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Transect survey biases and correction methods in Southern Africa

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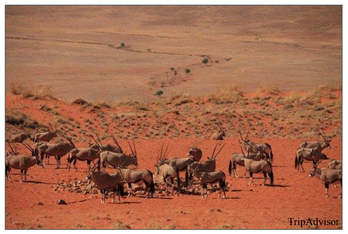
Background

Estimating the population size of wildlife within a given area can be done with transect surveys (Burnham et al. 1980)

In arid environments, the transect lines are often roads that are used for servicing manmade waterholes long the route. These waterholes draw animals in closer to the transect which leads to a skewed detection function (Johnson & Routledge 1985).



Gemsbok concentrated at a waterhole on the NamibRand Nature Reserve

Study Area

This study was based off the NamibRand Nature Reserve in Southwestern Namibia.

The landscape and terrain consist of savanna grasslands, sand and gravel plains, inselbergs, small mountain ranges, and vegetated dune belts.

The location of the NamibRand Nature Reserve in relation to Namibia and Africa

A gemsbok on the NamibRand Nature Reserve

Objectives

1. Assess the potential for bias in estimated animal populations as a result of human-influenced wildlife concentrations
2. Determine and compare efficacy of possible correction processes to account for these non-random animal concentrations

Simulation Methods

We simulated a population of 750 Gemsbok (*Oryx gazella*) on a landscape that was 1,000 meters wide and 50 kilometers long.

We randomly assigned each data point with an x-value and y-value along the transect line.

An algorithm randomly determined which data points were 'observed' and calculated a population estimate based on the observed gemsbok (**S0**). We then performed three more initial simulations with two hypothetical 'waterholes' along the transect where the closest 5%, 10%, and 20% of our simulated gemsbok would congregate (**S5, S10, S20**)

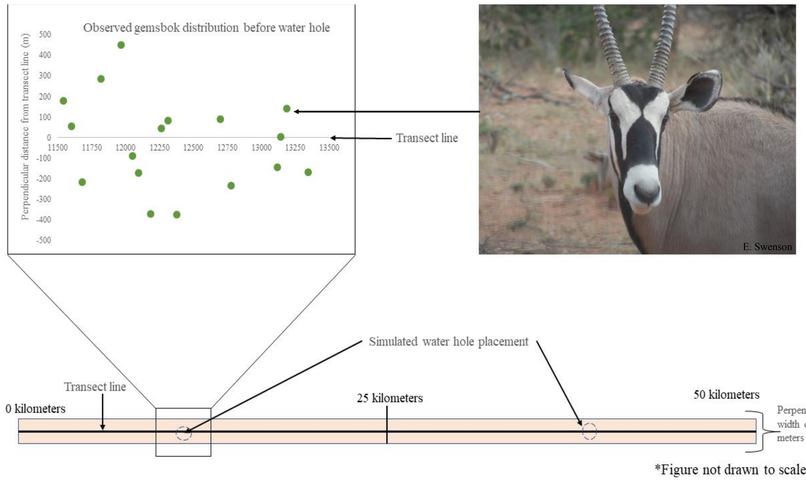
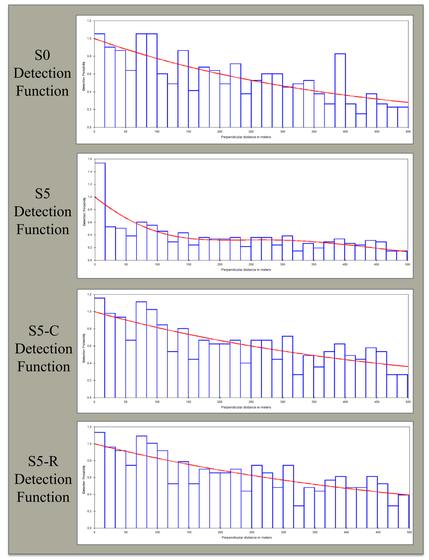


*Figure not drawn to scale

Correction Methods

1. **Censured (C)**: Removed the data points and corresponding lengths of transect before importing into DISTANCE for analysis
2. **Redistributed (R)**: Randomly redistributed 57% (based on the global detection probability) of the gemsbok from the waterholes back into the landscape

- Completed for **S5, S10**, and **S20**
- Compared which method resulted in population estimates closer to the initial value of 750
- The comparisons of the S5 simulations are shown to the right



Results

The resulting biases of all the simulations and their respective correction methods (Censured, C; Redistributed, R):

Simulation set	Density estimate (individuals/hectare)	Total population estimate (individuals)	Lower confidence interval	Upper confidence interval	Percent from actual value (750)
S0	0.160	798	698	912	6.7%
S5	0.251	1253	1053	1490	67.1%
S5-C	0.144	719	626	825	-4.1%
S5-R	0.138	688	601	789	-8.3%
S10	1.056	5279	4243	6568	603.9%
S10-C	0.148	740	643	851	-1.3%
S10-R	0.140	699	610	801	-6.8%
S20	1.600	8001	6837	9362	966.8%
S20-C	0.140	698	600	811	-6.9%
S20-R	0.132	662	574	763	-11.7%

Conclusion

The first correction method (C) in which we censured the waterhole portion of the data proved to be the most successful. This method can be used in environments in which any phenomenon may cause an unnatural distribution along the transect.

This study can benefit managers in dry landscapes where water holes are prevalent throughout the study area

Literature Cited

- Burnham, K. P., Anderson, D. R., & Laake, J. L. 1980. Estimation of density from line transect sampling of biological populations. Wildlife monographs. (72), 3-202.
- Johnson, E. G., and Routledge, R.D. 1985. The line transect method: a nonparametric estimator based on shape restrictions. Biometrics. 669-679.

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