Assessment of Queensnakes and Northern Watersnakes Living in a Trashy Creek

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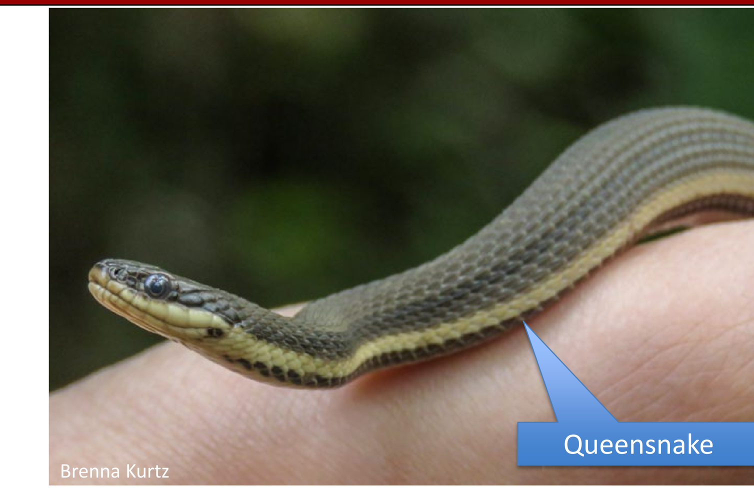


Abstract

In an increasingly populated world, habitat fragmentation is common which in turn often creates conditions which keep animal populations small. When these habitat fragments are in urban environments, they are often additionally impacted by pollution and other disturbances which make these small populations particularly vulnerable to extirpation. Yet populations of some species like *Regina septemvittata* (Queensnake, QS) and *Nerodia sipedon sipedon* (Northern watersnake, NWS), may persist is such environments and they are the focus of this research. We hypothesis that if the snake populations are viable then the population size and survival rates should remain stable over the years of the study and other estimates, like growth rates, should be comparable to those from the literature. Along an urban stream, a capture-mark-recapture study was done on QS and NWS. Passive Integrated Transponder (PIT) tags were used to mark snakes and the site was checked multiple times per year from 2019 to 2022 to obtain recaptures and basic measurements used to estimate population size and survival rates, growth rates and size class distribution. QS population estimates increased from 24 to 47 for the years 2019 to 2022 with an annual survival rate of 42%. Only a survival rate could be estimated for the NWS (25%) due to few recaptures between years. QS females grew faster than males and growth rates declined with age. This research gives a glimpse into these snakes' populations where at least QS seem to be thriving despite living in a trashy stream.

Introduction

Wildlife is always thought to exist in places that are rural or in protected areas where natural habitat exists. However, have you ever gone down the street in a developed area and seen something that you thought could only live in a forested area? This prompts the realization that there are pockets of wildlife in all kinds of locations, including urban areas. Sometimes, after observing an area, one can be surprised by the large diversity of wildlife that can be found there. Mammals, reptiles, amphibians, and birds may all exist in even highly polluted or human impacted areas. For reptiles, such as snakes, these areas are particularly hard to live in because of the negative connotation surrounding this group. Yet even a trashy creek near a four-lane road and department store parking lots in Lynchburg Virginia can house a thriving population of Queensnakes, QS, *Regina septemvittata* along with Northern watersnakes, NWS, *Nerodia sipedon sipedon* (Beiler et al. 2021).

We hypothesis that if the populations of these snakes are viable then their population sizes and survival rates should remain stable over the years of the study and other estimates, like growth rates, should be comparable to those from the literature. To assess this hypothesis, we did a capture-mark-recapture study.

Methods & Materials

In a 593 m section of an urban stream in Lynchburg VA landscape tarps were established in strategic areas along the streamside to facilitate capture of snakes during the active season: April through October. Snakes collected were caught, measured (snout-vent length, SVL), scanned for PIT tag, sexed, data recorded, and released. New snakes were PIT tagged unless they were too small, and these later snakes had sharpie marks drawn on them.

SVL data were plotted using histograms, recaptures were used to determine survival rates and population size using Program Mark and Jolly, respectively, as well as growth rates (cm/day). QS growth rates were then compared between males and females as well as SVL.

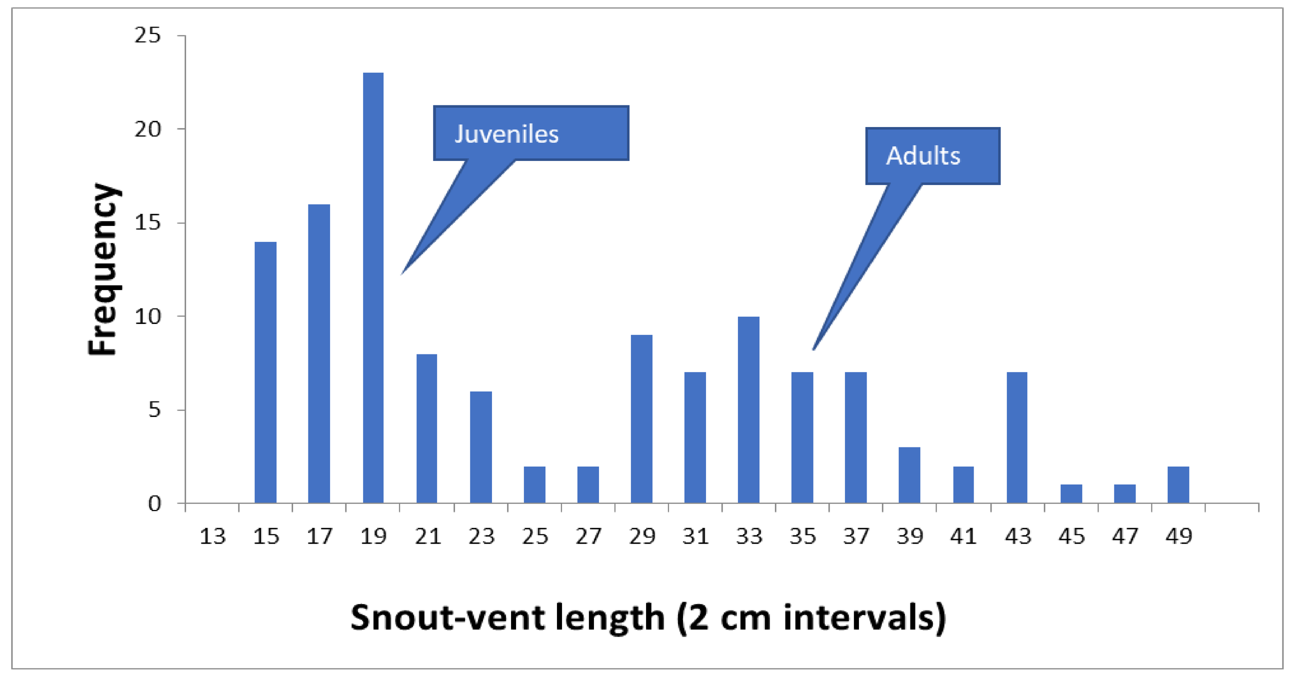


Figure 1. Histogram of Queensnake snout-vent length data showing both adults and juveniles were found.

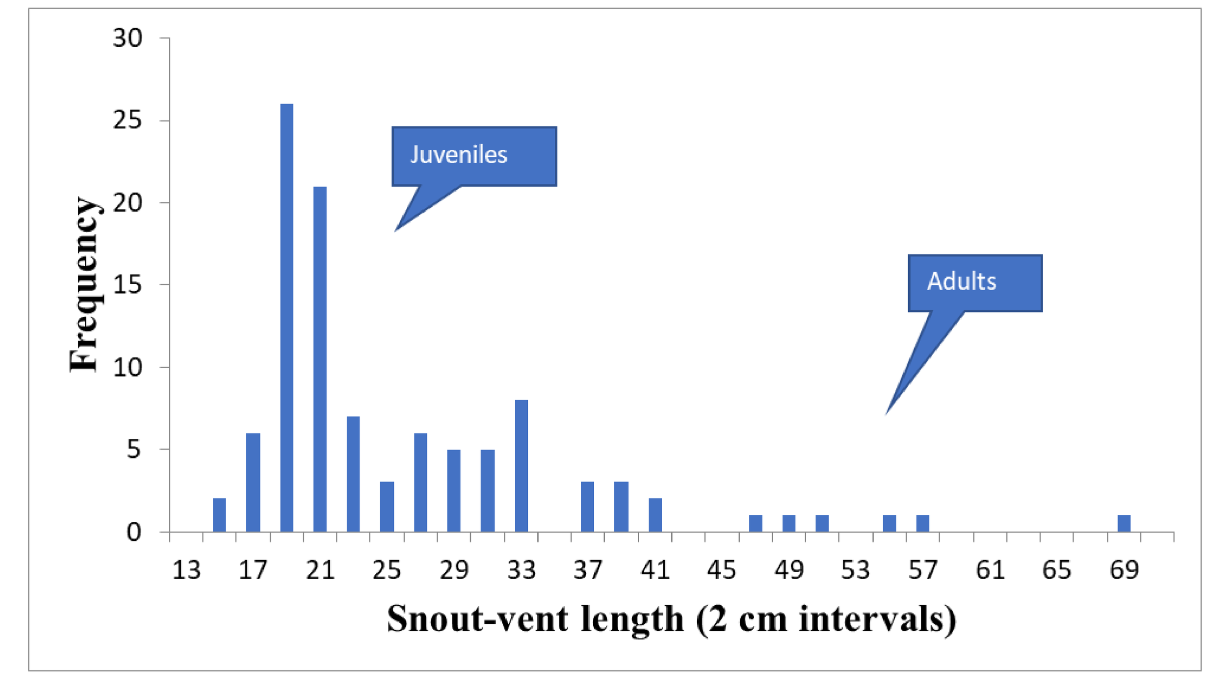


Figure 2. Histogram of Northern Watersnake snout-vent length data showing juveniles being primarily found.

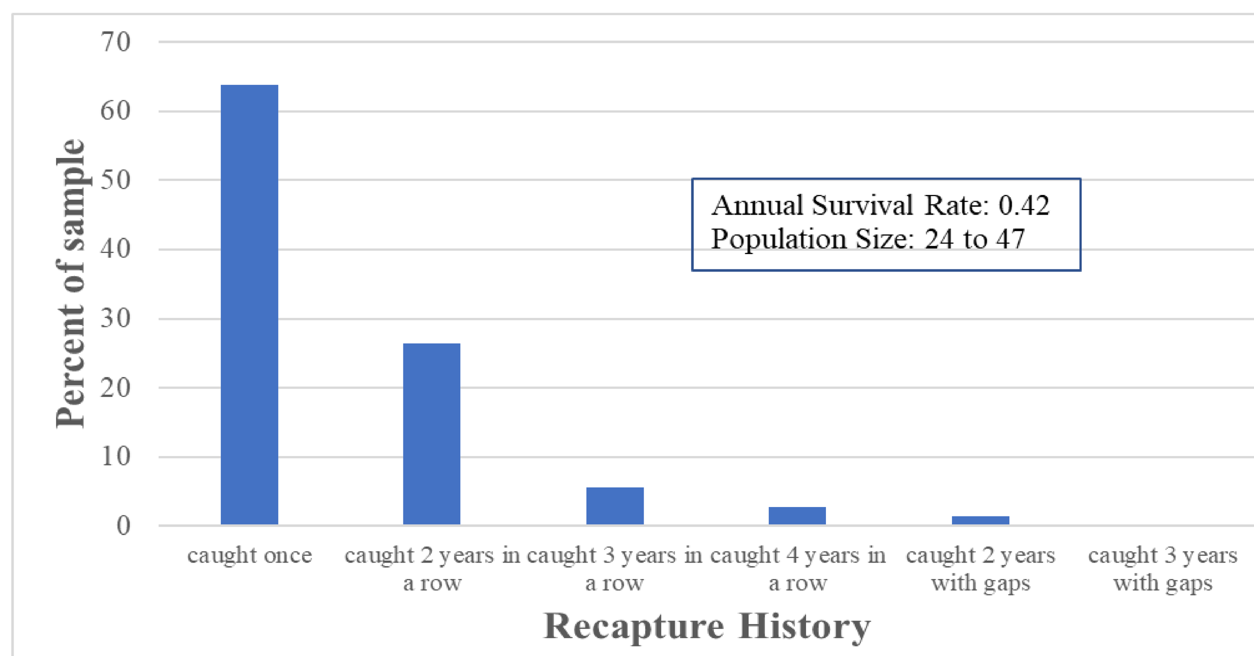


Figure 3. Summary of capture histories for Queensnakes along with population size and annual survival rate.

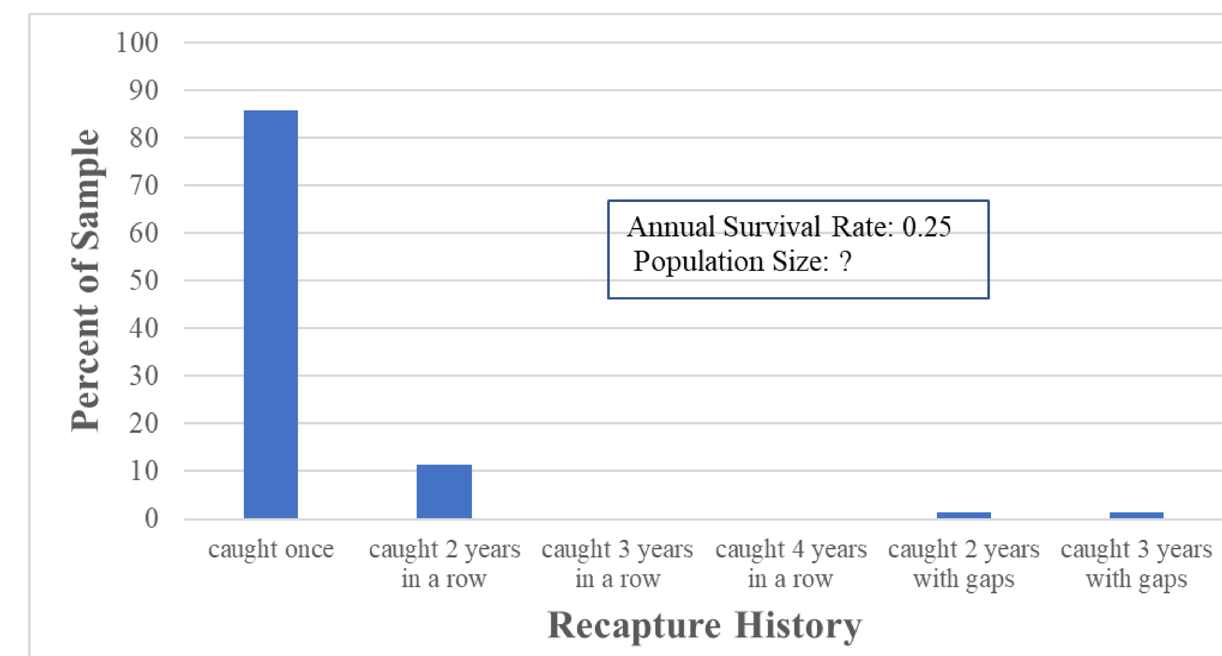


Figure 4. Summary of capture histories of Northern Watersnakes along with annual survival rate.

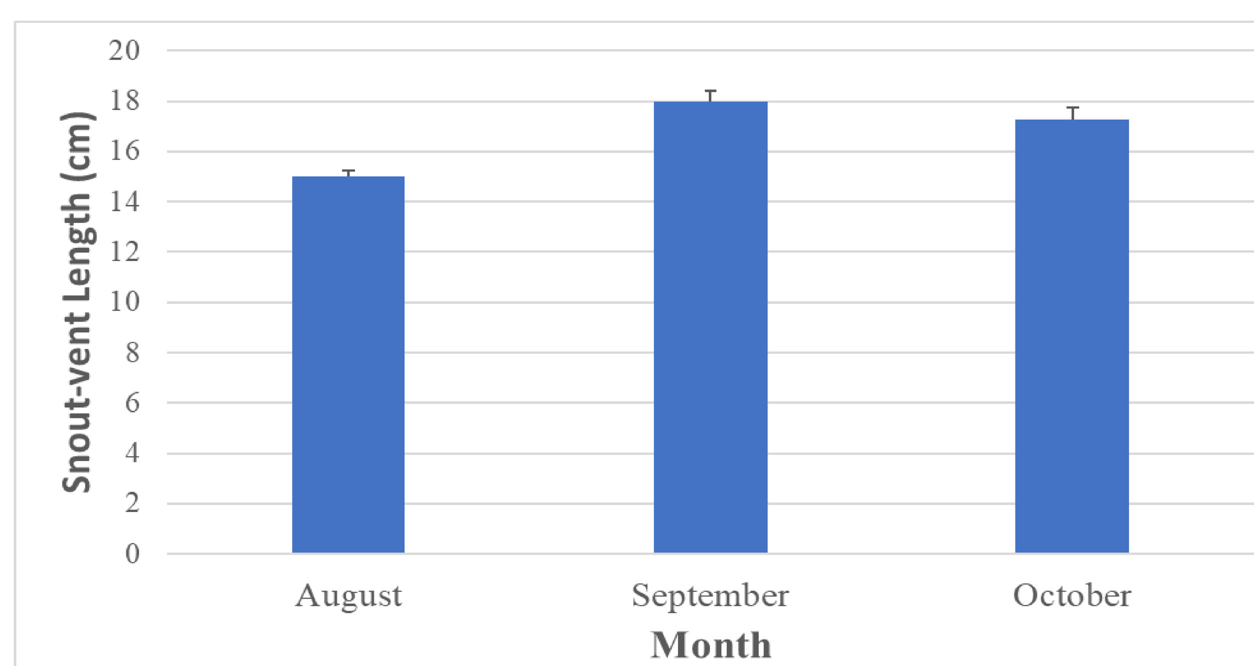


Figure 5. Mean neonate Queensnake snout-vent lengths, month by month, prior to first brumation.

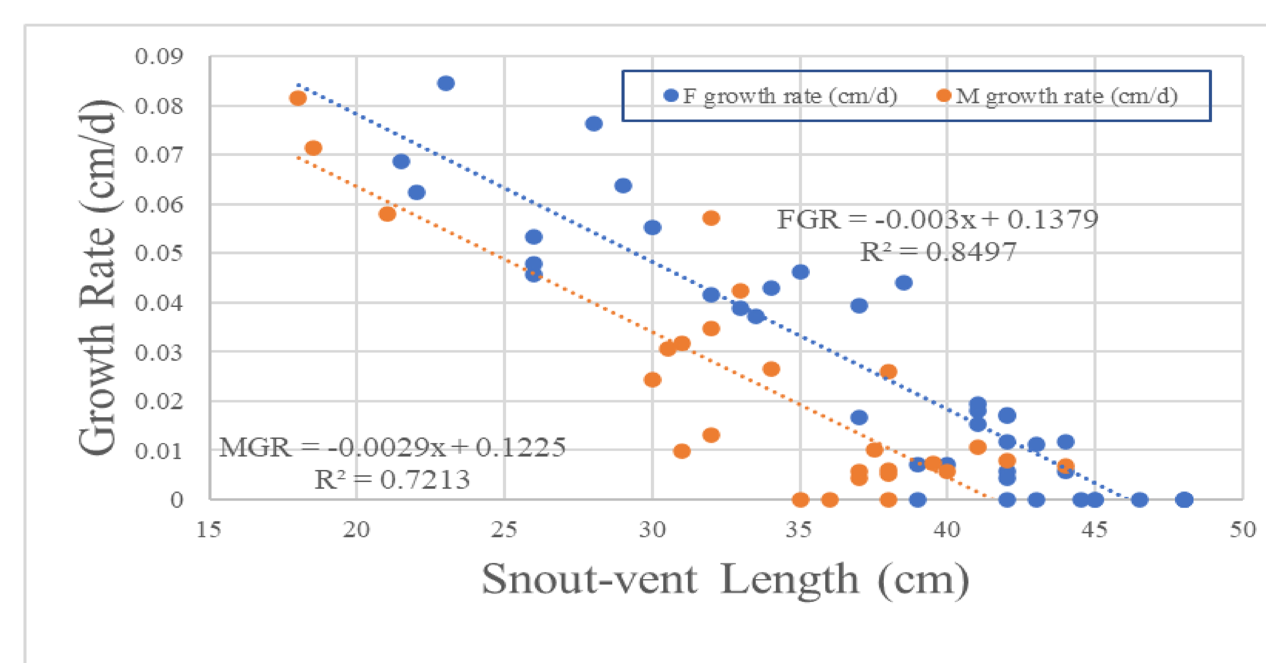


Figure 6. Growth rates (cm/day) of recaptured male (MGR) and female (FGR) Queensnakes regressed against snout-vent length (x).

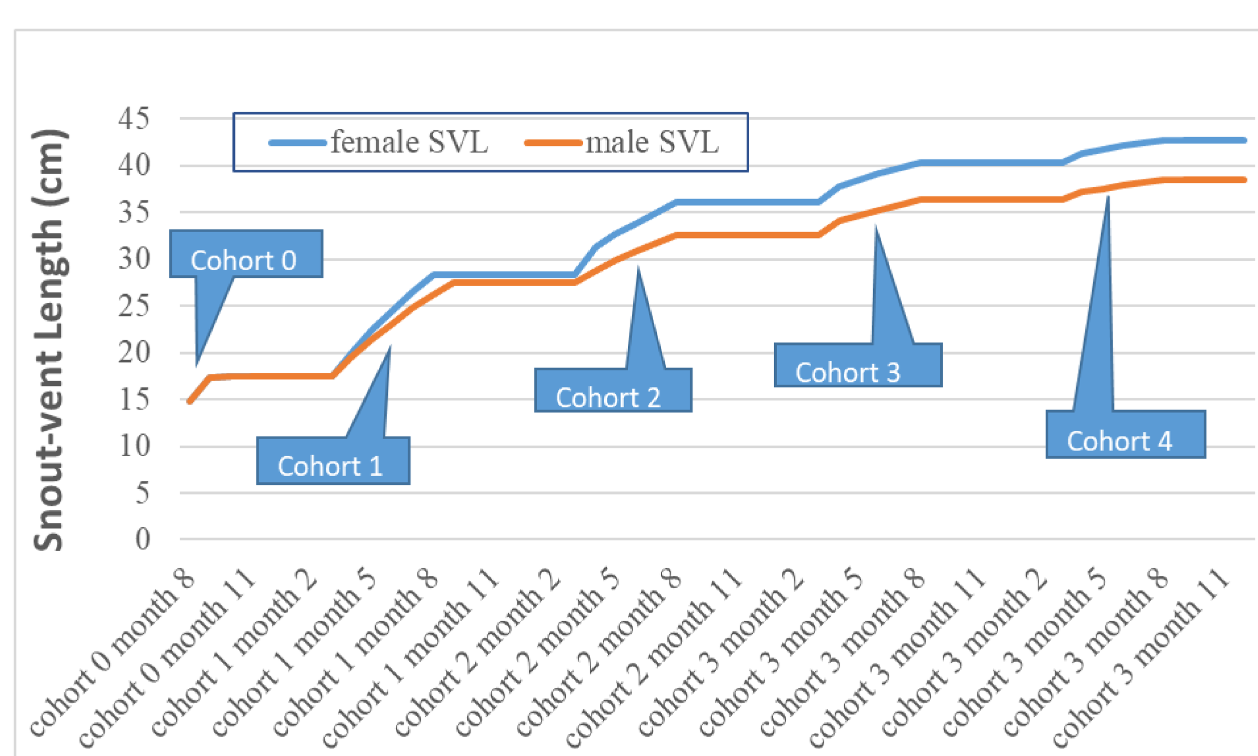
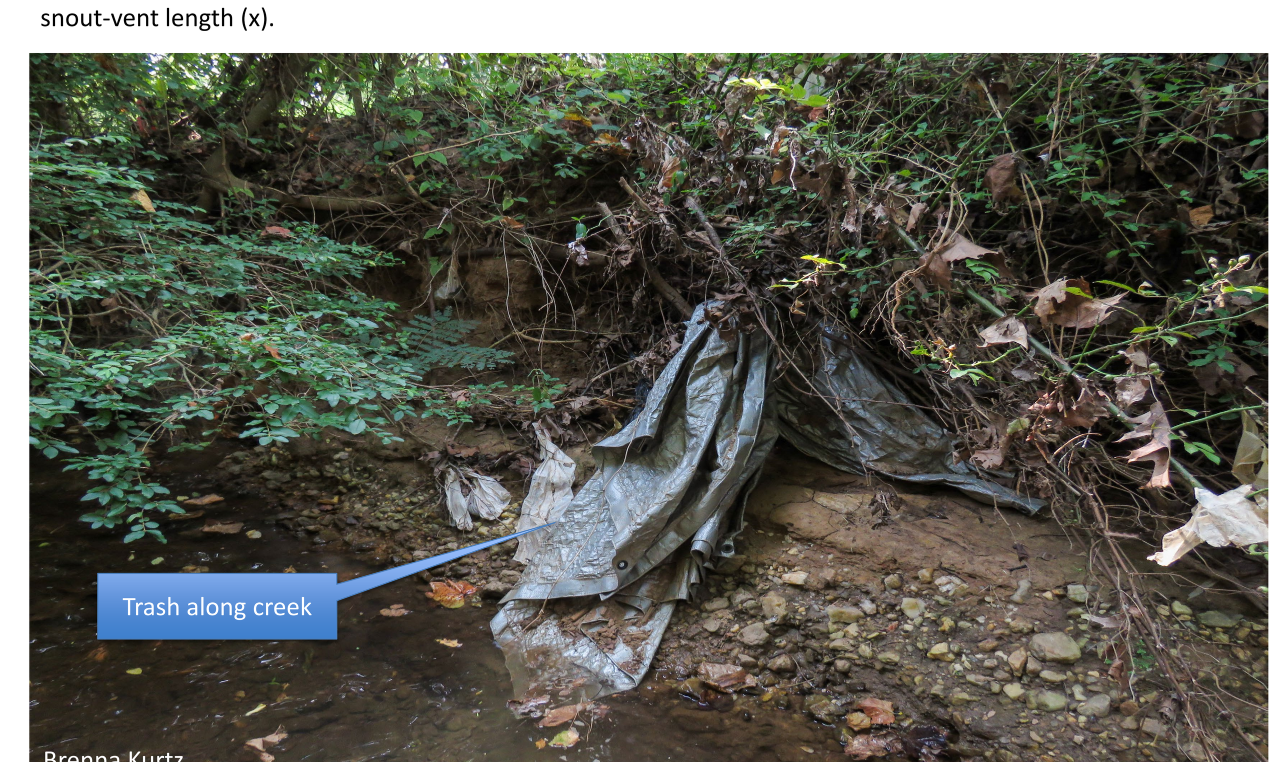


Figure 7. Modeling growth rates of male and female Queensnakes over time.



Results and Conclusions

- We were able to find QS of all sizes using our tarp structures as snakes ranging from neonates to adults used those structures as retreats or for thermoregulation (Fig. 1). In contrast, primarily young NWS used our tarp structures and therefore our data on the NWS are primarily for neonate and juvenile NWS (Fig. 2).
- The contrast in the size classes between QS and NWS is evident in the recapture histories and survival rates. Young snakes are more vulnerable to predation and therefore fewer NWS were recaptured as compared to QS (Figs. 3 and 4). This is reflected in the lower annual survival rates for NWS (0.25) as compared to QS (0.42).
- The size of neonate QS was found to increase significantly from 15 cm SVL (August) to 18 cm SVL (September) (t= 8.27, df=69, P=6.54E-12). Then from September to October there was little change, 17.96 to 17.25 cm SVL, showing that there was, essentially, no growth before brumation (t=0.253, df=79, P=0.8), which typically starts in late October (Figure 5).
- Male QS have lower growth rates than female QS and both sexes' growth rates declined with increase in SVL (Figure 6).
- QS grew about 20% from birth until first brumation. In Cohort 1 female QS grew faster than male QS and became larger adults as compared to males (Figure 7). While the larger size and faster growth rates for female QS support what is see in other studies (Beiler et al. 2021) the maximum size of male and females QS, as predicted by our growth model, did not match that seen with our field data. The maximum size for female and male QS found at our site was 51 and 46 cm SVL (Beiler et al. 2021) while our growth model predicted 43 and 39 cm SVL for female and male QS, respectively.
- QS growth rates from a study in Kentucky showed that neonates increased by 75% in their first year while yearling to second year snakes grew by 45% (Branson & Baker 1974). Our data showed growth rates for QS neonates during their first full year ranged from 73% to 87% and for yearling to second year snakes, 27% to 28%, for male and female QS, respectively.
- Population densities for QS ranged from 0.006 to 0.26 snakes/m (Branson & Baker 1974, Leuenberger et al. 2019). Our densities ranged from 0.046 to 0.090 snakes/m with a mean of 0.067 snakes/m.
- QS population estimates increased from 24 to 47 over the years of the study indicating population size being at least stable. Annual survival rate remained stable at 0.42 which is based upon Program Mark modeling where the model with the greatest support was one which had a constant survival rate over the years of the study.
- We hypothesized that if the snake populations were viable then a) population size and survival rates should remain stable over the years of the study [supported by our QS population size increases and stable survival rates] and b) other estimates, like growth rates, should be comparable to those from the literature [supported by our QS growth rate data and population densities being comparable to those in the literature].
- Similar support for stable NWS populations was not possible due to the lack of recapture data to estimate growth rates and population size.
- Overall, both species of snakes have, at the least, persisted over time despite being in a less-than-pristine urban environment.

Future Work

1. Assess snake fungal disease (caused by *Ophidiomyces ophiodiicola*), which may have been recently found on older Queensnakes at our study site.
2. Continue sharpie mark research to record growth and survival rates from birth until first brumation.
3. Extend the research site to include new tarps where Queensnakes and Watersnakes have been located beyond the original boundaries of the study site.
4. Calibrate growth model so that it matches our field data on QS maximum size.

References

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Branson, B.A., and E.C. Baker. 1974. An ecological study of the Queensnake, *Regina septemvittata* (Say), in Kentucky. Tulane Studies in Zoology and Botany 18:153–171.

Leuenberger, W., A.G. Davis, J.M. McKenzie, A.N. Drayer, and S.J. Price. 2019. Evaluating snake density using Passive Integrated Transponder (PIT) telemetry and spatial capture-recapture analyses for linear habitats. Journal of Herpetology 53:272–281.