

TUTORIAL WEEK 14

INTRODUCTION

The following article by Greg Welsh, under the title “Mean mammals send kiwis for cover”, appeared in *Monitor* on 13 March 2001.

Canberrans may view the brushtail possum as friendly and cute, but in New Zealand they have acquired a more sinister reputation among conservationists.

Videorecordings show that possums are a major predator of young native birds such as the kokako – a large insectivorous threatened endemic species. For the kokako to breed successfully requires very low numbers of possums in the area.

Associate Professor Jim Hone of the Applied Ecology Research Group and UC’s School of Resource, Environmental and Heritage Sciences recently travelled to New Zealand to study efforts to manage exotic predatory mammals, such as possums, stoats, ferrets and rats.

“There’s a variety of introduced mammals which are important predators [of the kokako],” Associate Professor Hone said.

“The possums are one, which was a bit of a surprise to everyone. The rats and stoats weren’t a surprise, but people in the past decade or two have really started to appreciate the significance of that predation for some of the native birds.”

The brushtail possum, which is native to Australia but not to New Zealand, is also responsible for destroying young native plants and carrying bovine tuberculosis.

It was introduced to New Zealand in the nineteenth century in order to establish a fur trade.

The introduction of exotic predators like the possum, stoat and rat by Europeans has caused havoc among native birds like the kokako, kiwi, kaka, kakapo and albatross.

“It started shortly after European settlement during the 1800s, particularly in the lowland areas and then more recently in the forest areas,” he said.

“Some species declined quickly and were thought to be extinct within a few decades. But others are pointing that way now, unfortunately.”

Associate Professor Hone said unless intensive and extensive pest control methods are used in New Zealand, many more species will disappear this century.

He said a few decades ago New Zealand authorities decided to establish populations of the threatened birds on small offshore islands which had been scoured of the exotic predators.

“They’ve established what they call an offshore Island Strategy and that seems to have been quite successful,” he said.

“They go to great efforts to get rid of possums and rats off the island and try to establish a network of islands with one or more of these pests being removed.”

Credit for image to J.G.Keuleman and Buller’s Birds of New Zealand: see <http://www.nzbirds.com/Kokako.html>



Materials needed

For each pair, a tape measure or ruler (bring your own if possible, a few will be supplied).

The setting

You are a member of the control team attempting to eradicate possums from an island. Repeated samples will be taken to estimate how many possums remain on the island.

Background

This activity will focus on issues associated with trying to monitor a very small number (it is hoped that the number of possums in an area is zero!) in a high-stakes situation. Conservators of the kokako do not want to release endangered birds onto an island where there are more possums than the birds can tolerate in order to breed. As with any data collected in a biological setting, variation from sample to sample is to be expected. We will examine this variability in the sampling, and attempt to advise biologists on the best strategy with the kokako.

THE EXPERIMENT

Step 1: Collecting the data

Mark out an island on the floor of the classroom, either on butcher's paper or with string or chalk. Set 10 traps throughout the island. These can be drawn on the butcher's paper or marked with coloured pen or small squares of paper inside the island. Each trap should be a square 5 cm along each side. We will try three different arrangements of traps. One possible arrangement is a random scattering of traps through the island. Another is to lay the traps in two rows of five traps each, which will be either close together or far apart.

Each pair in the class will be allocated a different one of the three trap arrangements (random, close lines and far lines) and a different one of three population sizes (5, 10 and 20). Write your combination at the top of Table 1.

Our experiment will use bears rather than possums, such as are found in boxes of Tiny Teddies. Start with 5 Tiny Teddies i.e. a population size of 5. Write down the population size at the top of Table 1a. Toss the 5 Tiny Teddies onto the island (gently! They are fragile creatures.). This process simulates a night's work trapping possums. Count how many possums are trapped i.e. how many Tiny Teddies land in a marked trap. The number of possums caught is used in calculating the RTCI. The RTCI value is the number of possums caught divided by the number of traps, which is 10 in this activity. The index is recorded as a percentage. For example, if you trap 3 Tiny Teddies, the RTCI is $(3/10) = 0.3$, recorded as 30%.

Repeat the trapping process 20 times, and record each time the RTCI in Table 1.

Write your trap arrangement here (random, close lines or far lines)
 and your population size here (5, 10 or 20) .

Table 1. $RTCI = (\text{number of possums trapped} / \text{number of traps}) \times 100\%$

Step 2: Individual data analysis

Open SPSS, and name the columns in the Data Editor *traps1*, *traps1b*, *traps1c*, *traps1d*, and so on up to *traps3d*. Carefully enter the numbers of possums trapped in Table 1a into *traps1a*, the numbers in Table 1b into *traps1b*, and so on up to *traps3d*. After entering the data and checking that it has been entered correctly, save the file as **traps.sav** or similar.

Let's begin our data analysis by looking at a histogram of these counts. To do this:

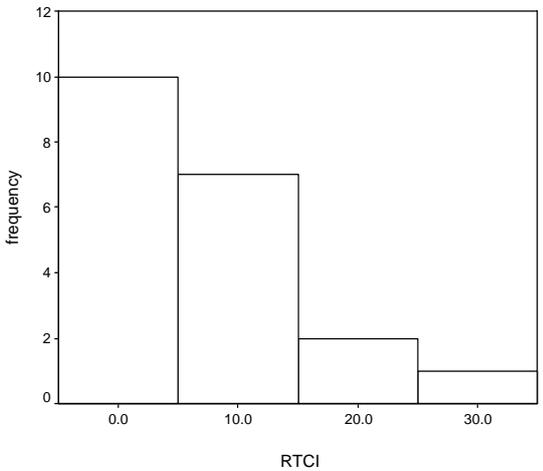
1. Select **Graphs – Histogram** from the main menu.
2. Move *traps1a* into the **Variable** box and click on **OK**.
3. Repeat this process for each of the columns *traps1b*, *traps1c* and so on up to *traps3d*.

To edit a graph, double-click in the graph somewhere: a small copy of it will appear in a Chart Editor window with a new menu. Add a title, change the width of the bins on the horizontal axis and change the colours as appropriate. Instructions on how to do this appear in previous tutorials.

When you have finished editing a graph, close the Chart Editor window. The small copy of the graph disappears and the one in the Output Navigator changes to suit.

A typical histogram of numbers of possums is shown in Figure 1.

Figure 1. Histogram of RTCI: population size 5, random traps.



What is the general shape of the histogram you produced of the data in Table 1?

For a given population size, the relative frequency probability that RTCI equals 0 is equal to the number of times RTCI equals 0 divided by the total number of samples taken. For the data in Figure 1 this probability is

$$\text{probability that RTCI equals 0} = \frac{\text{number of times RTCI equals 0}}{\text{number of samples}} = \frac{10}{20} = 0.5.$$

To obtain frequencies in SPSS that will help you calculate this probability, follow these instructions.

1. Select **Analyze – Descriptive Statistics – Frequencies**.
2. Move *traps1a, traps1b, ... traps3d* into the **Variable(s)** box and click on **OK**.

For the data set above, the output from this command produces the following table.

RTCI					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	10	50.0	50.0	50.0
	10.00	7	35.0	35.0	85.0
	20.00	2	10.0	10.0	95.0
	30.00	1	5.0	5.0	100.0
	Total	20	100.0	100.0	

The number of times that RTCI equals 0 (10 times) can be found in the first line of the table. Record your estimate of the probability that RTCI equals 0, given your population size and trap arrangement, here.

Probability =

Step 3: Class data analysis

We will now combine the information from each group and have a look at the variation from group to group in probabilities.

Each group will read out their trap arrangement, population size and probability in turn. Enter the numbers into Table 2 in the appropriate columns. What patterns do you see emerging in the table of probabilities?

Table 2. Class estimates of the probability that RTCI equals 0.

Group	5 possums			10 possums			20 possums			25 possums		
	random	close	far	random	close	far	random	close	far	random	close	far

CONCLUSION

The analysis you are undertaking here is a simple example of a Bayesian analysis. Given different assumptions about the underlying population, the probability of finding no possums in an area is calculated. This leads to a re-evaluation of the original assumptions.

REFERENCES

Brown, J.A. and Miller, C.J. (1998). Monitoring stoat *Mustela erminea* control operations: power analysis and design. Research Report No. 164, Department of Mathematics and Statistics, University of Canterbury, New Zealand.

Brown, J.A. and Thomas, M.D. (2000). Residual trap-catch methodology for low-density possum populations (Part I – Improving the precision of possum population estimates). Research Report UCDMS2000/6, Department of Mathematics and Statistics, University of Canterbury, New Zealand.

3. Using the probabilities in Table 2, summarise how changing the trap arrangement affects the RTCI.

4. Using the probabilities in Table 2, summarise how changing the population size affects the RTCI.