

Data Collection - Mark and Recapture

When estimating a population, for example of fish in the sea, one method is to capture a sample of the population, mark each one in the sample in some way, and then release them back into the main population.

After they have been given time to merge back in with the main population, a second sample is captured, and the number within that sample who had been captured and marked in the first sample is noted.

The population can then be estimated.

The ratio of the members of the population originally captured and marked, M , to the whole population, N , is assumed to be the same as the ratio of those who were marked and recaptured, m , to the total of the second sample, n .

$$\text{So } M/N = m/n$$

Rearrange the formula to find that $N = Mn/m$

$$\text{Estimated population} = \frac{\text{Number in first sample} \times \text{Number in second sample}}{\text{Number marked and recaptured}}$$

For example:

When estimating the number of fish in a river:

20 are captured and marked with a dye, then returned to the river.

A week later a second sample is collected, with 50 fish.

8 of the fish in the second sample is found to be marked.

$$\text{The population is estimated to be } \frac{20 \times 50}{8} = 1000/8 = 125$$

There are some assumptions we need to make:

We are assuming that the population isn't changing, by emigration or immigration (fish moving in or away) or by deaths.

We are assuming that the sampling methods are identical - each fish has an equal chance of being caught each time.

We are assuming that the method of marking the fish remains visible and does not affect the survival rate.

Now you try.

1. Birds in an aviary are sampled.

20 birds are caught and tagged, then returned.

Later, 40 birds are caught. 5 are found to have been tagged.

What is the estimated population?

2. Fish in a tank are sampled.

1000 fish are caught and tagged, then returned.

Later, a further 1000 fish are caught. 20 of these are found to be tagged.

What is the estimated population?

3. Explain the assumptions you are making in this method.