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A temperature driven matrix model for Culex mosquitoes population

There have been a lot of models for single species population, including for mosquitoes. Usually, the available models ignore the effect of daily weather conditions on the reproduction and hatching process of the mosquitoes. In this talk, I will first introduce the mosquito surveillance program and data from five health regions of Greater Toronto Area, then present our modeling studies of mosquitoes abundance. To facilitate the modeling of the impact of temperature on different stages of Culex mosquitoes, we define the mosquito annual calendar by separating each year as summer season and mosquito winter. The two periods are determined by the weather conditions of the year. We then build a matrix population model to track the impact of temperature on different stages of the mosquitoes development in each period, in particular, the daily average temperature and heat accumulation are incorporated to model the aquatic stages of culex mosquitoes. The average winter temperature and length are used to model the survival of overwintering adult mosquitoes. The trap counts of adult Culex from the weekly surveillance program in the regions are used to estimate some of the parameters, and the model simulation and calibration show that our model can catch the trend of mosquito abundance well. This is a joint work with Longbin Chen, Beate Sander, Steven Wang, Wendy Pons, Nicholas Ogden.