



<http://topdrawer.aamt.edu.au/Statistics/Good-teaching/Making-informal-inferences/Single-measurement-variables/Paperclips>

Paperclip investigation: Student worksheet

A container originally held 1000 paperclips, of 8 different colours.
A number of these clips have been used and not returned.

The challenge is to determine how many paperclips remain in the container and how many of each colour there are.

Materials

Container of 1000 coloured paperclips

Packet of 100 metallic paperclips

Accurate scale

Tag–release–recapture

Scientists use a technique called ‘tag-release-recapture’ to estimate populations of animals in the wild. They tag a certain number of animals and then release them into the unknown population. They then recapture a sample from the population and record the ratio of tagged animals in the sample. If the sample is random and representative, the ratio of the sample should be similar to the ratio of tagged animals in the population, and this information can be used to gain an estimation of the population size.

Research tag–release–recapture methods used by scientists.

Environmentalists released 100 tagged fish in a lake and the following week captured a sample of 40 fish. Of the 40 fish 8 were tagged.

1. Explain why the environmentalist concluded there were approximately 500 fish in the lake on the day they captured the sample.
2. Discuss some of the assumptions and limitations in using this method to determine the number of fish in the lake.



Total number of paperclips by tag–release–recapture

1. Take a number of paperclips out of the container of 1000 coloured paperclips.
2. Place 100 metal paperclips of the same size in the container and shake it until the clips are evenly distributed throughout.
3. Decide on an appropriate size for the samples you will draw from the container and explain your choice.
4. Draw the sample from the container, record the number of metal clips and return them to the container. Shake well.
5. Estimate the number of clips in the container based on this sample.
6. Repeat the sampling at least 10 times.
7. Use your results to make an estimate of the number of paperclips that were in the container originally.

Total number of paperclips by weight

Bank tellers do not count bags of coin. They know the weight of each coin denomination and, based on this, they can determine how many coins are in the bag and hence their value.

1. Remove the metal clips from the container and shake it.
2. Determine the weight of a single paperclip and the entire population.
3. Use this value to determine the number of paperclips in the container.

Comparison

1. Compare the two estimated values and the two methods used.
2. State the advantages and limitations for both methods.

How many of each colour?

Estimate how many there are of each coloured clip in the container by taking random samples from the container with replacement.

1. Choose the size of the sample. Justify your choice.
2. Replace the clips after each sample and ensure you shake the container.
3. Choose how many samples will be taken (at least 10). Justify your choice.
4. Make a prediction based on the results after:
 - (a) 5 samples
 - (b) 10 samples
 - (c) after all samples have been taken.
5. Use appropriate graphs to represent and compare your data.
6. Summarise your results and give a final prediction of the number of each colour in the container.

Count the population – a census

1. Count the number of each colour in the container and the total number.
2. Compare and contrast your estimates gained through statistical procedures with the actual numbers.

Conclusion

1. Write a final summary of the investigation.
2. Compare methods and state assumptions and limitations in your investigation.