The Fund-a-bird scheme provides nest boxes for British birds of prey.

But you can’t just put a box anywhere and expect birds to make a nest and breed – you have to put it somewhere suitable. For example, there has to be enough food for birds and their babies.

Kestrels feed on mice. Biologists use a method called capture–mark–recapture to estimate how many mice there are in an area.

**Procedure**

You will find a number of “mice” in a bag. Follow your teacher’s instructions to obtain a class set of results. Use this table to record your results:

<table>
<thead>
<tr>
<th>trial</th>
<th>captured, marked and released</th>
<th>captured second time</th>
<th>marked and recaptured</th>
<th>population estimate*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

true population

*How to calculate the population estimate*

If the marked “mice” mix freely with the total population they will be evenly distributed.

The fraction of marked animals in the total population should be the same as the fraction of marked animals in a set of captured animals.
number captured, marked and released \[=\] \[
\frac{\text{total population}}{\text{total captured second time}}\]
\[
\frac{\text{number marked and recaptured}}{\text{number captured, marked and released}} \times \text{total captured the second time}
\]

So, the total population =

\[
\frac{\text{number captured, marked and released} \times \text{total captured the second time}}{\text{number marked and recaptured}}
\]

For example:

- number captured, marked and released = 20
- total captured the second time = 30, of which number marked and recaptured = 5

\[
\text{total population} = \frac{20 \times 30}{5} = 120
\]

**Analysing the data**

Plot a graph of population estimate (y-axis) against total captured (x-axis).

Add a horizontal line to show the true population.

Compare the size of samples with the population estimate.

In your group, discuss and make some notes to answer:

- How important is sample size?
- How can you check that real life data are giving you a valid estimate?

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Studying science and maths can transform your career options.  
Future Morph: become someone.