

1 December 2018

Dear Reviews & Syntheses Editors:

We are writing to propose a synthetic review of the disconnect between the underlying ecological theory (i.e., match-mismatch hypothesis) and the phenological responses to climate change that are currently documented. There have been widespread shifts in the timing of species interactions over recent decades in response to climate change (1). While there have been theoretical (2,3) and empirical studies (4,5) based in single systems, it remains difficult to understand the consequences of those shifts for ecological communities and ecosystems. While other studies have further developed the match-mismatch theory (2,3), our paper furthers the field by:

1. Reviewing the type of data currently collected by researchers interested in testing or applying the mismatch hypothesis in the context of climate change.
2. Examining the array of potential mechanisms underlying the match-mismatch hypothesis.
3. Examining the concept of baselines in this literature.
4. Identifying how researchers can design their studies to more rigorously test the mismatch hypothesis.

We argue that there are methodological inconsistencies across studies and conceptual reasons that have made it difficult to test this hypothesis in the context of climate change. By highlighting the data-theory mismatch on the topic of trophic synchrony, our aim is to make better predictions about the impacts of shifts in the timing of species interactions on ecological communities.

This review has not been submitted elsewhere, and we welcome the opportunity to submit it to Ecology Letters.

Sincerely,

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1. Kharouba, et al. (2018) Global imprint of climate change on marine life. *Nature Climate Change* 3:919-925.
2. Johansson et al. (2015) The eco-evolutionary consequences of interspecific phenological asynchrony- a theoretical perspective. *Oikos* 124:102-112.
3. Bewick et al. (2016) How resource phenology affects consumer population dynamics. *The American Naturalist* 187:151-166.
4. Borcherding et al. (2010) Match or mismatch: the influence of phenology on size-dependent life history and divergence in population structure. *Journal of Animal Ecology* 79: 1101-1112.
5. Plard et al. (2014) Mismatch between birth date and vegetation phenology slows the demography of roe deer. PLoS Biology 12:e1001828.