A Review of the Conservation Status of the Chuditch *Dasyurus geoffroii.*

Progress Report

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by

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INTRODUCTION

At the time of European settlement, the chuditch *Dasyurus geoffroii* occurred in every mainland State and the Northern Territory (Figure 1). By the 1950s it had contracted its range to the south-west corner of WA (Figure 2), approximately 7 % of its former range. In the south west, chuditch were reported as common until the fox established in the 1930s, and then either disappeared or became very rare (Abbott 2006). In 1983, it was listed as fauna that is rare, or is likely to become extinct, under the State's *Wildlife Conservation Act (1950).* In 1992 it was listed as Endangered under the Commonwealth's *Endangered Species Act 1992.* During a review of the conservation status of Australian marsupials and monotremes, Maxwell *et al.* (1996) recommended that the chuditch be listed as Vulnerable, rather than Endangered, based on IUCN (1994) criteria. In 1999 it was listed as Vulnerable under the Commonwealth's *Environment Protection and Biodiversity Conservation Act (1999).*

A recovery plan was prepared in 1994 (Orell and Morris 1994), and a recovery team formed to oversee implementation of the plan. Many of the recovery actions arose out of the research undertaken into chuditch distribution, biology and ecology in the jarrah forest between 1986-1989 and a wildlife management program published for the chuditch in 1991 (Serena *et al.* 1991). This work estimated that only 6000 chuditch persisted in the south west at this time, with up to 4400 present in the jarrah forest. A review of progress of the recovery plan was published (Morris *et al.* 2003), and this suggested that based on the recovery to that time, a review of conservation status may result in the delisting of the chuditch. This paper reports on information relevant to chuditch distribution and abundance since that time and provides updated recommendations regarding the conservation status of the chuditch.

RECOVERY PLAN

The chuditch recovery plan identified 6 recovery actions:

1. Investigations into the impact of timber harvesting.
2. Investigations into the impact of prescribed burning.
3. Investigations into the impact of foxes and fox control.
4. Undertake captive breeding.
5. Translocate to areas outside current (1992) range.
6. Monitor existing and translocated populations.

Criteria for success:

- > 1 % trap success rates at monitoring sites.
- Establishment and maintenance of at least one semi-arid populations.
- Establishment of at least one self-sustaining population outside the 1992 range.

The recovery criteria were based to a large degree on the assumption that the total population in 1991 was approximately 6000 individuals, and this corresponded to trap success rates of 0 – 0.5% in the jarrah forest. It was believed that if trap success rates could be doubled to > 1 % then the population size would have doubled to approximately 12,000 individuals, and this would be sufficient to remove the chuditch from the Vulnerable category (need to have a population size > 10000 individuals) to a non-threatened category.

Recovery actions 1 and 2 were related to the management of jarrah forests which at that time were still harvested extensively. Recovery actions 3 – 6 were related more to increasing chuditch population size and distribution, and as such are probably more relevant to satisfying the recovery plan criteria for success, and for use in any assessment of status using IUCN criteria. A brief overview of the results of these actions, and an assessment against recovery plan and IUCN criteria follows.

RECOVERY ACTIONS

A) Impacts of foxes and fox control.

Before broadscale fox baiting could be commenced in the jarrah forest, the impact on the carnivorous chuditch had to be determined. While chuditch have some resistance to 1080, it is not as high as for native herbivorous species (King *et al.* 1989), and it was predicted that an individual would only need to consume two baits to obtain a lethal dose (Soderquist and Serena 1993). An initial trial of non toxic baits on captive chuditch indicated that moister food was preferred to the dried meat baits. A baiting trial using toxic dried meat baits was then undertaken on wild chuditch at Batalling forest to measure the impact of 1080 baiting on abundance and reproduction. Radio-collars were placed on 12 chuditch and their movements were monitored before, during and for three months after toxic 1080 dried meat baits had been distributed. Longer term monitoring has continued by trapping along road transects.

None of the radio-collared chuditch died during the fox baiting trial. There was evidence that some baits were taken by chuditch but this was apparently not in sufficient quantities to kill them. Chuditch trap success has increased since fox control was commenced from approximately 0.5% in December 1990 to a peak of nearly 8% in July 1995 (Figure 3). Since that time, trap success rates have been maintained at 1 - 2 %. This pattern of a population increase for 6 – 10 years after fox control commences, followed by an apparent decline has occurred at other chuditch monitoring sites in the southwest of WA (see later).

One of the reasons chuditch increased in abundance at several sites in the south west has been the ability of CALM (now Department of Environment and Conservation DEC) to control foxes over large areas using dried meat baits impregnated with 1080. However increasing costs and concerns about continuity of bait supply led to CALM developing a cheaper sausage type bait. Marlow *et al.*(2003) demonstrated that this sausage bait, or Probait, was as palatable to foxes as the dried meat bait. It also needed to be demonstrated that it had no detrimental impacts on non-target native fauna, particularly carnivorous mammals. Bait acceptability trials with Probaits in the laboratory concluded that the dasyurid marsupials chuditch, mulgara *Dasycercus cristicauda,* and south west WA phascogale *Phascogale tapoatafa* were potentially at risk from toxic Probaits (Martin *et al.* 2002). A study was therefore undertaken at Julimar Conservation Park to assess the likely risk of operational use of toxic Probaits on chuditch in the wild Morris *et al.* 2005).

Chuditch were monitored by trapping and radio tracking before, during and after two successive aerial baitings using toxic (3 mg 1080) and rhodamine marked Probaits (5 baits / square km) at Julimar conservation park. The trial was undertaken from November 2004 to June 2005, at a time when young born in July 2004 were growing and dispersing from their natal home ranges. A total of 61 individual chuditch were trapped during this study. Trap success rates varied between 3 and 9%, and none of the 15 radio collared chuditch died as a result of ingesting toxic probaits.

Approximately 89 whisker samples were collected from 61 individual chuditch, and rhodamine fluorescent banding indicating bait consumption, was recorded in 26 (43%) of these. Traces of rhodamine dye were also found in the scats of six individuals. These results indicate that chuditch will find and consume toxic Probaits in the wild, but that they do not consume a sufficient quantity of baits (> 2-3 baits at a time) to be at risk. The results of this study were important in the process to obtain national registration for this alternative fox bait and for CALM to continue broad scale fox control programs for fauna recovery in WA.

B) Captive breeding

The first captive breeding program for chuditch commenced in 1986 at Dwellingup as part of the study into the ecology and management of chuditch (Serena *et al.* 1991; Serena and Soderquist 1988). In 1990, the captive-breeding colony was transferred to Perth Zoo to provide animals for CALM's proposed translocation program, and for display and education purposes. Because chuditch occurred at low densities in the wild it was not possible to source translocations with wild caught animals without some detrimental impact to these populations. Between 1990 and 2000, approximately 15 pairs of chuditch were maintained as breeding stock each year and 349 chuditch were bred. Of these, 316 (91%) were weaned successfully (Table 1).

Year	# Births	Sex ratio (m:f:unsexed)	# Weaned
1990	15	9.6.0	9.6
1991	14	4.8.2	4.8
1992	26	10.12.4	10.12
1993	20	7.10.3	7.10
1994	12	6.6.0	6.6
1995	37	16.19.2	11.18
1996	48	21.21.6	20.21
1997	54	27.26.1	27.26
1998	58	28.28.2	28.28
1999	53	27.20.6	27.20
2000	12	0.0.12	0.0.12
TOTAL	**349**	**155.156.38 = 349**	**149.155.12 = 316**

Table 1. Births and sex ratios of all chuditch born at Perth Zoo 1990-2000

To maintain a genetically healthy captive population of chuditch, details of the ancestry and relationships of all animals was put into the SPARKS (Single Population Analysis and Records Keeping System) program. SPARKS is software designed to assist in the genetic management of a captive population of animals in order to maintain genetic variation and demographic viability of the captive population. To ensure genetic variation was maintained in the population, wild caught animals were introduced into the captive breeding colony each year. Wile the captive breeding program operated, 38 wild caught chuditch were introduced to the breeding program and a low inbreeding coefficient (0.013) was maintained.

C) TRANSLOCATION

Chuditch had disappeared from about 90% of their former range and with the success of the captive breeding programs, and the apparent success of fox baiting, translocations were considered an essential component of chuditch recovery. Between 1987 and 2000, chuditch translocations have been undertaken to six areas of Western Australia where they formerly occurred: Lane-Poole reserve, Julimar Conservation Park, Lake Magenta nature reserve, Cape Arid national Park, and Mt Lindesay state forest. A summary of the numbers of chuditch translocated is shown in Table 2.

Lane-Poole Conservation Park

In 1987 an experimental translocation to the then unbaited Lane-Poole Conservation Reserve was undertaken. Nine captive - reared chuditch were radio-collared and release. This was unsuccessful, with at least seven of the nine being killed, or dying within a few months of release (Serena *et al.* 1991). The main causes of mortality were predation by cat, dog or pig and owls, illegal shooting, and road kills. The young age of the released animals was also considered a factor. A fox baiting trial at Batalling in 1990/1991 subsequently demonstrated that Chuditch abundance increased following fox control. Consequently, all subsequent translocations were undertaken to areas where fox baiting was undertaken as a normal management prescription: Julimar Conservation Park, Lake Magenta Nature Reserve, Cape Arid National Park, Mt Lindesay National Park and Kalbarri National Park.

Julimar Conservation Park

Between September 1992 and May 1995, 62 chuditch were released at Julimar conservation park. Annual monitoring of the population indicates that this translocation has been successful. In July 1998, trap success rates exceeded 14 % but have since reduced to 3 – 8 % (Figure 4). There are now regular sightings of Chuditch on roads and properties around the park.

Lake Magenta Nature Reseve

With the success of the Julimar translocation, a translocation to a semi-arid site became a priority for the recovery team, as extensive attempts to locate a substantial chuditch population within the semi-arid wheatbelt of Western Australia (where chuditch were known from earlier this century) had been unsuccessful. Lake Magenta nature reserve, approximately 450 km south east of Perth was selected because it was sufficiently large (108 000 ha) and chuditch were known to persist there until 1994.

Fox control commenced in July 1996 and 81 chudich were released between November 1996 and November 1998. Between 1996 and 2000 trap success rates increased to 2-3% suggesting that this translocation had been successful. However since 2001, trap success rates have declined to between 0 – 1% (Figure 5). At the same time the translocated woylie population declined to be not detectable and the naturally occurring brushtail possum and quenda populations similarly declined. In order to satisfy the second recovery plan criteria for success (establishment of a population in a semi arid area) it was necessary for the Lake Magenta population to persist.

Cape Arid National Park

After the success of translocations to Julimar and possibly Lake Magenta, and in accord with the third objective of the recovery plan, a third translocation was undertaken to Cape Arid National Park, 150 km east of Esperance. This was outside the known range of chuditch at the time. There were no historic records of chuditch at Cape Arid, although they were very likely to have occurred there. The closest known records are from Hopetoun in 1990 (200 km west of Cape Arid) and at Kambalda in 1971 (300 km north of Cape Arid).

Between March 1998 and March 1999, 61 chuditch were released at Cape Arid national park. Monitoring in 1999 and 2000 confirmed that breeding and recruitment were continuing, however by 2003 chuditch were no longer detectable at Cape Arid and this translocation is now considered to have been a failure (Figure 6). With the withdrawal of Commonwealth recovery plan funding in 2000, resources were not available to closely monitor this population, hence reasons for the lack of success are unknown. However only one third of Cape Arid national park is baited for foxes and both foxes and feral cats remained in the release area.

Mt Lindesay State Forest

Mt Lindesay is a proposed National Park approximately 400km south of Perth. Although linked to other forest areas to the west, the park forms a peninsula of native vegetation surrounded by farmland. This site is near the eastern and southern most extremity of the Jarrah forest in Western Australia, and chuditch had not previously been recorded in this area, but may have occurred at low densities.

Sixty three chuditch were released at Mt Lindesay between March 1999 and April 2000. Monitoring was carried out predominantly by hairtubing and trapping by a community group. No recruitment of new chuditch was recorded and they have not been recorded at this site since February 2002 (Figure 7).

Kalbarri National Park

The final translocation undertaken as part of the recovery program was to Kalbarri National Park, approximately 650 km north of Perth, on the northern edge of the wheatbelt. This was another site outside the recent chuditch range. Between July 2000 and March 2001, 49 chuditch were released at Kalbarri. Monitoring since then indicated that the population had not established and by April 2004 no chuditch were detected on the standard Western Shield monitoring transects. However in May 2006, during a targeted trapping program (Murchison River gorge and Junga) 10 individual chuditch were trapped and it is possible this population will establish and increase in the preferred gorge habitat (Figure 8).

Year	# Released	Source	Release sites
1987	9	Captive bred - Dwellingup	Lane Poole Conservation Park
1992	23	Perth Zoo	Julimar Conservation Park
1993	19	Perth Zoo	Julimar Conservation Park
1994	18	Perth Zoo	Julimar Conservation Park
1995	2	Perth Zoo	Julimar Conservation Park
1996	31	Perth Zoo	Lake Magenta Nature Reserve
1997	35	Perth Zoo	Lake Magenta Nature Reserve
1998	15	Perth Zoo	Lake Magenta Nature Reserve
1998	40	Perth Zoo	Cape Arid National Park
1999	21	Perth Zoo	Cape Arid National Park
1999	48	Perth Zoo	Mount Lindesay National Park
2000	15	Perth Zoo	Mount Lindesay National Park
2000	15	Perth Zoo	Cape Arid National Park
2000	35	Perth Zoo	Kalbarri National Park
2001	14	Perth Zoo	Kalbarri National Park
TOTAL	**339**		**6 sites**

Table 2. Numbers of chuditch released at translocation sites in WA.

MONITORING

Fifty seven fauna monitoring sites were established in the south west of WA when the Western Shield fauna recovery program commenced in 1996 (Orell 2004). Chuditch have been recorded at 25 (44%) of these. In 13 (52%) of these 25 sites, chuditch have increased in abundance, since fox baiting commenced. In another 4 sites chuditch appear to have increased initially, then declined and are no longer detectable on the Western Shield monitoring sites. Two of these were sites where chuditch had been translocated but have not persisted. At another 8 sites chuditch have remained at very low trap success rates (<1%). More intensive trapping at the

sites where chuditch have declined is required to identify if these populations have declined to extinction or not.

Total number of Western Shield monitoring sites	Number of monitoring sites where Chuditch have been recorded	Number of monitoring sites where trap success rates have increased to and remained at > 2 % since fox control	Number of monitoring sites where trap success rates increased initially since fox control, then declined	Number of monitoring sites where trap success rates have remained >0 – 1%
57	25	13 (52%)	4 (16%)	8 (32%)
	Includes 5 sites where chuditch were reintroduced	Includes 3 sites where chuditch were reintroduced (Kalbarri, Julimar, Lake Magenta)	Includes 2 sites where chuditch were reintroduced (Mt Lindesay, Cape Arid)	Chuditch not regularly trapped at these sites.

Table 3. Summary of abundance trends at Western Shield Chuditch monitoring sites.

An preliminary analysis of annual trap success rates for several mammal species in the Western Shield program has been undertaken (Williams 2006) and this shows that chuditch trap success rates at monitoring sites 1994-2005 has averaged 1.7%, but that there has been a significant (p=0.006) decline in trap success rate over this period (Figure 9). The 2006 data has not yet been included in this analysis and this is required to establish whether this is a continuing decline. As there is also considerable variation in seasonal traps success rates for chuditch, this also needs to be included in any more detailed assessment.

IUCN CRITERIA FOR VULNERABLE

The chuditch was initially listed as Vulnerable using IUCN (1994) criteria. The latest IUCN criteria were released in 2001 (version 3.1), however the criteria for listing threatened taxa did not change significantly from 1994. The chuditch was listed on the basis of meeting Criteria C (1) for Vulnerable – *Population size estimated to number fewer than 10000 mature individuals and an estimated continuing decline of at least 10% within 10 years or three generations.* At this time the population in the jarrah forest was estimated at approximately 2500 - 4400 individuals (Serena *et al.* 1991) with perhaps another 1500 in other parts of the south west and wheatbelt. With the introduction of fox control over mush of the range of chuditch, it was anticipated that this population size could at least be doubled to 12000, with an increasing trend, and subsequently be removed from threatened species lists. However this is probably not the case at this stage.

While it is difficult to determine the population size of a wide ranging and low density species such as chuditch, there have been some attempts to do so at monitoring

sites where regular trapping sessions have allowed Known To Be Alive estimates to be derived. At both Batalling and Julimar estimates of KTBA suggest that up to 30 chuditch can persist in a 10000 ha area of jarrah forest/woodland. Extrapolated to the 1.6 million ha of jarrah forest under DEC control, this equates to a population size of approximately 4800 individuals in protected areas. This could be an overestimate as both Batalling and Julimar support higher density populations. This extrapolated figure is also based on a uniform distribution of chuditch in the jarrah forest, and this is not the case. Based on this and the apparent declining population trend (as determined by trap success rates), it is likely that chuditch still meet the C(1) criteria for Vulnerable.

Chuditch may also meet the Vulnerable criteria A (2) where there has been a > 30% population decline in the last 10 years and where the reduction or its causes may not have ceased, or may not be understood, or may not be reversible. Over all chuditch monitoring sites, trap success rates were at a maximum in 1995 (2.2%) and have declined to 1.5% in 2005, and the reasons for this are unclear.

Chuditch would not meet the Vulnerable criteria B (geographic range) or D (small populations). Criteria E – a quantitative analysis – has not been undertaken.

CONCLUSIONS

It is our view that it is premature to consider removing chuditch from State and Commonwealth threatened fauna lists. Using the recovery plan criteria for success, it could be argued that trap success rates at monitoring sites are being maintained at > 1%, however there is a declining trend. Providing the Lake Magenta population continues to persist, the second recovery plan criteria for success (establish a semi arid population) could be met. If the Kalbarri population continues to expand and persist the third recovery plan criteria (establish a population outside 1991 range) could also be met, but this is not yet the case. Using the IUCN criteria, chuditch still remain Vulnerable under both the A(2) and C(1) criteria. It is also important to consider the IUCN "five year rule" where a taxon can only be moved from a category of higher threat to a category of lower threat if none of the criteria of the higher category has been met for five years.

It will be important to undertake a more detailed analysis of trap success rate trends and to include 2006 data as soon as possible. This should be followed by a more detailed assessment of chuditch status against IUCN criteria in a publishable form, and the revision of the chuditch recovery plan if it still meets the Vulnerable criteria. If this is required, the recovery team (which has not met since 2001) should be reconstituted to play a lead role. The recently provided Biodiversity Conservation Initiative funding will allow this more detailed assessment to occur.

Several medium-sized mammals have exhibited the pattern shown by the chuditch – an initial population increase in response to fox control from 1996-2000, then a decline from 2001 – present. DEC is now providing significant funding to research programs to determine the reason(s) for this.

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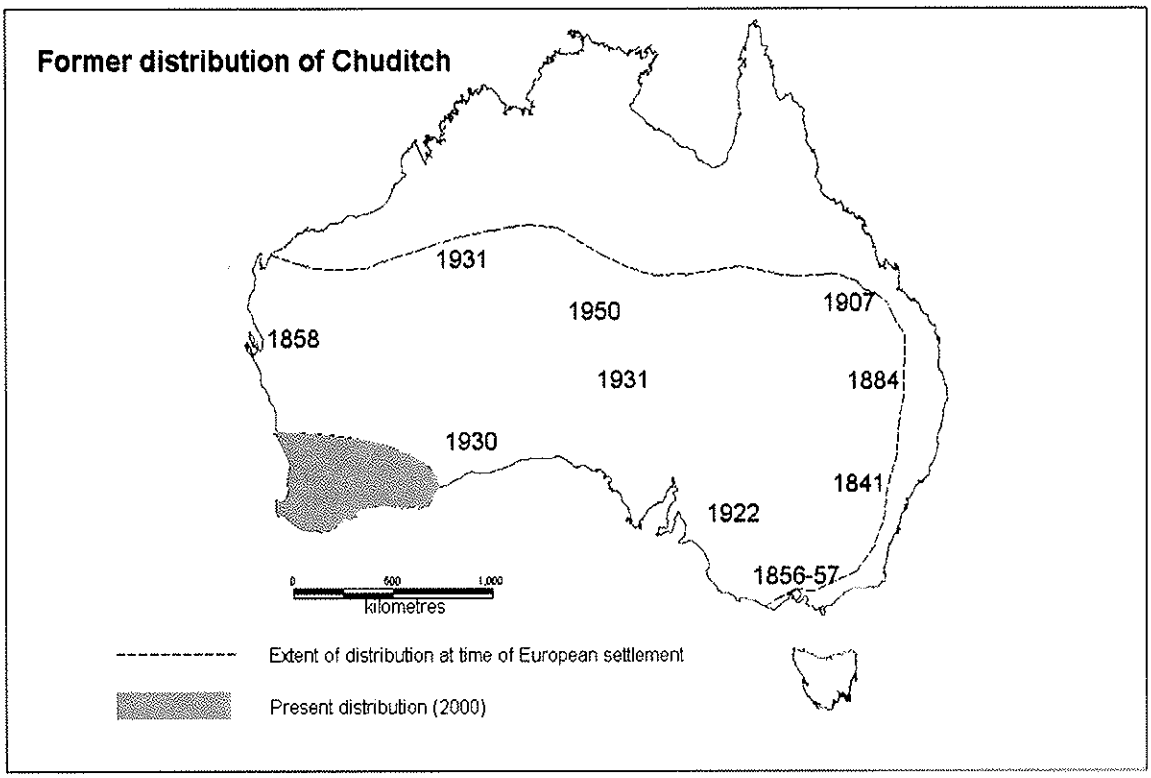

Figure 1. Former distribution of the chuditch.

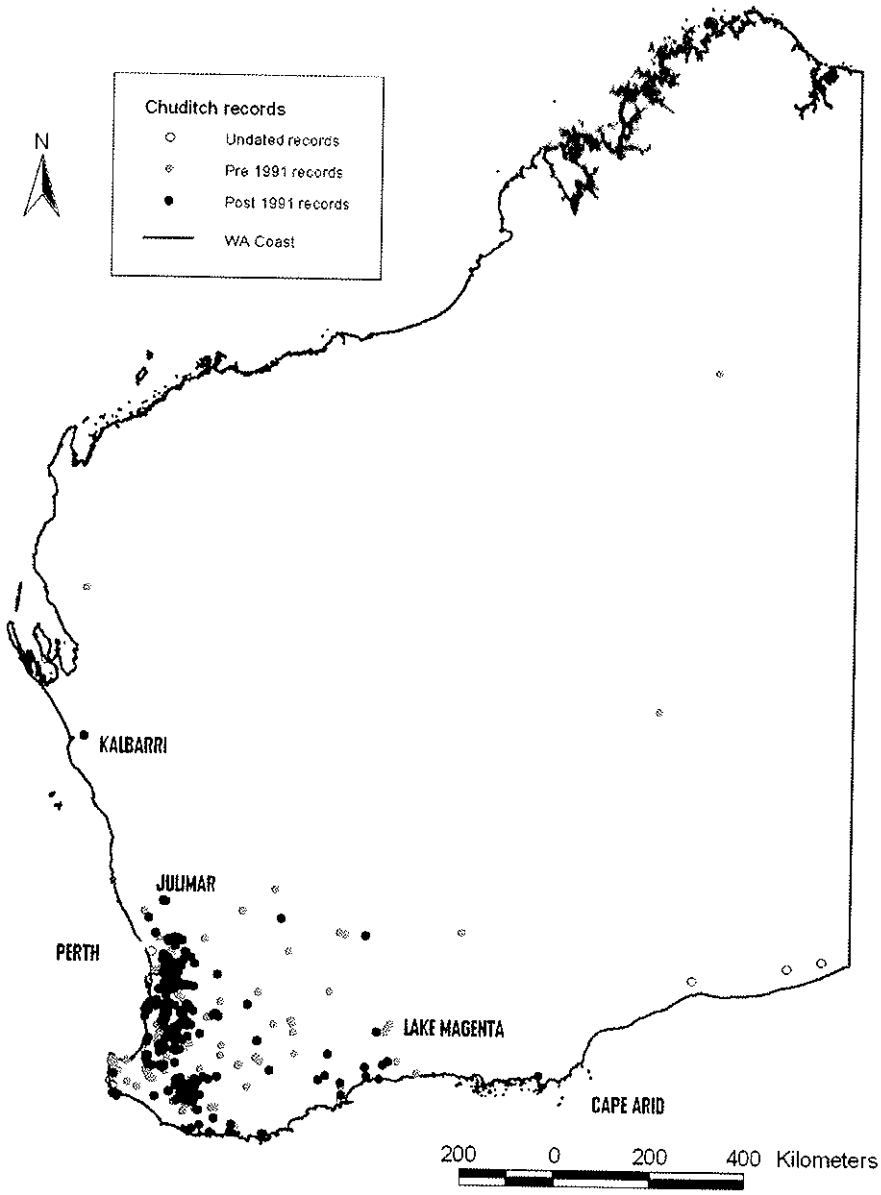

Figure 2. Current distribution of the chuditch. (records from FaunaFile)

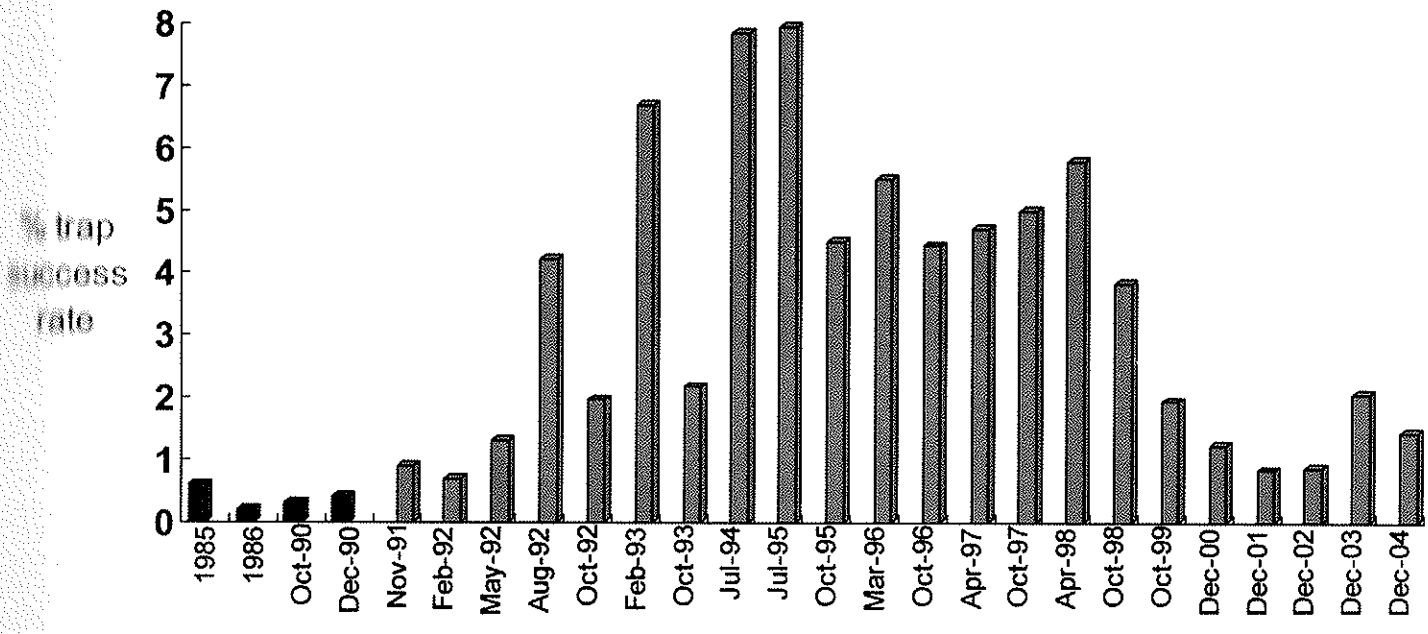

Figure 3. Response of chuditch to fox control at Batalling forest.

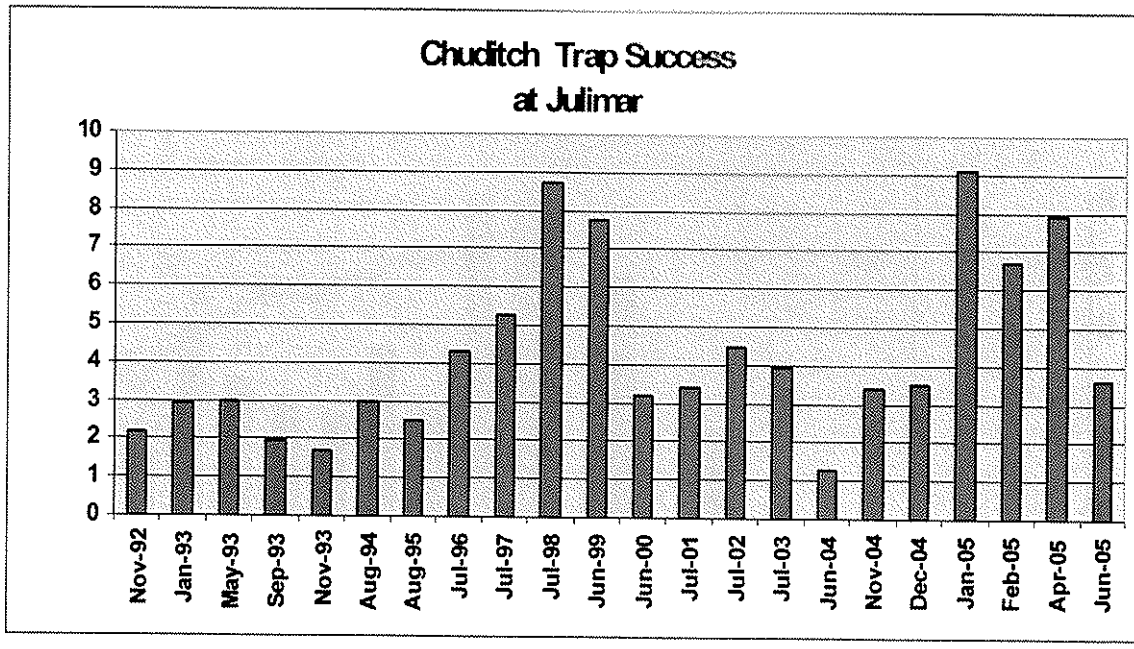

Figure 4. **Chuditch trap success rates at Julimar conservation park following translocation in 1992.**

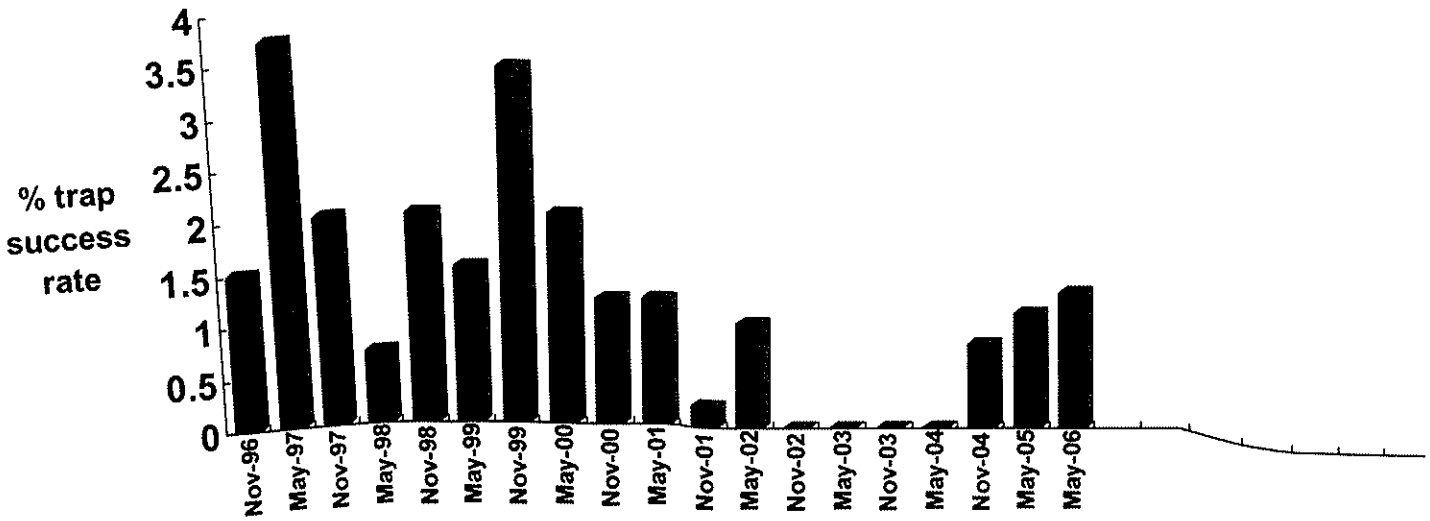

Figure 5. Trap success rates for chuditch at Lake Magenta nature reserve following translocation in July 2006.

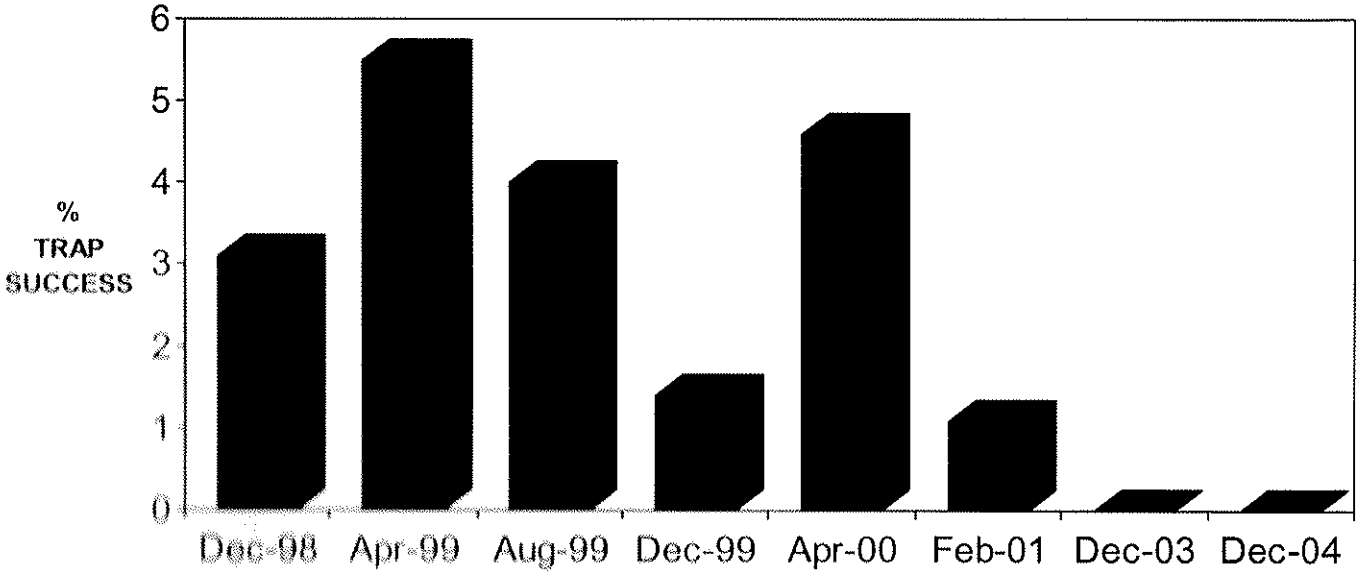

Figure 6. Trap success rates for chuditch at Cape Arid national park following translocation in March 1998.

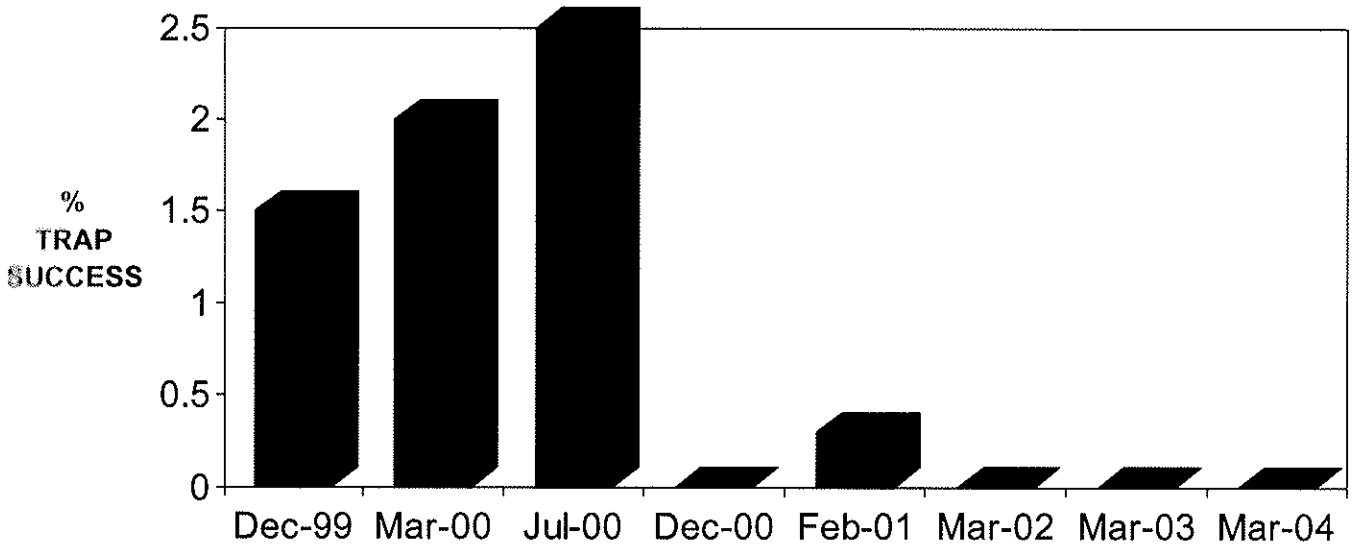

Figure 7. Trap success rates for chuditch at Mt Lindesay following translocation in March 1999.

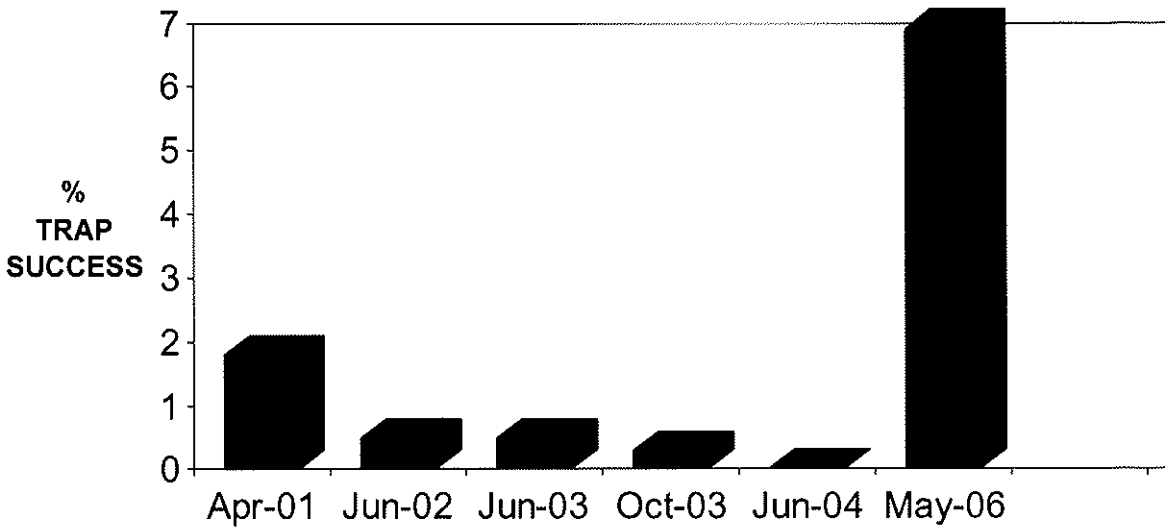

Figure 8. Trap success rates for chuditch at Kalbarri national park following translocation in July 2000. (Note: transects run in May 2006 were different to those run previously)

Figure 9. Long term trends in trap success rates for chuditch at Western Shield monitoring sites (from Williams 2006).