frontiers | Frontiers in Ecology and Evolution

EDITORIAL
published: 09 May 2022
doi: 10.3389/fevo.2022.925403

Editorial: Determinants and Consequences of Perceived Predation Risk: From Individual Behavior to Transgenerational Effects

Chiara Morosinotto[1]*, *Peter Banks*[2], *Toni Laaksonen*[3] and *Julien Terraube*[4]

[1] Bioeconomy, Novia University of Applied Sciences, Raseborg, Finland, [2] School of Life and Environmental Sciences, The University of Sydney, Sydney, NSW, Australia, [3] Department of Biology, University of Turku, Turku, Finland, [4] Vulture Conservation Foundation, Zurich, Switzerland

Keywords: predation risk, non-lethal effects, foraging, antipredator strategies, anthropogenic disturbance

Editorial on the Research Topic

Determinants and Consequences of Perceived Predation Risk: From Individual Behavior to Transgenerational Effects

OPEN ACCESS

Edited and reviewed by:
Jordi Figuerola, Doñana Biological Station (CSIC), Spain

***Correspondence:**
Chiara Morosinotto
chiara.morosinotto@novia.fi

Specialty section:
This article was submitted to Behavioral and Evolutionary Ecology, a section of the journal Frontiers in Ecology and Evolution

Received: *21 April 2022*
Accepted: *25 April 2022*
Published: *09 May 2022*

Citation:
Morosinotto C, Banks P, Laaksonen T and Terraube J (2022) Editorial: Determinants and Consequences of Perceived Predation Risk: From Individual Behavior to Transgenerational Effects. Front. Ecol. Evol. 10:925403. doi: 10.3389/fevo.2022.925403

Predation is a major evolutionary and ecological process that shapes population dynamics and community structure directly, *via* lethal effects, but also indirectly, through non-lethal "fear" effects. The papers in this Research Topic provide new information on how these effects take place, from community to individual level and *via* transgenerational effects.

The fear of being killed may result in animal movements being shaped according to the distribution of predators. Prey move to reduce the risk of encountering predators while predators will move toward areas rich in prey. For prey, predation risk creates a mosaic of risky/safe areas, the so-called "landscape of fear." Scrosati reviews the evidence for non-lethal effects in a fascinating coastal study system, where the dog whelk prey upon barnacles and mussels. These sessile prey organisms are able to use water-borne cues from dogwhelk to avoid settling in areas of predator presence, a behavior that may have evolved to reduce predation risk and thus increase survival. Burgas et al. show that such an effect of a predator on the distribution of a prey can be long lasting for a whole community. The large prey species preferred by the northern goshawk are less abundant close to goshawk nests, an effect that also lasts for years after the hawk no longer nests there. For smaller prey species the trend seems to be opposite, as their abundance can be even higher close to the top predator nest—potentially due to the protection provided by the goshawk against smaller predator species.

Although prey may avoid settling close to their predator, they rarely can avoid it altogether and are thus exposed through their life to various degrees of predation risk. Predator presence alone creates non-consumptive effects on individual prey fitness by affecting prey foraging behavior and habitat-use. Kelleher et al. use auditory calls of predators to assess the interactive effects of habitat, refuge availability and predator type, fox (cursorial) vs. owl (ambush predator), on the foraging behavior of white-footed mice. Foraging behavior of prey was most reduced and altered (increased use of refuges) when exposed to foxes at the open forest edge (the habitat where mice are the most vulnerable to predation), suggesting that environmental context can modulate prey responses to risk.

Predator presence can also alter prey development and physiological stress responses. Abondano Almeida et al. show that increased predation risk (through a simulated bird attack) influences warning signal efficacy and several life-history traits like growth and molting events in wood tiger moths. Larvae exposed to predation increased melanin deposition, reached a smaller body size, and molted more often. Phenotypic plasticity is thus a potential mechanism to respond to novel predation risk in aposematic species. These species also deter predators by using a combination of defenses, e.g., visual signaling or aversive tastes. Using an experimental approach, Winters et al. investigates the multimodal aposematic defense in the wood tiger moth to blue tit predators. They show that color, taste and smell are used as a warning signal impacting predator attack at different stages. In addition, moth color and smell impacts their survival, as moths of the white morph with methoxypyrazine smell were captured and killed less often by birds.

In addition to the direct effects to individuals, predation risk perceived during breeding can flow on between generations, as "stressed" parents modify their offspring's phenotype. Mohring et al. investigates hormonal profile and reproductive investment of female eider ducks breeding under high predation risk. Females breeding in high risk areas had higher levels of prolactin, thus showing surprisingly high parental investment, which resulted also in higher offspring condition. This could be linked to selective disappearance of breeders in low body condition in high risk sites. In addition to affecting parental behavior and condition, predation risk perceived by the parents can also directly affect offspring. Sievert et al. indeed show that pups of predator-exposed bank vole females grow faster in smaller litters whereas pups of mothers exposed to conspecific alarm cues show the opposite pattern.

The effects of predation risk can not only affect the first generation of offspring, but may persist in the population through multiple generations. In these cases, the time necessary for the insurgence of inducible antipredator defenses can be key in the effectiveness of the antipredator response in later generations. Graeve et al. tests if inducible response indeed get faster in *Daphnia spp.* if predation risk persists in the population over several generations. In the third generation, individuals had a much faster response and also mounted a stronger response. Moreover, embryos directly exposed to predator cues, in addition to mother's exposure, will have an even stronger response at birth. Thus, combined direct and indirect experience of predation risk may strengthen prey response across multiple generations.

The strongest predator effect on animal communities globally is undoubtedly that of humans. In their hypothesis-paper, Smith et al. discuss novel insights on how animals in the anthropogenic world may exhibit mismatches between the actual risk they are facing and their response to them. Animals may perceive a risk by human activity that is not real, and respond to it even if there would be no need to (assessment mismatch hypothesis). It is easy to think of many species in the modern world that are afraid of people who in the current times would no longer harm them. Animals may also show an under-response to cues of human activity (selection mismatch hypothesis) or the response to the cue could simply be wrong (response mismatch hypothesis), such as freezing behavior in response to a fast approaching vehicle.

In this Research Topic we gathered recent discoveries on the effects of predation risk on prey, from behavioral responses at the individual level to transgenerational effects and cascading effects at population and community levels. These articles open new avenues for investigating predator-prey interactions, which is crucial to better understand the functional role of predators in rapidly changing ecosystems.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.