Optimising your survey design using DSsim / Distance 7.0

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Abstract: Every distance sampling survey is unique, being carried out in a specific region, on specific species and with its own set of unique challenges. Until now we have relied on general rules of thumb to formulate what we believe to be the best survey design for the specific circumstances. Such guidelines have been derived through experience and individually constructed simulations, with the hope that they are generally applicable.

We have developed a distance sampling simulation framework that allows people to generate simulated populations with particular characteristics in their specific region of interest. They can then investigate how the choice of survey design and sampling protocol affects the accuracy and precision of density / abundance estimates. We have used this simulation framework to demonstrate how easily bias can be introduced into surveys through the subjective selection of transect locations. We have also explored the bias and precision trade-off between a zigzag and systematic parallel line transect design based on equal survey budgets. While the zigzag line transect design in a convex hull can introduce some bias when applying standard analysis techniques, the parallel design suffers lower precision due to the increased off-effort transit time between transects.

The question of how to locate transects is one aspect of survey design for which the simulation framework can be applied. Other design questions, such as how best to stratify, or even the effects of different sampling protocols, such as deciding on the number and location of cut points for binned distance data, can also be investigated. This simulation framework will therefore enable each researcher to achieve the best quality data they can for the budget they have.

References

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https://github.com/DistanceDevelopment/DSsim