Distance sampling with animal movement

Richard Glennie
University of St Andrews
rg374@st-andrews.ac.uk

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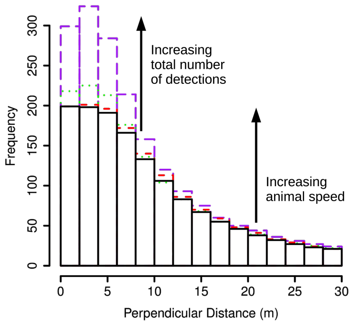
Violations

1. Responsive movement: survey protocol, left truncation, or double observer methods (Conn et al. 2018).
2. What about movement independent of the observer?

$$\hat{N} = \frac{n}{\hat{p}}$$

Bigger n



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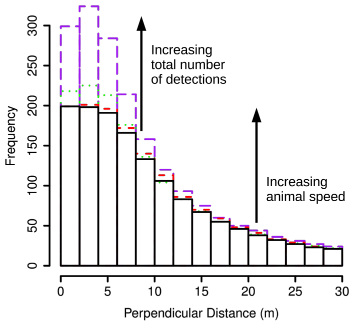
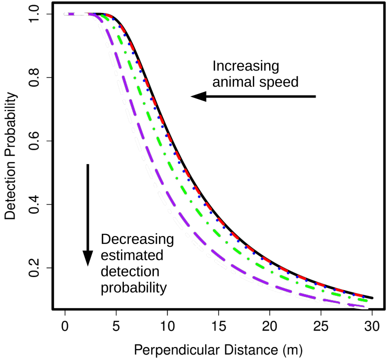


Smaller $\hat{p}$



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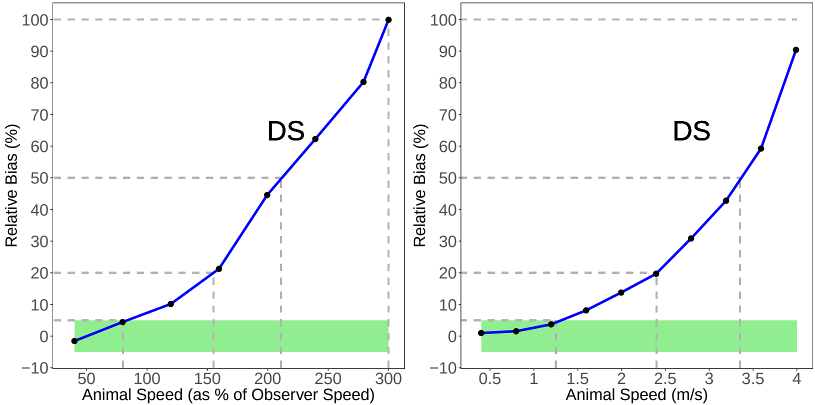
Simulation Study



Estimated percentage bias in estimated abundance from a simulated line (left) and point (right) transect survey.

Survey protocol

How to reduce bias?

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- Search further perpendicular to the line or further from the point.

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- Use a snapshot method.
- Avoid counting overtaking animals in line transects or newly arrived individuals in point transects.

DS

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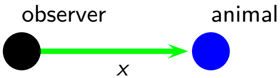

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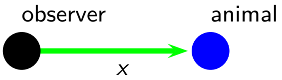

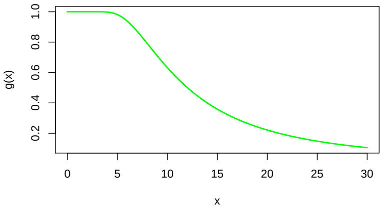

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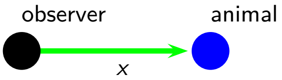

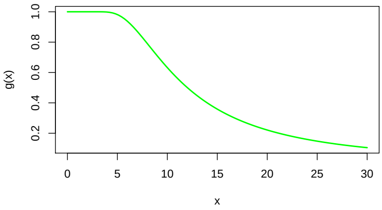

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Average over all locations:

$$\hat{p} = \int \hat{g}(x)\pi(x)\,\mathrm{d}x$$

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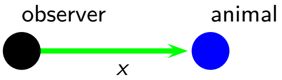

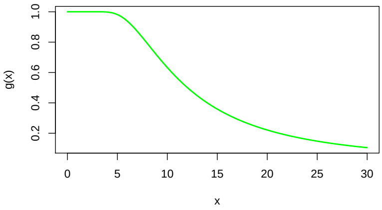

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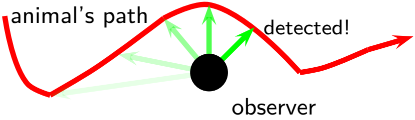

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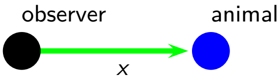

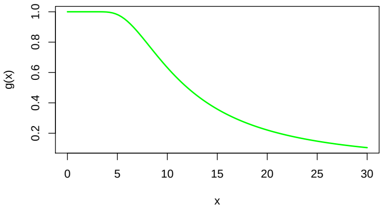

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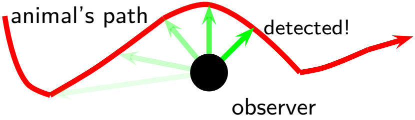

Use hazard of detection in a very small time, e.g,:

$$h(r) = \frac{100}{r}$$

to get probability of detection in a segment of path.

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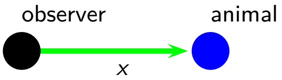

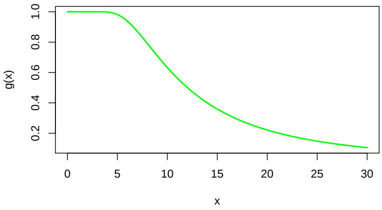

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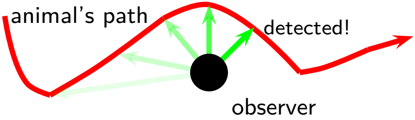

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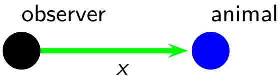

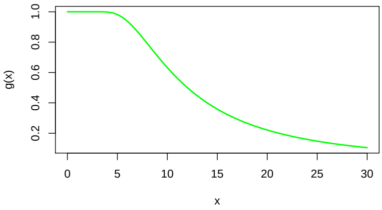

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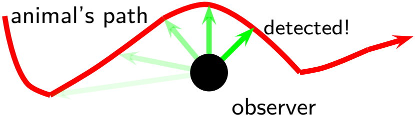

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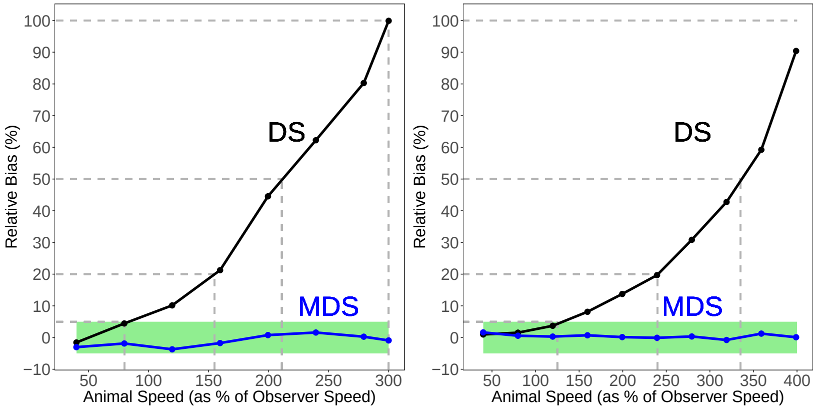

Estimated percentage bias in estimated abundance from a simulated line (left) and point (right) transect survey for conventional distance sampling (DS) and with movement model included (MDS)

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- Any questions or discussion welcome!

Key References

- Conn, P. B., & Alisauskas, R. T. (2018). Simultaneous modelling of movement, measurement error, and observer dependence in mark-recapture distance sampling: An application to Arctic bird surveys. The Annals of Applied Statistics, 12(1), 96-122.
- Glennie, R., Buckland, S. T., & Thomas, L. (2015). The effect of animal movement on line transect estimates of abundance. PloS one, 10(3), e0121333.
- Glennie, R., Buckland, S. T., Langrock, R., Gerrodette, T., Ballance, L., Shivers, S., Scott, M. and Perrin, W. F. (in prep). Incorporating animal movement into distance sampling.