Recent evolution of chamois weight: Exploring Ticino's hunting data

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The Alpine chamois (*Rupicapra rupicapra*) in the Alpine arc shows a steep decline in population size since 1995, and possibly in body mass. In Switzerland, which hosts 20% of the Alps population of this ungulate, the chamois hunting bag increased constantly from 1950 until 1994 when it reached a maximum in Switzerland. Since this peak, both population size and hunting bag declined steadily until today.

Here, we focus on the environmental determinants of the weight of chamois. This trait is influenced by many factors and we analyse here the effects of biotic (intra- and interspecific competition with red deer) and abiotic factors (elevation and meteorological conditions) in Ticino. A long-term dataset, covering 1992 to 2018, is available for this canton. It allows us to additionally analyse the temporal trends for weight and for body condition (scaled mass index). Our analysis was done separately for males and females and for four age-classes. As weight is influenced by age, we defined an age-corrected weight as the residuals of a custom weight-age model. We used linear mixed-effects models for the analyses. Hunting regulation, coded as a factor with 10 levels, was included in all environmental models as a fixed effect.

We found that biotic factors play a major role in body weight. Weight is negatively related to chamois abundance, indicating intraspecific competition. Surprisingly, the relationship with red deer abundance is positive. Although this result cannot exclude interspecific competition, it shows that the chamois weight may respond to the same environmental variable than red deer population size, for example food availability. Expectedly, chamois hunted at higher elevation were heavier. These patterns are consistent within sex and age-classes. The effects of abiotic conditions were significant only for male subadult individuals. Interestingly, the strongest effect was a negative relationship with maximum snow cover during their first year of life. Contrary to observed stability of weight in the canton of Grison during the same period, we observe a clear decline in weight in all age classes except yearlings. This represents globally a decline of approximately 7% in 27 years. Although the reasons are likely multifactorial, notably by changes in population structure due to variable hunting regulations, we cannot exclude an effect of global change.

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