Cyanide Baiting to Sample Fox Populations and Measure Changes in Relative Abundance

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Abstract

An efficient technique for sampling fox populations which also measures changes in relative abundance is described and assessed. The method involves the use of cyanide bait stations. The value of this technique in rabies control, should an outbreak occur in Australia, is discussed.

Introduction

The fox has been studied extensively in Europe and North America mainly because of its role as a vector of rabies. In the event of an outbreak of rabies, information is required on the numbers and distribution of foxes in the affected area (Trewhella, Harris & McAllister 1988). Wandeler (1980) has shown that there is a correlation between fox population densities and a rabies epizootic. Rabies transmission will occur at fox densities greater than or equal to 1 fox per km^2, while the spread of the disease is inhibited at fox densities of less than 0.2 animals per km^2 (Bogel & Moegle 1980; Lloyd 1980).

Containing a rabies epizootic requires knowledge about the incidence and extent of the disease within a fox population. To meet this requirement, it is necessary to sample the fox population efficiently. To control, and preferably, to eradicate the disease requires the reduction of the host population to a level that negates transmission of the virus. Realising these objectives in the field can be difficult, time-consuming and labour intensive.

Scent stations or track counts have been designed for examining abundance of coyotes and foxes (Linhart & Knowlton 1975; Griffith *et al.* 1981). The relationship of these indices to actual densities, however, is generally unknown. We have tested both these techniques in the field and found them to be unreliable indices (Algar & Kinnear, unpub.).

In Europe, an index method based on hunters' returns is used to estimate fox density. This index is calculated from hunting statistics and is described by the number of foxes shot or trapped annually per unit area (Artois & Andral 1980; Bogel & Moegle 1980).

Alterative approaches to censusing foxes provide estimates of absolute fox density. Active dens are surveyed during the cub-rearing season to determine the number of fox family groups present. Home range determinations can also provide estimates of fox density. Both of these approaches require a knowledge of social structure, i.e. sex ratios and fox family group organisations. If such information is available, then it is possible to determine the number of foxes per unit area (Harris 1981; Harris & Smith 1987) and to calibrate density indices.

Our research has focused on estimating fox abundance before and after the application of a given control procedure, in this case cyanide baiting transects. Preliminary results of this procedure are presented here. Additionally, data

wildlife rabies: contingency planning in Australia are presented which show that cyanide bait transects provide a rapid and efficient method for sampling fox populations. Potential uses of this technique in rabies control operations are discussed.

Materials and methods

Cyanide bait stations

The technique is similar in concept to that used by Knowlton (1972) who estimated coyote densities by Coyote-getter or M44 transects.

The technique involves laying dry sodium cyanide encased in a capsule comprised of a mixture of paraffin and micro-crystalline wax. This combination of waxes produces a sufficiently robust but brittle capsule, having a relatively high melting point. Two different coloured capsules, coated with an attractant, are placed at each bait station. A white capsule is coated with a mixture of condensed milk and icing sugar and a red capsule covered with a lure of blood and liver blended together into a paste. Each capsule is tethered to a buried metal plate thus preventing a fox from carrying off an intact capsule. Capsules are laid at dusk at stations located at 200 m intervals along firebreaks or tracks, and retrieved at dawn. Foxes are attracted to the stations by a scent trail created by dragging a carcass behind the vehicle along the track. When the capsule is taken by a fox it crumbles in its mouth and death is virtually instantaneous ensuring retrieval of all victims.

The index generated by cyanide bait stations is called the CPUE (Catch Per Unit Effort) and represents the number of foxes killed per 100 bait stations. The basic assumption is that the index is proportional to fox density given a constant sampling effort.

Baiting trial

A preliminary assessment was conducted to test whether the CPUE index would reflect relative changes in fox abundance as a result of a 1080 baiting program. Watheroo National Park, situated in the northern wheat-belt region of Western Australia, was selected as the study area. The park was divided on a north-south basis into approximately two equal sections of similar habitat. Foxes were trapped throughout the park and fitted with radio-transmitters.

In April 1989, three cyanide transects were carried out in the northern area to generate a CPUE index, immediately prior to the 1080 baiting program. Next, the resident radio-tagged foxes were located, then the whole of the park was aerially baited with dried 40–60 g meat baits (4.5 mg 1080) applied at a rate of 6 baits per km^2. During the two weeks following the 1080 baiting, the radio-tagged foxes were re-located and the number poisoned was ascertained. When it was evident that mortality due to the 1080 baiting had ceased, a CPUE index was determined for four transects in the southern area of the park.

Results

CPUE indices

The CPUE indices for cyanide trials are shown in Fig. 1. For the northern trial conducted prior to the 1080 baiting program, the index was 11.4 ± 1.9 (mean ± s.e.). For the post-baiting trial in southern area, the index was 1.5 ± 0.6. Of the radio-tagged foxes resident within the park immediately prior to 1080 baiting, a 91% mortality (n=11) occurred as a result of the baiting program.

Trapping data collected during the course of fitting transmitters indicated comparable capture rates at both sites and thus it is reasonable to assume that fox density in both areas was similar. The 86% decline in the CPUE is comparable to 91% mortality resulting from the 1080 baiting.

Sampling the fox population

The cyanide transects (16.4 km) carried out in the northern section prior to the 1080 baiting yielded 24 foxes on the first day. The procedure was repeated on the two successive days and

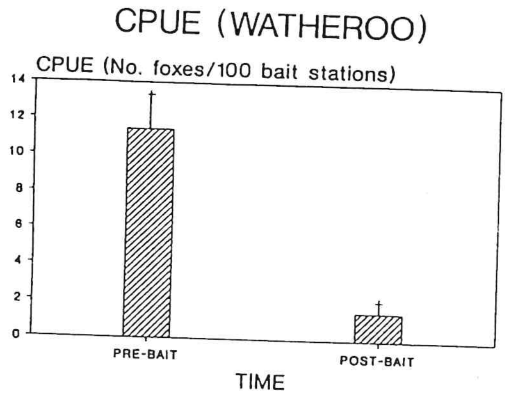

Fig. 1. CPUE values (mean ± s.e.) for cyanide bait transects prior to and after fox population reduction with 1080 meat baits.

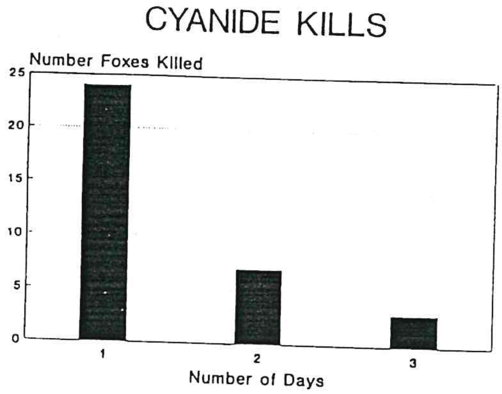

Fig. 2. Fox sampling data obtained from cyanide bait transects in the northern area of Watheroo National Park on three successive days.

yielded 7 and 3 foxes respectively. Thus a total of 34 foxes was recovered. These data imply that the method could be used to generate population estimates by applying population removal statistical procedures (Fig. 2).

Discussion

These preliminary results highlight the potential value of the CPUE index as a measure of fox abundance. The changes in the index paralleled the mortality of radio-tagged foxes in the baiting trial. Efforts are now being made to replicate the procedure and to calibrate the index against absolute density.

The cyanide baiting procedure would be of considerable utility in the event of a sylvatic rabies outbreak in Australia. The procedure enables retrieval of foxes at individual bait stations, making it possible to rapidly assess the incidence of rabies within a population and to delimit the geographic distribution of the outbreak.

Foxes retrieved along the cyanide transects can also provide data on a number of other demographic parameters relevant to control strategies and rabies transmission. Rabies transmission depends on contact between individual animals and therefore on the social structure of the population during the non-dispersal period (Wandeler 1980). During this period rabies has to be transmitted between or within territories. From data collected on sex ratios, the locations of kills and the percentage of vixens producing young, it should be possible to infer population social structure.

It has been shown that fox dispersal will affect the rate of rabies spread (Artois & Andral 1980; Wandeler 1980). Dispersal of sub-adult foxes is believed to be responsible for the autumn peak of fox rabies in Europe, and to be of particular importance in the long term progression of the disease. More studies are in progress with emphasis on dispersal factors such as timing of dispersal, age classes involved, mortality and distances travelled. Cyanide baiting is proving to be an useful tool in this research.

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