28 February, 2019

Dr. Ruth Nussinov  
School of Medicine  
Tel Aviv University  
Editor-in-Chief  
PLOS Computational Biology

Dear Dr. Nussinov,

I am pleased to submit "The Regime Shift Detector: a model to identify changes in dynamic rules governing populations," for your consideration for publication in PLOS Computational Biology

Abrupt changes, or regime shifts, in ecological processes and dynamics are an important area of research, because understanding the drivers of transitions is a key factor in ecosystem management. Although theoretically well described and understood, empirical tools for evaluating and characterizing these shifts are lacking. Yet, methods for identifying shifts in empirical data are crucial for both researchers and managers. This manuscript presents the development and testing of an algorithm to address this knowledge gap, with a specific focus on identifying populations shifting between dynamic states. We developed a modeling framework, the “Regime Shift Detector” to identify changes, weigh the evidence of their occurrence, and characterize the magnitude of the shift. We then test the performance of the model under a variety of simulation conditions, and using two real-world case studies: the decline of Monarch butterflies at their overwintering grounds in Mexico and the invasion process of Multicoloured Asian ladybeetle to the US Midwest. We show how our model was not only able to consistently detect regime shifts of various characteristics in simulated data, but also shifts corresponding to human land use change in both the monarch and ladybeetle case studies.

In this manuscript, we include our modelling methods prior to our results and discussion, as the development of the methods themselves are a core element of the paper. My co-author, Elise Zipkin, and I participated fully in this study and accept responsibility for this work. The co-author has approved the submitted version of this manuscript and all persons entitled to authorship have been included. None of the material contained in this manuscript is under consideration for publication elsewhere.

Thank you for your consideration. I look forward to hearing from you.

Yours sincerely,

  
Christie Bahlai Ph.D., Assistant Professor  
Department of Biological Sciences, Kent State University  
[cbahlai@kent.edu](mailto:cbahlai@kent.edu) | <https://bahlailab.org/>