Exploring the ecological niches and bioclimatic differences of the greater and lesser Capybara

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ABSTRACT

In my study, I explored the differences in ecological niches and bioclimatic preferences of the Greater and Lesser Capybara. Wallace was used in obtaining the locality and bioclimatic data required to generate ecological niche models and determine if any significant differences existed between the species. The lack of information regarding the lesser capybara, indicated by the data deficient designation on IUCN, emphasizes the need to study the differences between both species rather than assuming they are the same. With the literature indicating that the lesser capybara is a subspecies with little ecological differences, I hypothesized that there would not be any significant differences in the bioclimatic variables predicting their ecological niche. However, I discovered that there was a significant difference in the minimum temperature of the coldest month and temperature seasonality between the two species.

INTRODUCTION

Hydrochoerus hydrochaeris and the *Hydrochoerus isthmius*, which are commonly known as the Greater Capybara and Lesser Capybara respectively, are semi-aquatic species of rodent that reside in the dense, marshy areas of Central and South America (1). Capybaras provide value for the ecosystem as part of food chains, converting vegetative matter into forms consumed by predators such as jaguars, caimans, and anacondas. For humans, they have been used as food and as a source of leather (2). As do all animals, capybaras have specific ecological niches or preferences. A niche is a role an organism plays in a community. A species' niche encompasses both the physical and environmental conditions it requires, i.e. temperature or terrain, and the interactions it has with other species, i.e. predation or competition (3).

The Greater and Lesser Capybara both have similar physical details such as short, brownish hair with a blunt snout, short legs, small ears, and almost no tail. Both live in densely forested areas near bodies of water, such as lakes, rivers, swamps, ponds, and marshes, as well as flooded savannahs and along rivers in the tropical rainforest, which emphasizes how similar their ecological niches are (4).

To study capybaras without having to visit any special locations, I chose to use a program called Wallace to create ecological niche models, or heat maps indicating bioclimatic preference throughout a region, from locality data stored on GBIF, the Global Biodiversity Information Facility. Additionally, I analyzed the bioclimatic variables to determine if statistically significant differences existed between the two species. I hypothesized that the Lesser Capybara would prefer dryer areas compared to the Greater Capybara which typically lives in watery and more secluded swampy areas (5).

METHODS

Wallace was utilized to collect the locality and bioclimatic data for both the greater and lesser capybara, *H. hydrochaeris* and *H. isthmius* respectively. Occurrences were spatially thinned to minimize the possibility of an occurrence being the same individual. Models were generated using Maxent under Linear, Quadratic, and Hinge parameters. The model with the lowest resulting AICc score was determined to be the best model to generate the ecological niche models, or the heat maps depicting the probability of finding the species at a given location. T-tests conducted in DataClassroom were used to determine if significant statistical differences existed between the species for the bioclimatic variables used to generate the ecological niche models. These variables included the Mean Diurnal Range, Temperature seasonality, and Minimum Temperature of the Coldest Month.

RESULTS

I used multiple bioclimatic variables to determine the differences between the two species of Capybara. In my study, I found that the bioclimatic variables that predict suitability for the Greater and Lesser Capybaras are different. For all of the variables I used to generate ENMs, I found no significant difference in the Mean Diurnal Range (Figure 1), but did find significant differences in Temperature Seasonality (Figure 2) and Minimum Temperature of the Coldest Month (Figure 3). My null hypothesis was rejected as I found significant differences between the two species. The data I collected in my study is significant because it conflicts with my background research which supported that there was no difference.

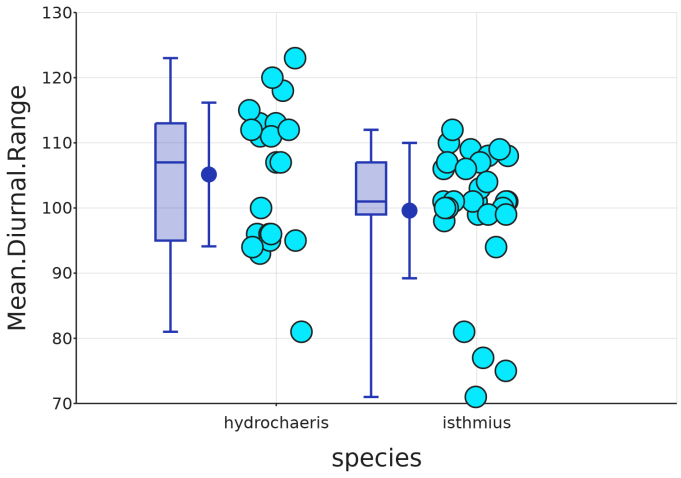

Figure 1: Differences in Mean Diurnal Range (MDR) between the *Hydrochoerus* species. The two species of capybara, *hydrochaeris* (greater) and *isthmius* (lesser) show no significant difference in Mean Diurnal Range, p-value = 0.08 > 0.05. The MDR in the greater capybara was slightly higher than the *isthmius*.

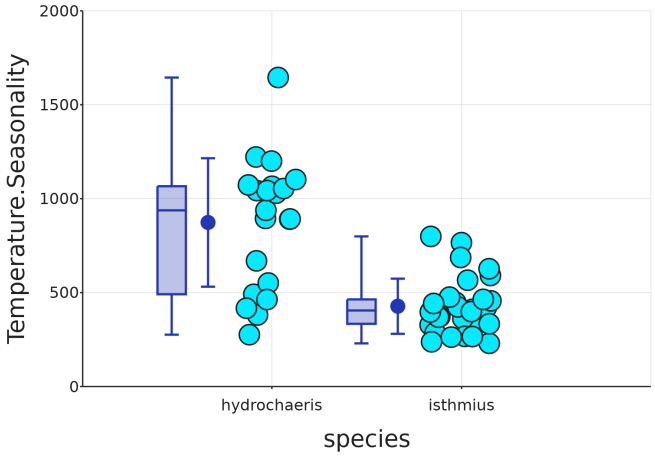

Figure 2: Differences in Temperature Seasonality between the *Hydrochoerus* species. The mean for the *hydrochaeris* (Greater Capybara) found in this graph was lower than the mean of *isthmius* (Lesser Capybara).

And the P-value = <0.01, which indicates that there is a significant difference between the two species. The error bars in the graph represent standard deviation with the dot representing the mean.

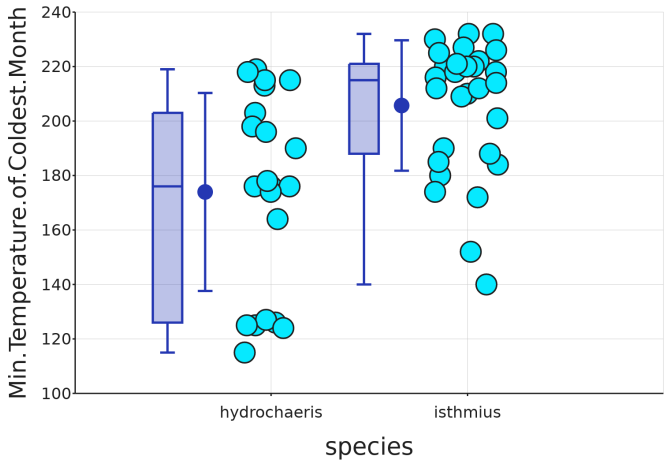

Figure 3: Minimum Temperature of the coldest month between the *Hydrochoerus* species. The mean for *hydrochaeris* (Greater Capybara) found in this graph was higher than the mean of *isthmius* (Lesser Capybara), and the P-value = <0.01, which indicates that there is a significant difference between the two species.

DISCUSSION

The Greater Capybara and the Lesser Capybara have a similar mean diurnal range. They have different temperature seasonalities and minimum temperatures of the coldest month in their environment. It leads to the conclusion that the Capybaras have many differences. This is extremely interesting because, in the background research done before this study, it was read that the only significant difference in the species is that the Lesser Capybara is much smaller and lighter. This information found in the study makes it seem that the Capybaras also prefer different Habitats. As seen in heat maps generated by Wallace, the greater capybaras live in Central America, near the equator. But, the Lesser Capybara lives in South America. Because the Greater Capybara lives closer to the equator, I predict that this means they prefer a warmer climate. Because they live in relatively different climates, they likely also have widely different ecological niches as they live in different habitats. This conflicts with the research that I found and may mean that more thorough research must be done on the Lesser Capybara before a fully backed statement can be made. My results overall did not align with other studies because I found many more differences in the species than what I read about in scientific articles.

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