Exposure to anthropogenic chemicals in wild carnivores: a silent conservation threat demanding long-term surveillance

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Top predators are fundamental drivers in maintaining ecosystems and preserving biodiversity. However, a number of species have experienced severe population declines and currently face critical conservation challenges. Although exposure to chemical contaminants has been recognized as a meaningful threat for wild carnivores, its population effect has been more rarely assessed. There are only a few case studies, based on monitoring across large temporal and spatial scales, that have been able to: identify the real thresholds at which chemical exposure adversely affect populations, demonstrate how populations have responded to such ecotoxicological challenges, or determine if chemical exposure has really been the cause of declines in wild carnivore populations. This work focuses on species in the mammalian order Carnivora to review some of the most relevant case studies that have led to identify chemical exposure as an anthropogenic forcé that may compromise the conservation of top predators. Some examples include both marine and freshwater carnivore species and their exposure to persistent organic pollutants (POPs) and methylmercury (MeHg); and terrestrial carnivores and their secondary exposure to anticoagulant rodenticides (ARs). The ongoing “chemical intensification” makes it critical to foster and keep efficient surveillance efforts on chemical exposure and their health impacts in carnivore populations long into the future. Thus, we also highlight the relevance of longterm monitoring surveillance in conservation programs, pointing out the challenges that should be considered in future ecotoxicological research on wild carnivores, including the need of establishing Adverse Outcome Pathways for different types of chemicals and the development of sensitive, precise and reliable biomarkers of exposure and effect by the use of non-destructive techniques. The inclusion of wild carnivores in ecotoxicological monitoring may deliver key and useful information for biodiversity conservation and One Health goals.