

Distance sampling: Methods and applications

Montrave case study: Three variations

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This study was carried out to compare different methods of surveying breeding songbirds (Buckland 2006). The study area was an area of woodland and parkland at Montrave Estate near Leven in Fife, Scotland. The target species identified for testing the methods were common chaffinch (*Fringilla coelebs*), winter wren (*Troglodytes troglodytes*), great tit (*Parus major*) and European robin (*Erithacus rubecula*). For the point sampling methods, data were recorded at the 32 points shown in Fig. 3.1 of the book, while for the line transect survey, the transects shown by the diagonal lines were walked. Each point was surveyed twice by each method, and the detections from the two visits pooled. Similarly, each line was surveyed twice in the line transect survey, and data pooled. Total time in the field under each method was recorded. Detection distances were estimated with the aid of a laser rangefinder. For all methods, only males were recorded.

- Method 1: conventional point transect survey.
 - The observer visited each point of the design, and recorded all males detected within a 5-minute period, together with their distances from the point.
- Method 2: snapshot point transect survey.
 - The observer visited each point of the design, and recorded all males whose locations were known at a snapshot moment, together with their distances from the point. The observer used the time before the snapshot moment to locate birds, and the time following the snapshot moment to confirm locations. Birds whose location could not be confirmed were not recorded.
- Method 3: cue-count survey.
 - The observer visited each point of the design, and recorded all songbursts detected within a 5-minute period, together with their distances from the point. The cue rate (songbursts per minute per bird) was estimated for birds located close to a point.
- Method 4: line transect survey.
 - The observer walked along each line of the design, and recorded all males detected, together with their distances from the line.

We consider analyses for methods 2-4 here.

1 Snapshot point transect sampling

Open Distance project Montrave `pointtransect` `snapshot`. The analyses in this project are summarised in Tables 6.5 and 7.2 of the book.

Suppose we wish to analyse the wren data.

1. Select analysis `robin` `uniform` `cosine` by clicking on it.

2. Just above the analysis summaries, click on the icon immediately following `Analysis:` to create a new analysis.
3. Double-click on the grey circle at the start of the analysis labelled `robin uniform cosine 1`.
4. Click on the `Inputs` tab.
5. Edit the analysis name to `wren uniform cosine`.
6. Click on the “New” tab for `Data filter`.
7. Edit the name of the new data filter to `wren w 110`.
8. Click on the `Data selection` tab.
9. Double-click on `species = 'r'` and change the `r` to `w`.
10. Click on the `Run` tab.

This generates analyses for `wren`, which can be examined.

If we want to change the model in the above analysis, then before clicking on “Run”, we can click on the “New” tab for “Model definition”, then on “Detection function”, followed by “Models”, click on the choice of “Key function” and change it as required, and do the same for “Series expansion”.

The Distance project analyses the distance data assuming they are exact. If you select an analysis and select the “Inputs” tab, then select “Properties” for one of the model definitions, then “Detection function”, and finally “Diagnostics”, then you will see cutpoints specified for grouping the distance data. When cutpoints are specified in this way, they are used only for plotting histograms of the distance data and for calculating goodness-of-fit test statistics; the models are not fitted to the grouped data. If there is considerable rounding in the data, it may be a better option to analyse the grouped distance data. To do this, select “New” under “Data filter”, click on the “Intervals” tab, and specify the cutpoints.

2 Cue-counting

Open Distance project `Montrave cuecount`. The analyses in this project are summarised in Tables 10.5 and 10.6 of the book. Open the “Data” tab. You can see here how cue rate and its standard error have been added as additional fields. Otherwise, analysis options are much as for point transect sampling. Note however that the goodness-of-fit tests indicate poor fits; this arises because some birds give multiple cues from the same location, so that the recorded distances are not independent. This complicates selection of a good model.

3 Line transect sampling

Open Distance project `Montrave linetransect`. The analyses in this project are summarised in Tables 6.1 and 7.1 of the book. Options are as for point transect sampling, but note that there are fewer plots; this is because for line transect sampling, the probability density function $f(y)$ has exactly the same shape as the detection function $g(y)$ (Section 6.2.2 of the book), while this is not true for point transect sampling (Section 6.2.3).

References

Buckland, S. T. 2006. Point transect surveys for songbirds: Robust methodologies. *The Auk* 123:345–357.

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