

Using the capture–mark–release–recapture method

The capture–mark–release–recapture method is a sampling technique that enables you to estimate the number of animals in an ecosystem. The technique involves catching some of the population and marking them. The marked animals are released back into the ecosystem and allowed to mix with the others in the population. A second sample of the population is captured. Some in the second sample will be marked and some will be unmarked. The proportion of marked to unmarked individuals in the second sample is the same as the proportion of the originally marked individuals to the whole population.

Here is the formula.

$$\frac{\text{number marked in the second sample } (n_2)}{\text{total caught in second sample } (n_2)} = \frac{\text{number marked in the first sample } (n_1)}{\text{size of the whole population } (N)}$$

or

$$\text{Population size } (N) = \frac{(n_1 \times n_2)}{n_3}$$

Worked example

Suppose you capture and mark 100 grasshoppers and release them back into the ecosystem. Then you capture another sample of 100 grasshoppers and find 10 of them are marked. Estimate the population size.

Solution

$$\frac{10}{100} = \frac{100}{N}$$

or

$$N = 100 \times \frac{100}{10}$$

$$N = 1000$$

This technique has its limitations:

- marks on animals may injure them;
- the mark may make the animals more visible to predators (if marked animals are eaten, your second sample will not be reliable);
- the method assumes that the population is closed (no immigration or emigration; very few populations are closed).

Does the method really work? You can try it at home with popcorn kernels. Count out 200 popcorn kernels and put them in a bag.

- remove 40 kernels and mark with a permanent marker;
- put the marked kernels back and shake the bag;
- remove 40 more kernels and record how many are marked;
- use the formula to determine population size.

Did you come close to 200? One sample is not enough data. To be accurate, you should repeat the sampling technique at least 5 times (10 times is even better). Average the results. How close are you to 200 now?