

Environment Driven Individual Based Model for Brown Marmorated Stink Bug Population Dynamics

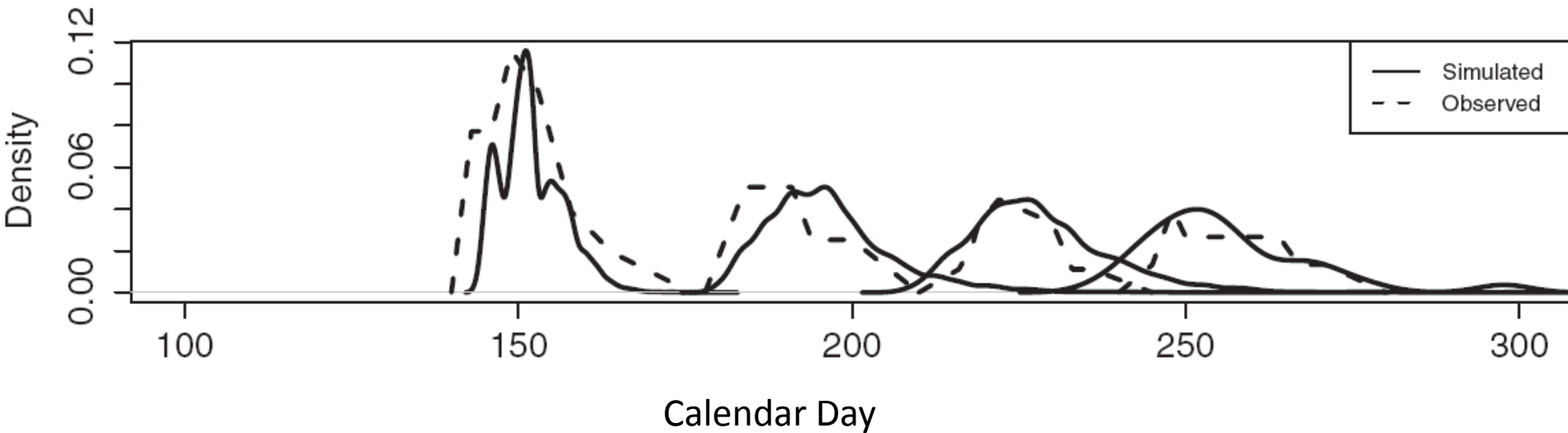
Nielsen *et al.*

2013

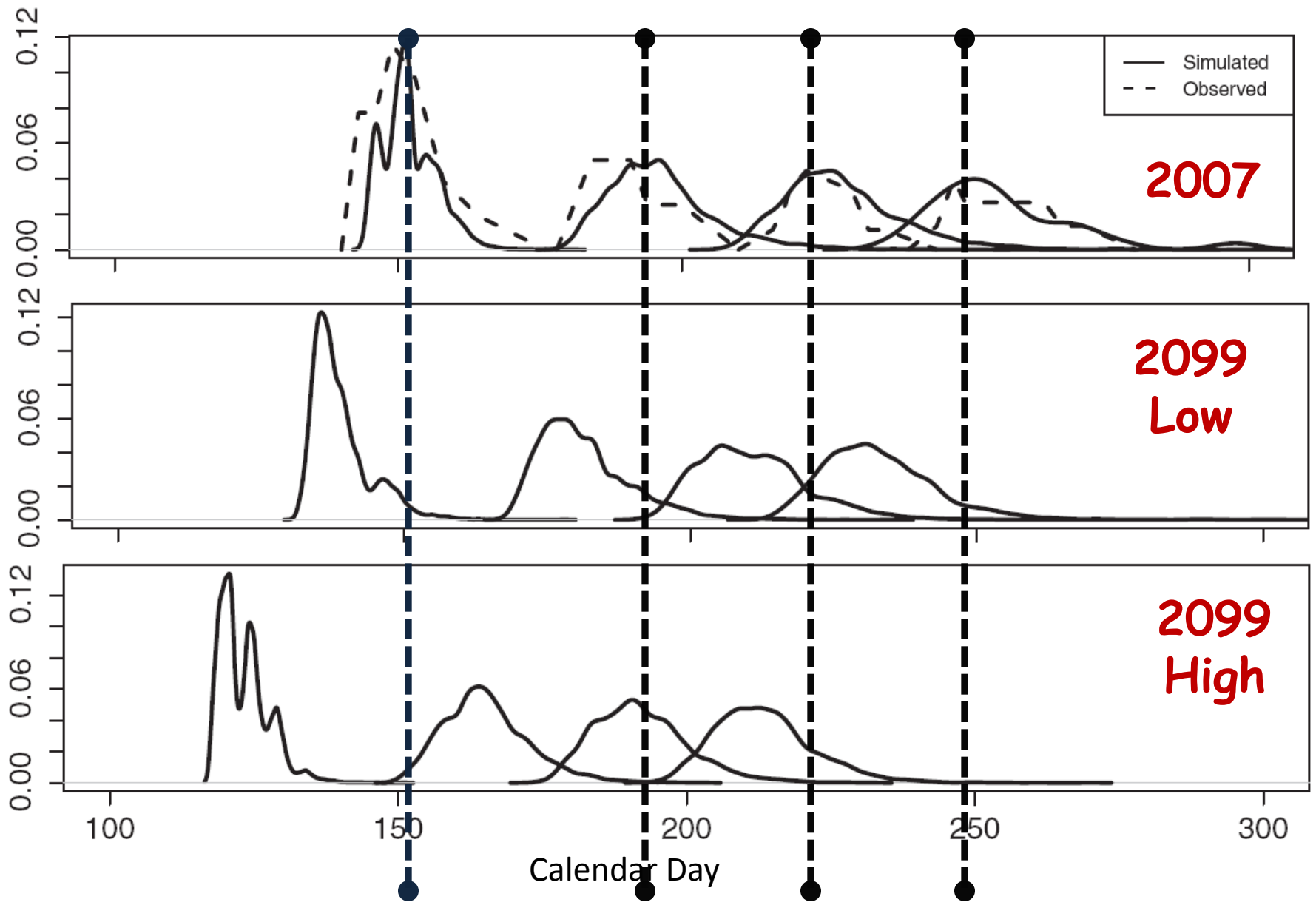
Individual Based Model

- Pros
 - Track each individual explicitly (deal with distributions)
 - Incorporate interactions between individuals
 - Easy to visualize
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- Cons
 - Need to have comprehensive knowledge
 - Computational burden

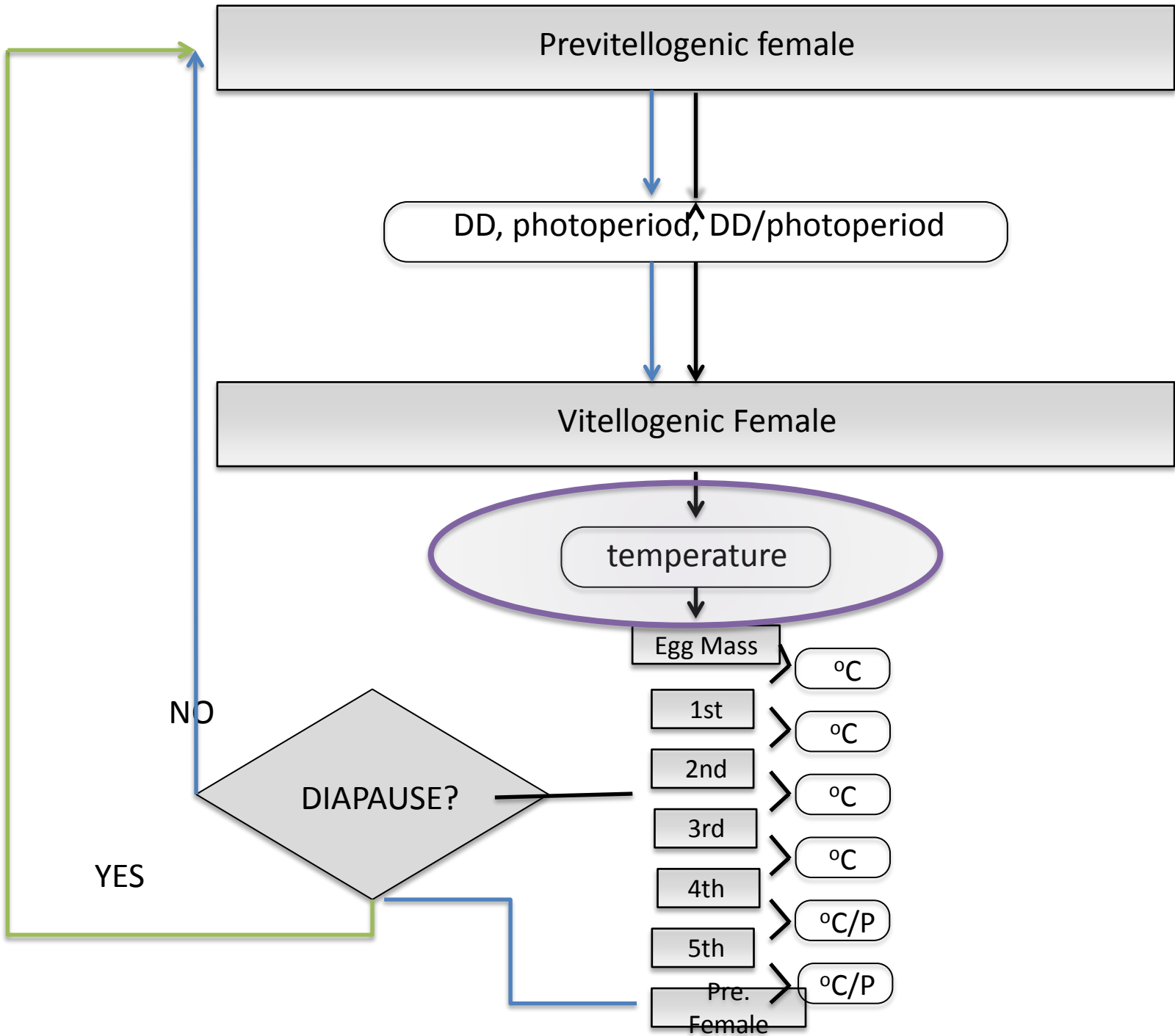
Validation with 2007 malaise trap data



S. Chen, P. C. Tobin, M. C. Saunders, and S. J. Fleischer. 2011. Projecting insect voltinism under high and low greenhouse gas emission conditions. *Environ. Entomol.* 40: 505-515



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External Environmental Variable

- Temperature
 - Diapause Termination
 - Development Rate (Stage-Specific)
 - Mortality Rate
 - Fecundity
- Photoperiod
 - Diapause Induction
 - Diapause Termination (*unverified*)

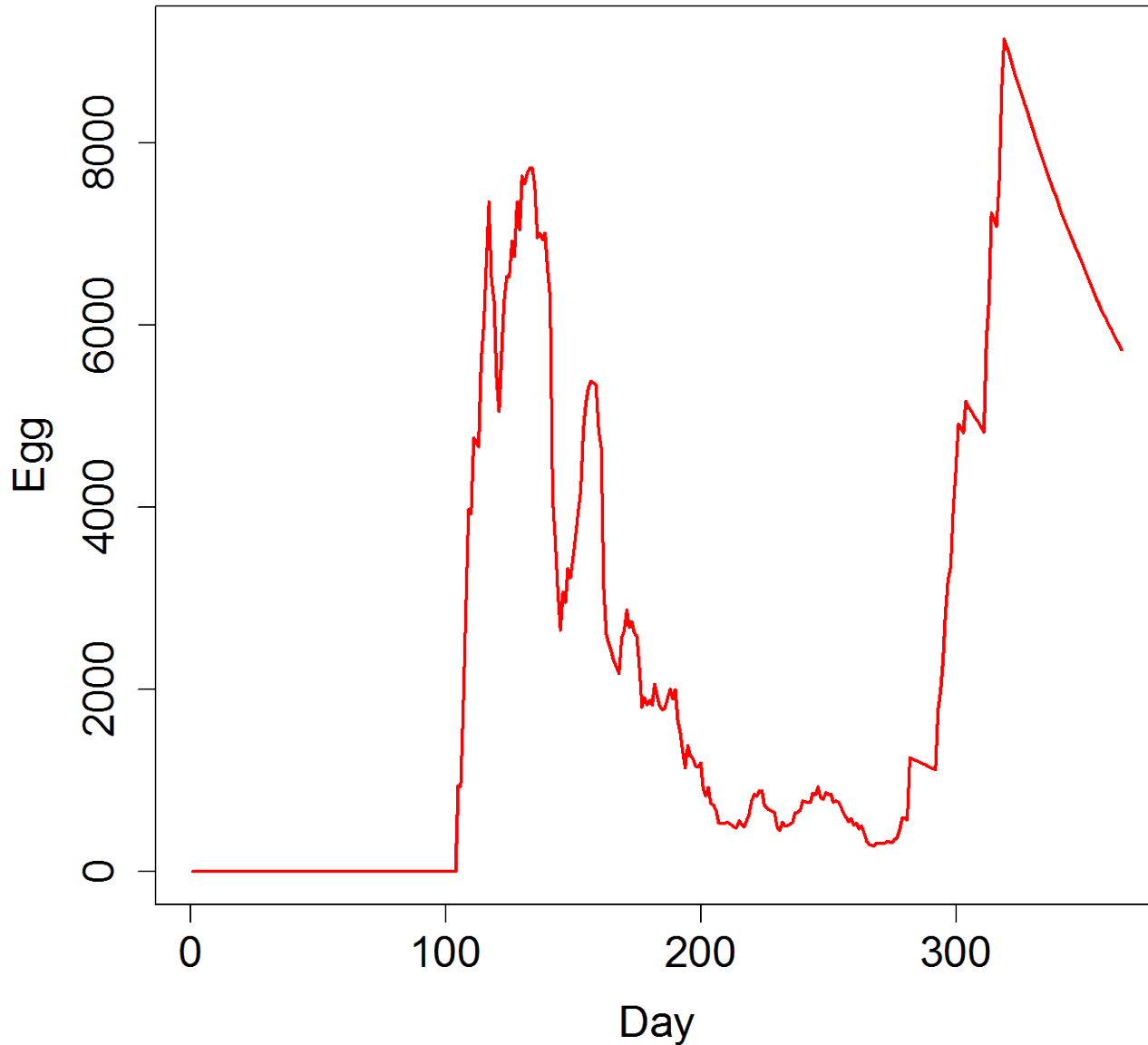
Key Processes

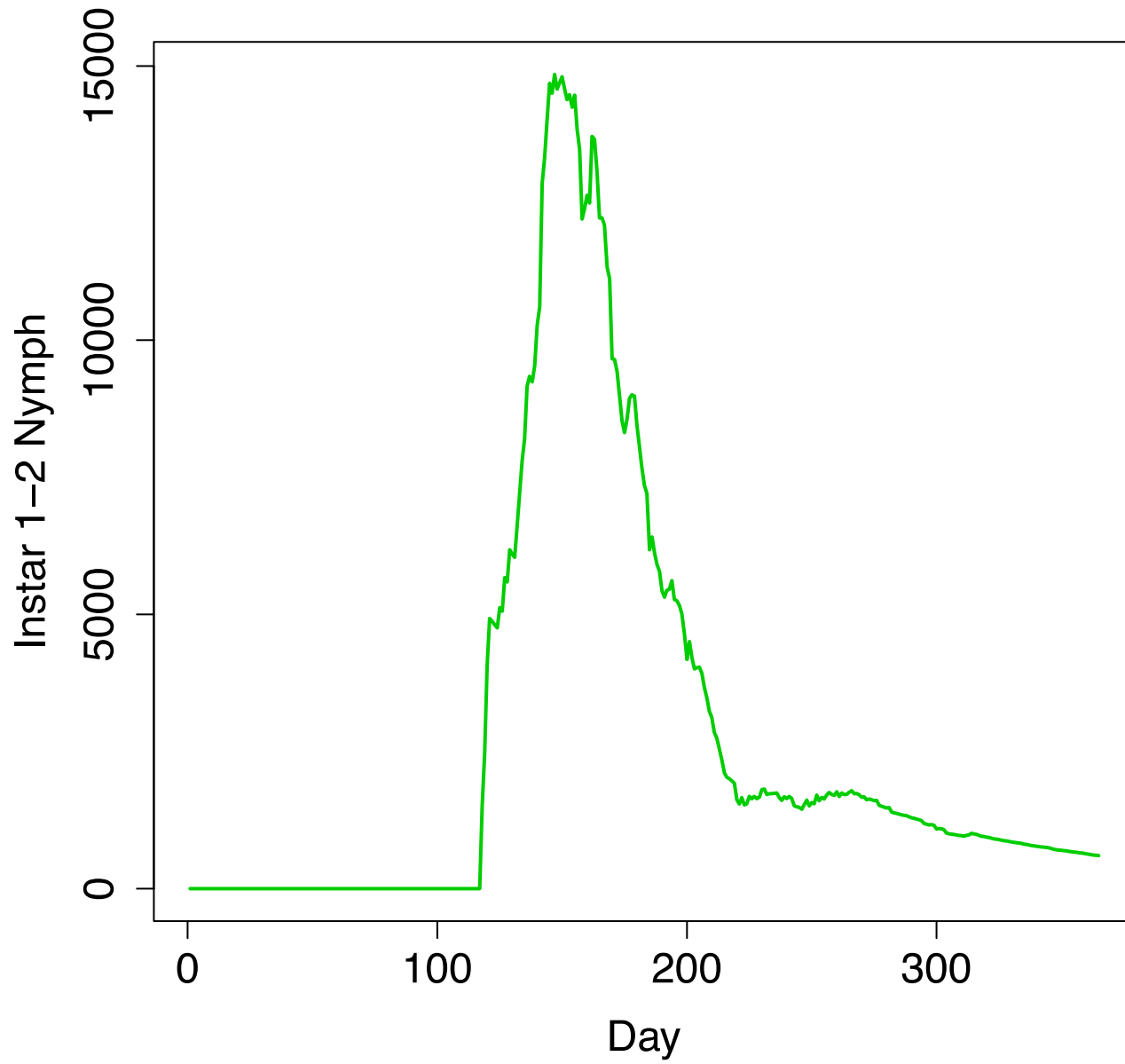
Process	Stage	Requirement	Source
Vitellogenic	Adult	Time	Yanagi 1980
Oviposition	Adult	Temperature	Nelson 2008
Development	Egg/Nymph/Adult	Temperature	Nelson 2008
Diapause			
Induction	Young Nymph	Photoperiod	Yanagi 1980
Mortality	Egg/Nymph/Adult	Temperature	Nelson 2008

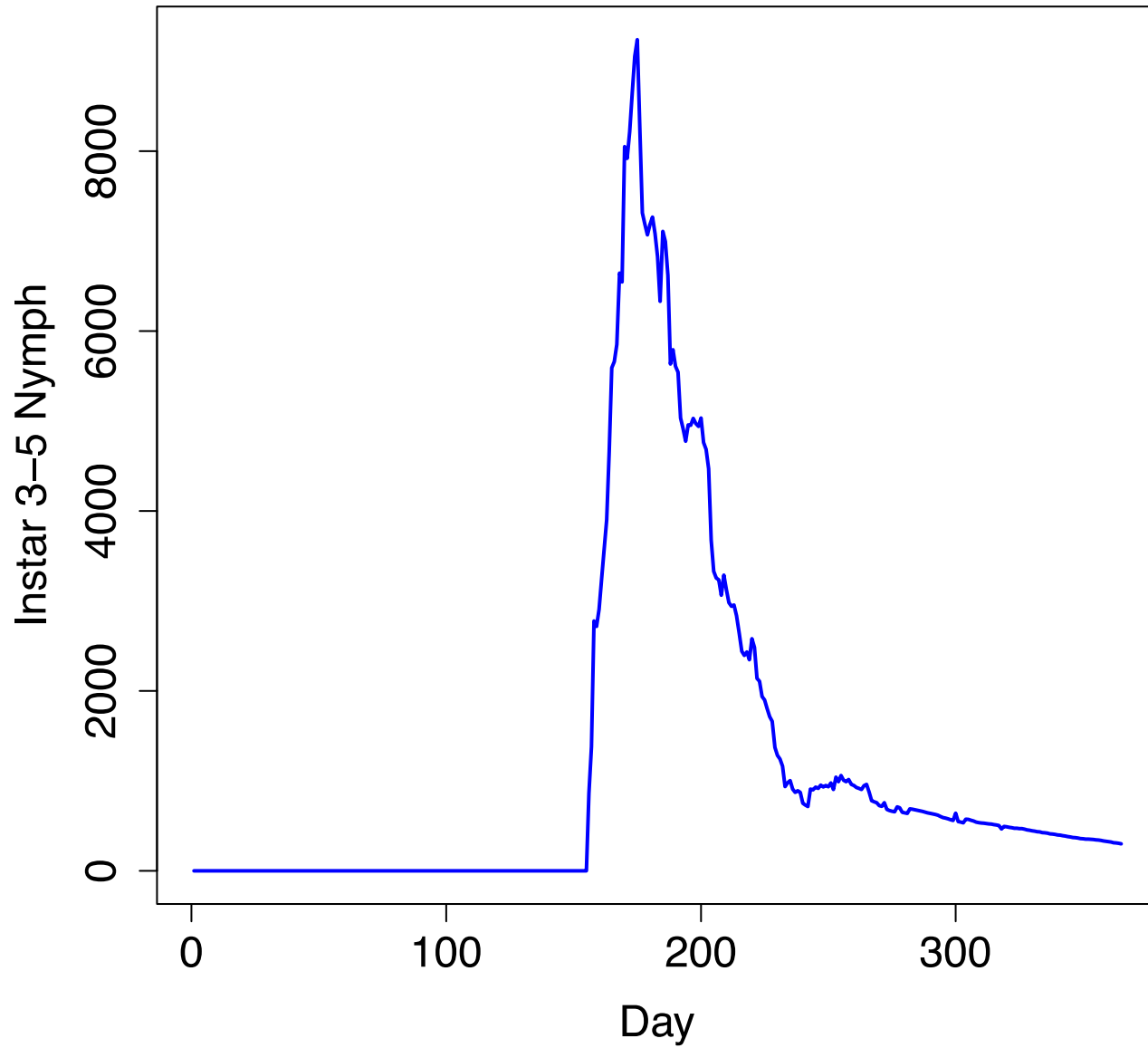
The Model

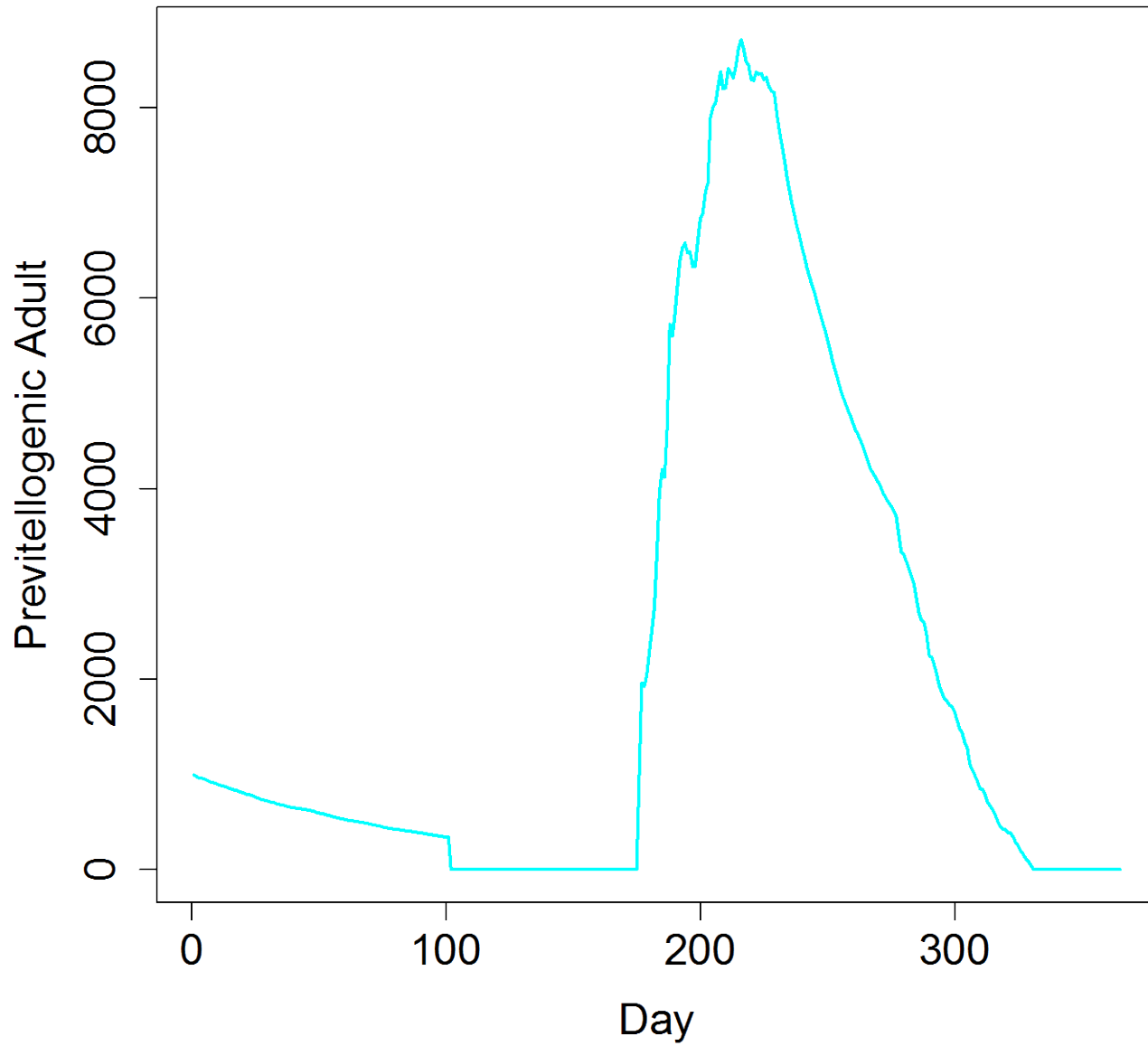
- **Initialization**
- 1000 Overwintering (Previtellogenic) Adult
- **Simulation** (in 1-day time step)
- Degree-day accumulation in each day for each adult
- Determine life history transit, birth/death, etc.
- **Output**
- Individual adult life history trajectory

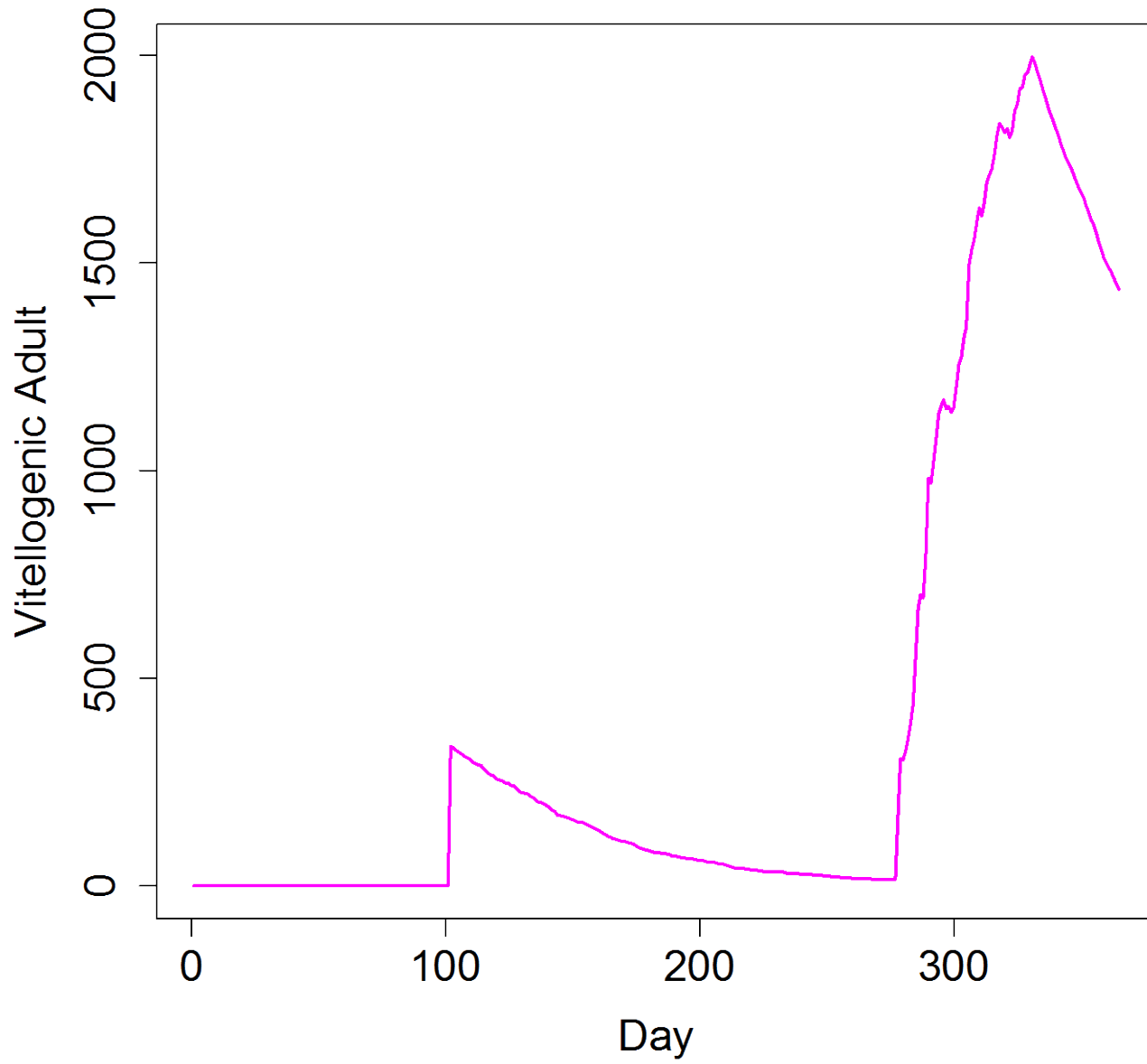
Initial Results

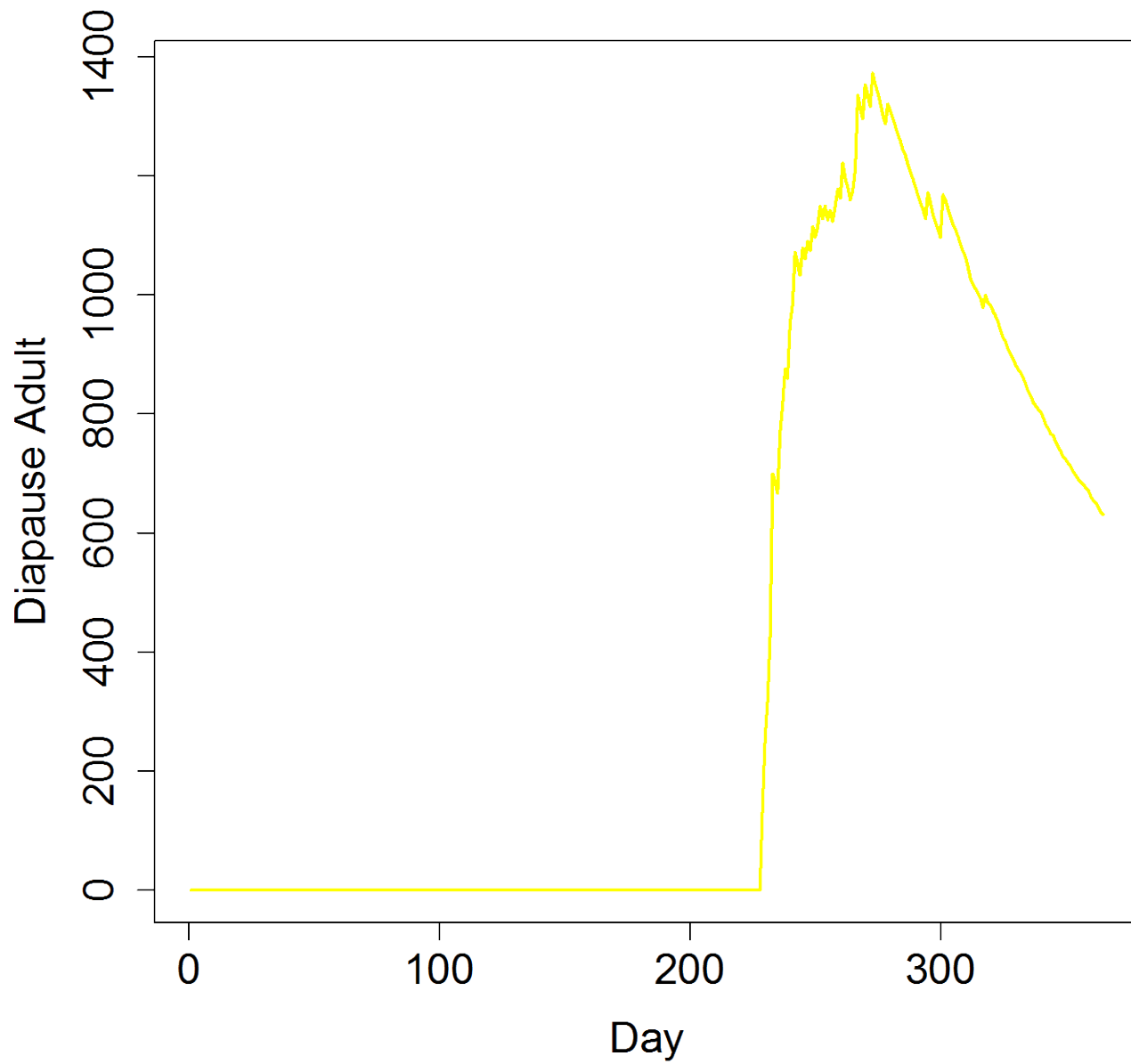


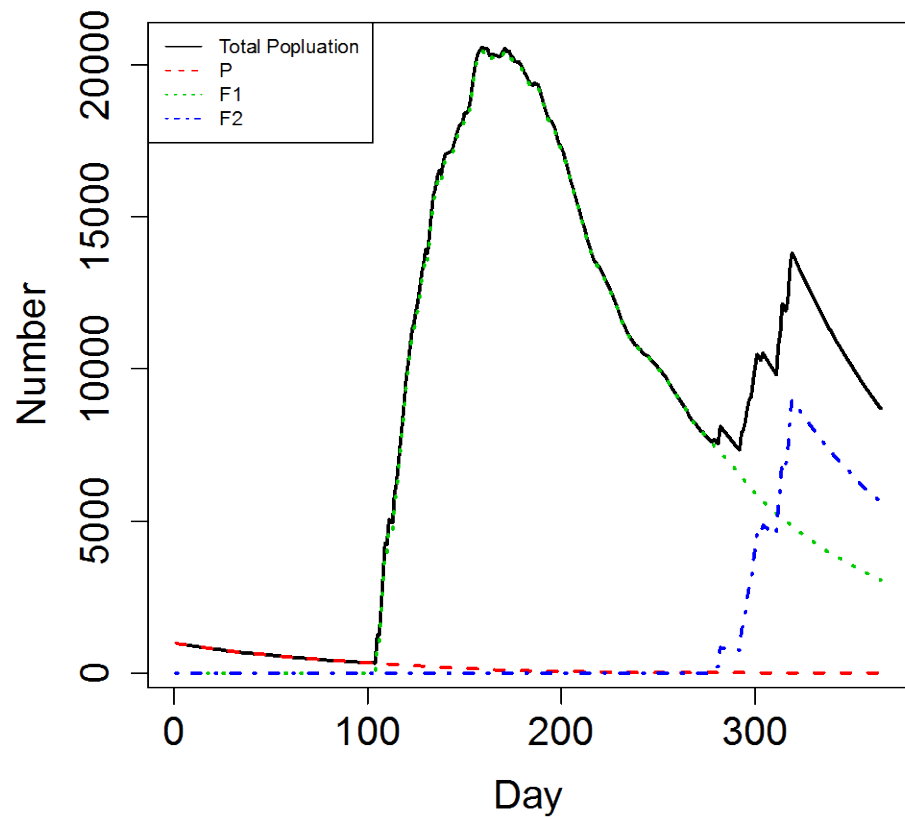
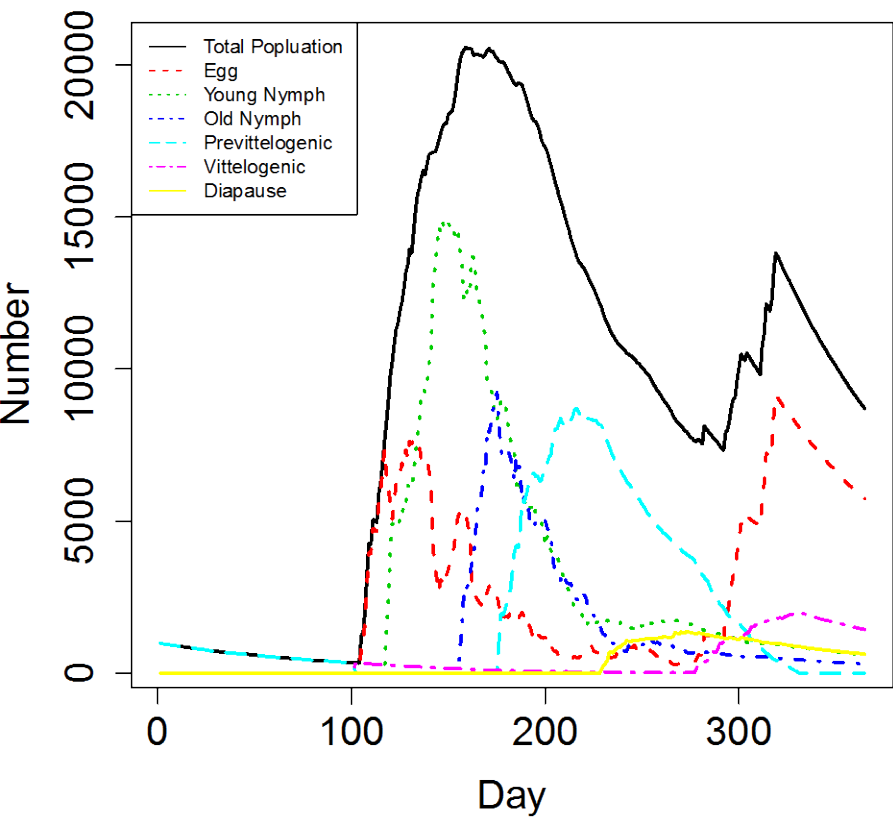












Open Questions

- Model Validation
- Life History Part
- Population Dynamics Part