Evaluating the ecological consequences of shifts in the relative timing of species interactions

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**Background/Question/Methods**

Due in large part to climate change, the relative timing of species interactions is shifting. The match-mismatch hypothesis (Cushing 1969) predicts that these shifts will lead to fitness consequences because there is selection for consumers and mutualists to synchronize their phenology to that of their resources to maximize their fitness (‘match’). Therefore, for those species in these roles, we would predict any shift in synchrony to lead to negative fitness consequences (‘mismatch’). While some studies have found important negative fitness consequences due to climate driven-shifts in synchrony, others have found that such shifts do not always have fitness consequences. Despite the potential implications of phenological mismatches for ecological communities, the degree to which shifts in relative timing have led to changes in species’ performance has not yet been synthesized across multiple interactions. Here, we conducted a meta-analysis to test for a relationship between species’ performance and the relative timing of the interaction, and whether shifts in the relative timing of interactions have led to changes in species’ performance over time. Based on the data available, we focused on the response of consumers to shifts in synchrony.

**Results/Conclusions**

Our search yielded 22 studies, experimental and observational, with phenology and performance data for 23 interactions. Our results suggest that there is a negative relationship between the relative timing of an interaction and species’ performance: in years where key life history events of interacting species are further apart in time, consumer performance was lower than an average year. Although these interactions are becoming further apart in time over the past 30 years, there was no decline in performance over these years. This is not surprising given that the shift in performance was not related to the shift in relative timing. Our results suggest that changes in the relative timing of species interactions may reduce consumer performance. However, it remains unclear whether these changes will translate into important population-level fitness consequences for these species.