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Modeling mammals food webs in the Orce sites: Quantitative reconstruction of prey-predator relationships for the first humans of Western Europe

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Abstract

Many researchers consider that meat was a relevant trophic resource for the first hominin populations that dispersed in Europe during Early Pleistocene times. Moreover, meat availability could have conditioned human presence if we take into account the intensity of competition with other carnivores for the access to these resources. From this point of view, it is very interesting to test past ecosystems which have fossil records before and after human presence. The Early Pleistocene sites of Orce (Baza Basin, SE Spain) offer a unique opportunity to analyze the food webs of the mammalian paleocommunities in these conditions. With an age of 1.6-1.5 Ma and absence of evidence on human presence, the Venta Micena site provides the scenery before the initial peopling. In contrast, Barranco León and Fuente Nueva-3, dated at around 1.4 Ma, preserve evidence of human presence at the Baza Basin. The latter sites have provided huge large mammals assemblages with an excellent state of preservation, which has allowed carrying out a number of taphonomic, geochemical isotopic and paleoecological analyses. This has allowed contextualizing the environmental context of the first human settlements in Western Europe. For this reason, it is very interesting to reconstruct the Orce food webs for estimating how meat availability could have influenced their structure. In this study, we have applied a mathematical approach based on Leslie matrices to quantify the biomass of large mammals available to the guild of secondary consumers, including humans in Barranco León and Fuente Nueva-3, in order to analyze the pattern of meat distribution and intraguild competition. The model determines: (1) the age structures that would make stable the population of each primary consumer; (2) the distributions of individuals among body mass categories; and (3) the average biomasses that could be extracted in the long term from these populations. Finally, it distributes the ungulate meat among the secondary consumers and estimates the sustainable densities of each carnivore species. The results for Orce allowed reconstructing the food webs of the sites, which showed that meat was not the main limiting factor to hominin presence in Western Europe before 1.4 Ma.