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Novel Visual Lures for the Management of Brushtail Possums

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ABSTRACT: The successful management of vertebrate wildlife populations can be dependent on the availability of reliable monitoring methods, and, depending on the status of the species in question, effective methods of conservation or control. The brushtail possum, introduced to New Zealand from Australia, is considered New Zealand's number one vertebrate pest. We assessed possum preferences for 3 types of visual lures and the potential use of this information for enhancing existing possum control technologies. Significantly more lures were interfered with by possums when the lures were associated with a luminescent strip, compared to lures that were plain white or UV-enhanced ($P < 0.01$ in both cases). In addition, more possums were killed when luminescent lures were attached to kill traps and bags of bait than when these devices were deployed without lures. This study has highlighted new information showing that luminescent lures could be a valuable new tool in the management of nocturnal marsupials, be they species considered pests (such as the brushtail possum in New Zealand), or species of conservation concern, such as many of Australia's marsupial species.

KEY WORDS: control methods, field tests, luminescent lure, possum, vertebrate pest control, *Trichosurus vulpecula*, visual lure

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INTRODUCTION

In New Zealand, the brushtail possum (*Trichosurus vulpecula*) is considered the most important vertebrate pest species because of damage it causes to native flora and fauna, and because it is a vector of bovine tuberculosis (Tb) (Livingstone 1994). During the past 5 years, one of the main organisations funding management activities for the brushtail possum, the Animal Health Board (AHB), has adopted a very low control target for possum densities in an effort to reduce bovine tuberculosis transmission from possums to domestic stock. This has been achieved in many areas using control techniques that rapidly reduce possum populations over short time periods. As a result, the AHB's emphasis has now shifted to maintaining these possum populations at low levels (maintenance control) to prevent possum numbers from rapidly increasing (see Thomas *et al.* 1995, Cowan 2000). Therefore, it is important to have tools that will provide sustained possum control over long periods without regular checking. Successful monitoring and control with bait stations and traps relies on the possums interacting with the control/monitoring tools used (Carey *et al.* 1997). Thus, the control tools need to be highly visually attractive to possums over long periods to maximise their effectiveness.

Three colours that are most likely to be attractive to possums were identified for the purposes of this study, i.e., white, white with a UV pigment, and photo-luminescent pigments.

White Lures

Field-based research trials have demonstrated that white visual lures can significantly increase possum captures in traps and visitations to potential baiting sites. Significantly more possums were captured in traps that

had a white backing board with a flour blaze (Warburton and Yockney 2000), and significantly more WaxTags[®] were bitten when used with a flour blaze (M. Thomas, unpubl. data). However, a flour blaze is not suited as a long-term attractant for sustained control of low-density possum populations as it can be eaten by rodents or washed off by rain.

UV-Pigmented Lures

It is likely that possums are similar to many other animals and have only dichromatic (2-colour) vision. With this type of vision, the ability to discriminate colours in the middle to long wavelengths, i.e., green, yellow, brown, orange, and red, is less effective. In contrast, the transmission of short-wavelength light is very high for the lens of animals that are active at dusk, dawn, and night. In low-light situations, some animals can detect light up to 1,000 times below human thresholds in the blue and UV wavelengths, i.e., 430-440 nanometres.

Research suggests that deer are better able to see clothing that is washed in soap powder containing UV brighteners (see <http://home.adelphia.net/~geffert/deer vis.htm>). Optical brighteners create brilliance by absorbing UV light, modifying the wavelength of light, and then emitting the light as blue fluorescent light between 400-500 nm. Consequently, special soap powders are manufactured in the U.S. that do not contain UV brighteners, in order to help improve hunting success. It is possible that possum vision is also sensitive to materials that contain UV light-emitting pigments.

Photo-Luminescent Lures

Carey *et al.* (1997) concluded that a light source may attract possums to control devices. The simplest, cheapest, and most practical light source available for field use

is photo-luminescent pigment. Photo-luminescent pigments can absorb store and re-emit ambient light without the requirement of a power source such as a battery.

The primary aim of the work presented here was to compare and rank, in order of preference, the attractiveness to possums of 3 types of visual lures: white; white with a UV additive; and white with a photo-luminescent pigment. An additional aim was to determine whether the effectiveness of existing possum control technologies could be improved using the preferred visual lure.

METHODS

The WaxTag[®] is a recently-developed device for estimating possum abundance (Thomas *et al.* 2003). Each WaxTag[®] consists of a 40-cm² piece of isosceles-triangular-shaped sheet plastic, with a 12-cc block of wax moulded to the sharpest point of the triangle. Possums are attracted to the tag, and their presence is recorded by bite marks on the wax. Development of this device has provided a means of indicating possum presence and has shown to be particularly useful in situations of low possum density (Thomas and Maddigan 2004, Kavermann 2004).

For this research, 3 types of WaxTags[®] were produced. The first type had a plain white plastic visual lure. The second type had a UV brightening agent incorporated into the plastic when the tag was produced. The third type was constructed of plain white plastic, with a 3.6-cm² luminescent strip attached.

Study Site and Possum Population

This study was undertaken in a mixed podocarp forest at Hohonu Forest, central Westland, New Zealand. In other research (Thomas and Maddigan 2004), it was found that this possum population had a density of 8% Residual Trap Catch Index (RTCI).

Design of Field Experiment

The WaxTags[®] of the 3 different types were located in 'stations' of 5 tags positioned in a cruciform pattern, with 1 central tag and the other 4 tags evenly spaced 10 m from the central tag.

Stations were deployed in lines of 3 stations, with a minimum 100-m spacing between stations and between lines. All 3 tag types were represented on each line, with each station containing 1 type (white, UV-enhanced, or luminescent; Figure 1). Station types were located in random order along the lines. The minimum of 100-m spacing between stations (for both stations on the same line and between neighbouring lines) was adopted to minimise the chances of individual possums moving between lines and stations (NPCA 2002). A total of 100 lines were deployed, giving a total of 100 stations and 500 WaxTags[®] for each lure type.

Every tag was checked for the presence of bite marks after 1, 2, 4, 7, and 14 nights. Where a tag was bitten, a record was kept of the tag colour type, the cruciform station, and the position of the tag in the station (North, South, East, West or Central). For each colour type, we

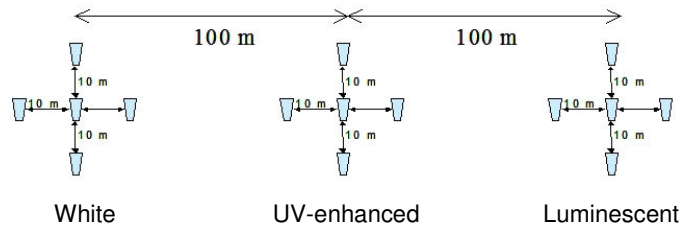


Figure 1. Layout of one experimental line, containing 1 station with each of the 3 tag types. A total of 100 lines were deployed. Order of the tag stations was randomised, with neighbouring lines at least 100 m away.

calculated the mean number of bitten tags per station for each sampling period, and paired t-tests were used to analyse differences between means for each of the colour types (i.e., white vs. UV, white vs. luminescent, and UV vs. luminescent).

Using Visual Lures to Improve Existing Control Technologies

We undertook further research to determine if luminescence could be used to increase possum kills with kill traps and toxic bait placed in paper bag 'bait stations'. The kill traps used were the Sentinel Kill Trap (Pest Management Services Ltd.) and paper bags containing 3 capsules of encapsulated potassium cyanide (Feratox[®], Connovation Ltd.).

This work was also conducted in the mixed podocarp forest at Hohonu, central Westland. For each control device, (i.e., either kill traps or bait bags), a total of 20 lines were located at least 200 m apart. Each line contained 10 control devices that were spaced at 20-m intervals from neighbouring devices, for a total of 200 of each control device. Experimental control devices containing standard white trap covers (for the kill traps) or blue bags (for the bait bags) were alternated with trap covers and bags with luminescent lures attached. The devices were all located on trees at a height of 700 mm above ground and were deployed for a total of 3 nights. Mean possum kills per line for treated and untreated devices were calculated, and means for the 20 lines were compared using paired t-tests (bait bags vs. bait bags with lure, and kill traps vs. kill traps with lure).

RESULTS AND DISCUSSION

Attractiveness of White, UV, and Luminescent Visual Lures

More luminescent tags were bitten by possums than the other 2 tag types, and this was consistent throughout the entire 14 days of the study (Figure 2). The luminescent tags made up the greatest proportion of the total bitten tags on every sampling day (Figure 3). It appeared that possums were able to find luminescent tags quicker than the other 2 tag types. After 1 night, 77 of the luminescent tags were found (and bitten) by possums, as opposed to 48 white tags and 44 UV tags.

The mean number of tags bitten by possums per station after 14 days was 2.23, 2.25, and 2.69 for white, UV-enhanced, and luminescent tag stations, respectively.

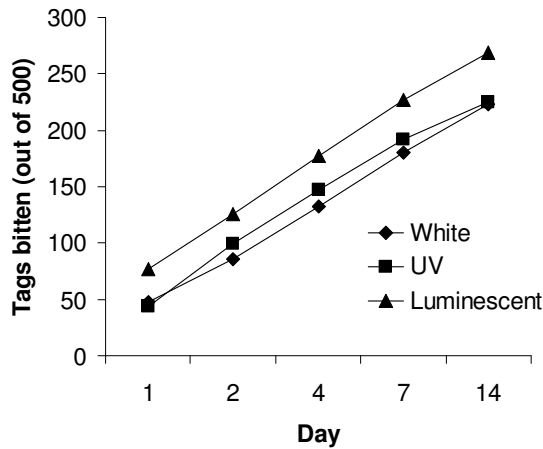


Figure 2. Number of tags of each colour type bitten by possums over 14 days. N = 500 tags for each colour type.

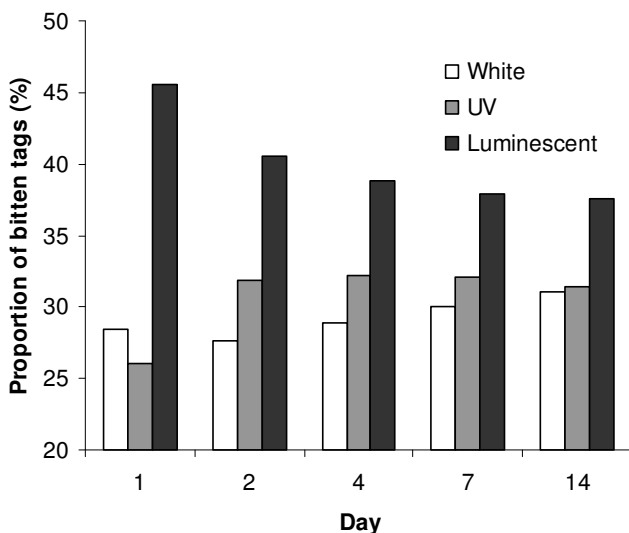


Figure 3. Tags bitten according to visual lure type, as a proportion (%) of all bitten tags.

There were significantly more luminescent tags bitten than either white ($P = 0.001$) or UV ($P = 0.001$). There was no significant difference between the white and UV tags ($P = 0.45$).

Possums have good night vision, and so it is perhaps not surprising that possums could find luminescent tags more readily than UV and white tags, given that these tags are actively emitting light. Possums might even have been able to see light emitted from the luminescent tags reflected off neighbouring objects or surfaces. This would significantly increase the effective area attracting possums and would explain the higher proportion of luminescent tags bitten compared to the other 2 tag types that were not actively emitting light.

These results are strong evidence that luminescent lures are more attractive to possums than plain white or UV-enhanced lures. Therefore, luminescence may be an improvement on plain white tags, in order to increase

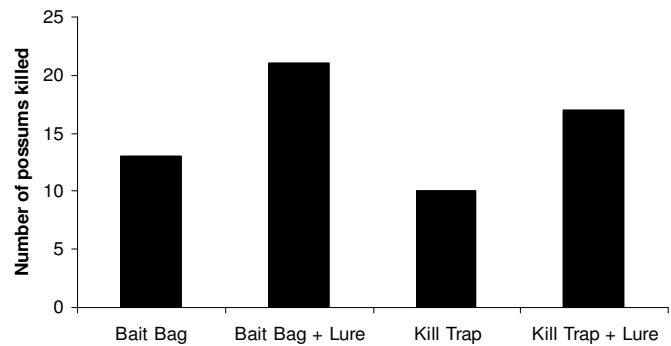


Figure 4. Number of possums killed with each control device, with and without a luminescent lure. Each of the 4 types was deployed for a total of 300 device-nights.

the number of possums that will find and bite tags and therefore increase the sensitivity of possum monitoring methods. Luminescent lures are also long-lasting, which is an advantage over flour-based lures that are currently being used, and that tend to be lost during rainy conditions.

Using Visual Lures to Improve Existing Control Technologies

Both the bait bags and the kill traps killed more possums when they were deployed in conjunction with a luminescent lure than without the lure (Figure 4). Of the possums killed by bait bags, 38% were at bags without lures and 62% were found at bags with luminescent lures. Similarly, of the possums killed with the kill traps, 37% were at traps without lures, while the remaining 63% were at traps with luminescent lures. These results indicate that the luminescent lure has the potential to increase the efficacy of both of these control tools.

Statistical analysis showed that the mean number of possums killed was close to significant for the comparison of kill traps with and without the lure ($P = 0.055$) and for the bait bags with and without the lure ($P = 0.059$). While these probabilities were not quite significant at the 5% level, they are nevertheless indicative of a lure effect. We would expect these results to happen by chance only 6 times out of every 100. In the field trial, we were logistically limited to a total of 20 lines of each of the 2 control devices, but it is likely that the results would have been significant at the 5% level if we had a larger sample size. For future studies of this nature, we would recommend that at least 40 lines of each device type are deployed. This is particularly important where possums are at low densities, as in the present study. Luminescent lures have the potential to provide a long-life alternative to the short-lived flour blaze often used in conjunction with possum control devices. This would make them more suited to control technologies developed to provide sustained control of low-density possum populations in high-risk Tb transmission areas such as forest/pasture margins.

Luminescent lures may also have application in monitoring the presence of endangered marsupial species.

In Australia, the brushtail possum is present in only a small part of its former range (Kerle 2001). Technologies such as wax tags with luminescent lures could prove useful for indicating the presence of rare and endangered marsupials.

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