FOX CONTROL IN THE NORTHERN JARRAH FOREST AND BEYOND

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INTRODUCTION

Over the last 20 years or so, Department of Conservation and Land Management (CALM) scientists have been able to demonstrate that fox predation is one of the primary causes in the decline of medium sized mammals in WA, and the same is probably true for other parts of Australia. Foxes followed the spread of rabbits from Victoria and arrived in the eastern parts of WA around 1910, and had reached the south west corner by 1930 (King and Smith 1985). Many mammals declined or became extinct soon after, although some had disappeared before this time and cat predation may have been a significant factor in this earlier decline, particularly among rodents. WA is fortunate in that the mammal fauna is largely resistant to the toxin sodium fluouroacetate, or 1080 (King *et al* 1978, 1981). This toxin occurs naturally in many species of *Gastrolobium* plants, primarily in the south west of the State and the fauna has evolved a resistance to it, enabling them to continue eating the plants despite this defence mechanism. Generally the herbivores have a higher tolerance than the carnivores. The introduced canids (and felids) are particularly susceptible to 1080 (McIlroy 1981) and this toxin can be delivered in dried meat baits at levels which are lethal to foxes but not to native mammal species. By reducing fox abundance by 80-90%, remnant populations of threatened mammals can increase in number and expand their ecological niche.

Christensen (1980) suggested that fox predation was restricting Woylies (*Bettongia penicillata*) to *Gastrolobium* thickets in the south west Jarrah forests, but it was not until the late 1980's that Kinnear *et al* (1988) demonstrated experimentally that foxes were limiting remnant rock wallaby populations. He showed that populations of the Black-footed Rock wallaby *Petrogale lateralis* that were subject to fox control increased in abundance and started foraging over wider distances, while those without fox control went to extinction. It has also been demonstrated that the Woylie abundance at Tutanning Nature Reserve and Brushtail Possum abundance at Boyagin Nature Reserve increased in the areas where fox control had been implemented (Kinnear *pers comm*). Friend (1990) showed a similar increase in Numbat (*Myrmecobius fasciatus*) abundance at Dryandra following fox control.

In 1991 CALM commenced some work on the Chuditch (*Dasyurus geoffroii*) in the Batalling forest to determine the impact of fox control on this threatened carnivorous species that was potentially at risk from 1080 poison baits. The Chuditch was known to have an LD_{50} for 1080 of approximately 7.5 mg/kg (King *et al* 1989) and by consuming two baits, an average-sized adult could receive a lethal dose (Twigg and King 1991). 1080 has also been shown to have some sub-lethal effects on mammals through sterility

in males. Ten Chuditch were radiocollared at Batalling and followed through two operational fox baitings (one every 3 months) which covered approximately 10 000 ha. No mortality was recorded and no impact on breeding was detected - all females continued to produce the normal number of pouch young. This population has subsequently increased and expanded into areas where Chuditch did not occur in the presence of foxes (Figure 1). It was clear that the fox predation and also competition for food, were primary factors in the low abundance of Chuditch in the Jarrah forest. Other species of medium sized mammals at Batalling also benefited from this fox control program. Populations of Woylie (Figure 2), Quenda (*Isoodon obesulus*) and Brushtail Possum (*Trichosurus vulpecula*) have also increased and expanded their distribution within the forest. Primarily because of fox control and the subsequent expansion of populations, the Woylie was removed from State and Commonwealth threatened fauna lists in 1996 (Start *et al* 1996).

BROADSCALE FOX CONTROL

Once it became clear that fox control using dried meat baits did not pose a problem to Chuditch in the Jarrah forest the way was clear to commence broadscale fox control in this area. This program was called Operation Foxglove and it commenced in 1993 with financial assistance from Alcoa. Fox control was implemented over 440 000 ha and its aim was to expand existing remnant populations of threatened mammals such as the Woylie, Quokka, Tammar, Chuditch and Ringtail Possum. This scale of baiting also provided the opportunity to examine the effectiveness of different baiting regimes in terms of fauna recovery. CALM was interested in determining whether 2, 4, or 6 baitings a year over large areas were as effective in fauna recovery. [2 baitings 221 000 ha; 4 baitings 130 400 ha; 6 baitings 89 000 ha; unbaited 103 500 ha] At the same time the Vertebrate Biocontrol CRC was interested in determining what level of fox control was necessary to elicit a fauna response and a partnership was struck with the CRC and Environment Australia to support this high cost work. Forty three monitoring sites (trapping grids) plus sand pad monitoring sites were established, with representation in each of the baiting regimes plus the unbaited area. As fauna number were low throughout most of the forest at this time he undertook translocations of Woylies to the treatment sites and compared survivorship in each. This work is continuing however some trends are apparent. When boundary and core sites are combined, Woylie survivorship in the 6 baited area is greater than in the other treatments.
In the core areas, Woylie survivorship in the 6 baited area was greater than in other treatments, but in boundary areas there was no difference in survivorship (de Tores 1996).

The success of Operation Foxglove in fauna recovery led to a more ambitious program of fox control covering most of CALM's estate (about 5 000 000 ha). Again WA is fortunate in that although several mammal species have declined significantly, remnant populations still occurred in the south west forests, or on islands and these could serve as founder populations for fauna recovery. This larger program was called Western Shield and was launched in early 1996 (Bailey 1996). The strategy was to lay baits aerially over large areas of conservation reserve and forest, targetting areas with remnant populations of threatened species and area identified as suitable for translocating threatened species. It aimed to return 23 species, mainly threatened mammals, birds and reptiles to 20 sites throughout the south west of WA over the next 10 years. The annual budget is approximately $ 1.9 million, and assistance will be sought from private sector sponsorship.

Western Shield will initially only cover about 4 000 000 ha of CALM land in the south west of WA that lies on the high rainfall side of the 350 mm isohyet. Previous experience has shown that where foxes are controlled in more arid environments, feral cat numbers increase and become a limiting factor in wildlife recovery (Christensen and Burrows 1995, Friend and Thomas 1995). Research on effective control methods for feral cats is currently under way and a moist bait has been developed, but unlike the dried meat bait, it is palatable to native species. The focus is now on determining a felid specific toxin, and once this becomes operational and non-target impacts determined, fox and cat baiting will be expanded to the more arid areas of WA. An exception to this is the 100 000 ha Peron Peninsula where much of the research into cat control is being undertaken. It is anticipated that cats will be under control by the end of 1997 and we plan to translocate 10 species of threatened mammal and the Mallee Fowl onto Peron Peninsula over the next five years.

Translocations under Western Shield commenced in November 1995 with the reintroduction of Numbats to Dragon Rocks Nature Reserve. In 1996 Woylies were reintroduced to the Jarrah forest near Mundaring, on the outskirts of the metropoloitan area, and Chuditch and Woylies were reintroduced to Lake Magenta Nature Reserve in the eastern wheatbelt.

FOX BAITING METHODOLOGY

Currently 4.5 mg 1080 is injected into 120g fresh meat baits which are then dried to approximately 70 g, with a texture like biltong. These baits are distributed, either from the air or from the ground at a density of 5 per square kilometre, at a frequency of four time a year, although baiting frequency does vary depending on the situation. The smaller wheatbelt reserves such as Dryandra are baited from the ground monthly, others such as Dragon Rocks (40 000 ha) where Numbats have recently been reintroduced are baited aerially every two months. Larger reserves such as Lake Magenta (100 000 ha) are baited aerially every three months, however this needs to be supported with more frequent ground baitings in late summer and early autumn while the young foxes are dispersing and occupying territories vacated by foxes killed previously by baiting.

The technique used involves a twin engined aircraft flying at 1 000 feet at 150 kts on 1 km transects. Baits are dropped every 200 m, and the aircraft can drop 1 000 baits an hour. The annual cost of this, including baits, aircraft and salaries is 24 cents/ha.

CALM has produced a Fox Control Manual (CALM 1996) which provides the operational guidelines for fox control on CALM lands. This covers the background to why we fox bait, what fox baits are to be used, how they are to be laid and what public notification is required.

THE FUTURE

Western Shield will be expanded into more arid areas once feral cat control becomes operational. The key to this program in WA will be the continued acceptance by the public in the use of 1080 and the ability to use any cat bait and felid specific toxin that is developed. While public support for fox control in WA has been good to date, the ability to control foxes and cats of such great importance to our wildlife conservation programs that research that examines alternative methods, such as sterility control, should also be

supported. Other States are now examining the possibility of similar fauna recovery programs to Western Shield and CALM is well placed to be able to offer advice and expertise to implemnet these. Although several native species in the eastern States do have relatively low tolerances to 1080, there are only a few that would probably be at risk. This risks reduced further if the level of 1080 is reduced and larger baits used. The most obvious at risk are the quolls. At 3 mg of 1080 per bait both the Eastern and Tiger quoll would have to consume a whole dried bait to receive an LD_{50} dose. Experience with Chuditch suggests that quolls don't consume dried meat baits, but do like the moister Fox - off or similar baits. Chuditch once occurred in western NSW and we already know that Chuditch are not affected by 1080 dried meat baits, so reintroduction programs in the future could be a reality providing fox control was in place. There is also enormous potential for ecotourism to be developed as part of fauna recovery programs and this can serve as a source of funding to continue baiting and monitoring work.

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