Sometimes good papers take a while to write. The idea behind this paper originated from a discussion I had with Judy Myers (Professor Emeritus, University of British Columbia) more than 8 years ago. We were discussing a chapter from my PhD thesis about the ecological consequences of shifts in the timing of pair-wise species interactions (i.e. phenological mismatch) due to climate change and whether these mismatches were going to be as prevalent and consequential as the initial research was suggesting. The first studies to demonstrate mismatch were done on a handful of species interactions. She pointed out how many different types of adaptions species have to be able to deal with interannual variability in their food and predators. A few months later, Lizzie and I were chatting after a departmental discussion group and she asked me whether there was any evidence in the literature to suggest phenological mismatches were going to be common. Soon after that discussion, Lizzie invited me to join her NCEAS working group and pitch these ideas to the group.

We soon realized that in order to have climate change-driven phenological mismatches, phenological shifts of different magnitudes between interacting species were needed. We scoured the literature and could not find a consensus about whether interacting species were shifting their phenologies in synchrony in response to climate change.

We decided to divide our ideas into two papers, the first of which became Kharouba et al. 2018 where we demonstrated that yes, the relative timing of interacting species have shifted significantly over the past 35 years. In other words, these interacting species are not shifting their phenology in synchrony. This is across 54 pair-wise species interactions from aquatic and terrestrial ecosystems all over the world.

When we sat down to write the second paper about phenological mismatch in 2017, our initial plan was to do the same thing—a meta-analysis of all the work done so far on phenological mismatches— and see how often studies were demonstrating empirical consequences of shifts in phenological synchrony. After pulling together all the relevant studies we could find, we tried our best to analyze the data in a single framework and ran into problem after problem. It was really difficult to compare the methodology of different studies. We seemed to be comparing apples and oranges. We ran into a tough time putting together a talk for Ecological Society of America’s annual meeting in 2017. Through the experience, we realized that the reason we were having such a hard time synthesizing the data was that the literature was a mess. So we decided to write a perspectives piece that would try to summarize the shortcomings we ran into along the way.

So in the end what did we find? Well on the one hand there’s a well-cited hypothesis (the Cushing match-mismatch hypothesis) with testable predictions about the magnitude of consequences in response to climate-change driven shifts in synchrony but on the other, we found that studies are not collecting the data required to test the assumptions and multiple mechanisms of the hypothesis nor are they defining a pre-climate change baseline in phenological synchrony. In other words, how did the timing of these interactions fluctuate over time before recent climate change began? Both of these research gaps make it difficult to predict whether climate change will have ecological consequences due to shifts in phenology synchrony for interacting species.

There is a way forward. The integration of different types of approaches or datasets, higher temporal resolution data (when possible) and null models can provide a powerful approach to test multiple hypotheses. Given the complexity involved, accurately forecasting phenological mismatch in response to climate change is a major test of ecological theory and methods. However, these improved approaches could rapidly advance our mechanistic understanding and thus allow robust predictions of shifts with continuing climate change.