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Editorial

Ecology of Predation and Scavenging and the Interface: A Special Issue

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Predation and scavenging are pervasive ecological interactions in both terrestrial and aquatic environments. The ecology, evolution and conservation of scavengers, and especially predators, have received wide scientific attention and public awareness. However, the close connection that exists between predation and scavenging has not been made explicit until recently [1–3]. The propensity to hunt or scavenge a prey may vary within individuals, among different individuals within a population, and among different populations and species, depending on an intricate array of both intrinsic (e.g., morphology, body condition) and extrinsic (e.g., availability of alternative food sources) factors. In turn, the recognition that carnivorous animals may obtain meat by either hunting prey or scavenging their carcasses has profound implications, from individual morphology, physiology, and behavior to population, community, and ecosystem structure and functioning [1–5].

Given the novelty of this integrative research topic, many relevant questions have yet to be resolved. This Special Issue, through the three research papers and the three reviews that comprise it, aims to deal with some of these questions from diverse perspectives and methodological approaches.

In the first paper of this SI, Ordiz et al. [6] describe, in detail, the predatory and scavenging behavior of wolves (*Canis lupus*) and bears (*Ursus arctos*) in a Swedish area to understand the intrinsic and extrinsic conditions that favor the coexistence of these competing top carnivores. They show that bears and wolves were connected by frequent indirect interactions, mainly through bear scavenging of wolf kills. Scavenging by bears diminished in the moose calving season, when both carnivores turned to the abundant and vulnerable calves as the main food source. Additionally, not all bears were equally prone to scavenging wolf kills, as these carcasses were avoided by females with cubs of the year, i.e., the bear population sector that is more vulnerable to predation.

Teurlings et al. [7] explore a major anti-scavenger strategy of the other top carnivore, the Eurasian lynx (*Lynx lynx*). To prevent scavenger access to the remains of large prey, and thus to secure subsequent meals, lynxes and other felids usually hide their kills by covering them with different materials, such as vegetation and snow. This study, conducted in an area of southeastern Norway, shows that this caching behavior is an efficient anti-scavenger strategy, as cached prey (namely, roe deer, *Capreolus capreolus*) were discovered later than non-cached prey by both vertebrate (especially, birds) and invertebrate scavengers. These results are crucial to fully explain the functional responses of lynxes to their prey, and lynx–prey dynamics in general.

In the next empirical study, Teurlings et al. [8] further focus on the Eurasian lynx–roe deer system to investigate whether above-ground ecological processes linked to predation can trigger cascading effects on below-ground processes via carrion supply and decomposition. Unlike similar studies conducted in other systems, Teurlings et al. did not detect any effect of carcass remains on key chemical parameters of soil and vegetation about two years after death. These findings could be explained by the relatively small size of roe dear carcasses and by their efficient consumption by lynxes and scavengers.

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The first review of this SI, made by Luna et al. [9], compares the scientific effort that has been devoted to date to predation and scavenging processes in urban habitats, which are increasingly represented in the planet Earth. The authors found that predation has been far more studied than scavenging. Moreover, urban ecologists became interested in scavenging several decades later than predation. The study species and areas of articles on scavenging were a subset of the species and areas studied in articles on predation. Luna et al. conclude that proper recognition of both the predatory and scavenging facets of carnivores will be needed to fully understand their role in urban food webs and their ecological consequences for urban environments.

A key question in predation–scavenging research is to identify the adaptations that make a species successful in exploiting a given niche within the predation–scavenging gradient. In this line, Potier [10] reviews the visual specializations associated with predatory and scavenging diurnal raptors. He finds that the eye size relative to body mass, as well as binocularity (as opposed to an enlarged field of view), increases towards the predation extreme of the gradient. He also identifies a qualitative anatomical difference between typical predators and more opportunistic and scavenger species, with the former having a second, temporally positioned fovea (probably used during prey capture) in addition to the central fovea that occurs in all species. These findings highlight the close relationship between visual system specializations and foraging ecology, which was often unrelated to phylogeny.

In the last contribution to this SI, Moleón and Sánchez-Zapata [11] reveal the important, though largely overlooked, role that carrion plays in the landscapes of fear and disgust. By reviewing the scientific literature, they identify the main ways in which carrion may be scary and disgusting, namely the principal interaction pathways between carcasses and their visitors (both carnivore and herbivore species) that expose the former to predators (see Ordiz et al. [6] for an empirical example in this SI) and parasites at carcass sites. In addition, they identify major knowledge gaps, which are mostly related to the disgusting facet of carrion. The presented conceptual framework may help to understand animal behavior and ecological processes, including cascading effects, around carrion resources.

The papers and reviews of this SI are proof of the explicit interest in the relationship between predation and scavenging that has currently pervaded many research groups worldwide. Nevertheless, as evidenced by this SI, important knowledge gaps still arise. For instance, investigations into marine, freshwater, and tropical terrestrial environments, as well as on invertebrates, would be especially welcome. I hope this SI may contribute to inspire future research ideas and effort on this general topic. Overall, the growing body of scientific knowledge on the interface between predation and scavenging will definitely dismiss the traditional view that they are disconnected ecological processes.

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