A Study Design To Assess the Effectiveness of a Modified Trap-set for Reducing By-catch of Hedgehogs (*Erinaceus europaeus*) in Stoat (*Mustela erminea*) Traps

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Landcare Research
Manaaki Whenua

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Summary

Project and Client

Hedgehogs (*Erinaceus europaeus*) are caught as by-catch in traps set for mustelids, primarily stoats (*Mustela erminea*), in Northland. When this happens, the traps are no longer available to trap mustelids, which reduces the effectiveness of efforts to protect native wildlife. Northland Regional Council asked Landcare Research to help design a study for testing the effectiveness of a modified, raised trap-set in reducing hedgehog by-catch. The study was funded by Envirolink Small Advice Grant NLRC89.

Objective

- To provide advice on an experimental design that could be used to test the difference in trappability of hedgehogs and stoats using a novel raised trap cover design compared with conventional wooden trap covers.

Main Findings and Recommendations

- Trap-catch rates for both stoats and hedgehogs are low and highly variable between individual traps.
- In order to detect a true difference in capture rates between two types of trap-set, large numbers of trap-sets would be required, e.g. at least a doubling of current effort would be required to detect a true difference when the higher of the two trap rates is around 140% greater than the lower rate. Note that this is not an absolute difference, but a percentage difference.
- Given this requirement for a large number of trap-sets and the probable logistical and financial constraints of individual trapping programmes, a practical compromise might be to combine data from more than one programme.
- In the trapping data provided by Northland Regional Council only 59.5 trap-nights out of a possible 20 790 (110 trap-sets × 27 weeks × 7 nights), i.e. 0.3%, were lost due to hedgehog by-catch. Programme managers would be advised to assess the potential benefits of running a full experiment compared with the costs likely to be involved.
- Another approach would be to run a smaller pilot study to assess the effectiveness of the modified trap-set in excluding hedgehogs. Such a study could observe captive adult hedgehogs' attempts to gain access to bait placed within the modified trap-set, without the trap.

1. Introduction

Hedgehogs (*Erinaceus europaeus*) are caught as by-catch in traps set for mustelids, primarily stoats (*Mustela erminea*), in Northland. When this happens, the traps are no longer available to trap mustelids, which reduces the effectiveness of efforts to protect native wildlife. A raised trap-set has been designed in an effort to keep predator bait dry and avoid hedgehog by-catch, but this has not been properly field-tested against current best practice techniques. Therefore, in August 2008, Northland Regional Council asked Landcare Research to help design a study for testing the effectiveness of this modified trap-set in reducing hedgehog by-catch and to carry out a preliminary analysis of trap-catch data arising from a trial of the new trap-set. The study was funded by Envirolink Small Advice Grant NLRC89.

The new trap-set is shown in Fig. 1. The single trap (a DOC 200 model) is set inside a wooden box with wire mesh covering each end. A 60-mm opening in the mesh at one end allows stoats access to the trap. This set is then raised 10 cm from the ground on a wooden platform with a rebated edge to make it more difficult for hedgehogs to enter the trap without affecting access by stoats.

Operational staff were unable to test the new trap-set in the field due to other more urgent work commitments, so no data on the effectiveness of the modified trap-set in excluding hedgehogs are available, despite delaying the due date for this report by three months.

Fig. 1 DOC 200 trap-set for stoats modified by setting on a raised, rebated platform (left) to exclude hedgehogs. Photo: Steve Henderson, Northland Regional Council.

In order to provide some indication of an appropriate study design for testing the effects of the modified trap-set on capture rates we were provided with the trapping data from 27 weeks of trapping covering the period October 2008 to May 2009. The data describe the captures in 110 DOC 200 traps, set following standard DOC operating procedures, from the Pataua Community Pest Control Area. We estimated the variability in trap-catch indices from this data set and used this to design an experimental protocol to allow any real difference in capture rates resulting from the modified trap-set to be detected with confidence.

2. Objective

- To provide advice on an experimental design that could be used to test the difference in trappability of hedgehogs and stoats using a novel raised trap cover design compared with conventional wooden trap covers.

3. Methods

In an experiment such as the one proposed here, experimental units will exhibit some intrinsic degree of variation. This is especially true of experimental units in field settings where the experimenter has limited control over environmental variables: examples of such variables in this case would be the presence of a hedgehog or stoat close enough to the trap to detect the bait, the individual's decision whether or not to enter a trap, or the availability of alternative foods. It is therefore important that treatments (in this case the trap-sets to be compared) are replicated so that treatment effects can be separated from 'background' variation. Defining the number of replicates is important for both statistical and economic reasons: too few replicates and the study will be unable to detect a result of practical importance; too many and resources will be wasted. To this end, we examined how the ability of the study to detect a real change in the response variable (trap rates), i.e. the 'statistical power', would vary with the number of replicates (trap-sets). There is a common convention for setting a threshold for statistical power at 0.80, i.e. an 80% chance of detecting a real difference of a particular magnitude should it occur. We have followed this convention in the subsequent analyses.

To estimate statistical power it is necessary to obtain an estimate of the 'background' variation in the variable being measured. Given the available data (total captures per species per trap), we had to make two assumptions: that habitat variables were homogeneous for all traps and that each trap-set was independent of the others. In any subsequent study based on this design, it is recommended that these assumptions are followed as closely as possible to reduce potential biases in the results. To estimate variation in trap rates we considered an individual trap to be an experimental unit and estimated the trap-catch index for hedgehogs in terms of captures per 100 corrected trap-nights (CTN) for that trap (Nelson & Clark 1973). This method expresses a capture rate corrected for the unavailability of traps due to some being occupied by captured animals for part of a period. The standard correction for traps that are checked daily is to assume that captures occur at the mid-point of the period between traps

being checked. Therefore it is necessary to subtract 0.50 trap-nights from the total for each trap occupied by a capture. For our data set, in which traps were checked weekly, we subtracted 3.5 trap-nights for each capture of any species.

We estimated the trap-catch rate for hedgehogs and stoats for each trap. We then estimated a mean trap-catch (and standard deviation) across all 110 traps for each species. We used the online power calculator 'PiFace' (http://www.stat.uiowa.edu/~rlenth/Power/) to carry out the power analysis, assuming that a two-sided, two-sample *t*-test would be used to test the difference in catch rates between modified and unmodified trap-sets. We set the power at the standard value of 0.8 with the standard value of 0.05 for the chance of a Type I error occurring (i.e. the detection of a difference when none is in fact present). We used these values to estimate the magnitude of the difference in capture rates (expressed as a percentage of the non-treatment capture rate for the unmodified trap-sets) that could reliably be detected by different numbers of traps (range: 20–120) in each treatment. This assumes a 'balanced design,' i.e. that the same number of modified and unmodified traps are used. We based our analysis on the trap-catch data set for hedgehogs. The mean capture rate for stoats (mean = 0.050 captures/100 CTN; SD = 0.192) was very similar to that for hedgehogs (0.086; 0.308), so the experimental designs investigated could also detect changes in stoat capture rates with a similar level of reliability.

4. Results

The numbers of trap-sets in each treatment (i.e. modified vs unmodified) required to reliably detect a range of absolute differences in capture rates are shown by the curves in Fig. 2. This shows that an experimental design using 20 modified and 20 unmodified trap-sets could reliably detect only a large difference of 328% in capture rates between trap-sets. With 110 trap-sets of each type (i.e. a doubling of current effort) a true difference of around 140% in capture rates could be reliably detected. To reliably detect smaller differences, the number of trap-sets required per treatment would run into many hundreds and probably be logistically impossible to impose with limited resources. Note that this is based on a two-sided *t*-test, which means that the difference in capture rates could operate in either direction, i.e. either trap-set has the higher trap rate.

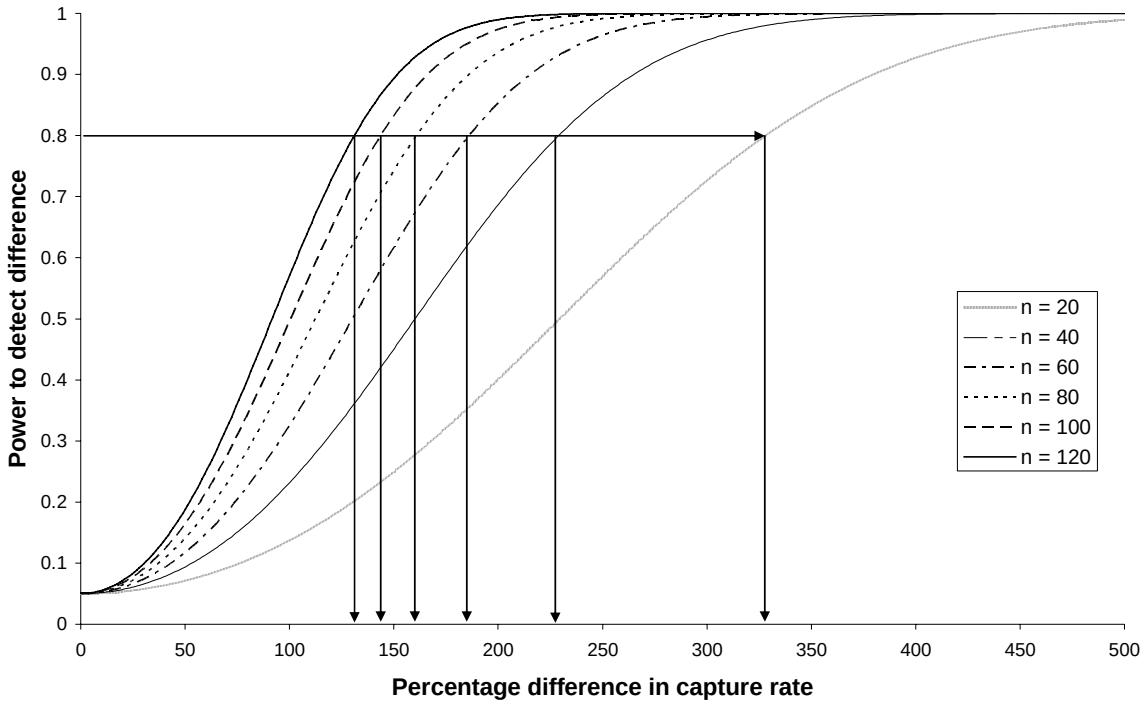

Fig. 2 Variation in the ability to detect a range of percentage differences in capture rates of hedgehogs with the number of trap-sets used (n). Vertical lines indicate the percentage difference that could be detected with a power of 0.80 for experimental designs ranging from 20 to 120 trap-sets per treatment.

5. Recommendations

The following points are based on the trap-catch data provided and assume:

[i] trap-sets are independent of each other
[ii] traps are set in the same habitat type
[iii] modified and unmodified trap-sets are distributed randomly within trap-lines

Trap-catch rates for both stoats and hedgehogs are low and highly variable between individual traps.

In order to detect a true difference in capture rates between two types of trap-set, large numbers of trap-sets would be required, e.g. at least a doubling of current effort would be required to detect a true difference when the higher of the two trap rates is around 140% greater than the lower rate. Note that this is not an absolute difference, but a percentage difference. For example, if the lower capture rate was 0.10 captures per 100 CTN, the higher rate would have to be 0.24 captures per 100 CTN for this difference to be statistically significant in a design using 110 trap-sets of each type.

Given this requirement for a large number of trap-sets and the probable logistical and financial constraints of individual trapping programmes, a practical compromise might be to combine data from more than one programme as long as the assumptions listed above are met.

Given that only 59.5 trap-nights out of a possible 20 790 (110 trap-sets × 27 weeks × 7 nights) were lost due to hedgehog by-catch. This represents 0.3% of possible trap-nights. Programme managers would be advised to assess the potential benefits of running a full experiment compared with the costs likely to be involved.

Another approach would be to run a smaller pilot study to assess the effectiveness of the modified trap-set in excluding hedgehogs. Such a study could observe captive adult hedgehogs' attempts to gain access to bait placed within the modified trap-set, without the trap. This could perhaps be carried out by a student or a community volunteer under advice from a scientist or biosecurity personnel. If hedgehogs were unable to enter the modified trap set, it would suggest that a large true difference in capture rates may be expected in a field trial and that the sample size could be reduced accordingly, based on the curves in Fig. 2 and the predicted effect on catch rates.

6. Reference

Nelson L, Clark FW 1973. Correction for sprung traps in catch/effort calculations of trapping results. Journal of Mammalogy 54: 295–298.