The Brothers: A Study of the Social Structure Between Two Captive Cheetahs

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ABSTRACT: Cheetahs (*Acinonyx jubatus*) are easily differentiated among other Felids. They exhibit unique physiological features, and their type of social structure has not been seen in any other species of Felid. Coalitions of male cheetahs are seen both in the wild and in captivity, while female cheetahs remain solitary. This paper is a compilation of a twelve-week observational study of the two male cheetahs at the Central Florida Zoo in Sanford, Florida. The focus of the study was the social structure between the two related individuals. The observational data showed that there is a lack of any hierarchy or displays of dominance between the brothers, although they do have definitive places in their enclosure that they scent-mark and patrol with virtually no overlap. The conclusion of the study is that the individuals in the study manifested behaviors that are very similar to what has been observed previously in other male coalitions, both in captivity and in the wild. These findings support to the notion that felids kept in captivity at high quality facilities are being cared for in such a way that allows their natural behaviors to be uninhibited.

KEYWORDS: cheetah; social structure; coalition; captivity

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INTRODUCTION

This paper is a compilation of a field study of the two captive Cheetahs (Acinonyx jubatus) at the Central Florida Zoo, along with a review of published research literature depicting studies of other captive and wild cheetahs with the purpose of obtaining a greater understanding of the social structure between the two Felids.

In order to understand these Felids and their behavior, a foundational understanding of their background, morphology, and traits that differentiate them from other Felids must be laid. To begin with, cheetahs are currently listed as “vulnerable” on the International Union for Conservation of Nature’s list of threatened species, with their population trend listed as “decreasing” (Durant, 2015). In terms of physical characteristics, cheetahs are most well known for their speed, being the fastest land mammal, able to run at speeds up to 60 mph. They are diurnal and inhabit a number of regions in Africa, as well as Iran. Cheetahs possess several characteristics that make them easily distinguishable; three of these features are: 1) spotted coat, 2) defined “tear streaks”, strips of black fur that extend from the medial corner of their eye to the upper lip just behind their canine teeth (Caro, 1994), and 3) relatively flexible and slender skeleton, in addition to long, slender legs that allow them to run at a high rate of speed.

The subjects of study for this paper are Jagati and Iraja, two intact males who were born into the cheetah breeding program at White Oak Conservation Center in Yulee, Florida in October of 2009. They have been residents of the Central Florida Zoo since October of 2013 (Central Florida Zoo website). During the course of this study they were observed bi-weekly, at various times of day for approximately two months. They live in an enclosure that measures: 35.66m x 30.48m x 41.30m x 45.96m. The interior of the area contains several trees, a roofed pavilion, two dirt mounds (one of which houses a "den" area), large plants, and scattered logs and rocks. The back of the paddock has a fully enclosed holding area that the researcher did not have access to. It is in this holding area that the cats are fed, in the morning and evening, and shifted into for the enclosure to be cleaned. The enclosure has fencing on three of the four sides, with the fourth side being a wooden wall with three plastic windows that allow guests to view the cats without the intrusion of a chain link fence. The Felids have limited interaction with the staff, being fed in a shifting area, and through the fence during educational “Keeper Talks” in the early afternoon. Other than these interactions and the occasional veterinary exam, the cats are left to themselves. Because the brothers were born in captivity and have always been within close proximity to humans, there is little evidence that the presence of the zoo patrons has an observable effect on them.

In addition to the large groups of people that surround the outskirts of their enclosure, they also have two neighboring exhibits, a different species on each side. To the left of their enclosure is a group of Giraffes (Giraffa camelopardalis), and to the right of their enclosure is a group of three Wart Hogs (Phacochoerus africanus). There is a strip of land measuring 4.11m between the Cheetah fence and the Giraffe fence, which narrows to approximately 1.52m at the front of the exhibit. Similarly, there is a strip of land measuring 2.29m between the Cheetah fence and the Wart Hog fence. All the fences are made of a metal chain link (with the exception of the front Cheetah fence, which also includes a wooden covering with large windows), which allows all of the neighboring individuals to have visual contact. Due to the layout of the enclosure, and their own instinctual behavior, a number of behaviors can be observed in this environment. The behaviors witnessed during the course of this study included: frequency of interactions between the cats and their animal neighbors, frequency of pacing/patrolling the perimeters of the enclosure, frequency of scent marking trees and other objects within the enclosure, and frequency of flehmen responses. These behaviors are observable and documentable. This study focuses primarily on the social organization between the two brothers, and how they interact with their surroundings within the context of their social structure.

Cheetahs are one of the only Felid species in which the males live together in groups, and the females live solitarily. Comparatively, Lions (Panthera leo) form prides containing both males and females, while other species of large cats tend to live asocially, regardless of gender (Sunquist, 2002). Male cheetahs naturally form coalitions in the wild, while female cheetahs tend to remain solitary except during times of mating (Lewin, 1987). The male coalitions typically range in size in the wild from approximately two to four individuals. The coalitions have been observed to be comprised of siblings, although it is possible for unrelated males to join together to create coalitions (Caro, 1994). Due to this behavior being their natural tendency in the wild, when cheetahs are housed in groups in captivity, it is typical to find groups of males together, while females remain...
alone or in very small groups. It could be hypothesized that males will form alliances in order to maintain territories more effectively, to participate in cooperative hunting, and also as an investment in genetic posterity (in the cases of siblings forming groups together) (Caro, 1994). It seems to be more advantageous in all aspects of life for the male cats to live in groups versus living in solitude. The captive males of this study, Jagati and Iraja, being brothers, may have remained together if they had lived in the wild. Since this is a completely natural housing arrangement, there is virtually no stress on what would be normal for their species. As a result, it is possible to observe behaviors that would be considered "natural", without the need to account for extenuating circumstances.

In the wild, members of the same alliance are very comfortable being, and appear to “choose” to remain, within close proximity of each other. When a member of the alliance was to stand up from a resting behavior and to walk to a different place, his companions would often follow behind him in some fashion. If he was not followed, or if the cats lost contact with each other, there would be vocalizations, and if that still did not incite his companion to move with him, he would then go over and instigate grooming behavior before walking off again (Caro, 1994).

In addition to being close to each other, it is common to observe frequent grooming behavior between coalition partners. Coalition members who find themselves alone seem to experience levels of distress. This implies that the group atmosphere is consistently preferred (Caro, 1994). Although a coalition of male cheetahs appears to have selective advantages in the wild, it is not void of stress factors. There are costs that come from living in a group environment. These costs are most frequently seen when it comes to competition over food and females. Often in times of feeding there are attempts to monopolize prey, passive aggressive vocalizations, and heightened aggressive outbursts such as slapping and physically setting up obstacles to prevent a fellow cat from obtaining access to a carcass (Caro, 1994). Competition over female cheetahs is similar to the competition over food sources, yet it manifested as more passive aggressive in nature, especially in coalitions of siblings (Caro, 1994). These are the primary two stress factors where competition will occur between alliance members. The remainder of the time the coalition will maintain a cooperative effort. Male cheetah coalitions are more like an "egalitarian society", versus a group with definitive dominant individuals or a hierarchy. In the words of one ethologist: “In conclusion, the lack of strong differences in responsibility for initiating behavior or sharing group benefits and the failure to find consistent asymmetries on behavioral measures between coalitionary males both signified that coalitions were relative egalitarian associations…” (Caro, 1994).

**OBSERVATIONS**

During the study period, Iraja and Jagati were provided with an adequate food supply, three times daily, approximately the same time each day. As a result, the concept of “hunting” for the sake of satisfying a hunger was not a factor in their behaviors. Due to cooperative hunting not being on the list of their daily activities, the closest that they came to moving together as a hunting unit is when they moved together to the back of the enclosure to be fed by their keeper. During the study period, both males lacked access to females. With food being constantly provided, and no females, there is no inherent need for the brothers to compete with each other. As a result, all of the observed interactions were cooperative. Previously recorded studies of the interactions between other individual members of captive male cheetah coalitions report remarkably similar behaviors that are found in cheetahs in the wild, with the exception of the removal of competition over resources and access to females. Based on the information that has been published thus far, Iraja and Jagati’s behavior is consistent with what has been observed in captive male cheetahs.

Although a definitive boundary is created by the fence that surrounds the perimeter of their enclosure, establishing their territory by default, there is pacing and patrolling behavior demonstrated by both cats. This pacing and patrolling behavior has also been observed in other captive felids, and can be hypothesized to be due to either a stressor or a response to an external stimulus (Dembiec, 2004). In the case of Iraja and Jagati, there are no other significant signs of stress, so it is assumed to be a response to an external stimulus such as the behavior of their keeper, the time of day, or a group of children nearby. The pacing/patrolling behavior is important to note when discussing the social interactions between the brothers because they appear to have divided their enclosure equally. Jagati appears to have an established pattern in which he paces up and down the fence closest to the giraffe enclosure. Only occasionally will he wander to the front left or the back left, but when actively pacing...
he is most frequently found directly along the giraffe fence. Iraja will follow a separate pattern in which he begins by walking alongside Jagati’s pacing and then will walk along the back fence, then turn to walk alongside fence closest to the Wart Hog enclosure. At this juncture in his patrol, Iraja will follow one of two paths: (1) he will continue to walk along the fence, then turn and walk along the front wall, circle around to walk alongside Jagati and begin again; or (2) he will cut across the middle of the enclosure and walk in a relatively straight line over to where Jagati is located and then begin again. Iraja shows a larger variation in his patterns and covers a large space, whereas Jagati follows the same pattern when he begins pacing and seems to be limited to the strip of land along the giraffe fence. These intervals of pacing/patrolling are somewhat sporadic, and can occur multiple times in a single day, or not at all. There have been occasions when only Jagati is pacing/patrolling while Iraja is lying down. It has also been observed that Jagati’s instigation of the pacing/patrolling behavior will incite Iraja to get up and be active, but this is not always the case, nor has it occurred in a distinct pattern. This example of Jagati inciting Iraja to patrol is one of the only instances in which it appears that the behavior of one cat has a direct effect on the other. In my view, this is not a sign of dominance or submissiveness between the two of them. It is rather thought to be a “preference” of the cat, depending on the circumstances surrounding the behavior (Caro, 1994).

Another observable behavior which indicates that the brothers have divided up their enclosure is scent marking. The two cats do not appear to have overlapping scent marking spots. They mark in the same general locations, or on trees that are within close proximity, but they have not been observed scent marking the same item or location. The scent marking and pacing/patrolling are hypothesized to be examples of the two brothers working together, cooperatively and equally, to cover their full territory (Caro, 1994).

Another example of cooperative behavior is when they engage in “allogrooming”. Observations indicate that the two brothers are able to recognize each other and are comfortable being within each other’s company. In periods of rest, they are almost always on the same side of the enclosure, at least within eyesight, if they are not lying directly next to each other. It was observed often that if they are not laying directly next to each other, after a while one of the two individuals will relocate and lie closer to his brother. When they move to be closer to each other, they often engage in grooming each other’s faces, ears, and neck prior to resuming rest. These types of behaviors have been observed frequently throughout the course of the study. This appears to indicate that they are a “tight-knit” group, and they engage in behavior that parallels what has been observed in the wild. Jagati is typically the “more observant” individual, and he is the first to have an external response to new or external stimuli (e.g. exposure to a new scent in the enclosure, such as the keeper walking alongside the enclosure). Jagati is most often the first individual observed to be investigating within or around the enclosure. Iraja will notice in a short amount of time that Jagati has responded to a stimulus, and he will walk over to the same relative location and participate. This behavior has been observed on several occasions for a variety of stimuli. There have been observed incidents when Jagati has been pacing/patrolling and has caught a smell near his pacing path. Iraja, in a short period of time, appears to recognize that Jagati is smelling something on the ground. After Jagati has resumed his pacing behavior, Iraja will stand in the same location Jagati had been smelling, and will engage in an identical “bowing” behavior that his brother performed (see Observation Data attached). Jagati also appears to be the one that notices that the keeper is walking to the back of the enclosure to feed them, so he begins to walk towards the back of the enclosure first, with Iraja close behind.

Vocalizations have been observed between the cats, although it was not a frequent behavior. This lack of obvious vocalization could be due to them being in such a close proximity that there is no need for it, or that the observer is not able to hear due to there being a limited observation area.

**CONCLUSION**

To date, observations indicate that Jagati and Iraja behave in a similar manner to what has been observed in other groups of male cheetahs (both wild and captive). The similarities give evidence that the cheetahs being in captivity has not entirely altered the natural behavior of their social structure. Although they do have distinct areas of scent marking and pacing/patrolling, other behaviors have been observed to be performed together. There is very little evidence indicating that one of the cats is “dominant” over the other in any of the situations observed. (Iraja having an increased number of scent marking locations indicates another aspect of their social structure, or it could have no significance; further
research is required.) Since they have behaved similarly to other observed members of their species, it could also be hypothesized that if competitions over food or females were introduced, there would be a directly correlated introduction of mild aggression between the brothers. As was mentioned above, wild male cheetah alliances typically lack any sort of hierarchy, but rather each member is an equal member and they will arrange themselves as such in whatever task, action, or behavior they are engaging in (Caro, 1994).

Iraja and Jagati appear to have formed an alliance with each other that is typical of adult male cheetahs (both in captivity and in the wild) in which they naturally live together and interact in a way unique to cheetahs within the Felid family. This coalition-type group formation projects a fully cooperative lifestyle with members being related (and on occasion unrelated), and living in relative harmony despite the occasional call for aggression when competition over resources occurs. Claiming definitive reasoning for the evolution of the social structure of cheetahs and then the survival significance, which would result from aforementioned evolution, is a difficult task. It could be said that male coalitions of cheetahs naturally form due to the advantages found in kin selection, cooperative hunting, and territorial defense. However, statistically speaking, studies have shown that it is not solely cooperative hunting, in the strictest definition of the phrase that motivates male cheetah coalitions to stay together (Caro, 1994; Rubinstein and Wrangham, 1986). It is suggested that a primary motivation for male cheetahs to remain in groups is to defend territories against other males more effectively (Caro, 1994), which could ultimately positively impact their survival and reproduction rates. The maintenance of a distinct territory could be a way for the group to reduce feeding competition with other predators, especially when preying on species that have the propensity to travel across territories (Caro, 1994). Another potential reason for both evolutionary and survival significance of male cheetah coalitions is that “cooperative hunting minimized the risk of starvation by minimizing variance in food intake…” (Rubinstein and Wrangham, 1986) This statement infers that it would be more advantageous to cooperatively hunt vs. solitary hunting because there is a greater chance of a successful hunt, rather than having to hunt multiple times daily in order to satisfy hunger. It is rare to find in nature a group of individuals congregating and remaining together, if there is no benefit to each of those individuals, since pure altruism is rare in the animal kingdom (Alexander, 1974). Male cheetah coalitions could be the result of many factors. It is possible that all three of the primary factors that affect all species—territory, nutritional resources, and the assurance of progeny—play a role in the evolutionary significance of cheetah coalitions, as well as allowing them to survive.

In conclusion, Iraja and Jagati’s “relationship” follows exactly what would be expected of them upon researching the patterns and interactions between individuals in other cheetah male coalitions, both wild and captive. It can be stated with some degree of certainty, based on the observations made, that Iraja and Jagati adhere firmly to the typical social structure that has been observed among their gender and their species. The fact that there is no significant finding in this study is in itself significant as it verifies that the zoological facilities are succeeding in their efforts to create a natural habitat within a captive space that can be used to educate the public and house breeding programs for endangered species, like the Cheetah.
Figure 1. Hand-drawn diagram of Cheetah enclosure
Figure 2. Left Quadrant of Enclosure, including Giraffe Fence and pavilion

Figure 3. Left Quadrant of Enclosure including secondary mound and pavilion
Figure 4. Right Quadrant of Enclosure including Warthog fence and “den” mound

Figure 5. Front Center of Enclosure, including “den” mound and back paddock
Figure 6. Iraja displaying “bowing” behavior

Figure 7. Scent Marking
Figure 8. Jagati Pacing along Giraffe Fence
Figure 9. Example 1 of Allogrooming

Figure 10. Example 2 of Allogrooming
Figure 11. Graph showing interactions between Jagati and Iraja

Miscellaneous behavior category includes allogrooming, observed training sessions, and other behavioral abnormalities.
Figure 12. Scent Marking Patterns

<table>
<thead>
<tr>
<th>Location</th>
<th>Jagati</th>
<th>Iraja</th>
</tr>
</thead>
<tbody>
<tr>
<td>Front right quad. tree</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Log under pavilion</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Bush</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Far right tree</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Front wooden wall</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Pavilion post (1-4)</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Front tree</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Back left tree</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Back fence</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Tree stump</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Back right tree</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

In each of the instances which there is overlap between the scent marking data (Front wooden wall, Pavilion posts, Back left tree, and Back right tree), the individuals scent marked different are-as on the same object. They have not been observed to scent mark in the same location.
REFERENCES


