Exploring the Effect of the Nestling Recruitment Curve on Enzootic West Nile Virus Transmission

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BAMM! Abstract

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Enzootic transmission of West Nile virus (WNV) occurs primarily between mosquitoes and birds and is highly seasonal with spatial and temporal variation in yearly outbreaks. Newly hatched, or nestling, birds may be more exposed to vectors due to lack of feather coverage and defensive behaviors. An increased biting rate on these young hosts has been shown to result in earlier, more intense WNV outbreaks. The timing and synchronicity of avian nesting varies by species, along with location and climate, and some species of birds may lay multiple clutches in order to maximize their reproductive success. Here we explore how avian phenology may structure WNV transmission. We use an established single-season WNV transmission model with host stage-structure and stage-dependent biting rates to determine how properties of the avian nesting curve affect outbreaks. We consider both unimodal and bimodal nesting curves, modeled by a single Gaussian and the sum of two Gaussian distributions, respectively, and explore how the mean, standard deviation, and amplitude of each affects both peak and total infectious mosquitoes over the course of a transmission season. In addition, we seek to accompany the deterministic model with a stochastic model in order to gain additional insight into determining WNV risk.