LETTER

Mammalian extinction in ancient Egypt, similarities with the southern Levant

Yeakel et al. (1) find that wild mammal extinction in ancient Egypt during the Holocene was nonrandom and coincided with abrupt climatic changes and a local cultural collapse. The authors provide compelling evidence that the deterioration of the natural Egyptian ecosystem gradually progressed during the Holocene. The extinction patterns provided vividly show that decreasing predator and prey (ungulates) diversity mirror increased desertification, human population growth, and political instability. We see strong ecological logic in Yeakel et al.'s (1) scenario and point to the advantages of conducting detailed comparisons of local extinction data to illuminate particularities and to better fine-tune broader hypotheses concerning Holocene extinctions.

Similar patterns of wild mammalian extinction occurred in many parts of the ancient world (2), including those we have recently reported for the adjacent, but ecologically different, southern Levant (3). Like in Egypt, Holocene extinction in the southern Levant occurred mainly in extinction cascades. The southern Levant's solid zooarchaeological database enabled demonstrating the time and pace of ungulate extinction. We have shown (3) that large-bodied mammalian herbivores (*Hippopotamus*, aurochs, and hartebeest) were the first to disappear, whereas several species resilient to environmental changes and to human activity have survived to date in both ecosystems (1, 3). Because the southern Levant climate was relatively stable throughout the Holocene (4), we suggested (3) that animal taxa turnover and extinction was related mainly to anthropogenic effects. Similarly to Egypt (1), direct hunting and habitat destruction were the major causes of animal extinction in the southern Levant (3).

The timing of extinction of a number of specific taxa in Egypt and in the southern Levant is similar. In both ecosystems, the first wave of faunal extinction occurred at the time of peak geopolitical vulnerability and a human demographic expansion. In the southern Levant it occurred during the end of the second mid-first millennium B.C.E. and in Egypt during the second-first millennium B.C.E. The first herbivores to become locally extinct in both regions were those large-bodied species that were on the verge of their distribution range. It is only during the last 150 y that the second major extinction wave has occurred (with the arrival of efficient firearms). This more recent occurrence resulted in a disproportionally fast extinction rate of most prey and predator species (>10 kg). The 19th–20th century extinction was the most fatal for the majority of wild mammalian taxa in both ecosystems (5).

Interestingly, we can see that similar taxa escaped extinction and survived to this date in both ecosystems. These groups include opportunistic ungulate (e.g., gazelle and ibex) and carnivore (fox, golden jackal, and hyena), taxa that are less sensitive to environmental changes, some of which inhabit the desert, a less populated habitat. Hence, these taxa were less exposed to the multitudes of human impacts. Most of these surviving species are in a way commensal and benefit from human impact. Gazelle can subsist in open agricultural areas, whereas the carnivores are attracted to human refuse. Moreover, the elimination of larger mammals may have also reduced competition within members of these guilds, further improving the survival of the resilient ones.

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