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The Giant Rodents of Sumak Allpa: A Preliminary Study of the Ecological Niche of Amazonian Capybaras in Ecuador

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Abstract.

Sumak Allpa is an island on the Napo River in the eastern rainforest of the Orellana Province of Ecuador that functions as a rehabilitation center for primates. The objective of this investigation is to conduct a preliminary study on the ecological niche of the Amazonian capybaras (*Hydrochoerus hydrochaeris*) that inhabit Sumak Allpa and a small adjacent island known in this study as Island A. Very little information is known about jungle capybaras, especially in Ecuador, and this study aims to establish baseline information about their distribution, diet, and population dynamics. Research was conducted throughout the day, with mornings dedicated to searching for evidence of capybara activity, including the presence of feces, tracks, and feeding, and afternoons spent hiding in one spot along the coast or a lagoon looking for capybaras. Additionally, one camera trap was used to supplement data collection for population analysis. Evidence indicated that capybaras cluster geographically along the eastern coast of Island A and travel between the two islands. Capybaras were found to eat grasses most frequently, and Alismataceae, Convolvulaceae, Poaceae, Pontederiaceae were all found to make up a portion of their diet. Finally, population data was lacking and insufficient to draw strong conclusions although they indicate diurnal activity and a tendency for capybaras to travel in small groups.

Resumen.

Sumak Allpa es una isla en el Río Napo en el bosque lluvioso oriental en la provincia Orellana del Ecuador que funciona principalmente como un centro de rehabilitación por los primates. El objetivo de esta investigación es para conducir un estudio preliminar del nicho ecológico de los capibaras amazónicos (*Hydrochoerus hydrochaeris*) que viven en Sumak Allpa y una isla adyacente se llama Isla A en este estudio. Hay poco información sobre los capibaras de la selva, especialmente en Ecuador, y este estudio trata que establecer información de referencia sobre su distribución, dieta, y dinámica poblacional. La investigación se llevó a cabo durante el día, con mañanas dedicada a la búsqueda por evidencia de la actividad de los capibaras, incluyendo la presencia del heces, las huellas, y el alimentación, y los tardes pasadas escondidas en un sitio en la costa o una laguna buscando por los capibaras. Adicionalmente, una trampa de caméra fue utilizada para complementar la colección de los datos por análisis poblacional. La evidencia indica que los capibaras agrupan geográficamente en la costa oriental de Isla A y viajan entre las dos islas. Los capibaras fueron encontrados para comer los pastos más frecuentemente, pero Alismataceae, Convolvulaceae, Poaceae, Pontederiaceae fueron encontrados para componer parte de su dieta. Finalmente, faltan los datos de población, y es insuficiente para hacer conclusiones fuertes a pesar de que indican actividad diurna y una tendencia para viajar en grupos pequeños.

Acknowledgements.

This project would not have been possible without the wonderful individuals that supported me throughout my investigation. I would like to thank Xavier Silva, Javier Robayo, and Diana Serrano for guiding me through uncharted territory and allowing me to pursue a pioneer study of capybaras through SIT. I would also like to thank my advisor, Hector Vargas for sharing his knowledge about capybaras, transporting me along the coast, and securing a camera trap, without which this project might not have been possible. A special thanks also to Ana Maria Ortega for helping me process my data and her unwavering kindness and support. Finally, I owe an enormous thank you to my Sumak Allpa family, Annamarie Ranallo, Emma Kelley, and Zach Bull, for constantly making me laugh and providing an endless supply of peanut butter and chocolate.

Ethics.

The camera trap and other methods of observation served as non-invasive approaches for studying capybaras on Sumak Allpa. The camera trap was placed away from development to prevent non-consensual photography of human subjects.

Introduction.

The objective of this investigation was to conduct a preliminary study on the ecological niche of the Amazonian capybaras (*Hydrochoerus hydrochaeris*) that inhabit Sumak Allpa (Fig. 1) and a small adjacent island known in this study as Island A (Fig. 2). While there are many studies surrounding the niche of savanna capybaras, there is far less information about jungle capybaras, especially in Ecuador. The goal is to contribute to the limited literature regarding the latter subject to help develop a better understanding of their distribution, diet, and dynamics in the Ecuadorian Amazon.

Ecuadorian capybaras are also locally known as chigüiros, carpinchos, or ronsocos. Although little is known about their niche, they can be found in the country's Amazon region, often along the Napo, Curaray, Pastaza, and Santiago Rivers. They inhabit rainforests usually below 400 m in altitude; however, the highest elevation at which they have been found is 1,130 m (Tirira 2007).

Sumak Allpa is a 115 hectare island on the Napo River in the eastern rainforest of the Orellana Province of Ecuador (Fig. 1, Main Project 2012). It is located about 315 m above sea level and characterized by high temperatures that oscillate between 24˚C and 27˚C and high annual rainfall of 3,200 mm (Bass et al 2010). The island functions as a rehabilitation center for

animals that have been kidnapped from their wild habitats. It is unique in that the animals learn to navigate their environment through very reduced contact with humans on the island. In this way, the rehabilitation process mirrors the reality of life in a rainforest, more effectively preparing the animals for reintroduction into the wild.

Figure 1. *This satellite map shows the geographic situation of Sumak Allpa along the Napo River in the Orellana Province of Ecuador. Sumak Allpa is circled in yellow and labelled. These images were screenshotted from Google Maps.*

Figure 2. *This 3D satellite map shows the geographic expanse of the investigation. Island A is located to the southeast of Sumak Allpa. Because of flooding from the Napo River, the satellite image of Island A is not accurate and an approximation of its shape during the investigation is attempted in blue. This image was screenshotted from Google Maps.*

While many resources are dedicated to researching Sumak Allpa's primate populations, there are few devoted to the study of the other mammiferous species that live on the island, including capybaras. According to Hector Vargas, the Project Director, the capybaras are native to the island and inhabited it when the rehabilitation center was founded almost 20 years ago. While he believes there are about 8-10 capybaras living there, they have never been exclusively studied before (Personal communication, 29 March 2019). This study can provide the locals and project staff with a better understanding of capybaras on the island and help create a more complete picture of the rehabilitation ecosystem.

Located next to biodiversity hotspot Yasuní National Park, Sumak Allpa presents a unique opportunity to study jungle capybaras in a rich and diverse area of the Ecuadorian Amazon. The small land area, easy traversability, and presence of multiple coastal areas of Sumak Allpa and Island A increases the likelihood of encountering capybaras during a short period of time. This preliminary study of jungle capybaras in Ecuador can provide important baseline information to contribute to the limited literature regarding these Amazonian creatures.

Recognized as the world largest rodents, capybaras' exceptional biological nature allows them to survive under several extreme conditions including intense heat, local parasites and diseases, and food of poor nutritional quality (Macdonald et al 2013). In addition to their large rodent status, they are also distinct for their caviomorphic and cecotrophic nature. As caviomorphs, capybaras are born with cheek teeth that are constantly growing and changing surface design. Their complicated dental structure has been an essential tool for identifying individuals taxonomically (Vucetich et al 2013). Yet, perhaps their most distinguished biological trait is that they are the world's largest hindgut fermenters. Having adapted to their highly fibrous diet through cecotrophy, they can take immediate advantage of any available nutrients before bacterial fermentation (Herrera 2013).

The high economic value of capybaras makes them quintessential for wildlife conservation studies. Although usually profitable for their meat or hide, capybara fat has been used for medicinal purposes, their teeth and bones have been incorporated into jewelry, and their manure can be used as fertilizer. They can also serve the economy as attractions for ecotourism, sport hunting, or zoos (Macdonald et al 2013). One study even suggested that capybaras could serve as human organ donors (Pinheiro & Moreira 2013).

As large mammals, especially grazers that are relatively docile, capybaras can often be easy targets for hunters who want to take advantage of their market value (Macdonald et al 2013). While the species as a whole is not considered endangered, illegal hunting has driven some local populations to near extinction (Aldana-Domínguez et al 2013). Capybaras constitute a portion of the Amazonian bushmeat trade, but the exact amount and risk to jungle capybaras is unclear. Furthermore, they are known to be hunted around Sumak Allpa. Although they are protected when they are on the island, they are in danger of hunters when they cross over to Island A or different terrain (Luis Aranda, personal communication, 14 April 2019).

Capybaras are also important subjects for conservation studies because of their breeding potential. They have a high reproductive capacity (Ojasti 1973) and high resistance to disease and parasites (Noguiera-Filho et al 2013). Additionally, the main component of their diet, grass, is cheap to provide (Mendes & Noguiera-Filho 2013). Moreover, capybara agriculture is more beneficial for the environment than invasive practices like cattle ranching as it requires little to no habitat modification and thus contributes to the conservation of wetlands and local wildlife (Moreira et al 2013). With the careful application of wildlife management laws, capybara farming has the potential to provide a new booming food resource in Latin American countries (Noguiera-Filho et al 2013).

Methods.

This investigation was conducted over the course of three and a half weeks, from April 14, 2019 through May 7, 2019. Mornings were dedicated to searching for evidence of capybara activity, including the presence of feces, tracks, and feeding, while afternoons, specifically between 15:00 and 18:00, were spent hiding in one spot along the coast or a lagoon looking for capybaras. The geographic coordinates of each instance of capybara activity was recorded using the iPhone application EasyTrails. Data collection took place both on Sumak Allpa and Island A.

One camera trap was used to supplement this study. It was moved to four different spots over the course of the investigation, usually to areas where evidence of feeding had been found. The first three spots were located along the coast of Island A and the final spot was in a lagoon on Sumak Allpa. Movement of the trap was limited to access to transportation to and from the coast of Island A and to sites that kept it hidden from potential thieves at night.

Feces

Capybara feces are oval shaped and shiny when fresh or matted and dry when older (Herrera 2013). They are found in piles of uniform shaped droppings.

Tracks

Capybara tracks are unique and easy to distinguish because they have partially webbed feet. Their forefeet have four toes while their hind feet have three toes (Moreira et al 2013).

Feeding

The most obvious sign of grazing occurs when there is a section of tall grass and a sudden patch of much shorter grass. Yet, clear evidence of feeding is found where the shoots of plants have been chewed off. The shoots grow fast, and as they increase in height, they indicate that more time has passed since alimentation (Vargas, H., personal communication, 14 April 2019). Capybaras also eat the leaves of plants, but this alone does not suffice since other creatures eat plant leaves as well. Hector Vargas was available to help me find feeding areas. Samples were taken from each area and organized into groups. Vargas helped to identify them by species.

Results.

Distribution

Capybara Distribution on Sumak Allpa and Island A

Figure 3. *This map shows the overall distribution of capybara activity on Sumak Allpa and Island A as defined by in-person sightings, feces, diet, and track marks. There are a total of 112 points, constituted by 3 sightings, 5 counts of feces, 26 counts of feeding, and 87 tracks. All camera trap locations are also marked. This map was made using ArcGIS Desktop and screenshotted for JPEG format. The basemap is an imagery map that does not account for the small community in the center of Sumak Allpa or the daily flood patterns of the Amazon.*

Heat Map of Capybara Distribution on Sumak Allpa and Island A

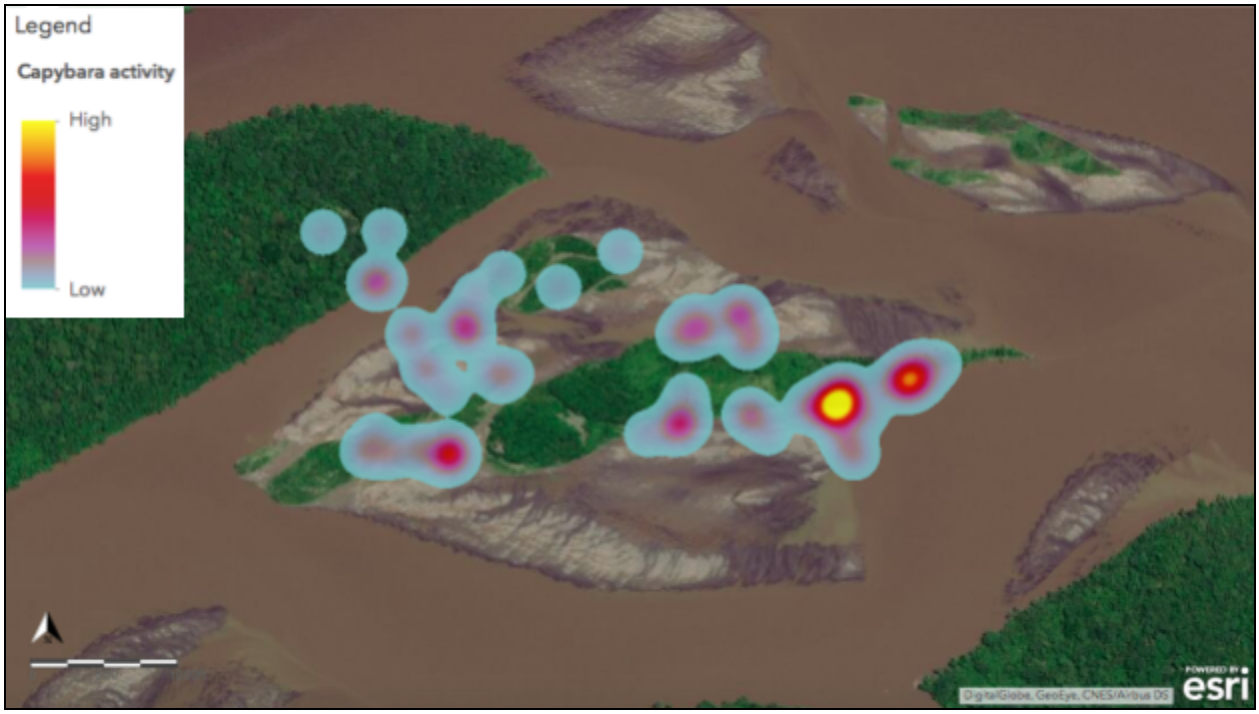

Figure 4. *This map combines all instances of capybara feces, tracks, feedings, and sightings to show the hotspots of capybara activity. This map was made using ArcGIS Desktop and screenshotted for JPEG format. The area of influence is the default setting while transparency was slightly decreased. The basemap is an imagery map that does not account for the small community in the center of Sumak Allpa or the daily flood patterns of the Amazon.*

For the duration of the project, the southeastern part of Island A was flooded, so the string of activity along the vegetation on the island marks the temporary coast line (Fig. 3). Most of the capybara activity recorded took place on Island A, especially near the coast where the two strongest hotspots are recorded (Fig. 4). Weaker hotspots occur near lagoons on Island A and the eastern coast of Sumak Allpa. Feces and evidence of feeding were found only on Island A and not on Sumak Allpa; however, capybaras were only directly spotted on Sumak Allpa (Fig. 3).

According to Map Developers Area Calculator for Google Maps, the total area covered by the capybaras based on the furthest points of their activity is approximately 77.4 hectares.

Diet

Feeding Habits of Capybaras on Island A

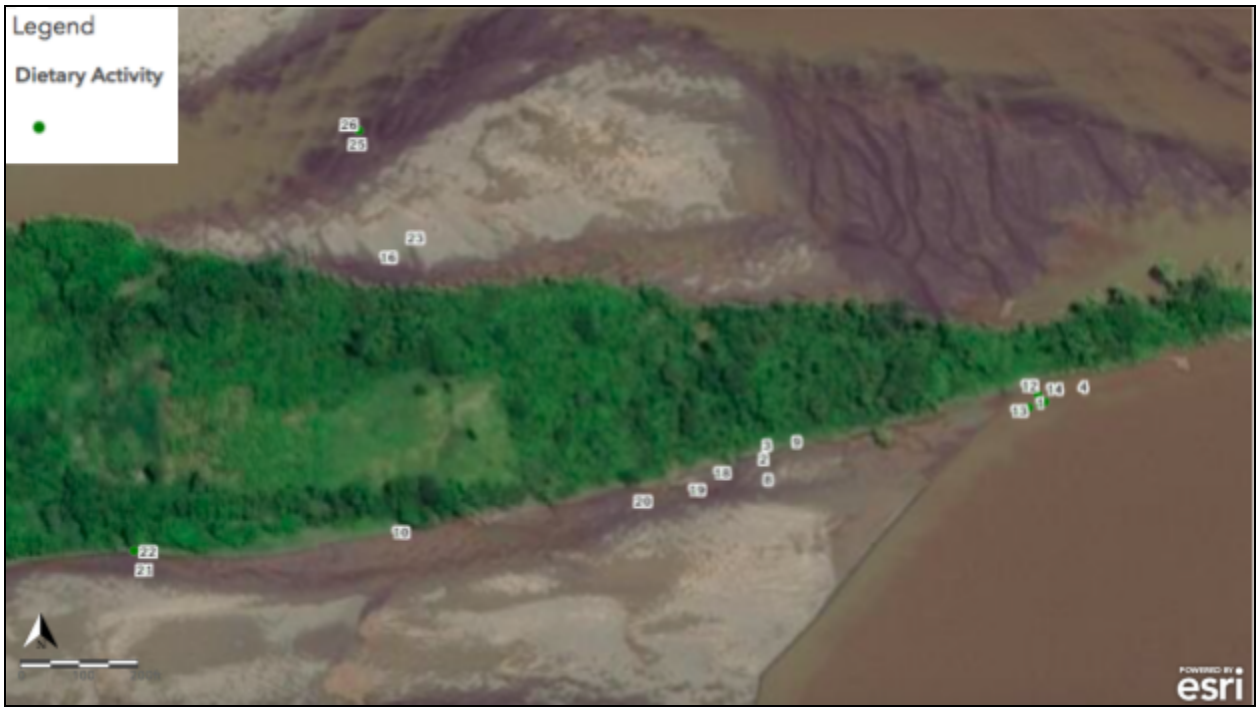

Figure 5. *This map documents the 26 locations where evidence of capybara feeding was found. All points are located on the eastern side of Island A, especially along vegetation in the southeast where the land was inundated for the duration of the project. Each location is labelled with a number to reference with Table 1 for identification of plants at the site. This map was made using ArcGIS Desktop and screenshotted for JPEG format. The basemap is an imagery map that does not account for the daily flood patterns of the Amazon.*

Table 1. Feeding Habits of Capybaras on Island A

Plant Family	**Species**	**Common Name**	**Sites Recorded**	**Total Number of Sites**
Alismataceae	*Echinodorus paniculatus*	Amazon sword plant	15, 17	2
Convolvulaceae	*Ipomoea batatas*	Sweet potato	2, 3, 7, 13, 20	5
Poaceae	*Panicum maximus*	Guinea grass	1, 2, 5, 6, 7, 8, 9, 10, 11, 12, 13, 18, 19, 20, 21, 25, 26	17

Poaceae	*Urochloa arrecta*	African signalgrass	3, 14, 16, 22, 23, 24	6
Pontederiaceae	Unidentified	Water hyacinth	4	1

This table identifies what types of plants capybaras ate by geographic location on Island A.

Evidence of feeding was found for 5 plant species, one of which was an unidentifiable type of water hyacinth. Capybaras showed a preference for plants in the Poaceae family, consuming two different species, *Panicum maximus* and *Urochloa arrecta*, at a total of 23 different geographic locations. While *Ipomoea batatas* was found to be eaten in a few different cases, *Echinodorus paniculatus* and the water hyacinth were less popular, only found twice and once, respectively.

Population Analysis

Geographic Locations of Capybara Encounters

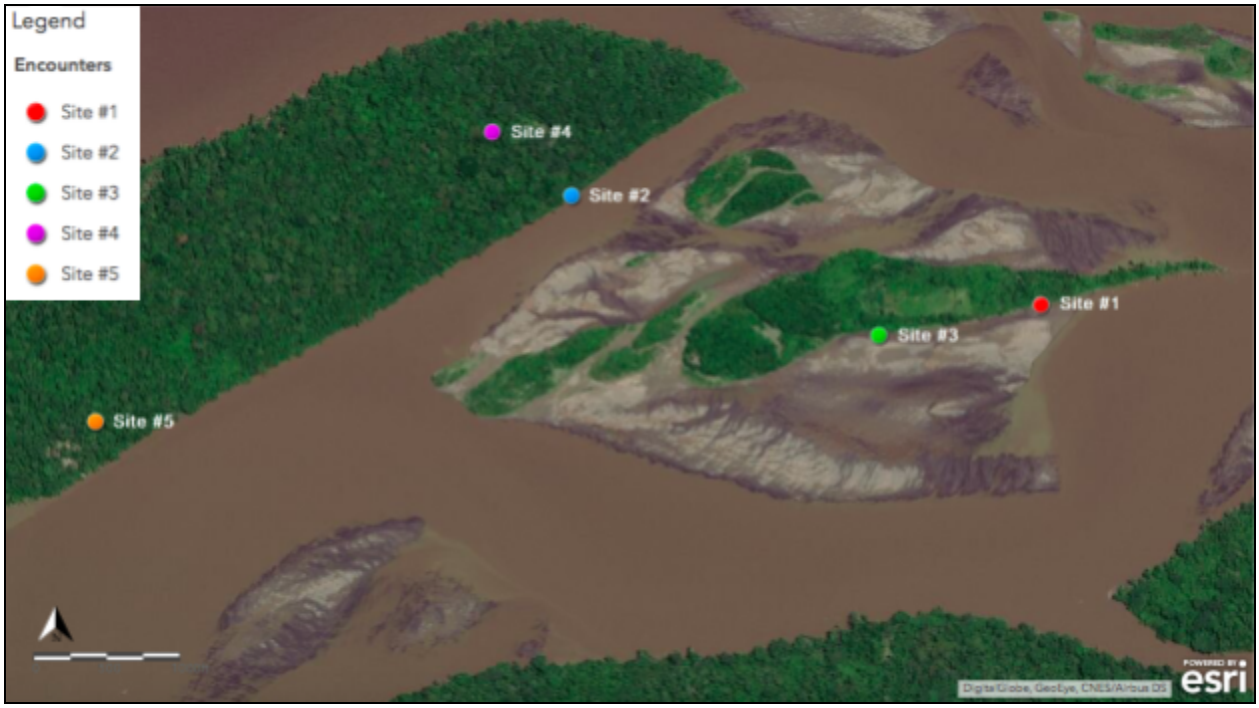

Figure 6*. This map shows the 5 geographic locations in which capybaras were observed by camera trap or direct encounter. Site #1 and Site #3 represent the locations of camera traps #1 and #2, respectively. The basemap is an imagery map that does not account for the small community in the center of Sumak Allpa or the daily flood patterns of the Amazon.*

Table 2. Capybara Encounters on Sumak Allpa and Island A

Site Number	Date	Time	Encounter Type	Number of Capybaras	Activity Observed
1	04-17-19	3:00	Camera trap	1	Walking from the coast into the vegetation; Stops and sits for 15 seconds in the brush
1	04-17-19	3:10	Camera trap	1	Investigating the camera
2	04-19-19	17:00	In person	1	Running across Jatún trail on Sumak Allpa
3*	04-24-19	15:45	Camera trap	1	Emerging from the vegetation; eating sweet potato (*Ipomoea batatas*) by the coast; walking to the coast
3*	04-24-19	16:50	Camera trap	1	Returning from the coast; eating sweet potato (*Ipomoea batatas*) by the coast; walking back into the vegetation
4	04-27-19	16:10	In person	1	Running across Sumak trail on Sumak Allpa
5	05-01-19	15:10	In person	1	Running

					across Jatún trail on Sumak Allpa

This table classifies each capybara encounter by date, time, interaction type, number of capybaras, and activity observed. Each time is rounded to the nearest 5-minute mark. The capybara observed at Site #3 (*) is the same individual.

At least three distinct individuals were observed in the camera trap at Site #1 and Site #3 (Fig. 7 & 8). While the two individuals spotted at Site #1 are adults, the individual seen at Site #3 is a juvenile (Fig. 9).

Capybara Walking into the Vegetation on Island A

***Figure** 7. This photograph shows an adult capybara walking from the coast into the vegetation at Site #1. It was taken at 3:00 on April 17, 2019 using a Bushnell camera trap.*

Capybara Investigating the Camera Trap on Island A

Figure 8. *This photograph shows a capybara approaching the camera trap at Site #1 from behind and investigating it. Because the flash obscures the picture, the capybara's eye has been circled for reference. This photo was taken at 3:10 on April 17, 2019 using a Bushnell camera trap.*

Juvenile Capybara Eating Sweet Potato (*Ipomoea Batatas*) on Island A

Figure 9. *This photograph shows a juvenile capybara eating the leaves of a sweet potato plant (Ipomoae batatas) on Island A. It was screenshotted from a video recorded at 16:50 on April 24, 2019 using a Bushnell camera trap.*

Each time a capybara was encountered, it was seen alone (Table 2). However, on at least two occasions, their tracks revealed multiple individuals travelling together (Fig. 9).

Multiple Capybara Tracks in the Sand on Island A

Figure 10. *The above photographs were taken of the same two sets of fresh capybara tracks that followed along the coast of Island A and disappeared where the land met the water. They were taken on April 23, 2019 between 17:00 and 18:00 using an iPhone X. The image on the left shows to sets of tracks oriented towards the same direction. The image on the right shows one spot where the tracks converged, revealing two different sized feet.*

Discussion.

Distribution

Most of the capybara activity on Sumak Allpa and Island A was observed along the coast or near lagoons (Fig. 3), and the three hottest spots of activity are located on the coast of Island A (Fig. 4).This is to be expected because of the semiaquatic nature of capybaras. They spend a significant portion of their lives in and around water where they drink, graze, mate, regulate their body temperature, and swim to escape from predators (Barreto & Quintana 2013).

While evidence of feeding and defecation was exclusively found along the coast and a lagoon in the northeastern corner of Island A, tracks and in-person sightings assist in expanding the distribution of activity. Tracks demonstrated capybara travel from the eastern coast of Island

A to Sumak Allpa. Likewise, sightings took place exclusively in the rainforest on Sumak Allpa (Fig. 3) and each time, the capybara was observed running across the trail. During Encounter #2, the capybara climbed from the water onto the trail and ran into the trees (Table 2). Thus, it is clear that they travel between the two land masses.

The size of their territory remains unclear. While their total distribution covered about 77.4 ha of land, this is likely a combination of the territories of different groups. Jungle capybaras in Peru had a distributive range that tended to vary from 17 ha to 41 ha, depending on the year (Soini & Soini 1992). In comparison, 77.4 ha is much higher, signifying that there is likely more than one group of capybaras occupying this area, although the exact number is unknown.

This study reveals little about the capybaras' range of travel once they are inside the rainforest. Only 7 of the 112 data points were collected in the jungle of Sumak Allpa (Fig. 3). This is a reflection of the limitations of this study rather than the actual distributive range of the capybaras. In all three in-person encounters on the island, the capybara was seen fleeing across the trail and into the thick vegetation (Table 2). Once they cross into the brush, it's difficult to follow their path because they travel quickly and leave almost no trace of tracks on the leaf litter that covers the soil. Likewise, tracks were difficult to find on the trails because the trails were often covered with footprints from tourists and other researchers. Future studies could explore this issue in more depth by stationing multiple camera traps off-trail on Sumak Allpa and leaving them for the duration of the investigation.

Furthermore, exploration of the western coast of Sumak Allpa was limited due to lack of water transportation. This contributes to the eastern skewing of the distributive range that can be seen on the heat map where hotspots only occur in the eastern realm of the map (Fig. 4). In fact, the capybaras are believed to cross the Napo River from the landmass to the west of Sumak Allpa all the way to the landmass to the east of Island A (Luis Aranda, personal communication, 15 April 2019). Therefore, Figure 3 and Figure 4 constitute a baseline distribution that can be considered a starting point for future studies that may aim to explore how far the borders of their range extend.

Diet

As mentioned above, evidence of feeding was found strictly in aquatic areas, including along the coast and around a small lagoon on Island A (Fig. 5). Thus, the capybaras appear to graze in or close to water. In these areas, teeth marks, chewed shoots, and video evidence of alimentation were found for five distinct plant species belonging to four different families: Alismataceae, Convolvulaceae, Poaceae, and Pontederiaceae. *Panicum maximus* was recorded

most frequently, at a total of 17 sites, followed by *Urochloa arrecta* which was recorded at a total of 6 sites (Table 2). Because both species are members of Poaceae, the grass family, it is clear that grass makes up a significant portion of capybaras' diet.

As selective grazers with anatomical and physiological adaptations for eating grass (Barreto & Quintana 2013), it is unsurprising that a majority of the capybaras' grazing activity on Island A showed evidence of grass alimentation. These rodents even gets their name from the Tupi word kapii'gwara which literally translates to "grass eater" (Moreira et al 2013). While some differences are expected with regards to jungle capybaras, Soini & Soini's study (1992) also found that Amazonian capybaras focused their diet on 11 main plant families, especially on plants belonging to Gramineae, another name for Poaceae. Two of the eight Gramineae plants recorded were members of the genus *Panicum*, but neither *Panicum maximus* nor *Urochloa arrecta* was observed in their study.

The consumption of *Echinodorus paniculatus* and *Ipomoea batatas* was less frequent than grass yet still comprise an important part of dietary analysis, especially since *Ipomoea batatas* was the only plant that was directly witnessed being eaten (Table 2). While not mentioned in any studies of jungle capybaras, both of these species having been recorded as part of the diets of savanna capybaras, although they are overshadowed by members of Poaceae (Forero-Montaña, Betancur, & Cavelier 2003).

The only other dietary overlap with Soini & Soini (1992) was with Pontederiaceae. While they found at least a low level of consumption of *Eichornia crassipes*, the sample of water hyacinth found on Island A was unidentifiable to the species level because most of what remained was a stalk. Yet, for savanna capybaras, the consumption of water hyacinth has only been observed during severe droughts and is believed to be generally avoided by capybaras (Ojasti 1973). Because only one instance of water hyacinth consumption was recorded among a total of 26 sites on Island A, it can likely be regarded as an outlier. However, in tandem with Soini & Soini's finding, it could be attributed to a different composition of diet for jungle capybaras.

As a final note, the capybaras were reportedly seen eating corn among the vegetation on Island A during this investigation (Local fisherman, personal communication, 16 April 2019). Although the exact site could not be located, this may be a dietary aspect for future studies to investigate as corn is also a member of the Poaceae family.

Population Analysis

Very little data regarding population size and dynamics was successfully collected, preventing a truly in-depth population analysis of the capybaras on Sumak Allpa. Yet, the few findings of this study can at least serve to provoke interesting questions and topics of discussion.

Although only corroborated by 7 encounters (Table 2, Fig. 7, 8, & 9), one trend was observed: the capybaras on Sumak Allpa do not travel in large groups. Both in-person and on camera, each individual was observed alone, even the juvenile. There is plenty of room for error in saying that they travel alone since another capybara could have been hiding behind the camera trap or running just ahead of the ones seen on the trail. However, this is very different from the behavior of savanna capybaras who live in large groups (Herrera 2013). Indeed, Soini & Soini (1992) recognized this behavior in Amazonian capybaras, determining that they lived in adult pairs or trios with offspring.

While each capybara was seen alone, some tracks provide evidence of at least two individuals travelling together (Fig. 10). The two sets of tracks in Figure 10 imply that two individuals walked across Island A, occasionally diverging and then converging until they reached the shoreline where their tracks disappeared. At one convergence point, the size of two different feet can be seen. Because one foot is noticeably smaller than other adult tracks found during the study, it is likely that of a juvenile travelling with its parent.

Another important trend is the time of encounter. Two encounters took place between 3:00 and 3:10 while the other five took place between 15:10 and 17:00 (Table 2). Although some capybaras are completely nocturnal (Verdade et al 2013), most are diurnal and active in the early afternoon and evening as well as during periods at night (Macdonald 1981). The data in this study supports the concept that jungle capybaras on Sumak Allpa are also diurnal and active during the same times during the early afternoon and night.

One major limitation of this study was restricted ability to observe capybaras at night, leaving behind questions about when capybaras are active at night and how they use their habitat during this time. They have been known to alternate between grazing and relaxing with a resting period around midnight (Barreto & Quintana 2013). Indeed, during one camera trap encounter at 3:00 (Table 2, Fig. 7), the capybara stops for a brief period of 15 seconds and appears to be eating on its way into the vegetation. Although inconclusive, the fact that two capybaras were seen within 10 minutes of each other at this early hour of the morning provides a starting point for scientists who may wish to do further research into the night time activity of capybaras on Sumak Allpa.

Another missing aspect of the population analysis is a male to female count of capybaras in the region. It is difficult to determine the sexes of individuals without looking at their genitalia which are not externally apparent. The presence of a dark protuberance of the nasal gland can sometimes indicate that an individual is a male, however, this can also be visible in a few females (Moriera et al 2013). In this study, sex determination could not be achieved from the fleeting and distant encounters with the animals. One capybara may exhibit a slightly raised nasal gland (Fig. 8), but it is impossible to dictate its sex without further information.

Unfortunately, this study does not take full advantage of the presence of a juvenile Amazonian capybara (Fig. 9) for difficulty observing it beyond its track marks and eating activity caught on camera. If its approximate age could be determined, it could add to the discussion of mating and fertility seasons among capybaras in the rainforest as there is little information to date. Many capybara populations, including those that inhabit Marajó Island in the Brazilian Amazon, have exhibited a peak in births at the start of the rainy season (Moreira 1995); however, this is not uniform. The Ecuadorian Amazon is constantly rainy with a peak rainy season from March to July (Varela & Ron 2019). Thus, the individual would have to be 1-2 months old to have been born at the peak of the Spring 2019 rainy season. Although impossible to tell as no extensive photographic literature of capybara life cycles exists, it seems unlikely that a juvenile so large was only born a month and a half ago. Because of time limiting factors, this study could not compare dry season and rainy season mating and birth patterns. Yet, in the future, it would be interesting to use a tracking device to gather more information about juveniles encountered on the island as a means to contribute to the understanding of the life cycle of jungle capybaras.

The potential for population analysis in this study was very limited due to the inability to explore the coastline regularly and at night. Fortunately, access to one camera trap permitted a small look at capybara behavior and population dynamics. Although the camera trap was mostly unsuccessful, it did capture imagery of three individuals that raises questions about group size, diurnality, sex, and fertility for future studies to pursue.

Conclusion.

As the first study of capybaras on Sumak Allpa, and one of few studies about jungle capybaras in the Amazon region, the objective of this project was to gather baseline information about their ecological niche, especially regarding distribution, diet, and population dynamics.

The distributive range of capybaras in this area of the Napo River extends beyond Sumak Allpa to an adjacent island named Island A. They cluster geographically along the eastern coast of Island A where the most evidence of feeding was found. They also spend time at lagoons on

both Sumak Allpa and Island A. However, the study lacks findings about the capybaras' distribution along the western border and inside the rainforest of Sumak Allpa. Additionally, the scope of this study does not extend beyond these two land masses even though it is believed that the capybaras travel as far as from the terrain to the west of Sumak Allpa to the terrain to the east of Island A. Thus, the distributive range found in this study is merely a starting point to expand upon for future studies.

Although a conclusive statistical study cannot be conducted to determine the percent composition of each plant family in the capybaras' diet, the data constitutes a starting point for understanding the diet and foraging habits of capybaras in the Amazon. Alismataceae, Convolvulaceae, Poaceae, Pontederiaceae were all found to make up a portion of their alimentation. As to be expected, they most frequently fed upon grasses, specifically *Urochloa arrecta* and *Panicum maximus*. All feeding activity took place on Island A, and it remains unclear if and what capybaras eat on Sumak Allpa.

The camera trap and attempts to observe capybaras directly were largely unsuccessful, and there is not enough data available to draw strong conclusions about population dynamics. However, two trends were observed pertaining to group size and diurnality. It is difficult to definitively say that jungle capybaras travel in isolation, but because they were exclusively seen alone, it can perhaps be concluded that they do not travel in large groups like savanna capybaras. Additionally, because encounters took place around 3:00 and later between 15:10 and 17:00, it can be said that they are diurnal rather than nocturnal, with at least one peak of activity taking place in the late afternoon and another at night.

The remaining encounter data leaves behind many questions that can enrich the understanding of the life cycle of jungle capybaras. The presence of a juvenile provokes the inquiry of mating and birthing seasons in the rainforest. It is not possible to identify this juvenile's age, but this information could reveal more about the relatively unexplored realm of jungle capybara fertility seasons.

The most pressing limitation of this study was the inability to fully observe the coastline, especially at night. Because the current was so powerful, it was very difficult to navigate the waters in a kayak. Thus, canoe transport was necessary to travel along the coasts. However, this was limiting in that someone with a license needed to operate the canoe which was not an option at night. Additionally, the canoe was restricted to specific areas because the river was often too low to navigate. To avoid these problems, a kayak with a small motor could be the most effective solution for completing this study as it would allow for more independence and flexibility.

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