

Bullfrog Diet of the Mora River

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Abstract

Invasive species are the single most important conservation problem at the species level. When a new species colonizes a new habitat, it finds good conditions since the local organisms do not have an evolutionary history of exposure to the invaders. Potential prey has not evolved defenses against the newcomer and predators do not recognize it as a prey. American bullfrog (*Lithobates castebiana*) was introduced in Northern New Mexico more than 50 years ago. Its impact on the local fauna has been quite important driving to extinction many local populations of native species. In this study we set out to assess the impact that the bullfrog predation on the local wildlife. We studied the diet of 268 via analyzing their stomach content. Surprisingly we did not find any of the native amphibians in the diet of bullfrogs. In fact, an invasive species of crayfish seems to be the dominant prey item in their diet. We hypothesize that local populations of leopard frogs might have evolved behavioral avoidance of bullfrog predation. The potential use of this population to restock places where leopard frogs have gone extinct is an appealing, and seemingly possible, alternative

Introduction

The American Bullfrog (*Lithobates castebiana* formerly *Rana catesbeiana*) are an invasive species in Northern New Mexico. An invasive species is a non-native (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (<http://www.invasivespeciesinfo.gov>). Originally from Central and Eastern U.S. they were introduced by the aquarium trade, for sport, food, and through the stocking of fish. The American bullfrog opportunistic and will consume just about anything that feasts in their mouth. Because of this they may produce pressure in local species that lack the adaptations to withstand the predation pressure of the invader. In order to better understand the nature and magnitude of the problem, we started a study on diet of adult bullfrogs. Obtaining a good description of the diet, we can better assess the impact of their presence and come up with possible mitigation or restoration measures that may be needed.

Methods

Frogs were captured in several ways: Seining; Net Capturing; Hand Capturing; Minnow Traps; Frogs Traps; Last resort .22 rifle when other methods of capture proved unsuccessful. Captured frogs are euthanized in a 10% ethanol dilution with water (AVMA 2007). Frogs die humanely within minutes (usually around two) by absorbing the alcohol through their skin also known as getting "drunk to death". Frogs who are with the .22 caliber rifle suffer instantaneous death. Euthanized frogs are then either placed in a fridge for immediate dissection or are frozen to be dissected another time. During the time of dissection, many measurements are taken such as mass, snout vent length, left hind leg, and when available tail length. After measurements of the frog are taken, it is opened up and sexed. The stomach content is secured by tying up the top and bottom of the stomach before cutting in the lower part of the esophagus and the beginning of the duodenum. Then we removed, and weighed the stomach and measured its volume (Figure 1). We cut open the stomach to analyze its content. We identified weighed and measured the volume of all contents of the stomach. The then weighed and measured the volume of the empty stomach. All unusual prey items are stored for further identification. The remains are then properly disposed. Measures were collected in a specific autopsy form (Figure 1)



Figure 1. Left, A night's catch of bullfrog. Center, Stomach ready to be cut open. Right, Autopsy form for restocking the river collection during dissections

Results

We analyzed a total of 268 stomach contents. Majority of the Bullfrogs diet consisted of Crayfish (likely *Orconectes virilus*), which also happens to be an invasive species in the Mora River. Bullfrogs also provide further evidence that they are top predators by preying on Birds, Snakes, and Mice, along with smaller prey items such as insects (Figure 2 & 3). This proves that Bullfrogs will eat anything they can catch and fit in their mouths. A large amount of white slime was also found in bullfrogs stomachs. Even though we are yet to determine what exactly this slime is we believe it could be egg masses from other frogs or fishes. Bullfrogs also seem to catch and eat whatever is in abundance. During the Miller's Moth Migration, the frogs' diet consisted of Millers Moth. Another example is during the breeding season of the Stink Bugs, Bullfrogs feasted on the easy to capture Stink Bugs. Bullfrogs also can have items such as sticks, leaves, and rocks found in their diet. This could be from missed attempts of grabbing its prey where the frog simply grabs something else, and being the generalist predators that they are they eat the odd objects anyway. Surprisingly, we did not find any leopard frog in the diet of bullfrogs (Figure 4)

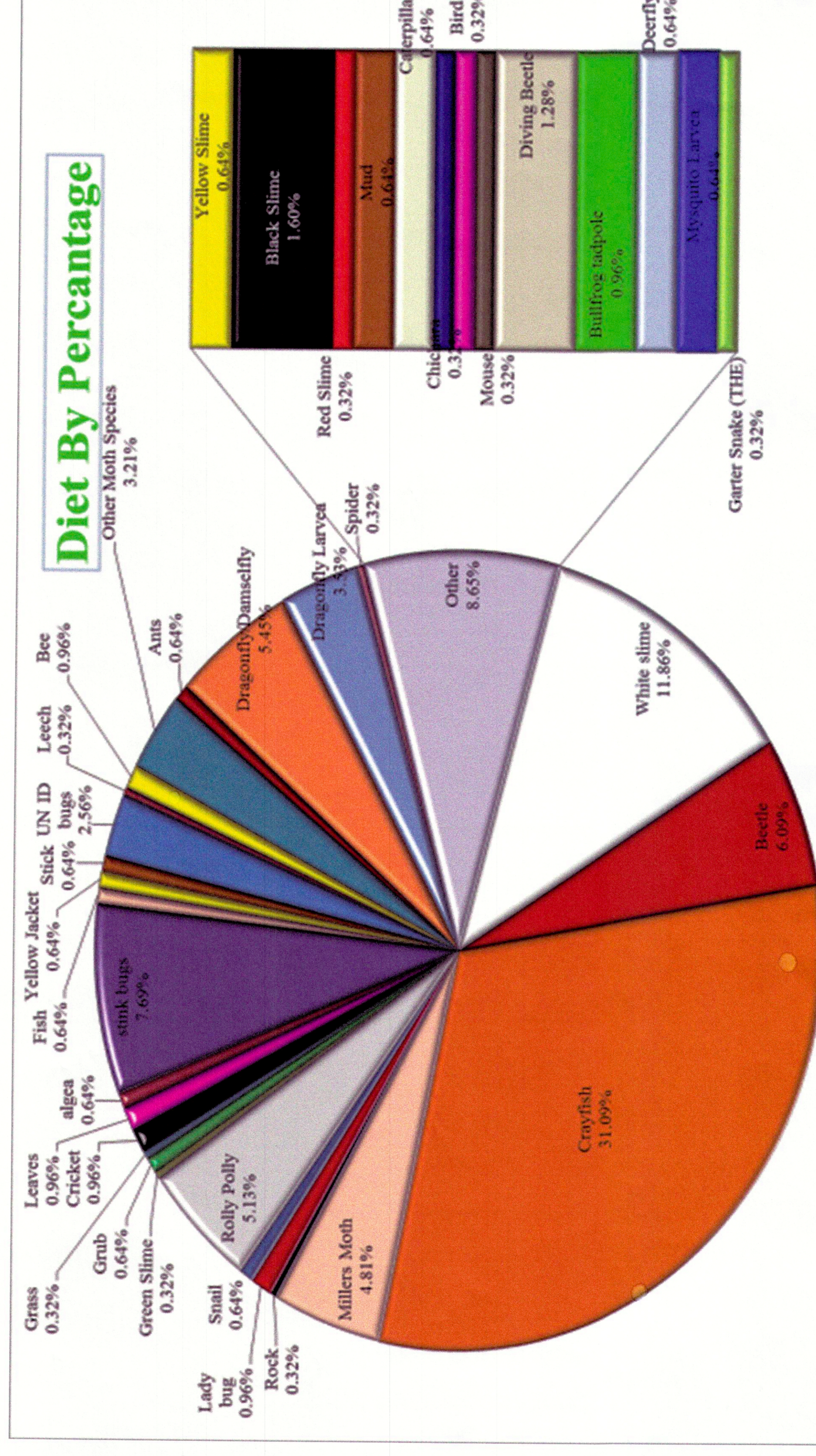


Figure 2. This pie shows the bullfrogs Diet in percentages of what they eat the most. Notice that crayfish comprises a large part of their diet.

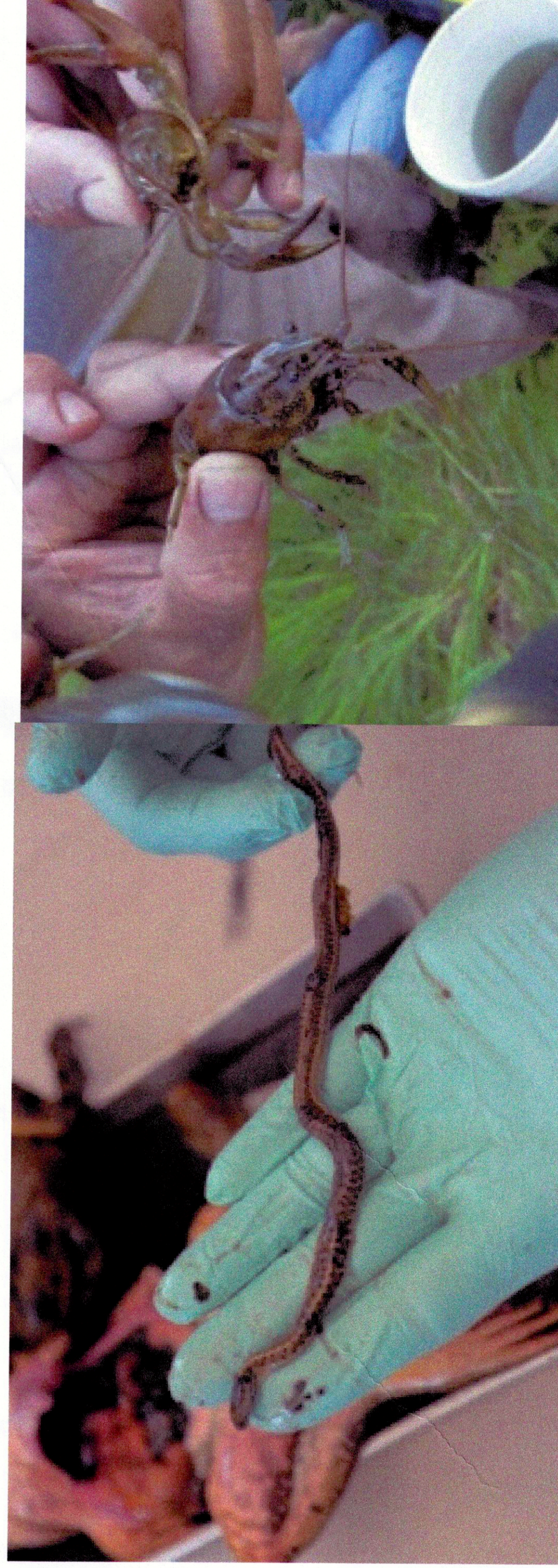


Figure 3. Left, Neonate wandering garter snake (*Thamnophis elegans*) found in the stomach of adult bullfrogs. Right, Crayfish (*Orconectes virilus*) very prevalent in the diet of bullfrogs



Figure 4. Native northern New Mexico wildlife we did not find in the diet of bullfrogs. Top row from left to right: Red-spotted toad (*Bufo punctatus*), Northern Leopard Frog (*Lithobates pipipes*), Tiger Salamander (*Ambystoma tigrinum*). Second row from left to right: Woodhouse toad (*Bufo woodhousei*), Gopher or bulisnake (*Pituophis melanoleucus*), Snapping turtle (*Chelydra serpentina*) held by *Justinianus sylvestriscus*.

Discussion

A fact that struck us when we looked at the results was the absence of frogs in the diet of bullfrogs. American bullfrogs are reported to feed on other amphibians, including Leopard Frogs (Adams 1999). Since the River has an active population of Leopard frogs we expected to find either leopard frogs or their tadpoles in the diet of bullfrogs. This was not the case. Instead, crayfish dominated the diet of bullfrogs in percentage of frequency of appearance (Figure 2). This dominance is even stronger when using percentage of volume. The high prevalence of crayfish in the diet of bullfrogs opens the door to many questions. Since the crayfish is exotic, is the bullfrog helping control the frequency of another invasive? Is the bullfrog's preference for crayfish responsible for the lack of predation on Leopard frogs? Or is the population of crayfish supporting a larger population of bullfrog that would exist otherwise? We are encouraged by the presence a relatively healthy population of Leopard frog that is absent from the diet of the bullfrogs. A possible explanation is that the local population of Leopard Frogs may have adapted to the presence of bullfrogs and it is now able to coexist with its presence. They may have developed behavioral avoidance or other patterns of habitat use or temporal activity that minimizes the exposure to bullfrog predation. Cursory data suggest that leopard frogs were always found in places where there were no bullfrogs or at times when the bullfrogs were not active.

That Leopard Frogs may have evolved behavioral avoidance that allows them to coexist with bullfrogs is very good news, not only because, this may mean Leopard Frogs in this population have better future than formerly believed but also because it could be used for Leopard frog conservation elsewhere. Eliminating bullfrogs from the areas will allow this stock of bullfrog-adapted leopard frogs to become more abundant and eventually we may be able to use animals from here to restock sites where leopard frog populations has been driven extinct by bullfrogs.

References

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