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Secondary poisoning of foxes following a routine 1080 rabbit-baiting campaign in the Western Australian wheatbelt

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ABSTRACT

There is circumstantial evidence that foxes (*Vulpes vulpes*) feeding on rabbits (*Oryctolagus cuniculus*) poisoned with sodium monofluoroacetate (1080 poison) die from secondary poisoning. A rabbit-poisoning campaign that occurred during a fox research study provided direct evidence to support the above view.

INTRODUCTION

In Western Australia (WA) 1080 was widely used by the Agriculture Protection Board (APB) to control populations of rabbits (*Oryctolagus cuniculus)* on farms. Typically, a bait trail of 'One Shot' 1080 oats (Gooding and Harrison 1964) was laid so as to intercept rabbits *en route* to their foraging areas. This method has been shown to be an efficient and effective method of control (Oliver *et al.* 1982; Robinson and Wheeler 1983).

There is circumstantial evidence that foxes feeding on poisoned rabbits die through secondary poisoning (Christensen 1980a; McIlroy 1981; King *et al.* 1981). This paper provides direct evidence to support this view.

METHODS

Study Site

Data were collected from an area of Watheroo National Park (450 km^2) approximately 200 km north of Perth in the northern wheatbelt (30° 14' S, 115° 45' E). Beard (1979) describes the vegetation as consisting mainly of undulating scrub-heath with *Banksia-Xylomelum* alliance on yellow sandplain, limited areas of *Casuarina* thicket on the lateritic ridges and *Eucalyptus* woodland in the depressions. Records from the WA Herbarium indicate the absence of 1080-producing *Gastrolobium* sp. (S. Patrick personal communication) in the area. The park is entirely bounded by farmlands and enclosed within the park is a farming property known as 'Warro Springs'.

Fox Study

Fifteen adult foxes had been captured and radio-collared in the north-western area of the park (approximately 100 km^2) during the spring of 1988. These foxes were periodically radio-tracked from fixed towers to provide information on home range and spatial organization.

While radio-tracking between 12 and 16 December 1988 it was observed that three foxes, whose home ranges were adjacent to the Warro Springs property, had not moved since the morning of 13 December. To investigate the possible reasons for lack of movement, these animals were located on 13 December, using a hand-held aerial; all three foxes were dead. Searches of the area were then conducted to locate any non-collared dead foxes.

Stomach contents were removed from all animals for laboratory examination; hair was identified as described in Brunner and Coman (1974). The foxes were not analysed for 1080 because of the difficulties of detecting small amounts of residue (D. King personal communication).

Rabbit Poisoning Campaign

On 12 December an APB officer, at the request of the owner of Warro Springs, had baited an area on the property which contained rabbit warrens and most of the farm boundary with one-shot 1080-poisoned oats. The oats were laid from a hopper into a furrow cut by a disc blade along a 6 km transect around the northern half of the farm.

RESULTS

Six non-collared, dead foxes were found on the firebreaks bordering the Warro Springs property the same day as the radio-collared foxes were located. An unusual sight was found at one site where three juvenile foxes lay dead in close proximity to each other. Nearby were the remains of a rabbit that had been almost entirely devoured, including the viscera.

All dead foxes, except for one that had died in a den, displayed signs that suggested that they had died from 1080 poisoning. All animals were lying on their side and the soil around them had been disturbed forming depressions, created by the sweeping movements of their limbs during the death throes which is typical of carnivores poisoned with 1080 (McIlroy 1981).

The three poisoned radio-collared foxes all contained rabbit hair in their stomachs as did the six non-collared foxes collected along the firebreak. Searches for other non-collared foxes were conducted in the surrounding area but the density of vegetation prevented any further animals being found. One other radio-collared fox that had occasionally been located around the farm area was located 2 km north during the rabbit-poisoning campaign.

DISCUSSION

Secondary poisoning of foxes has occurred following the 1080 rabbit-baiting campaign, causing a significant decline in their numbers. Data on carrion-eating animals found dead after rabbit poisoning campaigns in New South Wales (NSW) support the findings reported here. Foxes were the non-target species most frequently found dead after rabbit-poisoning operations in NSW State Forest areas (McIlroy 1982). McIlroy and Gifford (1991) similarly found that fox numbers were reduced by about 75 per cent after a trail-baiting campaign against rabbits with 1080-treated pellets in NSW.

In controlled secondary poisoning experiments that simulated field conditions, Marsh *et al.* (1987) fed 1080-poisoned ground squirrels (*Spermophilus beecheyi*) to 15 coyotes (*Canis latrans*). Three coyotes weighing 10.2-12.5 kg died after eating a squirrel that had consumed 3 mg of 1080 in a bait. Because One-Shot poisoned oats contains 4.5 mg of 1080 per oat, and since foxes (*ca* 4-6 kg) are considerably lighter than coyotes and have a similar tolerance to 1080 (Ward and Spencer 1947; McIlroy and King 1990), a rabbit that had eaten a single poisoned oat would be lethal to a fox. McIlroy and Gifford (1992) calculated that to receive the equivalent of an LD_{50} dose, foxes need to eat only about one-third of the muscle or half the liver of one poisoned rabbit. These amounts represent only 11 per cent or 2 per cent, respectively of their daily intake of food (McIlroy and Gifford 1992).

Direct evidence of secondary poisoning of foxes in this study further substantiates the arguments of Christensen (1980a) and King *et al.* (1981) that the fox has played a prime role in a suite of interacting factors leading to recent faunal declines and extinctions in south-west WA. These authors were the first to note the inverse relationship between fox abundance and the amount of 1080 used to control rabbits in WA. Since the completion of colonization of south-western Australia by foxes in 1931 (Long 1972), foxes increased in abundance until the mid 1950s when 1080 rabbit-baiting campaigns became widespread. By the late 1960s, the fox had declined to the point of rarity in south-western Australia (King *et al.* 1981) and in some areas, certain medium-sized marsupial species became conspicuously abundant (Sampson 1971; Christensen 1980b).

The use of broadscale 1080 rabbit-baiting campaigns declined for a considerable period (1970-78) following the introduction of the European rabbit flea, as widespread winter epizootics of myxomatosis caused a very high mortality in rabbit populations (King *et al.* 1981). Secondary poisoning was no longer of significance in controlling fox numbers and a dramatic increase in fox numbers was observed in the south-west during the 1970s (see Fig. 2 in King *et al.* 1981). Reduction in rabbit numbers and the increase in fox abundance may have resulted in increased predation on native species. As a consequence native species, even in refuge areas, declined drastically in numbers and their recovery has only followed the implementation of fox control programs. Kinnear *et al.* (1988) and Friend (1990) were able to aid the recovery of remnant populations of rock-wallabies (*Petrogale lateralis*) and numbats (*Myrmecobius fasciatus*) respectively by reducing fox numbers comparable to or in excess of secondary poisoning following rabbit control programs.

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