

Proposal

Title - Population Stability and Conservation of the Timber Rattlesnake (*Crotalus horridus*)

Program of Study – Zoology, B.S. & Mathematics, B.S.

Presentation Type – **Choose one of the following:** Print Poster

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Category – **Choose one of the following:** Experimental (Theoretical),

Abstract:

Population size and survival rates were estimated using the Jolly-Seber (J-S) method and mark-recapture data on adult female timber rattlesnakes (*Crotalus horridus*), collected over a period of eleven years. Change in population size was then modeled using the Leslie matrix, which required obtaining survival rates and fecundity values for each age class, and an initial population vector. Four age classes were chosen for the matrix: neonates, 1 year olds, 2-4 year olds, and breeding adults 5 years and older. An additional column and row were built into the matrix to allow simulation of losses from any age category. Survival estimates were obtained from the literature for age classes for which we did not have data. We used the most recent J-S population estimates from our data and doubled them to represent the total population of male & female snakes; this was used along with survival estimates for each age class to determine a starting vector for the age distribution. Fecundity values for both sites were estimated to be 0.875 young per adult, due to the fact that only one-fourth of the females in a population have young in any given year. Females have an average of seven offspring; all together, this gives a value of $\frac{7}{8}$ (0.875) applicable to most timber rattlesnake populations. The average population and survival estimates for adult snakes in the Wintergreen and Onion Mountain populations, were

respectively found to be ($\bar{x}_{\text{pop}} = 30$), ($\bar{x}_{\text{surv}} = 0.76$) and ($\bar{x}_{\text{pop}} = 9$), ($\bar{x}_{\text{surv}} = 0.80$). Several what-if scenarios were run using the Leslie matrix to determine population projections, as well as the impact of losing various age classes on the population. The Onion Mountain population appears capable of sustaining losses of no more than two adults per year before a decline is observed, while the Wintergreen Mountain population can barely sustain the loss of an adult every two years. This is likely due to the lower survival rate for adults in that population. We also determined that the adult age class is the most valuable to the population with regard to stability and long-term health. This is because the timber rattlesnake is a K-selected species and takes time to become reproductive, but then reproduces over multiple years. Further work that would improve our ability to model these populations includes obtaining a more accurate neonate survival rate. While this would be an intensive and difficult field project, the results would improve estimates of future population size.

Christian worldview integration:

Because I am a creationist, I believe that God created this earth and everything in it. As a Christian, I believe it is our responsibility to care for, steward, and exhibit dominion over the world; to use its resources wisely to enhance our lives, and to care for its creatures, whether they are kindly regarded or not. Timber rattlesnakes don't have a great reputation, and are not particularly well-liked. However, they are generally not a threat to humans, unless acting in self-defense, and they usually live out their lives quite peacefully in the mountains, far from humans. Because of these issues, their conservation ought to be a priority, particularly because they are often hunted for sport and loss of adults can quickly destroy an entire population, as demonstrated above. If we can understand where these populations are vulnerable, then we can create better conservation plans and keep this species from accidental extinction. As I share these

results, I hope to convert those who dislike snakes into people who will at least tolerate them, and perhaps even enjoy them, and help destroy some of the false rumors regarding rattlesnakes. This research is relevant within our culture, because conservation of species is considered a very important topic within organismal biology today, although the reasons secular scientists wish to conserve species are different from my own. Learning to communicate results with conservation implications is an important and marketable skill within biological and environmental fields, and will help improve my credibility as a creation scientist.