting colonies to remain viable.
- Studies of movement and population status along the Murray River in South Australia (e.g. Joseph 1978; Harper 1989; Smith 1992, 2001, 2004, 2011 *in press*). These show a continued decline especially up river from Lock 3.
- Surveys of breeding colonies and foraging habitat in Victoria (e.g. Tarr 1964; Webster 2002, 2003a, 2004, 2005b, Webster & Belcher 2005a, b, 2008a; Sluiter

2006). Primarily these focus on locating breeding colonies in proposed logging coupes along the Murray River.

- Studies of food provisioning rates and rates of attendance at nest sites by adult birds (Hurley 2009; Robertson & Hurley 2010). These essentially established higher activity levels during the morning and demonstrated a minimum two hourly survey period per location to allow for these activity patterns.
- Observations of habitat usage (namely flyways) by Regent Parrots during the spring breeding season in Victoria (Sluiter 2006; Sluiter 2007). These studies essentially confirmed the use of vegetated corridors as flyways for this species.
- Observations of habitat usage (namely flyways) by Regent Parrots during the non-breeding season in Victoria (Sluiter et al. 2008, 2009). These studies essentially confirmed the use of vegetated corridors as flyways for this species.
- Status assessments and management recommendations for New South Wales (e.g. Webster 1991, 1993, 1997, 1999, 2001, 2003b, 2005a; Webster & Belcher 2008a, b, c; Webster & Leslie 1997).
- Habitat protection in NSW, including gazettal of the 1,032 ha Kemendoc Nature Reserve in 1988 to protect River Red Gums in which Regent Parrots breed. The Western Lands Commission had instigated a ban on clearing of mallee within 20 km of the Murray River. Changes in native vegetation legislation now allow clearing within this area, but require the development of a vegetation plan that includes offsets to achieve a net conservation gain. The NSW Catchment Areas Protection Board established a 60 m wide protection strip adjacent to the Murray River. Forests NSW has implemented logging prescriptions designed to minimise the impacts on known breeding colonies. Recent assessment of the River Red Gum Forests by the Natural Resources Commission has recommended major changes to the management of these forests which should have major benefits for the eastern Regent Parrot in NSW.
- The use of environmental water to initially rescue River Red Gum from drought was first undertaken in Victoria in 2002. This has continued and The Living Murray project now involves the construction of water regulation structures at six 'icon' sites to provide more natural watering regimes to these wetland ecosystems.
- In Victoria, the River Red Gum Forests Investigation (VEAC 2008) resulted in the creation of the Murray River National Park that now protects most of the Murray River nesting colonies from timber harvesting within Victoria. However, firewood harvesting and collection is still approved in the former forestry coupes now administered by Parks Victoria.
- Development of a standardised nest survey method continues, as does surveys of nest contents to determine hatch and fledging rates in selected Victorian colonies (GHD 2009; Hurley 2009; Robertson & Hurley 2010; and Hurley DSE unpublished data).

Strategy for Recovery

This Recovery Plan contains actions that, within the five-year implementation time-frame, if fully implemented should result in halting recent population declines, and subsequently ensuring the persistence of a viable breeding population of the eastern Regent Parrot in south-eastern Australia. The strategy for recovery will include:

- Locating and protecting actual and potential nesting colonies, flight paths to foraging areas, foraging habitat within 20 km of nest sites and traditional watering points.
- Improving foraging habitat quality through reduction in total grazing pressure, timber harvesting and other degrading impacts.
- Controlling recreational impacts near nesting colonies.
- Reducing numbers of birds killed by shooting, poisoning and vehicles.
- Investigating key biological and ecological factors such as use of flyways, habitat usage and competition for nest hollows to inform management actions.
- Increasing community involvement in the recovery program.

Recovery Plans for other nationally threatened mallee species such as the Black-eared Miner *Manorina melanotis* (Baker-Gabb 2001) and the Malleefowl *Leipoa ocellata* (Benshemesh 2009) contain recovery actions that supplement this Recovery Plan.

Program Implementation and Evaluation

This is the first national recovery plan for the regent parrot. The Recovery Plan is intended to run for five years from the time of adoption. Implementation will be the responsibility of the Department of Environment and Natural Resources (for South Australia), the Department of Sustainability and Environment (for Victoria) and the Office of Environment and Heritage (OEH), Department of Premier and Cabinet (for NSW), supported by other agencies, organisations and research institutes as appropriate. A national Recovery Team has been established with representatives from each of the relevant state agencies, catchment management authorities and non-government organisations to coordinate implementation of the recovery plan. Local agencies (including catchment management authorities) will be responsible for preparing work plans and monitoring progress toward recovery. The Recovery Team will be responsible for informal annual reviews of implementation of this plan. State agencies will review the plan within five years of the date of its adoption under the EPBC Act and, if necessary, the plan will be revised.

Recovery Objectives

Within the life span of this Recovery Plan, the **Specific Objectives** of recovery are to:

1. Determine population trends in the eastern Regent Parrot.
2. Reduce environmental impacts and restore habitat.
3. Identify strategic flyways and their features and protect and enhance these.
4. Reduce human-induced mortality of eastern Regent Parrots.
5. Investigate key aspects of the biology and ecology of the eastern Regent Parrot.
6. Increase community involvement in the eastern Regent Parrot recovery program.

Recovery Actions

Objective 1: Determine population trends in the eastern Regent Parrot.

Performance criterion: Monitoring protocols are developed and adopted and an accurate measure of population trends is obtained.

Action 1.1 Locate and map all breeding colonies across all three range states.

Responsibility: DENR, DSE, PV, OEH

Action 1.2 Prioritise locations/colonies and areas of potential colonies for regular surveys and monitoring.

Responsibility: DENR, DSE, OEH

Action 1.3 Develop standardised monitoring techniques for locating colonies, counting nests, and resurveying colonies.

Responsibility: DENR, DSE, OEH

Action 1.4 Develop standardised techniques for determining flock sizes and proportion of adult males as a surrogate to determine levels of recruitment.

Responsibility: DENR, DSE, OEH

Action 1.5: Establish baseline data for each population to measure against recovery actions and threats.

Responsibility: DENR, DSE, OEH

Objective 2: Reduce environmental impacts and restore habitat

Performance criterion: There is an increase in population size and range.

Action 2.1 Identify and map critical habitat components (i.e. breeding and non-breeding season foraging habitats and the vegetated flyways or the flyways required to link these).

Responsibility: DENR, DSE, OEH

Action 2.2 Reserve additional areas of significant nesting habitat so that at least 2/3 of the known breeding population are located in statutory reserves.

Responsibility: DENR, DSE, OEH

Action 2.3 Protect at least 50% of breeding colonies and mallee remnants within 20 km of breeding colonies on private or leasehold properties.

Responsibility: DENR, DSE, OEH

Action 2.4 Assess the relative importance of roadside vegetated flyways and incorporate information into municipal planning schemes and/or Catchment Management Authority vegetation plans.

Responsibility: DENR, DSE, OEH

Action 2.5 Enhance flyways through re-vegetation works filling in gaps and broadening existing flyways and re-establishing flyways.

Responsibility: DENR, DSE, OEH, CMAs

Action 2.6 Protect nesting colonies and flyways to feeding grounds in state forests where timber harvesting occurs.

Responsibility: DENR, DSE, OEH, FNSW

Action 2.7 Develop protection for nesting and feeding habitat areas in fire management plans.

Responsibility: DENR, DSE, PV, OEH

Action 2.8 Include eastern Regent Parrot habitat requirements in environmental watering programs, especially health and long-term recruitment of trees in nesting colony/potential nesting colony areas.

Responsibility: DENR, DSE, OEH

Action 2.9 Assess if eastern Regent Parrot populations are exposed to Psittacine Beak and Feather Disease (PBFD) and, if required, manage any outbreaks through the national 'Threat Abatement Plan – PBFD affecting endangered Psittacine species' (DEH 2005).

Responsibility: DENR, DSE, OEH

Action 2.10 Investigate and monitor impacts of climate change and develop remediation strategies if required (e.g. responding to mortalities in nests).

Responsibility: DENR, DSE, OEH

Action 2.11 Quantify replanting outputs and incorporate these in targets for mallee planting for carbon offsets.

Responsibility: DENR, DSE, OEH

Objective 3: Reduce human-induced mortality of eastern Regent Parrots

Performance Criterion: Incidents of deliberate and accidental killing of eastern Regent Parrots, and illegal capture of wild birds, are greatly reduced.

Action 3.1 Promote and publicise load covering and grain spill policies and guidelines to grain farmers and relevant industry.

Responsibility: DENR, DSE, OEH

Action 3.2 Include measures to reduce take of poisoned grain by eastern Regent Parrots in Mouse Plague Incident Action Plans.

Responsibility: DENR, DSE, OEH

Action 3.3 Develop, implement and monitor the effectiveness of non-destructive control strategies for parrots affecting horticultural crops, in conjunction with industry groups.

Responsibility: DENR, DSE, DPI, OEH, DIPNR

Action 3.4 Investigate road kill 'hot spots' as artifacts of flyways or roadside vegetation morphology and develop strategies to ameliorate these.

Responsibility: DENR, DSE, OEH

Action 3.5 Investigate and implement measures to reduce human disturbance at nesting colony sites.

Responsibility: DENR, DSE, PV, OEH, FNSW

Action 3.6 Conduct patrols of nesting colonies to deter and detect illegal take of eggs, nestlings and/or adults and investigate DNA profiling to aid in aviary audits. Also develop protocol for the collection of cast feathers at known nesting sites in the wild for future DNA investigations.

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Responsibility: DENR, DSE, OEH

Action 3.7 Conduct targeted audits of aviary collections of eastern Regent Parrots and develop information material concerning the protected status of this species.

Responsibility: DENR, DSE, OEH

Objective 4: Investigate key aspects of the biology and ecology of the eastern Regent Parrot.

Performance criterion: Key ecological information including food resources, foraging sites, flyways and traditional watering points are identified, mapped and protected.

Action 4.1 Determine the important flyway features and develop strategies for enhancing these across the landscape.

Responsibility: DENR, DSE, OEH

Action 4.2 Assess habitat usage by eastern Regent Parrots, particularly the use of native vegetation and non-native vegetation as flyways, loafing and feeding areas.

Responsibility: DENR, DSE, OEH

Action 4.3 Determine if the existing configuration of flyways is limiting the access to other native vegetation feeding areas for eastern Regent Parrots.

Responsibility: DENR, DSE, OEH

Action 4.4 Investigate food plant species (both native and horticultural crops) and determine the significance of each to the diet of eastern Regent Parrots.

Responsibility: DENR, DSE, OEH

Action 4.5 Investigate the response of preferred food plants to fire.

Responsibility: DENR, DSE, OEH

Action 4.6 Assess the level of impact of eastern Regent Parrots on horticultural crops.

Responsibility: DENR, DSE, DPI, OEH, DII

Action 4.7 Examine the use of known eastern Regent Parrot nest hollows by introduced (e.g. feral honeybees (*Apis mellifera*)) and native species (e.g. Yellow Rosella (*Platycercus elegans flaveolus*) and Long-billed Corellas (*Cactua tenuirostris*)) to ascertain the level of competition and other impacts and investigate and trial mechanisms to reduce impacts.

Responsibility: DENR, DSE, OEH

Action 4.8 Determine breeding success and survival to adulthood of eastern Regent Parrots and factors impacting upon it.

Responsibility: DENR, DSE, OEH

Action 4.9 Determine the genetic variability and relatedness of colonies of eastern Regent Parrots.

Responsibility: DENR, DSE, OEH

Objective 5: Increase community involvement in the eastern Regent Parrot recovery program

Performance Criterion: There is an increase in community awareness of and involvement in the eastern Regent Parrot recovery program.

Action 5.1 Develop and implement an education program and community engagement strategy and actively involve local communities in increasing the number of sighting records of eastern Regent Parrots.

Responsibility: DENR, DSE, PV, OEH

Action 5.2 Develop materials and training workshops for educating landholders on eastern Regent Parrots, highlighting identification, limited distribution, threat status, ecology and habitat management and restoration.

Responsibility: DENR, DSE, OEH

Action 5.3 Promote natural resource management incentives for landholders/land managers to protect habitat, especially mallee woodland foraging habitat and associated flyways.

Responsibility: DENR, DSE, OEH

Action 5.4 Report recovery program results to the local community through the local media and information days.

Responsibility: DENR, DSE, OEH

Abbreviations: CMAs= Catchment Management Authorities; DENR=Department of Environment & Natural Resources (SA); DII = Department of Industry and Innovation (Agriculture) (NSW); DPI=Department of Primary Industries (Vic); DSE=Department of Sustainability & Environment (Vic); FNSW= Forests NSW; OEH=Office of Environment and Heritage, Department of Premier and Cabinet (NSW); PV=Parks Victoria

Cost of the Recovery Plan

The estimated cost of the recovery program is $1.419 million over five years.

	Year 1	Year 2	Year 3	Year 4	Year 5	**Total**
Totals	**1**	**2**	**3**	**4**	**5**	**0**

Affected Interests

The Regent Parrot occurs in areas with a variety of land management tenures and agencies, although much of this is in some form of public authority ownership and management. Consequently, there is management responsibility and/or interest from a range of agencies and organisations, including:

- Office of Environment and Heritage (OEH), Department of Premier and Cabinet (for NSW)
- Department of Industry and Innovation (Forests NSW and Agriculture)

- Department of Sustainability and Environment (Vic)
- Parks Victoria
- Department for Environment and Heritage (SA)
- Catchment Management Authorities (Lower Murray Darling (NSW); Mallee (Vic); Wimmera (Vic); Murray Darling Basin NRM Board (SA)
- Private landholders and leaseholders with breeding habitat and blocks of intact mallee or treed flight corridors within 20 km of the Murray River (all States) and the lower Wimmera River and Outlet Creek system (Vic).
- Horticultural industries, including almond and nut growers.

Role and Interests of Indigenous People

Indigenous communities on whose traditional lands the eastern Regent Parrot occurs have been consulted, through the relevant regional Indigenous facilitator, of this Recovery Plan and invited to be involved in its implementation. During the consultation process it was stated found that the eastern Regent Parrot was neither a totem animal nor known to be a food item to any of the indigenous communities on whose land it is known to have occurred. The relevant regional Indigenous facilitators encouraged any actions that support the conservation of this species.

Social and Economic Impacts

Implementation of this Recovery Plan will have minor social and economic impacts, which have been considered in the NSW Priorities Action Statement (DECC 2005). Their analysis indicates that implementation of the national Recovery Plan will have minor positive and negative social and economic impacts. The extent of these impacts is difficult to quantify. Negative impacts include those that result from a loss of income as a result of restrictions on River Red Gum logging, mallee harvesting for charcoal and the clearance of mallee for agricultural pursuits. The rate and extent of large scale land clearing in NSW and Victoria has substantially been reduced with the introduction of native vegetation clearance controls. Most of the Victorian River Red Gum forests containing known nesting colonies along the Murray River within the range of the eastern Regent Parrot will be converted to national or State parks following adoption of the VEAC Recommendations. A similar process is occurring in NSW and is expected to yield a similar outcome owing to unsustainable forestry practices and the deteriorating condition of River Red Gum forests due to current water regimes.

It is difficult to separate out those costs that might be incurred as a result of this plan being implemented over and above those that would be incurred as a result of existing environmental legislation, policies and plans. Positive impacts that may result from the implementation of the Recovery Plan include those associated with the maintenance of biodiversity, tourism and more sustainable use of forests and woodlands. The major recovery actions that could impinge on developments are, in the main, focused on public land. A large amount of foraging habitat in NSW is on leasehold land, so few private landholders would be affected. The main potential impacts on landholders are covered by existing legislation for native vegetation retention and wildlife protection in all three range States, or concern the offering of incentives to landholders for fencing and restoration of flight corridors and remnants.

Some development of non-destructive control methods of native parrots by almond and nut growers will be required.

Management Practices

Management practices necessary to avoid a significant adverse impact on the eastern Regent Parrot include:

- Measures to avoid damage to or destruction of foraging habitat and flight corridors, especially on private or leasehold land, and along road reserves, through activities such as clearing or grazing.
- Managing timber harvesting to avoid disturbance, loss of or damage to nesting or potential nesting areas, including protection and recruitment of nest trees.
- Managing recreational activities to avoid disturbance to nesting colonies.
- Protection of traditional watering points or provision of watering points in mallee habitat.
- Measures to reduce and where possible eliminate the deliberate or accidental killing of birds e.g. by orchardists, vehicle collisions, pest animal control.
- Providing information, education, training and incentives to landholders and the broader community on eastern Regent Parrots.

Biodiversity Benefits

The implementation of this Recovery Plan will have major benefits for a wide range of riverine and mallee species and habitats. Within the range of the eastern Regent Parrot there are a large number of nationally threatened birds (Table 1) that, like Regent Parrots, require large areas of intact habitat. Actions proposed in this Recovery Plan such as protecting colony sites, re-vegetating flight corridors, decommissioning non-essential artificial watering points, adding to the reserve system, implementing fire management strategies, implementing grain spill and pest poisoning protocols, and involving the community in surveys are all likely to assist a large number of other threatened birds.

In addition, a number of mammal and reptile species listed under the various State and national threatened species legislation would also benefit from protection of riverine and mallee habitats under recovery measures for the Regent Parrot. These included the South-eastern Long-eared Bat *Nyctophilus corbeni* (nationally Vulnerable), Western Pygmy-possum *Cercartetus concinnus* (Endangered in NSW), Bardick *Echiopsis curta* (Rare in SA, Threatened in Vic, Endangered in NSW), Mallee Worm-lizard *Aprasia aurita* (Threatened in Vic, Endangered in SA) Pink-nosed Worm-lizard *Aprasia inaurita* (Endangered in NSW) and Carpet Python *Morelia spilota* (Rare in SA, Threatened in Vic).

Table 1. Nationally threatened and declining birds within the range of the Regent Parrot

Common name	Scientific name	Status	
		G&C	EPBC
Emu	*Dromaius novaehollandiae novaehollandiae*	LC	
Malleefowl	*Leipoa ocellata*	VU	VU
Bush Stone-curlew	*Burhinus grallarius*	NT	
Major Mitchell's Cockatoo	*Lophochroa leadbeateri leadbeateri*	NT	
Scarlet-chested Parrot	*Neophema splendida*	LC	
Masked Owl	*Tyto novaehollandiae novaehollandiae*	NT	
White-browed Treecreeper	*Climacteris affinis affinis*	NT	
Mallee Emu-wren	*Stipiturus mallee*	VU	VU
Striated Grasswren	*Amytornis striatus striatus*	NT	
Redthroat	*Pyrrholaemus brunneus*	LC	
Southern Whiteface	*Aphelocephala leucopsis leucopsis*	LC	
Black-eared Miner	*Manorina melanotis*	EN	EN
Painted Honeyeater	*Grantiella picta*	NT	
Hooded Robin	*Melanodryas cucullata cucullata*	NT	
Southern Scrub-robin	*Drymodes brunneopygia*	LC	
Grey-crowned Babbler	*Pomatostomus temporalis temporalis*	NT	
Western Whipbird	*Psophodes nigrogularis*	EN	VU
Chestnut Quail-thrush	*Cinclosoma castanotum castanotum*	NT	
Crested Bellbird	*Oreoica gutturalis gutturalis*	NT	
Red-lored Whistler	*Pachycephala rufogularis*	NT	VU

G&C = Garnett & Crowley (2000). EPBC = Environment Protection & Biodiversity Conservation Act 1999. EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern

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Priority, Feasibility and Estimated Costs of Recovery Actions

Action	Description	Priority	Feasibility	Cost estimate					
				Year 1	Year 2	Year 3	Year 4	Year 5	Total
1	**Population trends**								
1.1	Locate/map breeding colonies	1	80%	**$30,000**	**$30,000**	**$20,000**	**$0**	**$0**	**$80,000**
1.2	Prioritise areas for surveys/monitoring	2	90%	**$30,000**	**$0**	**$44,000**	**$0**	**$44,000**	**$118,000**
1.3	Develop monitoring for colonies, nesting	1	90%	**$20,000**	**$20,000**	**$15,000**	**$0**	**$0**	**$55,000**
1.4	Develop monitoring for recruitment	2	75%	**$0**	**$20,000**	**$12,000**	**$0**	**$0**	**$32,000**
1.5	Establish baseline population data	1	70%	**$20,000**	**$40,000**	**$20,000**	**$0**	**$20,000**	**$100,000**
2	**Environmental threats and habitat restoration**								
2.1	Identify, map critical habitat features	1	80%	**$0**	**$20,000**	**$20,000**	**$0**	**$0**	**$40,000**
2.2	Reserve potential nesting habitat	1	100%	**$0**	**$0**	**$0**	**$30,000**	**$30,000**	**$60,000**
2.3	Protect habitat on private/leasehold land	2	75%	**$15,000**	**$10,000**	**$10,000**	**$0**	**$0**	**$35,000**
2.4	Assess and protect flyways	1	80%	**$0**	**$30,000**	**$30,000**	**$0**	**$0**	**$60,000**
2.5	Enhance/re-vegetate flyways	2	66%	**$0**	**$0**	**$20,000**	**$30,000**	**$40,000**	**$90,000**
2.6	Protect habitat in state forests	1	80%	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
2.7	Protect habitat in fire management plans	1	80%	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
2.8	Include habitat in environmental water program	1	60%	**$10,000**	**$20,000**	**$20,000**	**$20,000**	**$20,000**	**$90,000**
2.9	Assess and manage outbreaks of PBFD	2	50%	**$5,000**	**$2,000**	**$1,000**	**$2,000**	**$0**	**$10,000**
2.10	Investigate and monitor climate change impacts	1	70%	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$25,000**
2.11	Link mallee planting to carbon offset targets.	1	**75%**	**$20,000**	**$20,000**	**$20,000**	**$10,000**	**$5,000**	**$75,000**
3	**Human impacts**								
3.1	Promote covered load and grain spill policies/plans	1	100%	**$0**	**$5,000**	**$5,000**	**$5,000**	**$0**	**$15,000**
3.2	Reduce poisoned grain take	2	100%	**$0**	**$0**	**$0**	**$0**	**$0**	**$0**
3.3	Develop non-destructive control methods	1	75%	**$5,000**	**$10,000**	**$20,000**	**$20,000**	**$0**	**$55,000**
3.4	Investigate and reduce road kill incidents	1	60%	**$2,000**	**$0**	**$2,000**	**$0**	**$2,000**	**$6,000**
3.5	Reduce disturbance near colonies	2	70%	**$5,000**	**$0**	**$3,000**	**$0**	**$3,000**	**$11,000**
3.6	Undertake patrols to deter illegal take	1	80%	**$2,000**	**$2,000**	**$2,000**	**$2,000**	**$2,000**	**$10,000**

3.7	Targeted audits of aviary collections	2	100%	**$2,000**	**$2,000**	**$2,000**	**$2,000**	**$2,000**	**$10,000**
4	**Biology and Ecology**								
4.1	Determine flyway features	1	100%	**$20,000**	**$20,000**	**$0**	**$0**	**$0**	**$40,000**
4.2	Assess habitat usage	1	80%	**$0**	**$20,000**	**$25,000**	**$25,000**	**$25,000**	**$95,000**
4.3	Determine if flyway connections are adequate	2	60%	**$0**	**$0**	**$40,000**	**$0**	**$20,000**	**$60,000**
4.4	Investigate food plant species usage	1	60%	**$10,000**	**$10,000**	**$10,000**	**$0**	**$0**	**$30,000**
4.5	Investigate food plant species' response to fire	2	80%	**$0**	**$0**	**$6,000**	**$6,000**	**$0**	**$12,000**
4.6	Assess the level of impact on crops	1	100%	**$0**	**$10,000**	**$10,000**	**$10,000**	**$0**	**$30,000**
4.7	Investigate competition for nest hollows	1	80%	**$10,000**	**$10,000**	**$10,000**	**$0**	**$10,000**	**$40,000**
4.8	Determine factors impacting on breeding success	1	100%	**$6,000**	**$6,000**	**$6,000**	**$6,000**	**$6,000**	**$30,000**
4.9	Determine genetic variability of colonies	3	100%	**$0**	**$0**	**$20,000**	**$20,000**	**$20,000**	**$60,000**
5	**Community participation**								
5.1	Develop community engagement strategy	1	100%	**$15,000**	**$10,000**	**$10,000**	**$5,000**	**$5,000**	**$45,000**
5.2	Develop landholder education program	1	60%	**$10,000**	**$10,000**	**$10,000**	**$10,000**	**$10,000**	**$50,000**
5.3	Promote NRM incentives	2	60%	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$5,000**	**$25,000**
5.4	Report recovery program results	3	100%	**$2,000**	**$2,000**	**$2,000**	**$2,000**	**$2,000**	**$10,000**
	Totals			**$32,000.00**	**$27,000.00**	**$27,000.00**	**$22,000.00**	**$22,000.00**	**$130,000.00**