COMPARISON OF TRAP-CATCH AND BAIT INTERFERENCE METHODS FOR ESTIMATING POSSUM DENSITIES

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ABSTRACT

Leg-hold trapping is a standard method for estimating possum population densities in New Zealand. However, the method is costly because traps are heavy and bulky and by law are required to be checked daily. This limits the number of sampling lines that can be used, which reduces precision. Traps also threaten rare native ground-birds. We evaluated two lightweight alternatives that are more cost-effective to use, orange quarters and WaxTags®. WaxTags® are wax-blocks on a plastic tag and are marketed specifically for possum and rat population monitoring. Results showed that both the orange quarters and WaxTags® were more effective for indicating the presence of possums than leg-hold traps. WaxTags® were considered the better of the two alternatives because they did not attract more possums through time which can confound density estimates. Observers also indicated that possum bite-marks were easier to identify on the WaxTags® than orange quarters.

Keywords: possum, vertebrate pest management, census methods, population monitoring.

INTRODUCTION

The brushtail possum (*Trichosurus vulpecula*) was first introduced into New Zealand from Australia in 1837. Today about 70 million inhabit more than 90% of the New Zealand mainland, and this species is considered one of the most damaging animal pests throughout most of the country. Numerous native plant species have declined because of possum browsing. Furthermore, because possums have strong preferences for certain plant species, they may alter the composition of native forests and even cause the collapse of forest canopy in places where preferred species are abundant. Possums also compete with native birds for food or den sites, and prey on the eggs and chicks of some species. Possums are also an economic burden to New Zealand because they cause damage to agricultural crops and commercial pine plantations, and they carry bovine tuberculosis (Tb), which poses a potential threat to New Zealand's beef, dairy and venison industries.

Given all of these impacts, a large amount of research in New Zealand has focused on developing effective methods to reduce possum numbers. Estimating possum population density (monitoring) is an important component of this, because managers need to determine where possums are most abundant in order to prioritise control operations. Also the effectiveness of control operations needs to be assessed.

Leg-hold trapping has become the accepted monitoring method and is used throughout New Zealand. Leg-hold trapping was first suggested as a method to estimate possum population densities in the 1960s. Batcheler et al. (1967) found a log relationship between the index of abundance (percent trap-catch) and relative possum density. A variety of trap-catch methodologies were used until 1996, when the method was standardised

(NPCA 2002) so that estimates of possum abundance could be compared nationwide. This method, referred to as 'Trap-Catch' in this paper, is now the primary method used by Regional Councils, the Department of Conservation and research organisations in New Zealand to measure possum population density. Data from Trap-Catch are used to calculate a possum density index which has been called the residual trap-catch index or RTCI.

However, the Trap-Catch method is problematic for several reasons. It can be costly because the traps must be checked daily in accordance with the Animal Welfare Act, 1999. Also traps are heavy, which restricts the number of sample lines that can be used, and this reduces estimates of precision (Brown & Thomas 2000). In addition, areas where possum monitoring is undertaken may contain endangered flightless birds such as weka (*Gallirallus australis*) and kiwi (*Apteryx* sp). These birds can be killed or maimed if they are captured in the traps. One method to overcome this problem has been to raise the traps above ground but this reduces the numbers of possums captured which compromises the method's ability to detect possums (i.e. reduces sensitivity, Thomas & Brown 2001). These limitations have led to an increased interest in methods that use lightweight devices, do not require daily checking and do not threaten ground birds. Bait interference is one such method. This method uses the frequency of non-toxic baits eaten (or interfered with) by possums to provide density estimates (Bamford 1970).

First developed in the 1970s, the original bait interference method used a flour-paste. However, it was not possible to differentiate between possum interference and interference by other animals such as rats (Jane 1979). In the 1990s a new bait interference method that overcomes this problem was developed. This uses wax, allowing identification of species-specific bite-marks (Thomas et al. 1999). This method has been further refined by placing the wax on a plastic tag to improve visibility (McClinchy & Warburton 1999). This device is now sold specifically for possum and rat monitoring and is called WaxTag® (N.Z. patent 516900).

In this study, possum density estimates obtained using WaxTags® were compared with Trap-Catch density estimates. Another bait interference method that uses cut orange quarters was also included in the trial. This method has been used by Northland Regional Council to monitor possum populations in Northland.

METHODS

Field trials

Field trials were undertaken during January and February 2002 at four study sites in Northland. A total of 213 lines of 200 m long were marked out in 71 groups of three treatment types, i.e. Trap-Catch, orange quarters or WaxTags®. All lines were located at least 200 m apart to ensure that possum estimates on the lines were independent (NPCA 2002). Each set of three lines contained a centre line of leg-hold traps flanked by a line of orange quarters and a line of WaxTags®. The devices (i.e. leg-hold traps, orange quarters or WaxTags®) were all located at 20 m intervals on the lines, giving 10 traps/line. Trap-Catch lines were set according to the method described in the NPCA trap-catch protocol (NPCA 2002). Orange quarters were placed on bent wires that were pushed into the ground so that the orange quarter was approximately 20 cm above the ground. WaxTags® were stapled to trees 20 cm above the ground and a flour and icing sugar "blaze" was used following the method used for Trap-Catch (NPCA 2002).

All lines were located for three consecutive fine nights and were checked daily. Possums captured in traps were killed and the traps reset (NPCA 2002). Orange quarters and WaxTags® that were bitten by possums were replaced daily.

Calculating density estimates

Estimates of possum density using Trap-Catch (i.e. RTCI) were calculated by following the method described in the Trap-Catch protocol (NPCA 2002). Briefly, this involves calculating the percentage of traps/night that catch possums. This method was also used to calculate density estimates for the orange quarters and WaxTag® lines. The estimates of possum density for the orange quarters and WaxTags® were called the "residual possum index" or RPI. RTCI and RPI estimates were compared using ANOVA.

Sensitivity

The sensitivity of the three methods (i.e. their ability to detect possums) was measured by comparing the number of lines that detected possums (i.e. lines with at least one bitten orange quarter or WaxTag® or one trapped possum) over the three-night period. Differences were compared using the chi-square test.

Measuring contagion

One potential problem with all bait interference methods is that individuals may learn over subsequent nights that palatable baits are available and they may actively search for them. This could unrealistically inflate density estimates. We called this temporal contagion. Temporal contagion was measured by comparing nightly RPI estimates using ANOVA to determine whether significant increases occurred between nights.

RESULTS

Density estimates

The RPI estimates calculated from the orange quarter and WaxTag® lines for three nights were significantly higher than the RTCI estimates ($P<0.001$; Fig. 1). The higher estimates for orange quarter and WaxTag® lines occurred on each of the three nights when considered separately (Fig. 1).
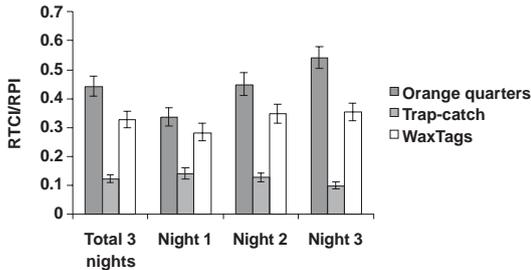
FIGURE 1: Comparison of RTCI (residual trap-catch index) and RPI (residual possum index) for orange quarters, Trap-Catch and WaxTag® lines (n=71 lines per device tested; lines contained 10 devices) for 3 nights, and for each night separately. Bars are the SEM.

Sensitivity

Significantly more orange quarter and WaxTags® lines detected the presence of possums than Trap-Catch lines ($P=0.01$; Fig. 2).
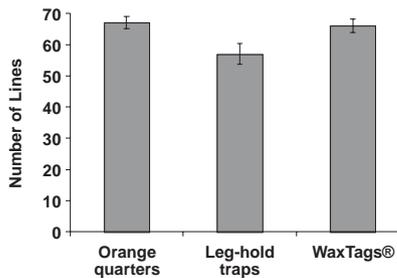
FIGURE 2: Number of orange quarter, Trap-Catch and WaxTag® lines (n=71 for each device) that had one or more possum captures or one or more devices bitten over a three-night period. Bars are the SEM.

Contagion

The orange quarter method was the only method that showed evidence of temporal contagion. The average proportion of orange quarters that possums interfered with increased significantly from night 1 to night 3 (P<0.001; Fig. 1). No significant change was observed for WaxTags® (P=0.15) or Trap-Catch (P=0.22) over the three-night period.

DISCUSSION

Both orange quarters and WaxTags show promise as alternative monitoring methods to Trap-Catch. The higher density estimates that were obtained for the orange quarters and WaxTags® could be advantageous for the following reasons. Firstly, the low estimates obtained from Trap-Catch tend to magnify small increases in possum captures disproportionately (Brown & Thomas 2000). For example, with a high-density estimate of 20%, one additional possum captured increases the estimate to 20.3% (a 1.7% increase). However with a low-density estimate of 2%, one additional possum captured raises the estimate to 2.3%, a 16.7% increase. Secondly, low density estimates tend to be derived from data that is skewed because it contains many zero counts. Skewed data requires either transformation, so that it appears more normal, or special statistical procedures (e.g. bootstrapping) to analyse the data. The orange quarter and WaxTag® may therefore be more suited to monitoring low density populations because of the larger estimates gained.

Both the orange quarter and WaxTag® methods indicated that they were more sensitive at locating possums than the current Trap Catch method. Research is indicating that to eradicate Tb from domestic herds, Tb vectors such as possums need to be reduced and kept to very low numbers (Coleman & Livingstone 2000). Therefore, it would be advantageous to have a monitoring method that can detect a larger proportion of the possums present than the current Trap-Catch method is capable of doing. Both alternatives examined indicated they were better able to do this than Trap-Catch.

The evidence that temporal contagion occurred when using orange quarters was not unexpected. Oranges are a highly palatable possum food and the results indicate possums learnt that the oranges were available and actively searched for them over successive nights. Using this method over several nights could inflate density estimates. The WaxTag® nightly estimates did not show significant increases probably because they are unpalatable to possums.

Overall WaxTags® were considered to be the best of the monitoring methods examined. They showed little evidence of temporal contagion and bite-marks on the WaxTags® were easier to identify than bite-marks on the orange quarters. Also the appearance of the WaxTags® was consistent whereas orange quarters varied in size, colour and palatability, which could influence their attractiveness to possums.

Compared to leg-hold traps WaxTags® were easier to use and required fewer procedures to locate in the field. WaxTags® are also more cost-effective to use than traps as they weigh only 4% of the weight of a leg-hold trap (15 g cf. 360 g). Therefore, more WaxTags® can be located in the field, improving sample sizes and precision of density estimates. In addition, when checked daily, the WaxTag® lines took approximately one-third of the time to set and check compared to the Trap-Catch lines.

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