

Variation in Diet Composition of North American Bullfrog between Evening and Morning Capture

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Introduction

American Bullfrogs (*Lithobates catesbeianus*, formerly *Rana catesbeiana*) are considered an invasive species in 11 of the Western United States. They are originally from Eastern United States and because of this are considered a native transplant in New Mexico. However, Bullfrogs have been so successful they can now be found throughout the world. As any invasive, they can have a large ecological impact on the ecosystems they inhabit. Bullfrogs have been implicated in the decline of native amphibians and reptiles (Preston & Johnson 2012). This is a particular concern in Northern New Mexico because they may be impacting the leopard frog (*Lithobates pipiens*) populations.

A long term study is currently underway examining the potential impacts Bullfrogs are having called "Synergistic effects of climate change and invasive species on native fauna in a highland aquatic ecosystem." This study is evaluating the effects bullfrogs have on native vertebrates and macroinvertebrates. One aspect of this study includes the eradication Bullfrogs from the experimental site in order to compare population densities of the native amphibians between the control and experimental regions.

The captured bullfrogs from the experimental site are euthanized and the contents of their stomachs evaluated in order to get a comprehensive representation of their diet to gauge the possible affects they are having on the declining native populations. However, since most captures are early in the evenings and the frogs are nocturnal, we hypothesize that soft items, which digest quickly, are underrepresented in the diet of frogs captured early at night compared to those captured later at night (close to dawn).

In order to evaluate diet composition, post metamorphic Bullfrogs were captured at two different times. One sampling time was shortly after sunset until close to night (2100-2300 hrs) and the other one was at the end of the night, right before dawn (0300-0500 hrs). The Bullfrogs were euthanized upon capture in order to: prevent further digestion of prey items, and minimize stress. Prey items were annotated to determine what organisms were being consumed and what percent of total diet they accounted for.

Methods

Bullfrogs were caught from Millers Pond and a stretch of the Mora River, located at Wind River Ranch, Mora county NM(N 35.838 W 105.060). In order to compare the day and evening diets of Bullfrogs, specimens were collected between 2100-2300 hrs, and 0300-0500 hrs. This allowed for the largest possible time gap between day and evening diet. Methods of capture for Bullfrogs were by netting, hand capture, and trapping. For those animals that we could not catch by any other means a .22 caliber rifle was implemented.

Fifty Bullfrogs were caught between 2100-2300 hrs and thirty Bullfrogs were caught between 0300-0500 hrs. All Bullfrogs were collected from the experimental area of the river. The specimens will be euthanized as captured by net or hand in a 10% ethyl alcohol solution (AVMA 2007; HACC 2004).

The following measurements were taken and observations made for each individual frog post mortume:

- Snout – Vent length (cm)
- Left Hind Foot length (cm)
- Total Mass (g)
- Stomach Volume Full (mL)
- Stomach Mass Full (g)
- Stomach Volume Empty (mL)
- Stomach Mass Empty (g)
- List of identifiable contents annotated
- Identifiable contents weighed (g, when possible)
- Sex

Findings



Figure 1. Percent of volume each item represents on the diet of bullfrogs captured in the early night versus later at night. Notice the similarity in most prey items except for moths.

Results and Discussion

Diet of bullfrogs did not differ substantially from early night to late night (Figure 1). An important part of the diet turned out to be Crayfish (likely *Orconectes virilus*). Since this prey item digest so slowly due to keratin in their skeleton, not surprisingly their representation in both times of sampling is very similar.

There was a prey item that seems to be more abundant earlier in the evenings than before dawn. It is a species of moth that was very abundant during the time of the sampling. We did not expect moths to digest very quickly. We believe that the differential representation has more to do with different days in which the sampling took place. There were a few weeks in which that particular moth became extremely abundant, possibly during a migration event. It so happens that some of the days of the early night sampling coincided with that migration. By the time the before-dawn sampling took place, the moth migration was over. In conclusion we do not believe that the differences in moth abundance in early sampling are related to the time of the day the sampling was conducted. Furthermore, if that was the case we would expect to find items in the morning that are not present early at night, which is the opposite of what we found with the than the moth.

The only item that is present before dawn but not earlier at night, supporting the idea of quick digestion, is a mouse (likely a white footed mouse, *Peromyscus leucopus*). It was found in the pre-dawn sampling and not in the evening sampling. This mouse was only a single individual that was so massive compared to the other prey items that it seemed to be over represented in the graph. We do not believe that this item would have been digested completely by night, so we should have been able to find it. Our finding suggest that there is no substantial difference between the diet of bullfrogs early at night and before dawn. So the time of sampling does not bias the data.

References

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- [HACC]Herpetological Animal Care and Use Committee. 2004. Guidelines for use of live amphibians and reptiles in field and laboratory research. Online
- Preston, D. L., & Johnson, P. J. (2012). Importance of Native Amphibians in the Diet and Distribution of the Aquatic Gartersnake (*Thamnophis atratus*) in the San Francisco Bay Area of California. *Journal Of Herpetology*, 46(2), 221-227. doi:10.1670/10-065