Contagion and Waxtag Possum Monitoring

Summary

We clearly demonstrate that Waxtag monitoring is **not** significantly affected by contagion.

Background

Temporal contagion of animal monitoring detection stations can invalidate the resulting population index. Temporal contagion is a phenomenon where an animal is detected at a monitoring station, and subsequently travels to a different monitoring station and is detected again (Bamford 1970).

The current proposal to use Waxtags for indexing possum populations in NZ, is meeting resistance, as industry participants believe temporal contagion will affect the index. Hence providing clear evidence that contagion does not occur at a significant rate is pivotal to acceptance of the technique. Waxtag monitoring has significantly better sensitivity at low population densities, so the contagion issue warrants close scrutiny.

The data gathered by Thomas, Brown and Madigan 2004 (AHB research report R-80621) is ideally suited to investigating contagion. Waxtags were placed in cruciform patterns containing 5 Waxtags, in a close 10m radius (Fig. 1). If possums were inclined to bite the unpalatable Wax tags repeatedly, this sampling design gave them every opportunity.

Revisiting the Thomas et al. (2004) data specifically from the perspective of contagion is illuminating.

Frequency Distribution - Number of Tags bitten per Tag Station
Firstly we can look at the frequency distribution of tags bitten inside individual cruciforms. Cruciforms comprise a close spacing of 5 tags in a 10m radius (Fig. 1). Each waxtag site was lured with flour, so an individual possum would presumably have good reason to visit more than one Waxtag site within the cruciform.

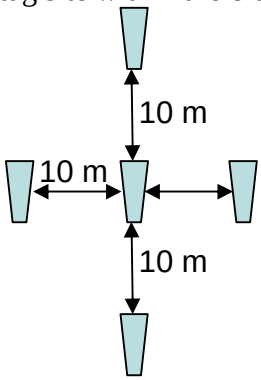


Fig. 1. A Tag Station consisting of 5 WaxTags® spaced at 10 m intervals and located in a cruciform shape.

Now if contagion was a problem, and individual possums did bite further Waxtags after their first experience, we would expect to see bimodality in the frequency distribution. A spike at zero (many cruciform stations that were not visited by a possum at all), a low incidence of cruciforms with 1, 2 or 3 tags bitten, and another spike at 4-5 tags bitten (representing rapacious individual possums chewing into every Waxtag available in its immediate proximity).

What actually happened is graphed below, with the data table also included.

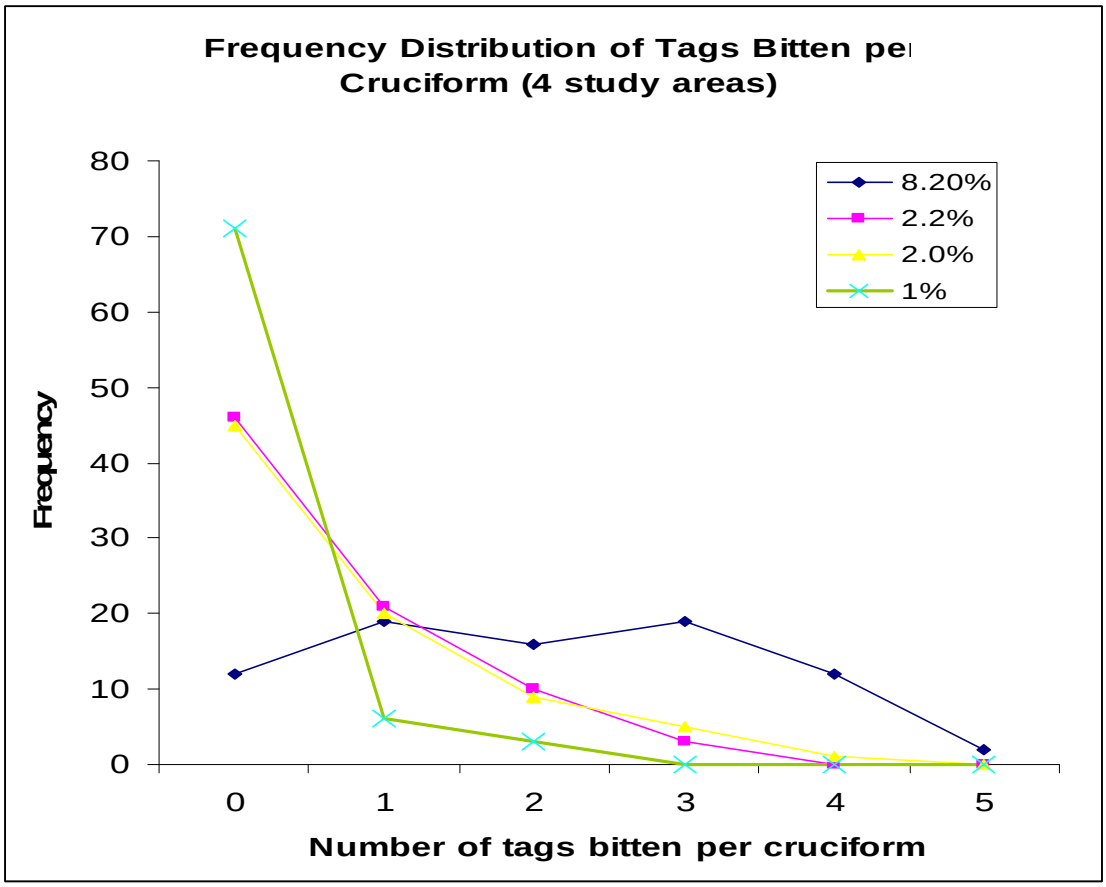


Chart 1 Data from 4 study areas, with their respective RTCI equivalents shown. A total of 80 cruciforms were located in each study area.

	8.20%	2.2%	2.0%	1%
0	12	46	45	71
1	19	21	20	6
2	16	10	9	3
3	19	3	5	0
4	12	0	1	0
5	2	0	0	0

Table 1 Frequency data from the 4 study areas, source data for preceding graph.

Clearly there is no evidence of the bimodal pattern that would indicate a high rate of contagion. Quite the opposite. Even at the highest population density (8.2%RTCI), only two cruciform stations had all 5 tags bitten. Of the 78 cruciforms that were visited by possums in the 3 low density study areas (2.2%, 2% and 1% RTCI), not a single cruciform had all 5 tags bitten, and only one cruciform had 4 tags bitten.

These patterns are consistent with individual possums biting Waxtags only once. Any contagion that exists must be at a low rate, not able to be observed in the data.

Cumulative PAI

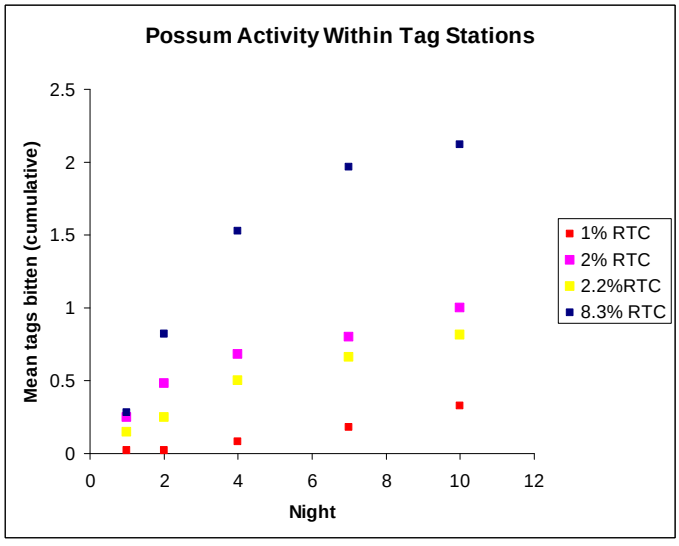
During the sampling, interference data were recorded at 1,2,4,7, and 10 nights.

The pattern of cumulative PAI increase can be interpreted in the context of contagion and this is a corroborating piece of evidence.

If contagion was rife, then the shape of the cumulative PAI would be exponential, quickly saturating the station. This is what's observed with the likes of orange on wire monitoring and the Bamford method of a flour paste in bottle tops attached to wires (Bamford 1970).

However, if new possums were to encounter the station at a constant rate over the monitoring period, but only bite tags once, then the shape of the cumulative PAI would be a straight line. When we further consider that possums are actually encountering the station at a reducing rate over the monitoring period (because every time a possum bites a Waxtag, there is one less possum available in the local population to be recorded, i.e. sampling without replacement), then the shape of the curve would decrease to an asymptote.

Plotting the data (below) shows curves decreasing to an asymptote for 3 of the 4 data sets. Very interesting chart patterns, and consistent with our scenario where contagion does not significantly affect the index. The fourth line comes from the low possum density area, and there is not enough data to generate a robust chart pattern.



Discussion

No doubt the odd possums will bite a tag twice. But at the level of the PAI index, it's clear that this contagion rate is very low, and will not unduly affect the index.

If anything, the data demonstrate that a deterrent effect is in force, and we need to think that through. Sampling the same population with this method within a 12 month period would be ill-advised without further research on how long this deterrent effect lasts.

In the case of monitoring performance control contracts, how will you prevent the control operators monitoring their own work with Waxtags?? A sure way to pass the formal monitoring , because possums will not bite a Waxtag twice….

However, in the absence of contagion, the Waxtag technique, and particularly the PAI provides an excellent opportunity for designing a low density monitoring technique.

We can ditch the cumbersome TSI index, and develop a more efficient sampling pattern based on the PAI. The PAI is based on tags at 10m spacings has been shown to correlate better (R2 = 0.98) with RTCI than the TSI (R2 = 0.92, Thomas et al. 2004). The only good reason for using TSI over PAI was to get around the contagion issue. That is no longer relevant.

Diederik Meenken, May 2005

References

Bamford, J. 1970. Evaluating opossum poisoning operations by interference with non toxic baits. *Proceedings of the New Zealand Ecological Society 17*, 118-125.

Thomas, M.; Brown, J.; Maddigan, F. 2004. Possum monitoring in the presence of ground birds (objective 1) calibrating TSI with RTCI. Pest Control Research contract report 2004/6 (unpublished)