NORTHERN ILLINIOS UNIVERSITY

DEMOGRAPHIC ANALYSIS AND INTEGRAL PROJECTION MODELING OF THE EASTERN MASSASAUGA (*SISTRURUS CATENATUS CATENATUS*)

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ABSTRACT

The Eastern Massasauga (*Sistrurus catenatus catenatus*) is a rattlesnake species with highly fragmented populations. Few populations are large and many are thought to be in decline. Because of these issues, there is demand for demographic data and analyses for this species. In this study, I used data from multiple populations across the Eastern Massasauga's range to estimate demographic parameters such as survival, temporal process variance of survival, population abundance, and population growth rate. I then used the integral projection model (IPM) technique to construct baseline population models for a northeastern, late maturing population (Georgian Bay) and a southwestern, early maturing population (Clinton County). Individual growth was slow in the late maturing population but individuals reached larger sizes than in the fast growing, early maturing population. Integral projection modeling is well suited for species with indeterminate growth because growth is modeled explicitly and vital rates (e.g., survival, fecundity) are modeled as functions of size. I also created adjusted survival and fecundity models to test the effects and importance of these vital and compared baseline IPMs to matrix projection models.

Mean annual adult survival was 0.67 (range = 0.35 – 0.95) for 499 telemetered snakes from 16 distinct locations throughout the range of the Eastern Massasauga. Annual adult survival

increased along a southwest to northeast geographic axis of its range. No consistent difference in survival due to sex was found. Annual adult survival, estimated from a long-term dataset of the Georgian Bay population, was 0.65 and its process variance was 0.038. The Georgian Bay population size ranged from 35 – 168 (mean = 64) and realized population growth rate was equal to 1.00. Projections of the baseline IPM for the two populations differed in stable size distributions, reproductive values, and elasticities. Adding stochasticity resulted in only small differences in probability of extinction between populations. Adjusting the survival function had a significant impact on model results but adjusting the fecundity function had much less impact. Demographic parameter estimates and population models created in this study provided valuable information that aids both further Eastern Massasauga research (e.g. population viability analyses) and conservation efforts.