How inbreeding depression affects the dynamics and the viability of the Pyrenean brown bear (Ursus arctos) population

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Résumé

The biodiversity crisis is characterized by species extinction as well as local declines and extirpations, leading to small and isolated populations prone to genetic problems such as inbreeding depression. The case of the critically endangered brown bear population in the Pyrenees exemplifies these challenges. Despite conservation efforts, including the reintroduction of 11 bears from Slovenia from 1996 to 2018, the growing population remains vulnerable, with an estimated count of approximately 80 individuals in 2023. Besides habitat fragmentation and conflicts with local communities, mainly due to livestock depredation, these bears present high level of inbreeding (average inbreeding coefficient = 0.184 ± 0.074 in 2020).
To quantify inbreeding depression in the Pyrenean brown bear, we estimated individual inbreeding using pedigree data, while correcting for the relatedness of founders based on microsatellite markers (n=158 individuals). This approach helped us to challenge the often inaccurate assumption that founders are unrelated. Using these refined coefficients, we examined the impact of individual inbreeding on various demographic parameters such as litter size and reproductive success using generalized linear mixed models, and survival rates across different life stages using capture-mark-recapture methods.

Our findings reveal that inbreeding affects negatively and significantly litter size and survival of cubs of both sexes. To translate these impacts into broader implications for population viability, we will employ an individual-based model (IBM). These models aim to project population growth under various management scenarios (i.e. reinforcements), both with and without the effects of inbreeding, utilizing our estimates of lethal equivalents.
These insights will be crucial for developing management strategies for the Pyrenean brown bear. Furthermore, understanding how the extent of inbreeding depression observed in various fitness traits can directly affect population viability, and how management can address this, remains a key concern in applied ecology.

Mots-Clés: Inbreeding depression, brown bear, population viability

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