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The benefits of genomics in small populations: case study of type traits in the Dual-Purpose Blue cattle breed

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The Dual-Purpose Blue (DPB) is a small cross-border breed from Belgium and the North-East of France. This local breed was preserved by breeders for its robustness and ease to handle. Several transboundary projects have resulted in the development of common genetic evaluations for this breed, including the estimation of (genomically enhanced) estimated breeding values ((G)EBV) for linear type traits. Once in a year, EBV and associated reliabilities (REL) are obtained using a multiple-trait animal model and then, subsequently used in a pseudo single-step GBLUP with Bayesian integration to obtain GEBV and associated genomically enhanced REL (GREL). This study aimed to assess the gain in REL for type traits of DPB when genomic information is added. Phenotypes included 23 traits, 18 individual and 5 overall traits (udder, development, feet and legs, muscularity, rump). All traits were scored from 1 to 9, except for stature, which was measured. In total, 10,360 records were used, with 2,195 animals being genotyped. Pearson correlations were computed between EBV/GEBV, and REL/GREL. Resulting correlations between EBV/GEBV, and REL/GREL were very high for all type traits (0.96-0.99). In general, REL enhancement for genotyped animals was observed, ranging on average from 0.07 to 0.13 points across traits, which is in line with our expectations. Specifically for genotyped bulls, REL enhancement ranged on average from 0.11 to 0.14 (maximum from 0.29 to 0.35) across traits. This clearly indicates the benefits of the use of genomic data, even in a small population, which will allow better selection decisions.

Genetic analysis of calf survival in a critically endangered antelope (Nanger dama mhorr)

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Mhorr gazelle (Nanger dama mhorr) is a Sahelo-Saharan antelope that is currently extinct in the wild. Its captive breeding program provides an important tool for rearing sustained populations, with offspring survival playing a critical role. The aim of this study was to determine the genetic parameters of perinatal (PS) and weaning survival (WS) of mhorr gazelle calves, and to investigate the possibility of using these fitness traits as breeding objectives in the conservation program. Up to 2185 calf survival records from the studbook were used in the analysis. All genetic parameters were estimated via mixed linear models within a Bayesian frame and using the TM program. The predictive value of the different models was compared using the logCPO value. The calf model had the best fit with data for the PS and the calf-permanent model for the WS. Heritabilities estimated for the direct genetic effect were moderate, 0.279 for PS and 0.157 for WS. The maternal environmental component in the WS was 0.048. Calves of multiparous dams had a higher PS, but there were no significant differences in WS depending on the number of calving. For both traits, male calves had a lower probability of survival than females, and offspring born from young and old gazelles were less likely to survive. High inbreeding coefficients of the calf reduce PS and high inbreeding of the dam make descend WS. Neither PS nor WS were affected by the maternal genetic effect, so mating strategies in the conservation program should focus on the direct genetic effect to increase the potential of the population to respond to selection on offspring survival rather than on the maternal contribution.