Background/Question/Methods   
The ongoing anthropogenic climate change increasingly affects species phenology. Especially, the resting period, when organisms remain inactive during part of the year, is often driven by temperature. In the case of a consumer and a resource, the synchrony of the end of their respective resting period is fundamental for the persistence of their interaction. Since the consumer and its resource are likely to respond differently to a change in temperature regime, the synchrony between them will likely be altered. However, a mechanistic approach that investigates the effects of climate change on the phenological synchrony of consumer – resource systems is still missing. In this study, we propose a general theoretical model that determines the duration of the resting period according to temperature, and its effects on synchrony or mismatch between phenological stages of two interacting species. We then illustrate our approach using the spruce budworm – balsam fir system in Eastern Canada as a case study.   
Results/Conclusions   
We found that an increase in temperature would usually advance phenology. However, the effects of a warm or cold spell during the resting period would strongly vary according to the time and the duration of the spell for a given species. Depending on the way each species reacts to the same temperature shift, the mismatch between the consumer and its resource may increase or decrease. For the spruce budworm – balsam fir system, our model predicts that an increase in temperature may increase the mismatch between the insect and the tree in Southern sites, but may increase the synchrony in Northern sites. This kind of modelling approach is of primer importance to investigate potential effects of climate change on consumer – resource systems. Among ecological interactions, consumer-resource relationships are fundamental to the functioning of terrestrial and marine ecosystems. The study of synchrony between interacting species is fundamental to predict future species distribution.

Authors must provide a statement outlining why Ecography is the best outlet for publication. This should include a description of why the submitted work makes a significant contribution to and is of general interest for understanding spatial and temporal patterns in ecology. You must provide a clear statement of how the manuscript builds on both recent work by yourself or your coauthors cited in this manuscript (published during the past 12 months, or in press, or submitted) and other published work.

Significance statement

The ongoing anthropogenic climate change increasingly affects species phenology. Especially, the resting period, when organisms remain inactive during part of the year, is often driven by temperature. In the case of a consumer and a resource, the synchrony of the end of their respective resting period is fundamental for the persistence of their interaction. Since species may react differently to the same temperature regime, and since temperature regimes differ across latitude, climate change leads to a shift in species phenology that affect the synchrony/mismatch between consumers and resources. Recent studies pointed out a significant shift in species phenology in recent decades (Post et al. 2001; Parmesan and Yohe 2003), particularly the timing of spring events at mid-high latitudes (Parmesan 2006; Cohen et al. 2018), as well as significant changes in phenological synchrony between species (see Kharouba et al. 2018), but observed patterns are difficult to explain mechanistically. In this study, we propose a general theoretical model that determines the duration of the resting period according to temperature, and its effects on synchrony or mismatch between phenological stages of two interacting species. We then illustrate our approach using the spruce budworm – balsam fir system in Eastern Canada (a major defoliator of the boreal forest) as a case study. The main model leads to general conclusions on species synchrony/mismatch under climate change. It can be parameterized for a large number of species showing a resting period in their life cycle. The model provides a mechanistic understanding of the effects of a change in temperature regime on the phenological mismatch between species and species interactions. Hence, this study provides a novel approach to explain temporal patterns (i.e., species emergence date from their resting period) and spatial patterns (i.e., species phenology across latitudes).