

Opportunities and challenges of citizen science for monitoring a recolonizing large herbivore

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Abstract

Monitoring is a prerequisite for evidence-based wildlife management, yet conventional monitoring approaches are often ineffective for species occurring at low densities. However, some species such as large mammals are often observed by lay people and this information can be leveraged through citizen science monitoring schemes. Assessing the quantity, quality, and potential biases of such data sources is crucial before making inferences at scale. For Eurasian moose (*Alces alces*), a species currently reoccurring in north-eastern Germany in low numbers, we compared three different citizen science tools: a mail/email report system, a smartphone application, and a webpage. Among these monitoring tools, the mail/email report system yielded the greatest number of moose reports in absolute and in standardized (corrected for time effort) terms. The reported moose were predominantly identified as single, adult, male individuals, and reports occurred mostly during late summer. Overlaying citizen science data with independently generated habitat suitability and connectivity maps showed that members of the public detected moose in suitable habitats but not necessarily in movement corridors. Also, moose detections were often recorded near roads, suggestive of spatial bias in sampling effort. Our results suggest that citizen science-based data collection can be facilitated by brief, intuitive digital reporting systems. However, inference from the resulting data can be limited due to unquantified and possibly biased sampling effort. To overcome these challenges, we offer specific recommendations such as engaging outdoor enthusiasts in suitable moose habitats, for improving quantity, quality and analysis of citizen science-based data for making robust inferences about wildlife populations.

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