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ABSTRACT

Ungulate population monitoring in a tundra landscape: evaluating distance sampling accuracy in the wild

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Researchers and managers are constantly striving for increased monitoring accuracy (i.e. less biased and more precise) of population sizes in order to improve inferences in population ecology. Distance sampling monitoring is used worldwide. Despite relying on strict sampling and modeling assumptions, distance sampling abundance predictions have rarely been verified in the wild. Here, we evaluate some of these assumptions using the sedentary and solitary Svalbard reindeer (*Rangifer tarandus platyrhynchus*) as model system. The Svalbard reindeer inhabit a high-Arctic tundra landscape fragmented in small isolated peninsulas. On two peninsulas, the reindeer sub-populations of Sarsøyra and Kaffiøyra were monitored both with total counts (since 2000 and 2002 respectively) and distance sampling (in 2013) during summer. A flexible Bayesian state-space model enabled to integrate repeated total counts to the annual monitoring and assess abundance estimates uncertainties. The characteristics of our studied model system (i.e. high sampling effort in a close population with high detection of reindeer) permitted to obtain precise total counts estimates (Sarsøyra had 220[206:235] reindeer estimated and Kaffiøyra 144[122:168] in 2013) used as a baseline for comparison with distance sampling estimates. We computed distance sampling analysis for small study sites by combining available tools in **unmarked** and **Distance/dsm** R package. Abundance estimates from distance sampling alone (n= 143 groups observed in total) tended to underestimate detection probability and thus overestimate reindeer population size. Furthermore, reindeer density was found to be highly correlated with vegetated surface, thus illustrating the importance that habitat structure must be carefully recorded, especially when modeling density spatially. This study illustrates that caution in analyzing distance sampling data is needed to avoid bias in population size estimates from easy accessible software.