



Nomination of a Western Australian species for listing as threatened, change of status or delisting.

To fill out this form you must refer to the attached Guidelines. Incomplete forms will result in delays in assessment, or rejection of the nomination.

Answer all relevant sections, indicating when there is no information available. Note, this application form applies to both flora and fauna species, and hence some questions or options may not be applicable to the nominated species – for these questions, type or write “N/A”.

Some questions on the form have additional information in a **Help** box and these are marked with an asterisk (*). If you require additional information, place your cursor in the text box into which you type your answer, press F1 and a Help box will pop-up.

SECTION 1. NOMINATION		
1.1. Nomination information		
Flora <input type="checkbox"/>	Fauna <input checked="" type="checkbox"/>	Nomination for : Maintaining Conservation Status
1.2. Scientific Name		
<i>Dasyurus geoffroii</i>		
1.3. Common Name		
Chuditch or Western Quoll		
1.4. Current Conservation Status		
Select one category for each of the five fields. If none, select ‘None’.		
International		
IUCN Red List: Vulnerable		
Categories and Criteria applicable to the highest rank category only: C1 (2.3, 1994)		
National (<i>EPBC Act 1999</i>) Vulnerable		
State of WA Wildlife Conservation Notice: Schedule 1 IUCN Ranking: Vulnerable Priority: None		

Is the species listed as 'Threatened' in any other Australian State or Territory No Yes

If Yes, list the States and/or Territories and the status for each

Table 1: History of conservation status of chuditch in Australia.

Jurisdiction	Legislation/Authority	Rank/Status	Year listed	Year removed
International	IUCN	Status inadequately known - survey required or data sought	1965	-
		Endangered	1994	1996
		Vulnerable (Vu C1 version 2.3 (1994))	1996	Current
National	Endangered Species Protection Act 1992	Endangered	1992	Replaced by EPBC Act
	1992 Action Plan for Australian Marsupials and Monotremes	Endangered	1992	Superseded by 1996 action plan
	1996 Action Plan for Australian Marsupials and Monotremes	Vulnerable	1996	Current
	Environment Protection and Biodiversity Conservation Act 1999	Vulnerable	1999	Current
Western Australia	Wildlife Conservation Act 1950	"Rare or likely to become extinct" ranked as Vulnerable	1983	Current
South Australia	National Parks and Wildlife Act 1972	Endangered	-	Current
Queensland	Nature Conservation Act 1992	Extinct	-	Current
Northern Territory	Territory Parks and Wildlife Act 2000	Extinct	-	Current
New South Wales	Threatened Species Conservation Act 1995	Not listed	-	Current
Victoria	Flora and Fauna Guarantee Act 1988	Not listed	-	Current
Australian Capital Territory	The Nature Conservation Act 1980	Not listed	-	Current
Tasmania	Threatened Species Protection Act 1995	Not Listed	-	Current

Does the species have specific protection (e.g. listed on an annex or appendix) under any other legislation, inter-governmental or international arrangements e.g. CITES? No Yes

If yes, please provide details

1.5. Nominated Conservation Status

Select one category for each of the five fields. If none, select 'None'.

International

IUCN Red List: Vulnerable

Categories and Criteria applicable to the highest rank category only: C1 (3.1, 2001)

National (*EPBC Act 1999*): Vulnerable

State of WA Wildlife Conservation Notice: Schedule 1 IUCN Ranking: Vulnerable Priority: None

1.6. Reasons for the Nomination

Briefly summarise the reasons for the nomination in dot points. Please include details relevant to the IUCN Categories and Criteria where appropriate.

There has been some debate regarding whether or not the chuditch still qualifies for listing as Vulnerable using IUCN criteria.

Arguments for delisting are:

- The conservation status of the chuditch is better understood following the implementation of the species recovery plan in 1994 and the results of research conducted to implement recovery actions has been completed and published (see Morris *et al.* 2003).
- There is evidence of chuditch recently recolonising parts of its former range.
- Draft reviews of the conservation status of the chuditch in 1998 and 2000 indicated that the chuditch no longer met IUCN criteria for listing as Vulnerable and suggested that the species may qualify for de-listing once the five-year rule had been satisfied (ie the species no longer met any of the criteria for listing for a minimum of five years). At the time, trap success for most monitoring sites had increased in comparison to pre-fox baiting trap success. These reviews assumed that the increased trap success would be maintained, and corresponded to a proportional increase in population size.
- Chuditch population size calculated by extrapolating chuditch density estimates across calculated area of occupancy and extent of occurrence estimates, increased between 2001 and 2006.

Arguments against delisting are:

- Recovery criteria set out in the species recovery plan have only partially been met. The species has been established at a semi-arid site (Lake Magenta Nature Reserve), has probably been established at a site outside the species range as it was in 1994 (Kalbarri National Park) but only 8 out of 27 monitoring sites in the jarrah forest, where sufficient data had been collected, have maintained a trap success of 1% or greater for the last five years.
- Estimating population size for such a wide ranging, low density species is difficult, but it is highly likely that the population size remains below 10 000 individuals.
- Evidence to support a continuing estimated decline of at least 10 % in the number of mature individuals within three years is difficult to provide because the variability inherent in monitoring techniques (such as trapping and spotlighting) for low density species. However, it is apparent that following the initial increase in trap success observed following fox baiting, trap success has not continued to increase (some sites are exceptions).
- Current monitoring techniques may not be adequate to identify trends in trap success/population size at a resolution needed to detect a decline or increase of 10% or more within three years, as required by IUCN criteria.

A summary has been provided in Table 2 that outlines which IUCN criteria apply to the chuditch and which recovery plan criteria have been met or not met.

From the information available it is recommended that the chuditch remain listed under Schedule 1 of the Wildlife Conservation Act and ranked as Vulnerable C1 (version 3.1).

Table 2: Summary of IUCN criteria and criteria for recovery set out in the chuditch recovery plan, that are relevant to assessing the conservation status of the chuditch.

IUCN Criteria (version 3.1, 2001)	Applies? (Yes/No)	
	Vu	En
A. <i>Declining population (past, present and/or projected)</i> (requires a minimum of a 30% decline in the recent past or projected for the future)	No	No
B. <i>Geographic range size and fragmentation, decline or fluctuation.</i> (Requires an extent of occurrence of less than 20 000km ² or an area of occupancy of less than 2000km ²).	No	No
C. <i>Small population size and fragmentation, decline or fluctuations.</i> (Requires a population size of less than 10 000 and a continuing decline of at least 10% within three years for Vulnerable or less than 2 500 and a 20% for Endangered)	Yes	No
D. <i>Very small population size or very restricted distribution.</i> (requires a population size of less than 1000 or known from a small area of occupancy or small number of locations)	No	No
E. <i>Quantitative analysis of extinction risk (e.g. Population Viability Analysis).</i> (requires a thorough population viability analysis to have been performed)	No	No
Criteria for Recovery in the Chuditch Recovery Plan	Met/not met?	
<i>Average daily trap success at monitoring sites in the jarrah forest remain at or increasing above 1%</i>	Not met	
<i>The maintenance of a population in at least one semi-arid monitoring sites</i>	Met	
<i>At least one self-sustaining population established outside present (1994) range.</i>	Met?	

SECTION 2. SPECIES

2.1. Taxonomy

Describe the taxonomic history, using references, and describe the key distinguishing features that can be used to separate this taxa from closely related taxa.

The chuditch is one of four *Dasyurus* species that occur in Australia. *D. geoffroii* is now restricted to southwest Western Australia, *D. maculatus* (tiger quoll) occurs in eastern Australia, *D. viverrinus* (eastern quoll) in Tasmania and *D. hallucatus* from northern Australia. Apart from distributional differences, the species of *Dasyurus* can be distinguished by the presence or absence of the following characteristics: spots on the tail, four or five toes on hind feet, ridges or granulous foot pads. *D. geoffroii* has no spots on the tail, usually five toes on the hind feet and granular foot pads (Ride, 1970).

Two subspecies have been recognised: *D. g. geoffroii* from inland Australia and *D. g. fortis* from south-western Western Australia. *D. g. fortis* is considered to be somewhat larger and whiter underneath but the lack of eastern Australian specimens makes this hard to confirm (Troughton, 1973). The validity of this taxonomy has also been questioned genetically (Firestone, 1999) and morphometrically (Serena *et al.* 1991). No subspecies are currently recognised by the Western Australian Museum.

The chuditch is most closely related genetically to *D. spartacus* which is one of two *Dasyurus* species that occurs in New Guinea (Firestone, 1999). *Dasyurinus geoffroii* is a recent synonym of *D. geoffroii*.

Is this species conventionally accepted? No Yes If no, explain why

Describe any known hybridisation with other species in the wild, indicating where this occurs and how frequently.

No hybrids have been recorded for this species.

2.2. Description

Describe the physical appearance, habit, behaviour/dispersion and life history.

The chuditch is Western Australia's largest endemic carnivore. They are reddish-brown to grey in colour with distinctive white spots and a long tail with a black brush (Figure 1). Females are smaller than males weighing 900g on average compared to 1300g for males (Orell and Morris, 1994).

Chuditch live for about two years in the wild and can breed in their first year. The young are deposited in a nest at two months of age and are weaned at 5-6 months old.



Figure 1: An adult female chuditch being released at Bindoon Defence Training Area.

Photo by: C. Freegard

2.3. Distribution

Describe the distribution of the species in Australia and, if possible, attach a map.

The chuditch formerly occupied nearly 70% of the Australian mainland, occurring in every State and Territory (Figure 2).

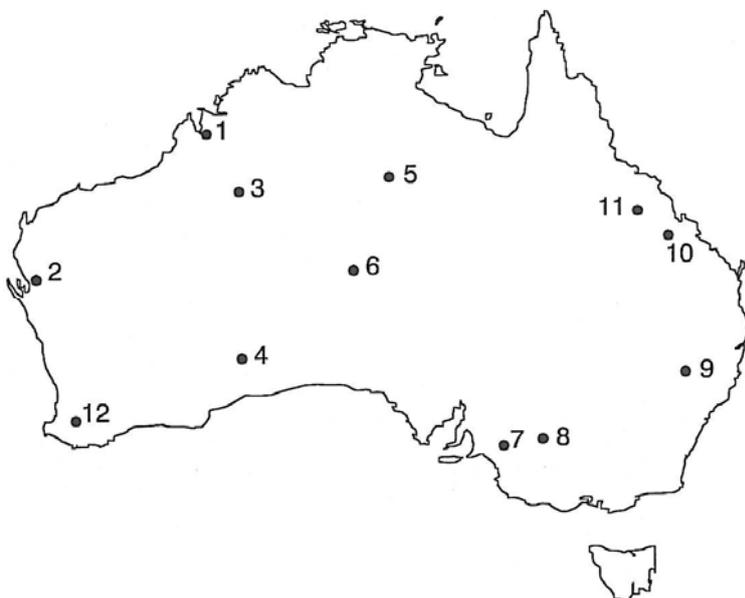


Figure 2: The distribution of chuditch at the time of European settlement, as documented by museum specimens. 1 Derby, WA; 2 Shark Bay, WA; 3 Kudarra Well, WA; 4 Rawlinna, WA; 5 Barrow Creek, NT; 6 S of Musgrave/N of Everard Ranges, SA; 7 Murray River, SA; 8 Juncture of Murray/Darling rivers, Vic; 9 Liverpool Plains, NSW; 10 Coomobooaroo, Qld; 11 Peak Downs, Qld; 12 Arthur River, WA. (From Serena *et al.* 1991).

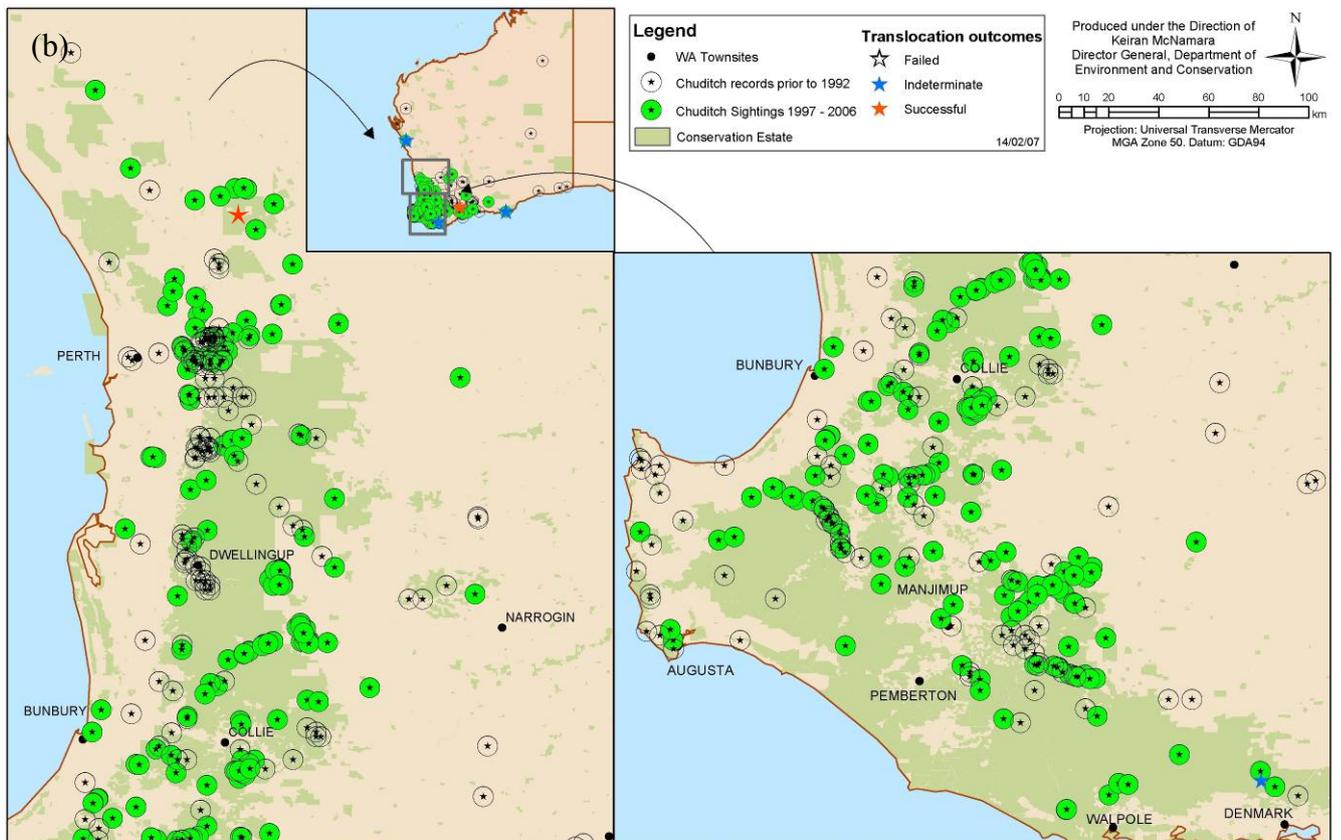
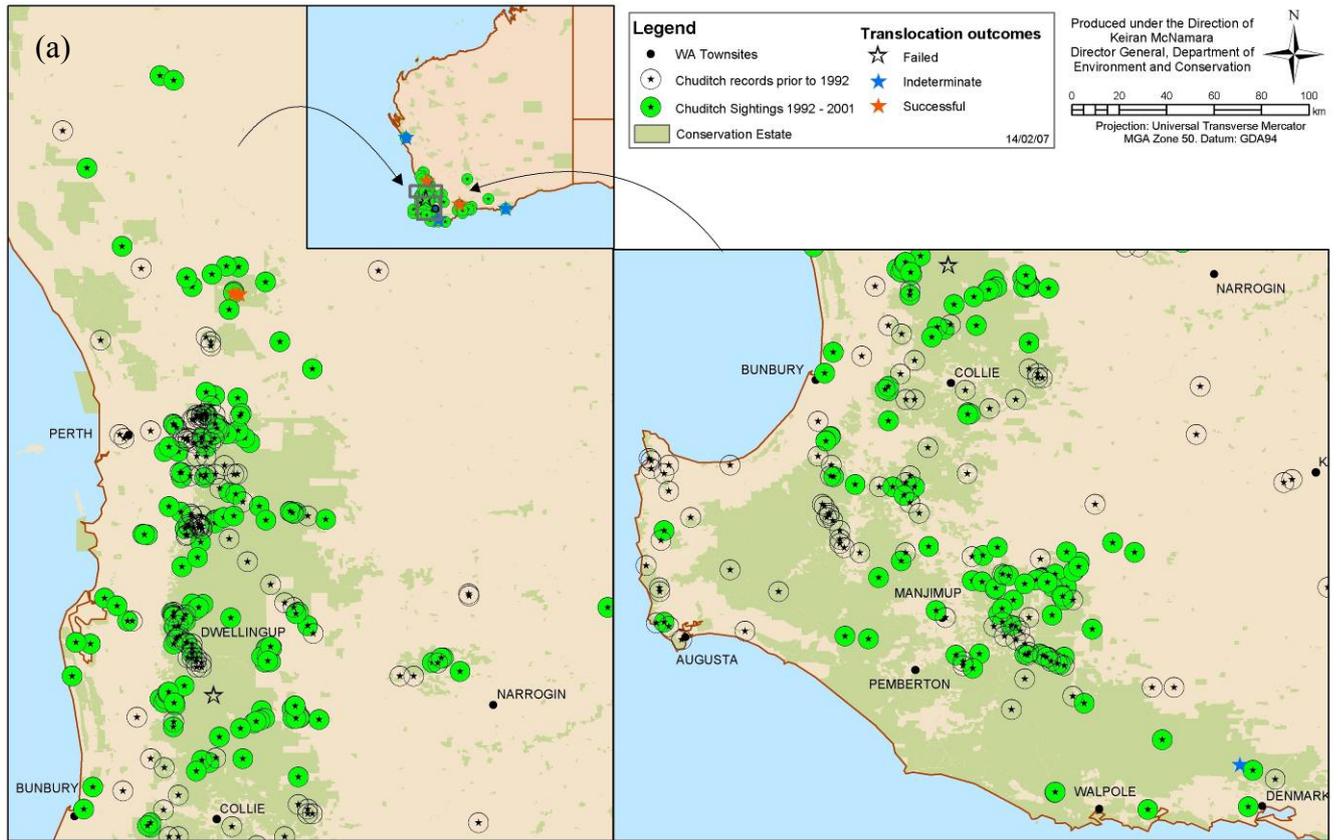
The last specimens were collected in New South Wales in 1841, Victoria in 1857, Queensland between 1884 and 1907 and in South Australia in 1931 (Orell and Morris, 1994). It disappeared from central Australia around the 1940's/1950's (Burbidge *et al.* 1988). In Western Australia it was recorded as breeding in Kings Park and the roofs of suburban houses by Troughton (1973) but had disappeared from the Swan Coastal Plain by the 1930's according to Orell and Morris (1994).

Ride (1970) describes the chuditch as being very rare in all parts of its former range except in the southwest of Western Australia where it is common but acknowledges that it was always rare outside the southwest.

The chuditch is now known only from Western Australia where it predominantly occurs in jarrah forest (Figure 3). At the time of writing the species recovery plan (1994) the chuditch was considered to occur in just 5% of the species original range. Occasional records are obtained from the wheatbelt and goldfields where it persists at very low numbers. The species has been translocated to Lane Poole Conservation Park, Julimar Forest, Lake Magenta Nature Reserve, Cape Arid National Park, Mount Lindsay National Park and Kalbarri National Park.

There is recent evidence of a return of the species to the outer metropolitan areas (e.g. Kalamunda Road, Gooseberry Hill) and the Swan Coastal Plain (e.g. Upper Swan, Yalgorup National Park).

Figure 3: Distribution of the chuditch in Western Australia in 2001 (a) and 2006 (b).



2.4. Habitat	
Describe the non-biological habitat (e.g. aspect, topography, substrate, climate) and biological habitat (e.g. forest type, associated species, sympatric species). If the species occurs in various habitats (e.g. for different activities such as breeding, feeding, roosting, dispersing, basking etc) then describe each habitat.	
<p>Non-biological habitat</p> <p>Chuditch previously occupied habitat in a variety of climatic zones. Chuditch are now restricted to the south west of Western Australia.</p>	<p>Biological habitat</p> <p>Chuditch can utilise a wide range of habitats including forest, woodland and desert. Prior to fox control densest occurrences were found associated with riparian vegetation. Chuditch require sufficient suitable den and refuge sites such as hollow logs and prey biomass (large invertebrates, reptiles and small mammals) to survive. Chuditch appear to utilise roadside vegetation in the wheatbelt.</p>
Does the (fauna) species use refuge habitat e.g. in times of fire, drought or flood? Describe this habitat.	
<p>Prior to fox control, highest densities of chuditch were found in riparian vegetation which may be because the food supply is better or more reliable and the dense undergrowth may provide protection from predators (Orell and Morris, 1994). With the implementation of fox control, high densities can also be found in upland Eucalypt woodlands.</p> <p>Chuditch are capable of surviving the current prescribed burning regimes (generally 5-7 year rotation) undertaken in the jarrah forest but it is likely that cooler spring burns are preferred where den logs are not consumed and invertebrate fauna recover more quickly (Orell and Morris, 1994).</p>	
Is the species part of, or does it rely on, a listed threatened ecological community? Is it associated with any other listed threatened species?	
<p>The chuditch does not rely on a listed threatened ecological community but it is associated with other threatened species. Chuditch have been translocated to sites considered Fauna Reconstruction sites under the <i>Western Shield</i> Program (e.g. Kalbarri National Park). These sites have been selected to reintroduce species that were present at the time of European settlement. As a result other threatened species are now present at locations where chuditch are known to occur.</p> <p>Chuditch are found in habitat also occupied by western ringtail possums (<i>Pseudocheirus occidentalis</i>), quokka (<i>Setonix brachyurus</i>), numbat (<i>Myremycobius fasciatus</i>), bilby (<i>Macrotis lagotis</i>), boodie (<i>Bettongia lesueur</i>) and red-tailed phascogale (<i>Phascogale calura</i>).</p>	

2.5. Reproduction

Provide an overview of the breeding system.

For flora: When does the species flower and set fruit? Is the seed produced viable? What conditions are needed for this? What is the pollinating mechanism? If the species is capable of vegetative reproduction, a description of how this occurs, the conditions needed and when. Does the species require a disturbance regime (e.g. fire, ground disturbance) in order to reproduce?

For Fauna: Provide an overview of the breeding system and breeding success, including: when does it breed; what conditions are needed for breeding; are there any breeding behaviours that may make it vulnerable to a threatening process?

Chuditch are seasonal breeders with females entering oestrus in late April and births occurring between May and September but peaking between June and July. Chuditch are promiscuous and a female may mate with several different males for the duration of her oestrus (approximately 4-10 days) (Stead-Richardson *et al.* 2001). Young are deposited in a den after two months in the pouch to allow the mother to forage (Orell and Morris, 1994). Young are particularly vulnerable at this time.

Table 3: Summary of chuditch breeding cycle (adapted from Serena *et al.* 1991, information added from Orell and Morris, 1994).

Season	Event
Late April – early July	Females enter oestrus, mating occurs. Gestation 17-18 days.
Mid May – mid July	Birth of 2-6 young. Pouch life 61 days.
Mid July – mid September	Young deposited in burrow/nest
Mid October – mid December	Young are weaned at about 170 days
November - January	Young disperse and will breed in their first year.

2.6. Population dynamics

Provide details on ages of sexual maturity, extent of breeding success, life expectancy and natural mortality. Describe population structure (presence of juveniles/seedlings, mature and senescing individuals).

Both males and females can breed in their first year however, it is likely that second year males are more successful at mating when they have achieved a larger size than females. Highest fecundity is associated with first year females which also comprise over half the breeding female population (Orell and Morris, 1994). The average lifespan in the wild is two to three years and they usually do not live beyond four years (Soderquist, 1988). In captivity chuditch have been known to live for at least 5.5 years (Serena *et al.* 1991). Sex ratios are close to parity for both pouch young and breeding adults (Orell and Morris, 1994).

Questions 2.7 and 2.8 apply to fauna nominations only

2.7. Feeding

Summarise food items or sources and timing/availability.

Large invertebrates form the largest portion of the diet of the chuditch and this is supplemented by small mammals, birds and lizards (Orell and Morris, 1994). Some plant matter has also been recorded in the diet including the red pulp surrounding zamia (*Macrozamia reidleyi*) seeds (Serena *et al.* 1991). Food is most limited during the colder months between June and August (Orell and Morris, 1994).

Briefly describe feeding behaviours, including those that may make the species vulnerable to a threatening process.

Chuditch primarily forage on the ground at night. They are able to climb trees to obtain prey or escape from predators. Chuditch can come into conflict with humans by scavenging food around campsites and by raiding chicken coups. Chuditch are known to forage along roads and to feed on carrion making them vulnerable to road traffic.

Several drownings have been recorded, presumably as a result of the chuditch slipping when drinking from water tanks, rivers and other water sources such as those provided by apiarists for bees.

2.8. Movements

Describe any relevant daily or seasonal pattern of movement for the species, including relevant arrival/departure dates if migratory.

Chuditch are primarily active at night, however activity during the day has been recorded during the breeding season and when cold, wet weather restricts nocturnal foraging (Orell and Morris, 1994). In the jarrah forest they shelter during the day in horizontal, hollow logs or earth burrows (Orell and Morris, 1994). In the desert the species utilised hollow logs and tree limbs, the earth burrows of other animals such as the burrowing bettong and bilby, as well as burrows in termitaria (Burbidge *et al.* 1988).

Seasonal movements have not been recorded for the species.

Give details of home range/territories.

Table 4: Home range estimates for chuditch at sites in southwest Western Australia.

Site	Males	Females	Reference
Batalling	7.91km ² (min convex polygon)	3.14km ² (min convex polygon)	Mathew, 1996
	5.09km ² (harmonic means)	2.78km ² (harmonic means)	Mathew, 1996
Murray River	15km ² with overlapping core of 4km ²	3-6km ² with non-overlapping core of 0.9km ²	Serena and Soderquist, 1989

SECTION 3. INTERNATIONAL CONTEXT

For species that are distributed both inside and outside Australia

3.1. Distribution

Describe the global distribution.

Not applicable. Species occurs only in Australia.

Give an overview of the global population size, trends, threats and security of the species outside of Australia.

Not applicable. Species occurs only in Australia.

Explain the relationship between the Australian population and the global population. What percentage of the global population occurs in Australia? Is the Australian population distinct, geographically separate or does part, or all, of the population move in/out of Australia's jurisdiction? Do global threats affect the Australian population?

Not applicable. Species occurs only in Australia.

SECTION 4. CONSERVATION STATUS AND MANAGEMENT

4.1. Population

What is the total population size in terms of number of mature individuals? Has there been any known reduction in the size of the population, or is this likely in the future? – give details.

It is difficult to estimate the population size of such a wide ranging and low density species such as the chuditch. In 1991 the population size was estimated to be 2500-4400 in the jarrah forest (Serena *et al.* 1991). This estimate was extrapolated from the average density of chuditch determined from intensive trapping studies at Boyicup and Yendicup forest blocks.

The 2001 and 2006 population size estimates for the south west forests was calculated using 40-70% of the density of chuditch per km² used by Serena *et al.* (1991) (ie ~0.32 chuditch/km²) and applying it to the area of occupancy of the chuditch in the southwest forest calculated from records in the Threatened and Priority Fauna Database and Translocations Database using 10 and 25km² grids square (see section later in nomination for more information) (Table 4).

It was conservatively assumed that chuditch occurred outside the forest area at 1% of the density recorded by Serena *et al.* (1991). This was then applied to the total extent of occurrence of the chuditch minus the area of occupancy in the jarrah forest (calculated using a 10 and 25km² grid) and used to estimate the population size outside the jarrah forests for both 2001 and 2006 (Table 5).

Table 5: Chuditch population size estimates.

Year	Site	Estimated number of mature individuals	Reference
1991	Australia	<6000	Serena <i>et al.</i> (1991)
1991	Jarrah Forest	2500-4400*	Serena <i>et al.</i> (1991)
1994	Batalling	41	Bencini <i>et al.</i> (in prep.)
1998	Julimar	43	Bencini <i>et al.</i> (in prep.)
1998	Jarrah Forest	12500	Morris, 1998
1998	Wheatbelt/Goldfields	2000	Morris, 1998
2000	Jarrah Forest	12500	Morris, 2000
2000	Wheatbelt/Goldfields	2000	Morris, 2000
2001	Jarrah Forest	1212-2121 (Using area of occupancy calculated using 10km ² grid) 3900-6825 (Using area of occupancy calculated using 25km ² grid)	This nomination
2001	Wheatbelt/Goldfields	616 (Using area of occupancy calculated using 10km ² grid) 549 (Using area of occupancy calculated using 25km ² grid)	This nomination
2006	Jarrah Forest	4800	Morris <i>et al.</i> 2006
2006	Jarrah Forest	1368-2394 (Using area of occupancy calculated using 10km ² grid) 4125-7219 (Using area of occupancy calculated using 25km ² grid)	This nomination
2006	Wheatbelt/Goldfields	601 (Using area of occupancy calculated using 10km ² grid) 532 (Using area of occupancy calculated using 25km ² grid)	This nomination

*This estimate assumes that the density of chuditch throughout the jarrah forest production areas and privately-owned forest (19 500km²) is equivalent to 40-70 per cent of the average density of the unusually high quality population occupying the Perup Nature Reserve. The Perup density estimate was calculated on the results of trapping surveys undertaken in Boyicup and Yendicup blocks in the period 1974-1988, excluding years in which no animals were caught in a given area (ie years in which chuditch numbers may have been unusually or atypically low) – details of trapping results in appendix I of Serena *et al.* (1991).

A population size of greater than 10 000 mature individuals is required for the species to no longer qualify for listing as vulnerable under IUCN criteria (version 3.1). The population size estimates are very broad but it is likely that the population size of chuditch is less than 10 000 mature individuals.

A decline in population size is also an indicator of a threatened species. To be listed as Vulnerable under IUCN criteria, a population size of less than 10 000 must be accompanied by a decline in the number of mature individuals of at least 10% within three years. Changes in trap success are used to observe trends in population size both within and between populations. Trap success figures for chuditch are available from fauna monitoring sites established through the *Western Shield* program. Trap success is typically low for chuditch because it is a sparsely distributed species and it also varies seasonally. Highest trap success rates for chuditch are usually observed in June or July (Serena and Soderquist, 1988). Trap saturation can also reduce trap success for chuditch. This is particularly apparent at sites where species such as brushtail possums and woylies reached trap success rates in excess of 50% (e.g. Chariup, Batalling). For these reasons, trends in abundance of chuditch are difficult to separate from variability inherent in the monitoring techniques. In an attempt to reduce some of this variability, trap success was averaged for three-year periods for sites with at least nine years of monitoring data and summarised in Table 6 but it must be emphasized that this is a very coarse assessment.

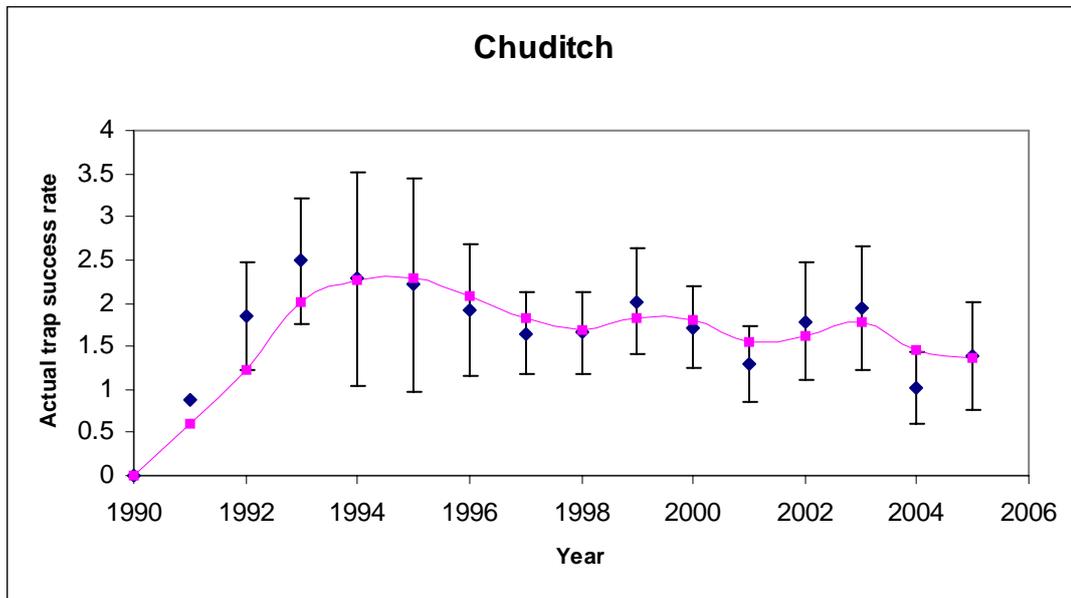
Table 6: Summary of trap success for chuditch at sites that have been monitored for at least nine years.

Monitoring site	Average trap success for three-year intervals			Trend
	1998-2000	2001-2003	2004-2006	
Batalling	2.3	1.2	0.7	Decreasing
Gervasse	1.9	0.5	0	Decreasing?
St John	0.03	0.5	0.2	No change
Tone	1.0	1.7	0.3	No change
Moopinup	2.8	0.7	1.0	No change
Chariup	1.1	0.2	0	Decreasing?
Boycup	0	0	0.1	No change
Myalgelup	0.4	1.4	0.7	No change
Denmark (Mt Lindsay)	1.6	0.3	0	Decreasing?
Camballan	0	1.5	6.6	Increasing
Catterick	0.4	2.5	5.5	Increasing
Noggerup	1.8	6.7	7.2	Increasing
Milyeannup	0.1	0	0	No change
Lake Magenta NR	2.2	0.4	0.5	No change
Moir Track (Fitz. R NP)	0.1	0.1	0	No change
Julimar	7.1	3.5	1.9	Decreasing
AVERAGE:	1.4	1.3	1.5	No change

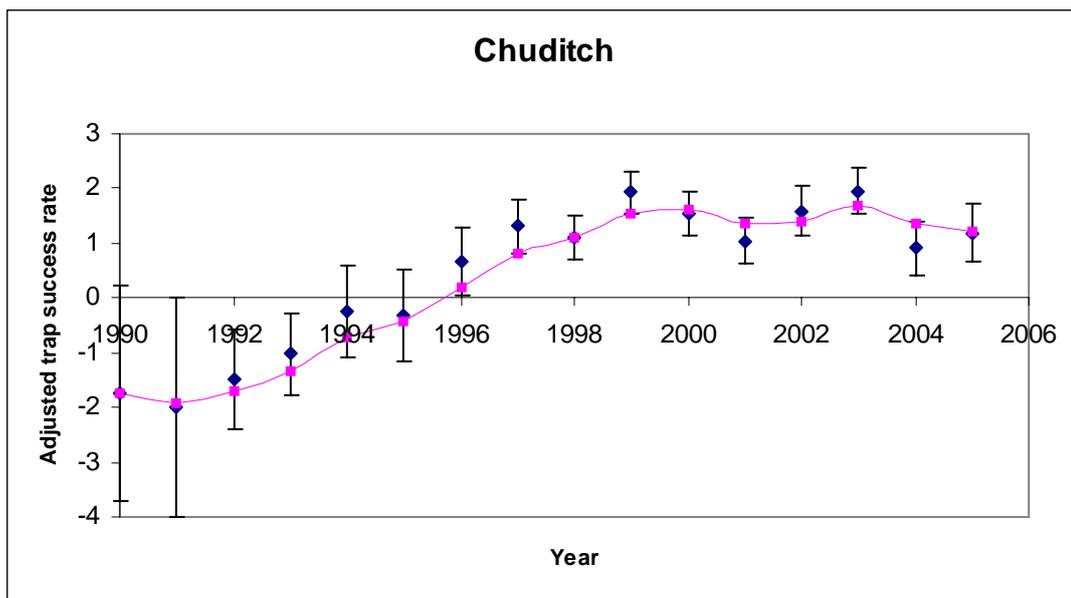
Williams (2006) conducted a preliminary analysis of trapping results under the *Western Shield* program with the aim of assessing the ability of existing monitoring strategies to detect changes in abundance of species. Preliminary graphs for the chuditch are shown in Figure 4.

Figure 4: Average chuditch trap success rates at 32 *Western Shield* monitoring sites showing (a) raw trap success rates and (b) estimated trap success rate after adjusting for site and seasonal difference in sampling. The fitted line is a 3 year moving average based on current and previous two years of data with weights 3/6, 2/6 and 1/6 respectively.

(a)



(b)



A criteria for success of the species recovery plan was for average daily trap success rates at monitoring sites in the jarrah forest to remain at or increase above 1%. To assess if this recovery criteria has been met trap success data for monitoring sites were considered for the last five years. From these results, monitoring sites were placed into four broad categories; sites where trap success remained above 1%, sites with a trap success that remained below 1%; sites where trap success has varied above and below 1% and sites where chuditch were only occasionally trapped (Table 7). This shows that only 8 out of 26 monitoring sites in the jarrah forest, where sufficient data had been collected, had maintained a trap success of 1% or greater for the last five years. This means that the chuditch does not meet criteria for success in the species recovery plan.

IUCN criteria A and C require that a percentage decline in either population size or the number of mature individuals. There is not enough evidence from monitoring data to suggest that an obvious decline is apparent. A minimum 10% decline in population size within three years (with a population

size less than 10 000) is required for listing under criterion C1. This is the category under which the chuditch is currently listed. Figure 4 indicates that a decline has occurred over the last three years but these figures should be treated with caution given the low number of captures involved in producing trap success figures of less than 2%. **It would be conceivable that the chuditch continues to meet IUCN criteria for listing as Vulnerable C1 (version 3.1).**

Table 7: Summary of the status of chuditch at monitoring sites in Western Australia. Sufficient monitoring results were unavailable for some sites and these have been excluded from the summary.

Category	MONITORING SITES						TOTAL
	Perth Hills District	Wellington District	Blackwood District	Donnelly District	Warren District	Isolated Reserves	
Sites where trap success has remained above 1% between 2002 and 2006	Julimar Bindoon DTA Avon Valley NP	Centaur	Camballan Catterick Noggerup	Balban			8
Sites where trap success has remained below 1% between 2002 and 2006			Whicher	Winnejup		Kalbarri NP	3
Sites where trap success varied above and below 1% between 2002 and 2006		Hadfield Batalling	St John	Warrup Keninup Moopinup Myalgelup		Lake Magenta NR	8
Sites where chuditch are only occasionally trapped		Davis Gervasse Lennard Dr	Milyeannup	Tone Yendicup Yackelup Camelar Chariup Boyicup Boyndaminup	Denmark (Mt Lindsay)	Dragon Rocks NR Twertup Moir Track Karakamia Sanctuary	16
	3	6	6	13	1	6	35

Give locations of: captive/propagated occurrences or *ex situ* collections; recent re-introductions to the wild; and sites for proposed re-introductions. Have these sites been identified in recovery plans?

Chuditch have been successfully bred in captivity at Perth Zoo. Between 1990 and 2000, Perth Zoo maintained approximately 15 pairs of chuditch and provided 330 animals for release at translocation sites selected by the species' recovery team. Perth Zoo no longer maintains an active breeding colony. Two institutions currently house chuditch and these are detailed in Table 8.

Table 8: Locations and numbers of *D. geoffroii* held in captive collections around the world (Data sourced from the International Species Information System, www.isis.org on 3/1/2007).

Country	Institution name	M	F	Births (last 6 months)	Total
Australia	Alice Springs Desert Park	2	2	0	4
Australia	Perth Zoological Gardens	1	0	0	1

The only private organisation currently licensed to keep chuditch under the Wildlife Conservation Act is Caversham Wildlife Park where a single individual is kept (as at 5/1/2007).

Apart from zoos and private collections, other non-naturally occurring occurrences have been established by translocation to parts of the species former range. Table 9 summarises chuditch reintroductions that have been undertaken.

Table 9: Summary of chuditch reintroductions in Western Australia.

Release site	Release years	Source site	Number released	Outcome
Lane-Poole Reserve	1987	Dwellingup	9	Failed
Julimar Forest	1992-1995	Perth Zoo	62	Successful
Lake Magenta Nature Reserve	1996-1998	Perth Zoo	81	Successful
Cape Arid National Park	1998-2000	Perth Zoo	61	Probably unsuccessful
Mt Lindsay National Park	1999-2000	Perth Zoo	63	Indeterminate
Kalbarri National Park	2000-2001	Perth Zoo	49	Probably successful

The species recovery plan identified Julimar Conservation Park as a trial translocation site and suggested that a translocation site in a semi-arid location be selected following further research into the biology and distribution of chuditch in semi-arid areas (Orell and Morris, 1994). Chuditch were translocated to Julimar between 1992 and 1995 and to Lake Magenta Nature Reserve between 1996 and 1998.

No translocations of chuditch are currently planned for the near future. Site-based fauna reconstruction projects such as those being implemented for Dirk Hartog Island, Lorna Glen and Francois Peron National Park have plans to reintroduce chuditch but are establishing other species first.

Criteria for success in the species recovery plan stated the requirement for the establishment of at least one population [subpopulation] in a semi-arid environment and at least one population [subpopulation] outside the species present range (in 1994). Chuditch have been successfully established at semi-arid Lake Magenta Nature Reserve. Two attempts have been made to establish occurrences outside the species' present range, the outcome of both is currently indeterminate but the translocation to Cape Arid National Park has probably been unsuccessful whereas the translocation to Kalbarri National Park has probably been successful. Additional time is required to further assess the species' persistence at Kalbarri National Park before it is consider successful (ie extent of occurrence both in the gorges as well as throughout the park).

How many locations do you consider the species occurs in and why?

Defining locations in which the chuditch occurs is inappropriate for this taxon. The species can travel large distances, has large home ranges and is sparsely populated through a large portion of its range. The species is present in varying densities throughout the jarrah forest, is present at Kalbarri National Park and is sparsely populated in the wheatbelt and goldfields areas.

Has the number of individuals been counted , or is this an estimate . Provide details of the method of determining the number of individuals.

See previous section.

Has there been any known reduction in the number of locations, or is this likely in the future? – give details.

No major contraction in the species range has been observed in the last 15 years. Attempted reintroductions to Cape Arid National Park and Mount Lindsay National Park have probably been unsuccessful however reintroductions to Kalbarri National Park, Lake Magenta Nature Reserve and Julimar forest have probably been successful. There is some evidence of recolonisation of parts of the species former range (e.g. swan coastal plain).

What is the extent of occurrence (in km²) for the species; explain how it was calculated and datasets used. If an accurate estimate is unavailable provide a range of values or a minimum or maximum area estimate.

The extent of occurrence of the chuditch was estimated to be 215 400 km² in 2001 and 211 800 km² in 2006.

This was measured by constructing a minimum convex polygon around records in the southwest of Western Australia plus the area of Kalbarri National Park (Figure 5 and 6). The records were obtained from the Translocations Database which contains information on the movement of animals for conservation purposes and from the Threatened and Priority Fauna Database which contains records from a variety of sources and includes sighting records, roadkills and museum specimens. Records between 1992 and 2001 were used for the 2001 estimate and records between 1997 and 2006 were used the 2006 estimate (ie 10 year time intervals). The polygon was cropped to the coastline and all islands excluded from the estimate.

Table 10: Estimates of extent of occurrence of chuditch in Australia.

	% of Australian mainland	Extent of Occurrence (square kilometres)	Reference
Pre-European (1800's)	Nearly 70	[~5 362 000]	Orell and Morris, 1994
1994	Less than 5	[~383 000]	Orell and Morris, 1994
1998	Less than 5	360 000	Morris, 1998
1999	-	215 000 (climatic envelope)	Pouliquen-Young, 1999
2000	Less than 5	360 000	Morris, 2000
2001	Less than 5	215 400	This nomination
2006	Less than 5	211 800	This nomination

The difference in extent of occurrence estimates over time in Table 9, reflect the differences in how they were calculated. Estimates by Morris, 1998 and 2000 are very broad based on distribution with an arbitrary line drawn. The extent of occurrence estimates for 2001 and 2006 were estimated using real data.

Figure 5: Extent of occurrence for the chuditch in 2001 using data from 1992 to 2001.

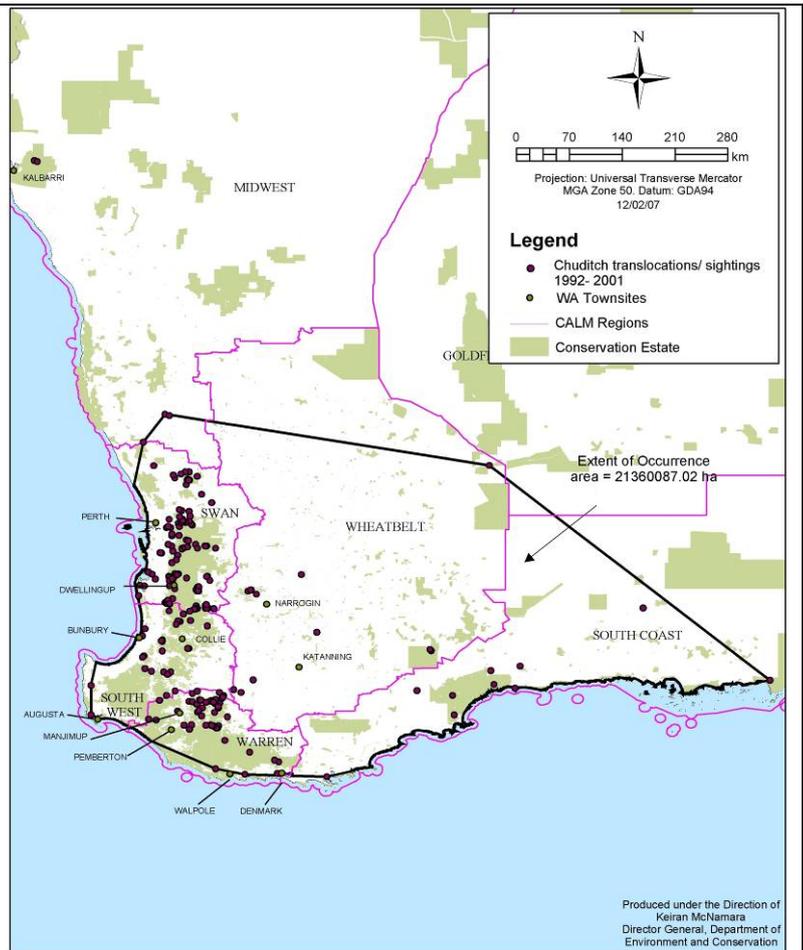
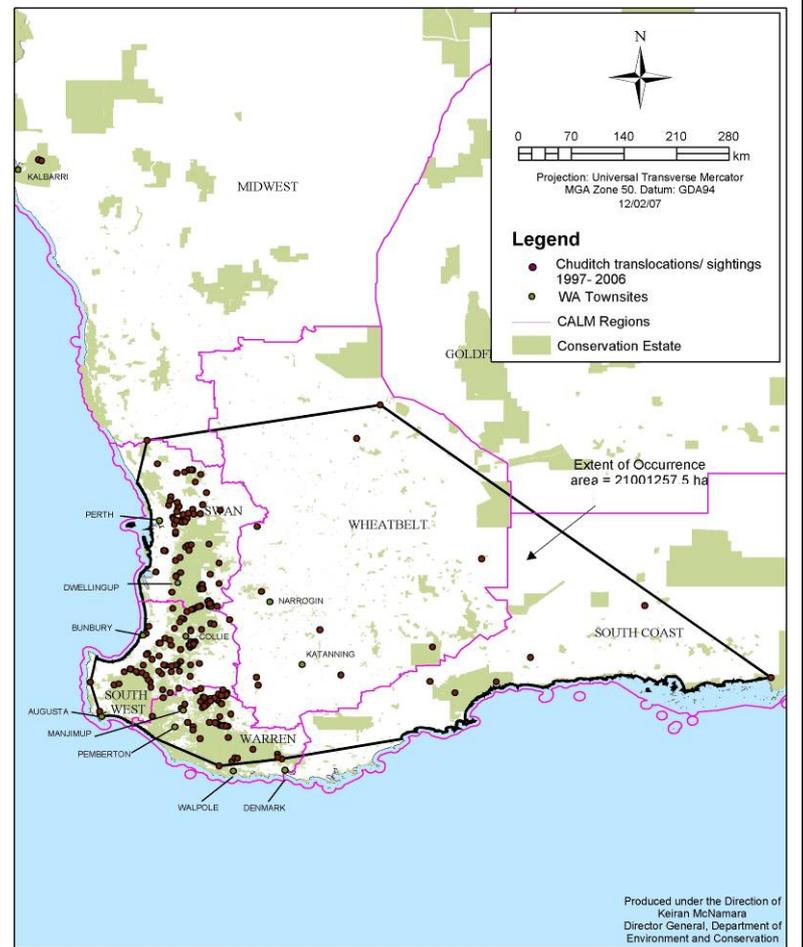


Figure 6: Extent of occurrence for the chuditch in 2006 using data from 1997 to 2006.



An extent of occurrence of greater than 20 000 km² is required for a species to no longer be listed as vulnerable under IUCN criteria (version 3.1). The chuditch has undergone a significant range contraction since European settlement but it's current extent of occurrence is greater than 20 000km² and so does not qualify for listing under IUCN criterion B1.

What is the area of occupancy (in km²) for the species; explain how it was calculated and datasets used. If an accurate estimate is unavailable provide a range of values or a minimum or maximum area estimate.

The current area of occupancy of the chuditch is an estimated to be between 13 800 km² and 45 625 km² in 2006 using 10 and 25 km² grids to estimate the area of occupancy respectively.

This estimate was derived from a GIS analysis using grid squares in which chuditch are known to occur based on records in the Threatened and Priority Fauna Database and Translocations Database. Only records more recent than 1992 for the 2001 estimate and, 1997 for the 2006 estimate, were used in the calculation. Estimation of this parameter is particularly scale dependent and difficult to estimate. Consideration was given to the home range size for chuditch when deciding on grid square size but the size of home range varies considerably between the sexes and across the distribution of the species. Chuditch are also known to travel considerable distances so it is possible that chuditch disperse between occurrences in the wheatbelt and goldfields.

Table 11: Area of occupancy estimates for the chuditch in Australia.

Year	Area of occupancy outside forest areas (km ²)	Area of occupancy in jarrah forest (km ²)	Total area of occupancy (km ²)	Reference
1998		10 000 (assumes distribution is continuous in jarrah forest)		Morris, 1998
1999			3500 (high quality habitat)	Pouliquen-Young, 1999
2000		10 000 (assumes distribution is continuous in jarrah forest)		Morris, 2000
2001	3000 (using 10 km ² grid squares) 12500 (using 25 km ² grid squares)	10100 (using 10 km ² grid squares) 32500 (using 25 km ² grid squares)	13100 (using 10 km ² grid squares) 45000 (using 25 km ² grid squares)	This nomination
2006	2400 (using 10 km ² grid squares) 11250 (using 25 km ² grid squares)	11400 (using 10 km ² grid squares) 34375 (using 25 km ² grid squares)	13800 (using 10 km ² grid squares) 45625 (using 25 km ² grid squares)	This nomination

There is some evidence of chuditch recolonising parts of its former range. Chuditch were observed for the first time in Walyunga National Park in 2005 (S. Strachan, pers. comm. 11/2005). There is also recent evidence in the form of roadkills and sightings reports that indicate that chuditch are returning to the outer metropolitan areas and Swan Coastal Plain.

An area of occupancy of greater than 2 000 km² is required for a species to no longer be listed as vulnerable under IUCN criteria (version 3.1). The current area of occupancy for chuditch as well as the estimate for five years ago, are both greater than 2 000km² and so the chuditch does not qualify for listing under IUCN criterion B2.

Is the distribution of the species severely fragmented? Why?

The majority of chuditch are recorded from the contiguous forest of southwest Western Australia. Occasional records for the species are obtained from the wheatbelt and goldfields regions. Chuditch are, however, known to travel large distances (e.g. a male chuditch was captured in Salmon Gums – 180km from where it had been translocated to in Cape Arid National Park – Anon, 1998) and so the species habitat cannot be considered highly fragmented.

The species is known to occur at greater than ten locations and a large portion of its current distribution is not fragmented (ie south-west forest). The species therefore does not qualify for listing as vulnerable under IUCN criterion D (version 3.1).

Identify important occurrences necessary for the long-term survival and recovery of the species? This may include: key breeding populations, those near the edge of the range of the species or those needed to maintain genetic diversity.

The southwest forests are the most important habitat for the long-term survival and recovery of the species.

Reintroduced occurrences are present at Lake Magenta Nature Reserve, Julimar forest and Kalbarri National Park that help to expand the extent of occurrence for the chuditch. Chuditch are persisting at Lake Magenta Nature Reserve despite the decline to undetectable levels of other small-medium sized mammals in the reserve (Figure 7). At Julimar forest chuditch numbers peaked around 1998/1999 and have dropped back below 3% trap success for the last four years (Figure 8). At Kalbarri National Park chuditch are occasionally trapped on the *Western Shield* transect (Figure 9). In 2006 trapping targeted for chuditch was undertaken that concentrated on the gorge habitat in the national park and resulted in a significant increase in captures.

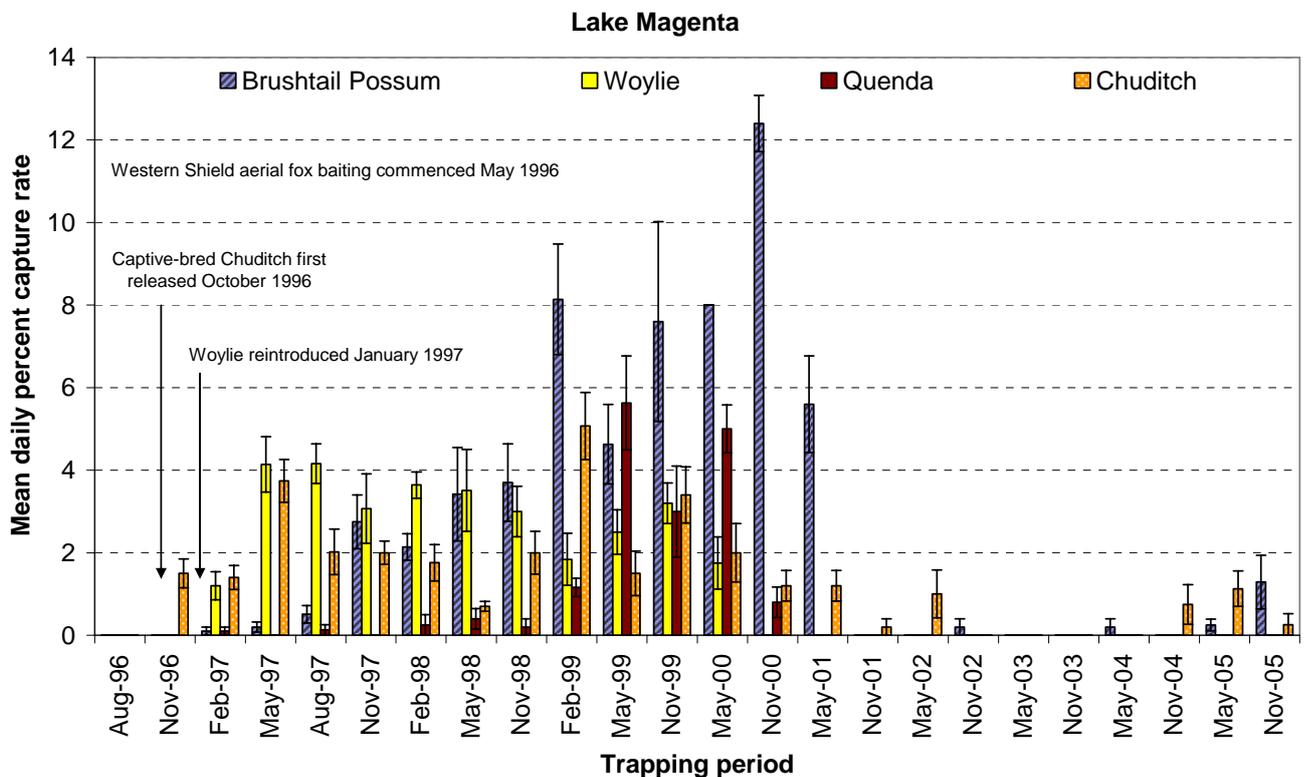


Figure 7: Chuditch trap success rates at Lake Magenta Nature Reserve.

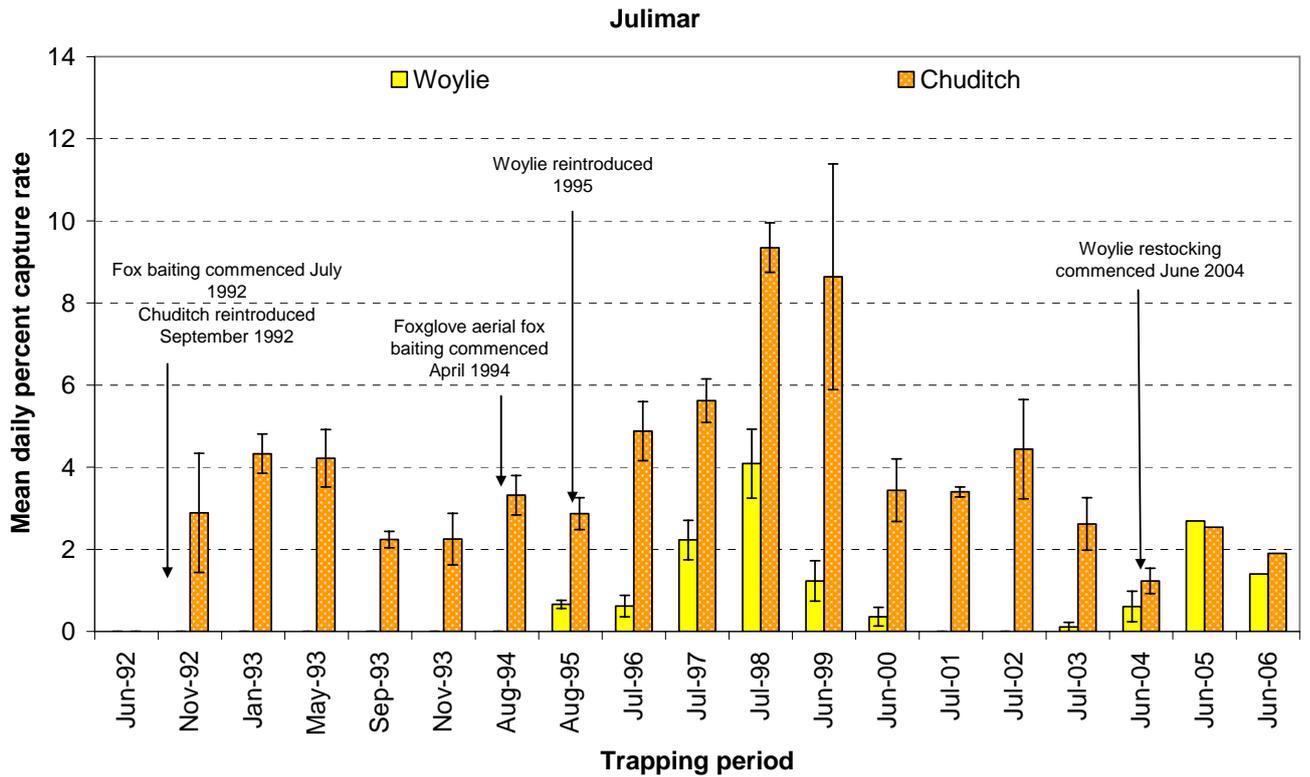


Figure 8: Chuditch trap success rates for Julimar forest.

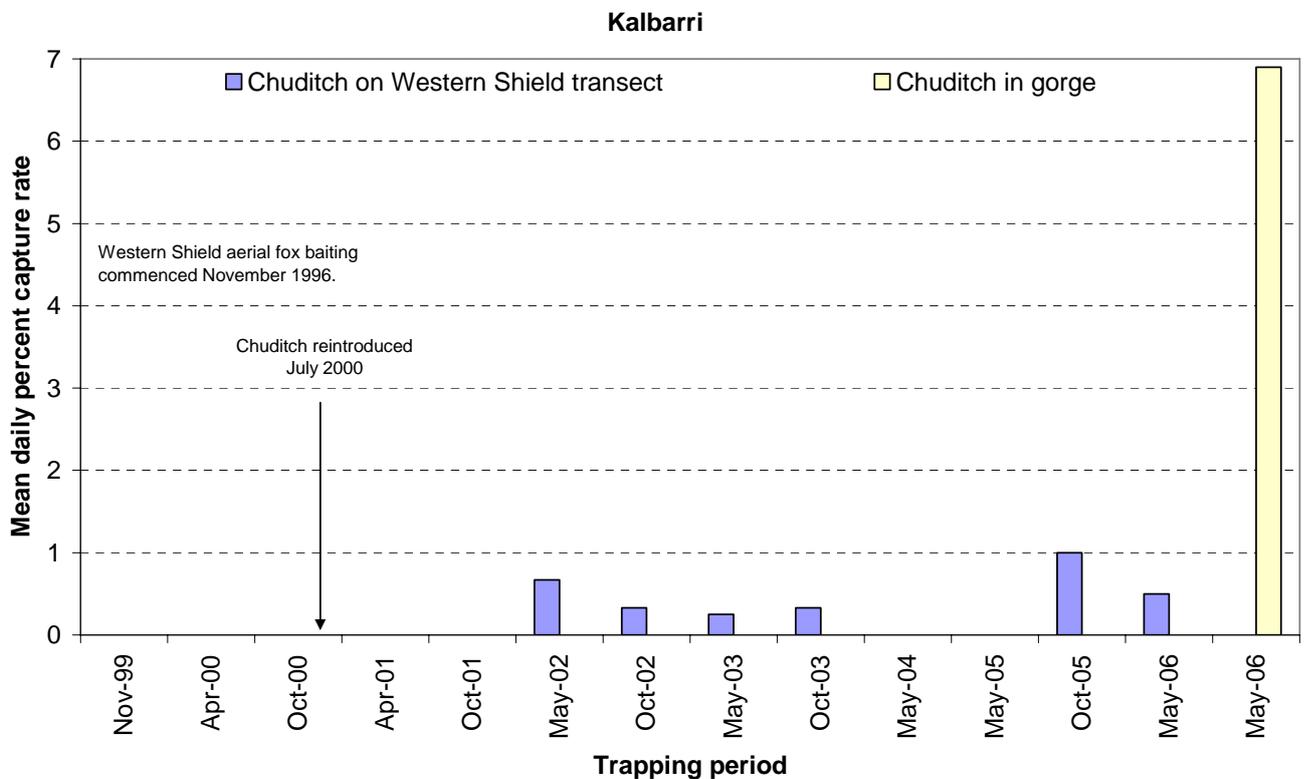


Figure 9: Chuditch trap success at Kalbarri National Park.

4.2. Survey effort

Describe the methods to conduct surveys. For example, (e.g. season, time of day, weather conditions); length, intensity and pattern of search effort (including where species not encountered); any limitations and expert requirements.

The standard trapping method for monitoring under the *Western Shield* program is 100 cage traps placed at 200m intervals along tracks and baited with a mixture of rolled oats, peanut butter and sardines. Chuditch are captured using this method but capture rate can be improved by using a meat based bait. Chuditch are nocturnal so traps are set overnight and checked early in the morning.

Chuditch appear to be most readily trapped in June/July when food is relatively scarce and males are roaming widely in search of mates (Serena and Soderquist, 1988). Trapping is not recommended between mid-August and early October when juveniles are first deposited in dens and are most vulnerable to cold and predators (Serena and Soderquist, 1988). Consideration should also be given to weather conditions when trapping (e.g. too hot or too wet).

Chuditch are relatively placid to trap and handle but experience in mammal handling is required.

Chuditch are occasionally seen whilst spotlighting but this is not considered a reliable method to detect the species in an area or to monitor changes in distribution and abundance.

Give details on the distinctiveness and detectability of the species, or the distinctiveness of its habitat, that would assist survey success.

Chuditch are not easily confused with another species and can reliably be identified by geography because they are the only quoll species that occurs in south-western Australia.

Whilst they are easily identified when observed or trapped they are not always easy to detect. Chuditch are known to persist at very low densities at some locations and therefore may be undetectable by standard trapping.

Has the species been reasonably well surveyed? Provide an overview of surveys to date (include surveys of known occurrences and surveys for additional occurrences) and the likelihood of its current known distribution and/or population size being its actual distribution and/or population size. Include comments on potential habitat and surveys that were conducted, but where the species was not present/found.

Chuditch are regularly trapped throughout the jarrah forest. Forty fauna monitoring sites are regularly monitored under the *Western Shield* fauna recovery program which commenced in 1996 (Orell, 2004). Chuditch are captured at 23 of these sites. In addition to these 23 sites, a total of seven transects setup to monitor reintroduced species also capture chuditch. A further 11 transects are regularly monitored for a variety of research purposes and provide additional information on chuditch in those areas. The results from these 41 monitoring transects that have captured chuditch, form the basis for reviewing the conservation status of the species (Appendix I).

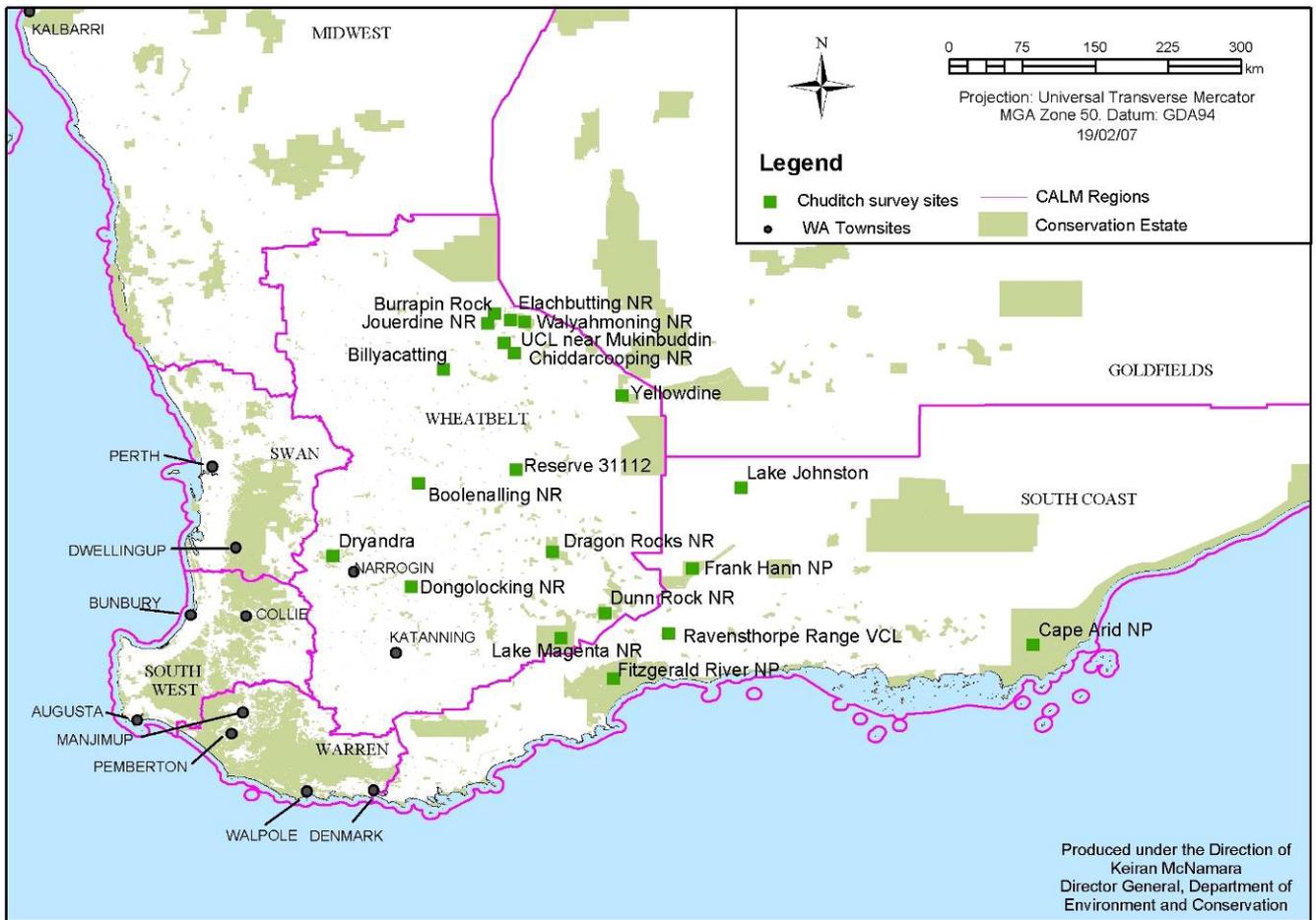
Outside the southwest forest, chuditch are rarely trapped and most records are from roadkills. Chuditch are known to be sparsely distributed over large areas and a considerable amount of effort is required at these locations to confirm the presence/persistence of the species.

Various biological surveys have been undertaken throughout Western Australia that could have confirmed the presence of chuditch. A selection of surveys undertaken is summarised in Table 12 and illustrated in Figure 10.

Table 12: Surveys conducted to determine the presence or absence of chuditch.

Site	Area (ha)	Date	Trap nights	Number of chuditch trapped	Comments
Billyacatting	-	Nov 1972	101	0	
		Apr 1974	94	0	
		Sep 2005	640	0	
Lake Magenta NR	110 000	Sep 1990	800	1	
		Apr 1994	1050	0	
		Jul 1994	1400	1	
		Apr 1995	2289	0	
Frank Hann NP	50 000	Jun 1990	800	1	There were several sighting and roadkills records from the national park in mid 1980's to early 1990's.
		Sep 1994	1800	0	
Fitzgerald River NP	342 000	1984-7	330	0	
		1988	500	0	
North Karlgarin NR	5 168	Apr 1994	250	0	
		Jul 1994	250	0	
		Oct 1994	200	0	
Reserve 31111	3 000	Jul 1994	520	0	
Dongolocking NR	1 400	1994	1000	0	
Boolenalling NR	700	1994	482	0	
Dunn Rock NR	27349	Apr 1995	1741	0	
		Nov 2006	440	1	
Ravensthorpe Range VCL	-	1982-7	420	0	There have been several sightings and roadkills of chuditch between Ravensthorpe and Hopetoun.
Yellowdine area	-	Apr 1995	3500	0	
Dragon Rocks NR	32 218	Apr 1995	1888	0	
Cape Arid NP	278185	Nov 1997	400	0	
Dryandra	-	Dec 1998	680	0	There have been several sightings of chuditch in and around Dryandra.
Lake Johnston	-	Oct 2003	150	0	A mammal survey was conducted after a numbat sighting in the area.
UCL near Mukinbuddin	-	Dec 2004	440	0	Trapping was conducted in the area following the report of a roadkill chuditch collected near Dandanning in the Shire of Mukinbudin.
Chiddarcooping NR	5262	Dec 2004	100	0	
Elachbutting (23339) reserve	-	Dec 2004	100	0	
Jouerdine NR	1117	Dec 2004	80	0	
Burapin Rock	-	Dec 2004	60	0	
Walyahmoning NR	20925	Dec 2004	400	0	

Figure 10: Locations of trapping surveys in the wheatbelt and goldfields that attempted to capture chuditch.



4.3. Threats

Identify past, current and future threats indicating whether they are actual or potential. For each threat describe:

1. How and where they impact this species.
2. What the effect of the threat(s) has been so far (indicate whether it is known or suspected; present supporting information/research, does it only affect certain populations?).
3. What is its expected effect in the future (is there supporting research/information; is the threat only suspected; does it only affect certain populations?).

If possible, provide information threats for each occurrence/location:

Past Threats

Many factors are likely to have contributed to the progressive decline of chuditch in different areas. Habitat alteration is likely to have affected many occurrences through the combined influences of grazing by livestock and rabbits, land clearing and altered fire regimes. Disease has been implicated in the decline of many species but is difficult to prove. Predation by and competition with European foxes and feral cats is also likely to have affected the abundance of chuditch. Shortridge (1909) noted that chuditch were “killed off as much as possible in the agricultural and more thickly populated districts on account of being so destructive to poultry”. Shooting and poisoning both deliberately and as a side effect of targeting other species (particularly rabbits and foxes) probably contributed to the loss of chuditch from some areas.

Current Threats

Being a top-order predator, the fate of the chuditch is tied to the abundance of its prey and the health of the ecosystem. Many factors affect the abundance of prey and ecosystem health including weather or climatic conditions, disease and habitat destruction. Landclearing or removal of suitable den logs can limit the ability of the chuditch to move through the landscape and therefore restrict the area of suitable habitat available to the chuditch.

Predation by and competition with foxes and feral cats are likely reduce the success of occurrences of chuditch. The trial use and possible widescale implementation of cat baiting has the potential to impact chuditch negatively if the cat baits are delivered in such a way that chuditch have the opportunity to consume a fatal dose. Further research is underway.

Chuditch come into conflict with humans by raiding chicken coups and therefore may be subjected to poisoning, trapping and illegal shooting. Chuditch are occasionally found drowned in water tanks.

Reports of chuditch are often through the collection of roadkills. Road traffic is therefore a current threat to chuditch populations and may contribute to the decline in abundance of the species in the vicinity of roads.

Future Threats

A study by Pouliquen-Young (1999) predicted that if climate change caused the temperature to increase by 2°C then the area north of the line between Perth and Norseman will become climatically unfavourable for the chuditch. It has been predicted that by 2040 the temperature in Western Australia will rise between 2 and 4°C with the greatest warming in the south and in winter (Arnold, 1988). The largest portion of the chuditch population currently occupies habitat south of this line. However, subpopulations at Julimar State Forest and in the Avon Valley may become sparser as a result of climate change. However, being a wide-ranging species which formerly occupied arid areas, it is likely to be less impacted by climate change than other endemic south-west species.

Identify and explain why additional biological characteristics particular to the species are threatening to its survival (e.g. low genetic diversity). Identify and explain any models addressing the survival of the species. Chuditch re likely to be less effected by climate change than many other species.

Burbidge and McKenzie (1989) showed that most terrestrial Australian mammals in the weight range of 35 g to 5.5 kg mean adult body weight have declined or become extinct. The chuditch falls within this “critical weight range”.

A preliminary population viability analysis for the chuditch in the northern jarrah forest was undertaken by McComb *et al.* (1994). However, a thorough quantitative analysis showing probability of extinction has not been undertaken for the species. The chuditch therefore does not qualify for listing under IUCN criterion E (version 3.1).

4.4. Management

Identify key management documentation for the species e.g. recovery plans, conservation plans, threat abatement plans etc.

A bibliography covering references relevant to the chuditch was prepared by Smith *et al.* (2004).

A document describing field techniques for working with chuditch was prepared by Serena and Soderquist (1988). A wildlife management program was written for the species by Serena *et al.* (1991) and this was used as the basis for preparing the species recovery plan that was written by Orell and Morris (1994). The recovery plan was written to run for a term of 10 years and has now expired. A recovery team was formed to oversee the implementation of the plan. The recovery team last met in 2000.

A case study of the recovery of the chuditch was written by Morris *et al.* (2003) and summarises the results of implementing recovery actions proposed in the species recovery plan.

Research has been conducted into the vulnerability of chuditch to baits laid to control introduced predators (European fox and feral cat). Research by Soderquist and Serena (1993) and King *et al.* (1989) provided guidelines regarding the dosage of 1080 and density of baits that could be laid without adversely impacting chuditch occurrences. These guidelines were used when determining a broadscale method for controlling foxes. Morris *et al.* (1995) successfully tested the proposed method on chuditch at Batalling. The *Western Shield* program uses dried meat baits containing 4.5mg (reduced to 3mg in 2002) at a density of 5baits/km² and laid at a frequency of four times a year. However, when increasing costs and concerns about the continuity of bait supply led to the development of a cheaper sausage style bait, further research was conducted to determine the susceptibility of chuditch to this new style of bait. Morris *et al.* (2005) report that although chuditch consumed the baits, no study animals consumed a fatal dose.

Does this species benefit from the management of another species or community? Explain.

The chuditch is a top-order predator and is therefore linked to the abundance of prey and health of the ecosystem. Any projects that improve the ecosystem health have the potential to benefit chuditch (e.g. weed eradication, fox baiting under *Western Shield* etc). Chuditch are a wide ranging species and so any project that improves their ability to move about the landscape potentially improves their conservation status (e.g. revegetating wildlife corridors).

How well is the species represented in conservation reserves or covenanted land? Which of these are actively managed for this species? Give details.

Chuditch are well represented on conservation estate. They occupy the contiguous state forest of south-west Western Australia including several national parks and nature reserves. Largest numbers of chuditch are known from conservation estate baited under the *Western Shield* program. Chuditch are also recorded on other tenure including road reserves and private property. An increasing number of private property owners in the Land For Wildlife program report chuditch as present on or near their properties (P. Hussey pers. comm. 22/01/2007).

Are there any management or research recommendations that will assist in the conservation of the species? Give details.

Research into effective cat baiting strategies that minimise impact of chuditch will provide advice regarding the feasibility of broadscale or site-based cat control projects. Effective cat baiting strategies could allow the expansion of reintroduction projects into arid areas.

Research is currently being conducted into the interactions between predators, both native and introduced. The results of this research are expected to have direct management implications for chuditch and feral predator control programs including *Western Shield*.

Large numbers of chuditch currently inhabit the Bindoon defence training area, north of Julimar Forest. The numbers appear to be high enough to provide animals for a translocation directly from the wild – something that wasn't previously thought possible and hence the great effort that was put into captive breeding at Perth Zoo. Investigation into the reasons for the high numbers could benefit the conservation and management of the species.

To help guard against climate change, Pouliquen-Young (1999) recommends encouraging reintroductions of species to widely spaced geographical areas, especially those species that are now restricted to areas at the limit of their historical distribution (e.g. Cape Arid National Park). Plans are in place to translocate chuditch to Dirk Hartog Island and Lorna Glen in the arid zone of Western Australia.

4.5. Other

Is there any additional information that is relevant to consideration of the conservation status of this species?

Appendix II contains preliminary results of investigations by Maria Cardoso into the genetic diversity and population structure of chuditch.

SECTION 5. NOMINATOR
Nominator(s) name. Christine Freegard
Signature(s) – This is not needed for emailed nominations as your email is proof of your identity.
Organisation (s) Department of Environment and Conservation
Address Locked Bag 104, Bentley Delivery Centre WA 6983
Telephone 08 9334 0314
Email christine.freegard@dec.wa.gov.au
Date 23 rd February, 2007
If the nomination has been refereed or reviewed by experts, provide their names and contact details:
Keith Morris Principal Research Scientist Woodvale Research Department of Environment and Conservation Phone: 9405 4159
Peter Orell Zoologist (<i>Western Shield</i>) Species and Communities Branch Department of Environment and Conservation Phone: 9334 0455
Peter Mawson Principal Zoologist Species and Communities Branch Department of Environment and Conservation Phone: 9334 0421
Brent Johnson Principal Technical Officer Woodvale Research Department of Environment and Conservation Phone: 9405 5106
SECTION 6. REFERENCES
What references or sources did you use to prepare your nomination? Include written material, electronic sources and verbal information. Include full references, address of web pages and the names and contact details of authorities with whom you had verbal communications.
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Experts consulted:

Hussey, Penny (Senior Project Officer, Land For Wildlife – Department of Environment and Conservation). Phone: (08) 9334 530. Email: penny.hussey@dec.wa.gov.au.

Strachan, Steven (Senior Range – Walyunga National Park – Department of Environment and Conservation). Phone: (08) 9571 1371. Email: steven.strachan@dec.wa.gov.au.

SECTION 7. RECOMMENDATION

7.1. Approval (to be completed by the TSSC Chair)

Is the nomination accepted? Yes No

Status for the State of WA

IUCN Status

Categories and Criteria

Priority

CALM Region(s)

CALM District(s)

7.2. Non-approval	
If nomination not accepted, give reasons.	
<hr/> <hr/> <hr/> <hr/> <hr/>	
7.3. Date of recommended change of status	
7.4. Comments	
Were any conditions applied to the recommended change in conservation status? Provide details of actions required to be completed if nomination was deferred or rejected.	
<hr/> <hr/> <hr/> <hr/> <hr/>	
Were any management or research recommendations made for the species? Provide details.	
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APPENDIX I

Summary of chuditch monitoring sites and trapping effort in Australia.

Location	Land status	Monitoring sites	Date of most recent survey	Latest trap success (%)	Max trap success reached (%) and year	Monitoring year range	Number of years monitored	Number of monitoring sessions for site
Perth Hills District (Northern Jarrah Forest)								
State Forest	SF	Hills Forest N Hills Forest S	Apr-02 Oct-01	13.18 0	14.09 (1999) 0.91 (1999)	1993-2002 1994-2001	10 8	19 15
Wellington District (Central Jarrah Forest)								
State Forest	SF	Hadfield Centaur Batalling	Aug-05 Jun-06 Nov-06	1.57 5.0 0	1.72 (2004) 9.85 (2003) 7.96 (1995)	2003-2005 1999-2006 1990-2006	3 8 17	2 9 21
Wellington National Park	NP	Davis Gervasse Lennard Dr	May-05 Mar-05 May-05	0 0 0	0.68 (2001) 3.75 (1997) 0.23 (2003)	2001-2005 1992-2005 2003-2006	5 14 4	4 10 4
Blackwood, Donnelly and Warren Districts (Southern Jarrah Forest)								
State Forest	SF	St John Tone Warrup Camballan Catterick Kinkin	Jun-06 Feb-06 Nov-06 Jun-05 Mar-06 Mar-06	0.23 0 0.5 11.33 10.37 0.5	1.26 (2003) 2.5 (2000) 2.5 (2005) 11.33 (2005) 10.37 (2006) 0.5 (2006)	1997-2006 1996-2006 2001-2006 1998-2005 1998-2006 2006	10 11 6 8 9 1	13 11 8 6 9 1
“Greater Kingston” NP	NP	Winnejup Corbal	Nov-06 Nov-06	0.5 0.5	0.6 (1998) 2 (2005)	1994-2006 2005-2006	13 2	8 3
Boyndaminup National Park	NP	Boyndaminup	Mar-06	0.67	0.67 (2006)	2003-2006	3	4
Lake Muir Nature Reserve	NR	Myalgelup (Poorginup)	Feb-06	0.5	2 (2002)	1996-2006	11	11

Location	Land status	Monitoring sites	Date of most recent survey	Latest trap success (%)	Max trap success reached (%) and year	Monitoring year range	Number of years monitored	Number of monitoring sessions for site
Mt Roe/Mt Lindsay National Park	NP	Denmark (Mt Lindsay)*	Feb-06	0	3.25 (1999)	1997-2006	10	13
Tone-Perup Nature Reserve	NR	Keninup	Oct-06	4	7 (2005, 2006)	1999-2006	8	10
		Balban	Nov-06	5	7 (2003)	2000-2006	7	9
		Yendicup	Oct-06	0	2.64 (2000, 2001)	2000-2006	7	14
		Moopinup	Nov-06	0.5	4 (1997)	1996-2006	11	13
		Yackelup	Oct-06	0	2 (2000)	2000-2006	7	14
		Camelar	Nov-06	0	0.5 (2002, 2004)	2000-2006	7	8
		Chariup	Nov-06	0	2.67 (1998)	1998-2006	9	10
		Boycup	Nov-06	0	0.5 (2006)	1998-2006	9	10
Greater Preston National Park	NP	Noggerup	Mar-06	5.84	10.95 (2003)	1997-2006	10	15
Milyeannup National Park	NP	Milyeannup	May-06	0	0.24 (1998)	1997-2006	10	11
Whicher National Park	NP	Whicher	Jun-05	1.28	2.81 (2002)	2002-2006	4	4
Isolated Reserves				0.23				
Lake Magenta Nature Reserve	NR	Lake Magenta*	Nov-05	0.26	5.07 (1999)	1996-2005	10	24
Dragon Rocks Nature Reserve	NR	Dragon Rocks	Jun-05	0.25	0.25 (2005)	1999-2005	7	6
Kalbarri National Park	NP	Kalbarri*	May-05	0	0.67 (2002)	1999-2006	8	12
Fitzgerald River National Park	NP	Twertup	Nov-06	0	0.4 (1999)	1999-2006	8	9
	NP	Moir Track	Nov-06	0	0.8 (1998)	1997-2006	10	13
Cape Arid National Park	NP	Cape Arid*	Feb-01	0	4.4 (1999)	1997-2001	5	6
Karakamia Sanctuary	PP	Karakamia	Jul/Aug-06	Low	Low	-	-	-
Avon Valley area								
Julimar Forest	SF	Julimar*	Jun-05	2.54	9.35 (1998)	1992-2006	15	19
		Bindoon DTA	Jun-05	17.08	20.4 (2005)	2002-2006	5	5
Avon Valley NP	NP	Avon Valley	May-06	3.9	8.9 (2004)	2003-2006	4	4
Paruna Sanctuary	PP	Paruna	Aug/Sep-06	-	-	-	-	-

* = Translocated population

APPENDIX II

Preliminary results of investigations by Maria Cardoso into the genetic diversity and population structure of chuditch.

- Please note that the results presented here are only preliminary. Further data analysis will be performed and finalized by the end of 2007 as part of an ongoing PhD project.
- Some samples have not been included in this analysis as they were only collected recently. They will be included in the final analysis. The populations included in this analysis are shown in Table 1.

Genetic Diversity and Population Structure of western quolls (*Dasyurus geoffroii*)

This project was set up to complement ecological data being gathered by the Department of Environment and Conservation in Western Australia. The aim is to monitor the success of reintroductions of western quolls to areas where feral predator control is being implemented.

The genetic diversity of western quoll populations was found to be moderate to high and greater than that observed for the three other Australian quoll species. Reintroduced western quoll populations currently have a level of genetic diversity similar to that found in naturally occurring populations (Figure 1) and there is thus far no evidence of short-term losses to genetic diversity due to founder effects (small number of founding individuals) and/or inbreeding. This does not necessarily mean that losses will not occur long-term, after many more generations, so it is highly recommended for these populations to continue to be monitored for changes in population size and genetic diversity over time. This is particularly important for the Lake Magenta and Kalbarri populations, which due to their geographical isolation, are less likely to be supplemented with animals from other areas by natural migration. They thus run a greater risk of further genetic divergence (Figure 2). There is genetic evidence that animals are dispersing between the Julimar, Bindoon and Dwellingup populations as no significant genetic differentiation between them was detected. Natural wildlife corridors between these areas should be maintained so that movement of animals is not restricted. This will allow the exchange of genetic material between populations so that a high level of genetic diversity is maintained and the risk of genetic divergence due to isolation is reduced.

This study thus provides us with baseline data to work from in the future. Further genetic sampling of all western quoll populations over time will allow us to identify whether the Kalbarri, Lake Magenta and Kingston populations should in fact be treated as separate Management Units due to high genetic differentiation, whether they should be supplemented with further animals and which populations should be used for supplementation. I must here emphasize that in order to ensure the success of translocation and supplementation programs, both long-term genetic and ecological data, as well as local environmental adaptation should be taken into consideration. And finally, but very importantly, feral predator control and the maintenance/restoration of natural wildlife corridors should continue to be implemented in these areas to ensure the future survival of all western quoll populations.

Table 1 – Western quoll populations so far included in the genetic analysis

Reintroduced western quoll populations	Naturally occurring western quoll populations
Julimar (JLM)	Batalling State Forest (BTG) - source of founding animals for reintroductions
Lake Magenta Conservation Reserve (MGA)	Dwellingup (DGP)
Kalbarri National Park (KBI)	Bindoon (BDN)
	Kingston (KGN)

Figure 1 – Genetic diversity of western quoll populations. He, heterozygosity; AR, allelic richness or number of alleles per locus standardized for differences in sample size

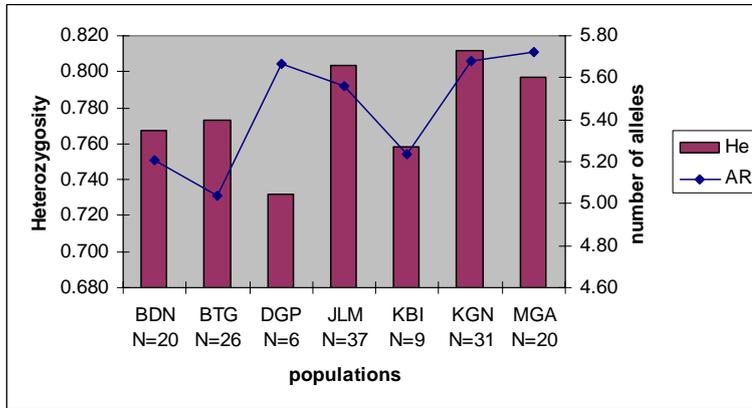


Figure 2 – Pattern genetic differentiation among western quoll populations screened at 6 microsatellite loci. The tree was drawn using the neighbour-joining method of Saitou and Nei, 1987 using the software package MEGA version 3.1.

