Assessing the Impact of Dingo Predation on Wildlife Using an Activity Index

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Abstract

Three methods of assessing relative abundance of wild canids were evaluated on a population of dingoes *(Canis familiaris dingo)* on a cattle station in south-western Queensland in 1993. One of these methods, the Activity Index, measures the number of dingoes, crossing tracking stations placed at kilometre intervals along transects. While all three indices have a high level of agreement for detecting daily changes in dingo activity, with correlation co-efficients exceeding 0.85, the Activity Index is the most sensitive, producing proportionally more positive responses than either of the other two indices.

This index simultaneously captures the relative abundance of a broad range of wildlife based on activity (spoor) and has subsequently been used to monitor population trends in response to dingo control policy. While other abundance assessment techniques are being used, the Activity Index appears to be more robust and sensitive, capable of detecting and monitoring relatively uncommon species such as koala (*Phascolarctos cinereus*), feral cats (*Felis catus*) and Fat-tailed Dunnarts (*Sminthopsis crassicaudata*). While factors other than relative abundance may affect the activity of wildlife, for many studies an index of species' activity may be a more relevant measure than actual abundance.

Introduction

Throughout Australia studies have been conducted on wild canids using a variety of methods to assess relative abundance. Methods include visitation rate to bait stations, (Thompson and Fleming 1994), a cyanide index (Algar and Kinnear 1991), questionnaire survey of spoor and howling (Mitchell *et al.* 1982) and activity around water facilities (Best *et al.* 1974).

In 1993, as part of a project to evaluate the impact of dingo (*Canis familiaris dingo*) predation to the northern Australia beef industry, we compared three methods of measuring the relative abundance of dingoes to determine which method(s) were the most sensitive to dingo activity. The methods we tested were; the Scent Station Index (Roughton and Sweeny 1982); a Buried Meat Index (Thompson and Fleming 1994) and the Activity Index.

Because dingo predation can be potentially beneficial to graziers and the environment by controlling pest species of wildlife, one of the major objectives of the primary study is "to evaluate the potential long-term impacts dingo predation and dingo control has on introduced and native wildlife populations". Specific attention is therefore focussed on monitoring trends in feral pig, rabbit, fox and kangaroo populations, but the whole suite of wildlife species is of interest. To monitor wildlife abundance over an area of approximately 2500 km^2, the area

proposed in this dingo project, the methodology(ies) needed to be rapid and simple, yet sufficiently sensitive to reflect changes in wildlife abundance over space and time.

In the 1993 experiment, all three methods were found to be similar at tracking dingo population trends (correlation co-efficients >0.85). However one of the methods, the Activity Index, proved significantly more sensitive ($P<0.005$) at detecting dingo presence. As the tracking stations used in the Activity Index simultaneously "captures" the spoor of many wildlife species this Index has subsequently been used to monitor the abundance of a wide variety of wildlife.

A thorough description and discussion of the 1993 experiment comparing the three dingo abundance indices has been submitted for publication. In this paper we present but a portion of the 1993 results concentrating on the subsequent 18 months of monitoring wildlife populations with the Activity Index.

Methods

Activity index.

Two 50 kilometre transects, separated by a 10 km buffer, were established along vehicle tracks throughout an extensive beef cattle property of 800 km^2 in the Upper Maranoa catchment, (Lat. 25.30° South, Long. 147.45° East). The buffer was imposed to ensure the areas are independent (Thomson 1987, 1992b). At kilometre intervals along the transect, a one metre-wide swathe was raked across the road from gutter to gutter. Where the road surface was too hard and/or vegetated, the vegetation was removed and a fine dust or sand sieved over the surface. This tracking surface was monitored and swept daily and all dingo (and other wildlife) tracks crossing the swept area were recorded.

After four to six consecutive days of assessment, relative abundance was calculated as the mean number of animals of each species crossing the 50 tracking stations along the transect.

Dingo Predation Pilot Trial

In May 1994 we commenced a one-property pilot trial on the same site as the 1993 evaluation of dingo abundance indices using essentially the same transect, methodology and tracking stations as were used the previous year for the Activity Index. The only difference was the movement of ten of the 100 tracking stations and renumbering the sequence they are inspected to facilitate the task being done by one vehicle/operator.

To evaluate the impact of dingo predation, one half of the property has been arbitrarily selected to receive dingo control and the remaining half receives no dingo control. The two 50 km transects are located centrally to these two treatment areas and are separated by a 10 km buffer and stock fence.

Assessments of wildlife abundance have been made in May 1993, May, June, September and November 1994. Following the May and September 1994 assessments, 100 kg of kangaroo meat representing approximately 800 poisoned baits (6.0 mg 1080 $bait^{-1}$) were laid by air and ground over the northern half (approximately 400 km^2) of the property. The June and

November 1994 assessments subsequently represent post-baiting assessments of wildlife abundance with the southern half of the property providing a nil-treatment comparison.

Results

Figure 1 shows the daily visitation rates to tracking stations and cumulative means recorded by the three indices of dingo abundance at the three density levels in 1993. Irrespective of the time interval between assessments or the density level of dingoes, the Activity Index resulted in a significantly higher interaction with dingoes than the other two indices. These results were consistent for both north and south replicate sites.

Figure 2 shows the relative abundance of dingoes, birds (mixed species), rabbits *(Oryctolagus cuniculus)*, macropods (various species including *Macropus giganteus, M. rufogriseus, Petrogale penicillata* including the rat-kangaroo *Aepyprymnus rufescens*), dunnarts (*Sminthopsis crassicaudata*)[1], possums *(Trichosurus vulpecula)* and cats *(Felis catus)* as recorded by the Activity Index since 1993. Species other than those presented in Figure 2 have been recorded from the Activity Index sites. One of the most notable being the koala (*Phascolarctos cinereus*).

Only one person, a fencing contractor, has ever sighted a koala on this property in the past 15 years (Pers. comm. Station Manager). Similarly the spoor of feral pigs *(Sus scrofa)*, dunnarts, feral cats and echidnas (*Tachyglossus aculeatus*) have been recorded by this Index. Some of these, such as the dunnart appear relatively common (September mean of 23.8 dunnart tracks, transect^{-1} day^{-1}), yet from observation, Elliot and pitfall trapping and spotlighting none of these four species have actually been sighted during surveys over the past 18 months.

Discussion

The Activity Index is distinct in that it detects uncommon and neophobic species or individuals in the population and simultaneously "captures" a suite of wildlife species using a relatively rapid yet sensitive method. To detect presence/absence or measure species abundance with alternative assessment techniques would require a major undertaking using perhaps a combination of several assessment methods such as pit-fall trapping, spotlight counts, pellet counts, line transect counts and aerial surveys.

One question in this approach, however, is how well is species' "activity" correlated to abundance? Several factors may affect animal activity at tracking stations other than the density of populations. However Bider (1968), in a comprehensive study that produced 182 000 wildlife crossings of sand transects, evaluated population density as the most significant factor affecting activity on tracking stations. He shows, (see hierachical order and discussion of these factors pp. 297-305), seasonal phenological activity, that is, activity related to reproduction; seasonal differences in food availability; seasonal migration; dispersal of young; and of lesser importance, weather at the time of assessment and climatic events, may influence

[1] The spoor of the dunnart is distinctive but its identification is tentatively inferred from a specimen of the animal recovered from the Station's "house cat"

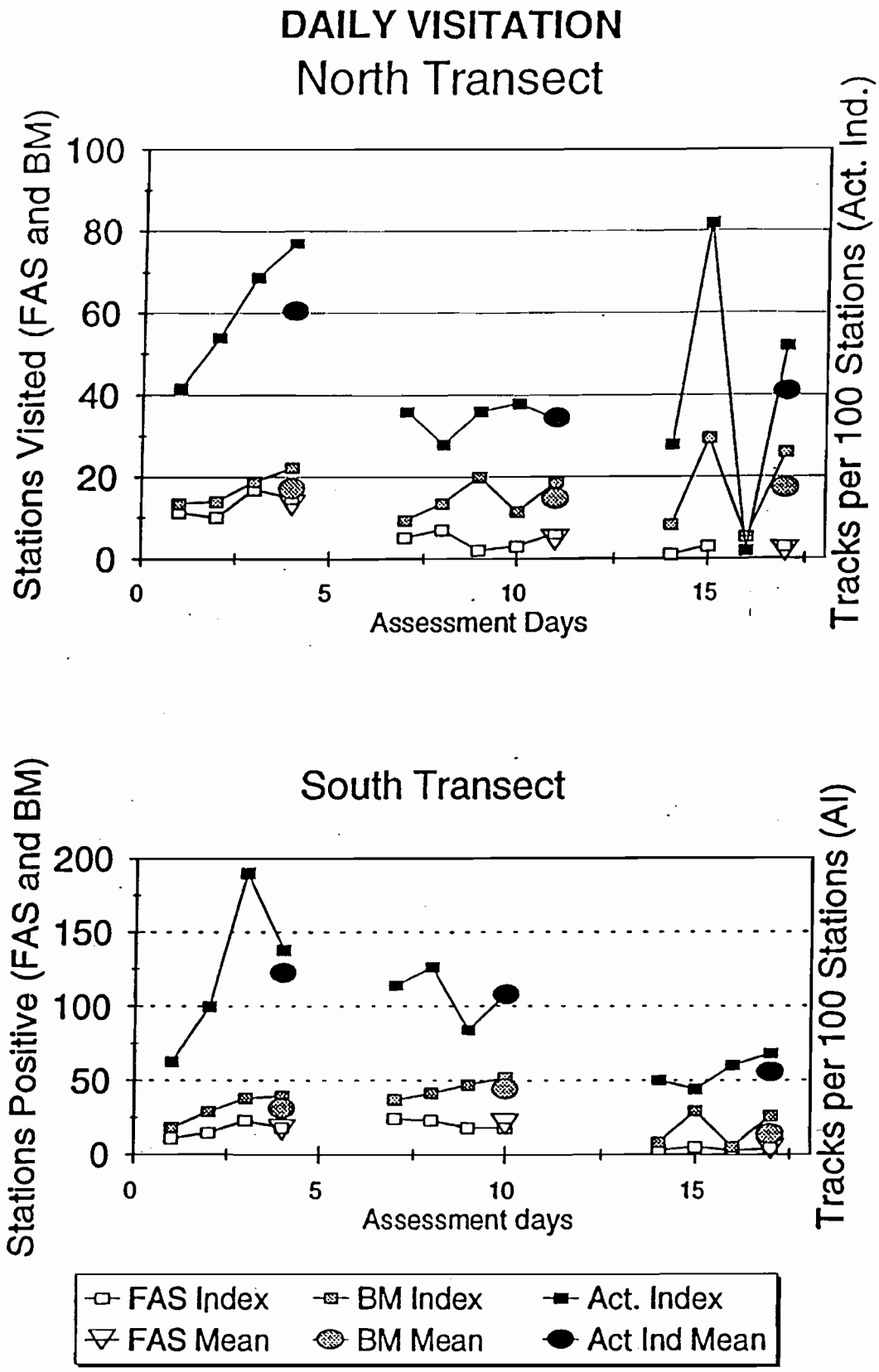

Figure 1. Daily visitation rates and cumulative means of dingo activity at three density levels, pre- and post baiting, as measured by the Fatty Acid Scent Station Index, Buried Meat Index and Activity Index at two replicated sites.

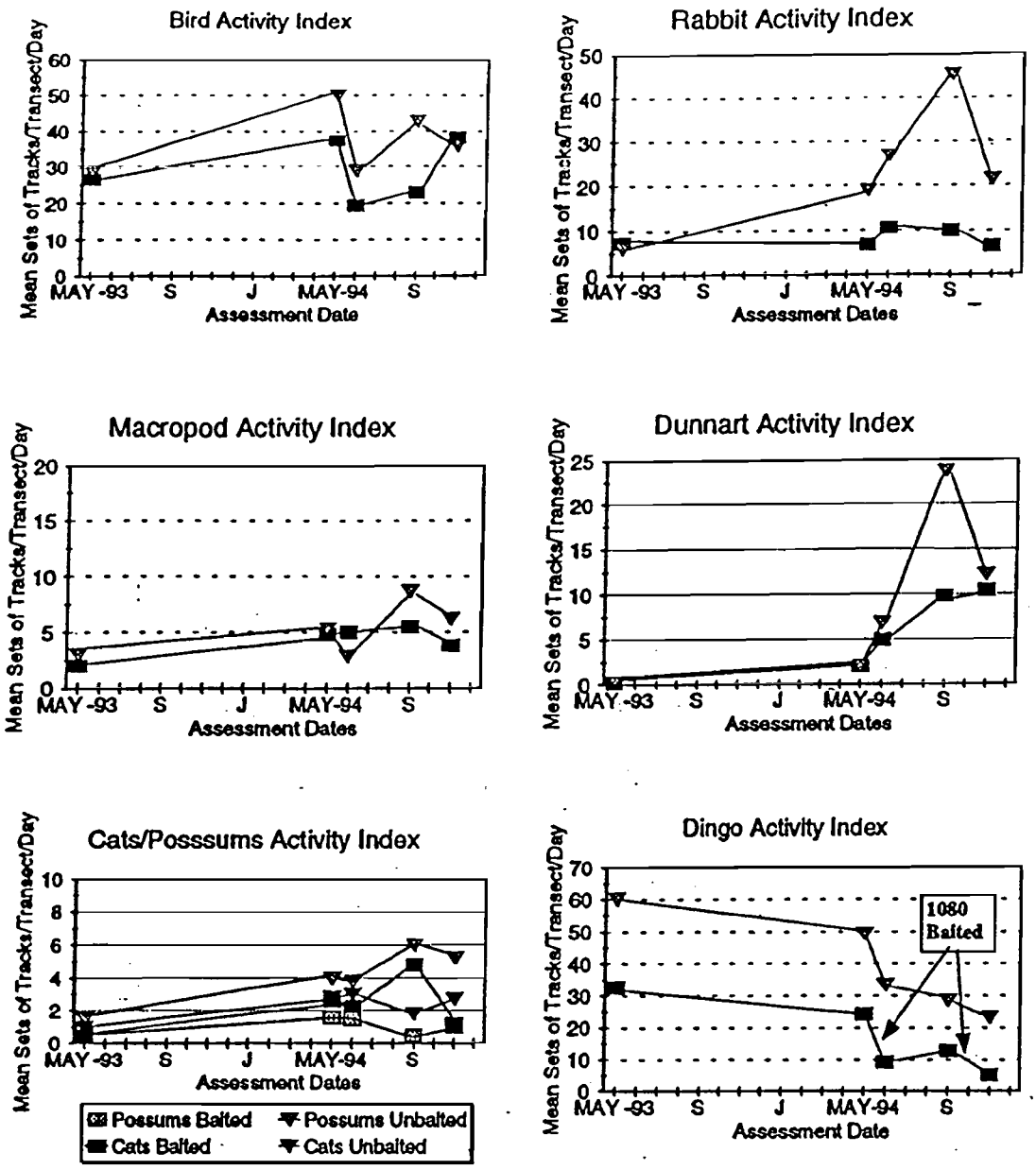

Figure 2. Index of relative abundance of seven species or categories of wildlife assessed over an eighteen month period in south-west Queensland. The index is calculated from animal spoor along two 50 km transects, one transect located in an area where dingoes are regularly baited with Compound 1080 baits (Square symbol), the other area is un-baited (Triangular symbol).

animal activity and potentially affect their index of abundance. The data indicate that predation did not by itself strongly influence the relative activities of mammalian species, as it is only one of the many factors which influence activity. Correlation co-efficients between dingo activity indices and those of the other mammalian conspecifics reinforce this notion as none of the correlations achieved an absolute magnitude greater than 0.4.

Alternative methods of assessing wildlife abundance, such as spotlight counts and trapping, as well as the Buried Meat and FAS indices, are also affected by animal activity, and therefore influenced by the factors discussed above. The high correlation we obtained in 1993 between the Activity Index, FAS Index and Buried Meat Index on dingo populations was because these indices are indirectly a measurement of daily activity. For many predator studies, activity is probably a more relevant measure, to the researcher, than actual abundance, for predation of wildlife and livestock is likely to be more closely correlated to predator activity than predator abundance. The same can be argued for studies involving the impact of wildlife on crops or vegetation.

The methodology used to assess population abundance can have significant effects on species behaviour or activity and hence bias estimates. See for example, Saunders and Bryant's (1988) report of feral pigs 'acting dead' during aerial surveys of helicopter-shot pigs and Caughley's (1977) discussion on individual/species behaviour to trapping devices and survey methods affecting the integrity of survey data.

Two characteristics of the Activity Index are worth noting at this point. As a passive index there are few, methodology-induced changes to wildlife behaviour or activity that might bias results. Secondly, because the tracking stations are inspected for spoor every 24 hours there is a time dimension in this index that alternative assessment techniques don't reflect. Alternative techniques for example are often sensitive to the time of day when they are undertaken, relative to each species peak period of activity. Each wildlife species will be active at different times of the day or night and these peak periods of activity may be further influenced by ephemeral events such as rain, moon phase, cloud cover, temperature, wind speed, vegetation cover and other factors (Bider 1968). Therefore the exact timing of spotlight and line transect counts for example will influence population estimates.

Because the project for which this index has been developed seeks to monitor a suite of wildlife species whose peak activities vary throughout the day, this time dimension has important consequences. As Bider (1968) explains "the transect is fixed and animals move, therefore, it is only a matter of time before all species which inhabit an area, cross the tracking surface". The presence of each of these species is simultaneously captured from spoor along a Activity Index transect inspected at 24 hour intervals. The Activity Index thus assumes that the mean daily rate at which members of each species cross the transect is a function of their relative density and this provides a simple measure of each species relative abundance.

As the movement of dingoes along tracks will often be attributed to maintenance of territory (Harden 1985), seasonal patterns will occur. During the four weeks between mid-May and mid-June 1994, there was a 32% decrease in the dingo index in the un-poisoned treatment area. This decline is consistent with the monthly changes in dingo activity reported in Thomson (1992a) following the seasonal peak in breeding activity in April/May. While seasonal changes in activity don't necessarily compromise the value of the index, studies which involve comparisons of treatment effect based on population responses using this index, should

be made during comparable seasons (for dingoes see Figure 4 in Thomson 1992a and Bider 1968 for invertebrates, reptiles, birds, amphibians and carnivores).

Most species populations being monitored have shown a consistent pattern between treatment areas and season. Two exceptions are noted. One exception being the rabbit Activity Index in the southern, un-poisoned area. In this area there has been an eight-fold increase in rabbit activity over the first 18 months of monitoring compared to a relatively stable population on the neighbouring baited site (Fig 2). While the difference between treatment areas remains inexplicable, (the laying of poisoned meat baits assumed to pose no primary or secondary hazards to rabbits), there was a noticeable increase in day observation of rabbits during September 1994 in the southern area corresponding to the Activity Index. The other difference has been predictable. Dingo activity in the baited area (Fig 2. north transect) declined, relative to the un-baited half of the property, by approximately 56% and 53% respectively following 1080-baiting in May and October.

Observer bias and the activity index

This index relies on the detection and correct identification of spoor left on tracking stations. Failure to detect spoor can occur if the tracking station is inadequately prepared and if the observers are inexperienced. Rainfall, direction and intensity of sunlight, strong wind and/or traffic (livestock and vehicles) may further obscure or obliterate all or perhaps only the faint or lighter animal traces. Loss of information cannot be prevented completely but the careful attention to preparation of tracking stations reduce these losses. As each species index of abundance is averaged over several days and collected from 50 stations, the loss of some data does not seriously affect the index of abundance.

One significant factor is the observer's ability to both detect and correctly identify spoor. This ability can be learnt through experience and field guides to spoor identification like "Mammal Tracks and Signs" (Trigg 1985) but there are other sources. We have found spotlight and ground surveys and referring to distribution maps to determine what species are known to exist in the area to be helpful aids to identifying spoor.

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