2020

Observational Study of Two Ex Situ North American River Otters (Lontra canadensis)

Julia Rifenberg
University of Central Florida, rifenbergj@knights.ucf.edu

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Recommended Citation
Observational Study of Two Ex Situ North American River Otters (*Lontra canadensis*)

By: Julia Rifenberg  
Faculty Mentor: Mr. Frank Logiudice and Dr. Eric Hoffman  
UCF Department of Biology

**ABSTRACT:** Zoos enable the ability to study how captive conditions impact the behaviors of animals. In this study, I observed two North American river otters housed at the Central Florida Zoo to evaluate behavioral changes after the male had been removed from the female for a month-long medical examination. The aim of this study was to 1) determine if mating behaviors were still occurring between the two river otters following the male’s removal and 2) to assess the welfare of the male and female river otters in captivity by observing their interactions and individual behaviors. Observed behaviors were compared to documented behaviors of wild river otters to determine if captive conditions induced these behaviors. It was found that the male still expressed mating behaviors towards the female, but she was not receptive to his mating attempts after his reintroduction. Furthermore, the male spent more time sleeping ($n = 3,472$ minutes) than the female ($n = 1,628$ minutes) which could be an indicator of poor health. Contrary to the male, the female vocalized daily (average 3 times per day) and swam stereotypical swimming patterns which were likely displacement behaviors. These findings are useful for understanding the behaviors of captive animals and provide zookeepers information on how to better care for zoo animals.

**KEYWORDS:** *Lontra canadensis*, North American river otter; animal behavior; mating behavior; stereotypical behavior; biology; observational study; Central Florida Zoo; stereotypy; captivity; observations; zookeeper; displacement behavior

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INTRODUCTION

Zoos have evolved to support science, conservation, and education (Watters et al., 2018). Animals that reside in zoos represent wild species the public can observe, and researchers can study. Countless research has been conducted in zoos, which have been published in scientific journals and books (Kaufman et al., 2019). Zoo environments provide further knowledge of animal behavior, because they allow for animals to be studied up close. However, animals may behave differently in a zoo environment compared to the wild, because the animals do not have complete control or choice over their lives, such as the ability to roam or feed freely (Watters et al., 2018). In nature, the environment can change over time, but zoo environments lack this variability and thus, have difficulty accounting for natural changes that would occur in the wild (Kaufman et al., 2019). Although the presence of wild animals in zoo environments is vital to understanding these species, their overall welfare in captivity is just as important.

The North American river otter, Lontra canadensis, is one species commonly found in zoos. The North American river otter is a heavily built mammal of 5 to 14 kg, with a flat head, short legs, and a strong tail (Lariviere et al., 1998). River otters are adapted to aquatic life, having a two layered coat for insulation and a third eyelid for underwater vision (Lariviere et al., 1998). They live in rivers, lakes, streams, reservoirs, and wetlands within the United States and Canada (Lariviere et al., 1998). River otters are a top predator in ecosystems and respond to changes in the health of coastlines and watersheds. As a result, they are ecologically important as a bioindicator in coastline and water habitats (Black et al., 2016; Lunnon & Reynolds, 1991).

At the Central Florida Zoo, there is a male river otter, Buster, and there is a female river otter, Molly, who reside together in a realistic habitat. In late February of 2019, the male otter was removed from the habitat for medical attention due to limping on his front right leg. When he was determined to be healthy, the male was re-introduced to the exhibit in March of 2019. Once re-introduced, he displayed forceful mating behaviors (extensive mounting and intercourse) towards the female.

As a result, the female had spots on her back from his biting and hyper grooming. Three days post-reintroduction, zookeepers noticed a large decline in the mating behaviors as they had anticipated. For this study, the two river otters were observed to identify if mating behaviors still occurred, beginning in May 2019 and ending in August 2019.

In addition to observing mating behaviors between the otters, all non-mating behaviors and interactions between the otters were observed, as well as behaviors specific to each otter while residing in the same habitat. The welfare of the otters was evaluated by characterizing the behaviors elicited by the otters studied and comparing them to documented behaviors of wild river otters. Behaviors observed in captivity but not in the wild, can indicate that residing in captivity produces these behaviors. Overall, this study sought to 1) determine if mating behaviors were still occurring between the two river otters following the male’s removal and 2) understand the welfare of the male and female river otter in captivity by observing their interactions and individual behaviors. The behaviors exhibited by the otters residing at the Central Florida Zoo may differ from behaviors documented by other captive otters, which is vital information. By obtaining this knowledge, their behavior can be better understood, and changes can be made with the intention of reducing behaviors induced by their captive environment.

METHODS

This study was conducted at the Central Florida Zoo, in Sanford, Florida, USA. The river otters studied were a male and a female who were both approximately 11 years old. The otters resided in a naturalistic exhibit that can be viewed by the public and an off-exhibit holding area of 6,096 m² by 6,096 m. The naturalistic exhibit was comprised of a sandy and vegetated land area with a large pool in the middle and a waterfall which ran from the back of the exhibit and flowed into the pool. The otters were observed for a total of 90 hours between May and August 2019. Observational periods occurred three times a week with three-hour visits and were completed at various times of the day to ensure all daily behaviors were monitored. The otters were observed only in the display habitat and not in the holding area; these gaps were accounted for in the observation hours. Observations were made through three glass windows of the otter exhibit: a 2.1 x 0.9 m window on the left side of the exhibit, two 2.5 x 0.9 m windows by the pool, and a 2.1 x 1.0 m window on the right side of the exhibit. Time and description of the behavior were recorded to establish the total amount of time each behavior was displayed and to develop behavioral categories. The categories included:
observed mating behaviors, observed behaviors by both sexes, observed behaviors specific to female, and observed behaviors specific to male.

**Observed Mating Behaviors**

Mating behaviors were observed for the entire duration of the study: 90 hours over 30 days. Mating behaviors observed were biting the female and mounting. Biting indicated mating behaviors because during copulation periods, male otters will use their teeth to grab a female by the neck in attempt to mate with her (Lariviere & Walton, 1998).

**Observed Behaviors by Both Sexes**

Behaviors observed by both otters included sleeping, swimming, scent marking, digging, grooming, feeding behaviors and foraging. Scent marking behaviors included dust bathing (when the otter rolled in sand to retrieve/cover a scent), using the latrine on top of a previous fecal pile, or using the latrine on top of their daily enrichment item(s). Sleeping, swimming, grooming, and foraging were measured by time in minutes. Digging, scent marking and feeding behaviors were measured by times observed due to their short duration, making it difficult to record the time spent completing these activities.

**Observed Behaviors Specific to Female**

Behaviors observed by the female were categorized by sleeping, swimming, off-exhibit, foraging, self-grooming, and allogrooming. Other activities included walking around the exhibit, eating, dust bathing, urinating/defecating, digging, den building behaviors (i.e. dragging palm fronds into the tree trunk), and playful behaviors (i.e. splashing or playing with toys in the water). Off-exhibit meant the otters could not be observed at that time because they were out of view in the holding area. The male would often remain in the holding area when the feeding door was left open after the evening feeding, which comprised most of his off-exhibit time. Aside from the combined “other” activities, the male spent most of his time sleeping, followed by being off-exhibit.

**RESULTS**

**Observed Mating Behaviors**

The male was observed biting the female’s neck on multiple occasions \((n = 20)\) while both otters were in the pool. The female was not receptive and swam away from him consistently. Additionally, the male was observed holding the female down in attempt to mount her \((n = 2)\) while on land, but each time she immediately ran away from him after being mounted.

**Observed Behaviors by Both Sexes**

**Sleeping**

The otters slept near each other when they were both sleeping \((n = 23)\). In some observations, the otters would sleep in separate spots, but one would eventually move so they would be sleeping beside each other. Throughout all the observations, the otters slept together against the back wall \((n = 14)\); in the grassy area/inside the log on the left side of the exhibit \((n = 2)\); next to the trees on the left side of the exhibit \((n = 1)\); or inside the tree trunk on the right side of the exhibit \((n = 6)\).

The female was observed to be more restless than the male. In every observation when the otters laid down to sleep at the same time, she took much longer to fall asleep than the male \((6-34\) minutes longer). Restlessness was indicated by picking her head up constantly and looking around numerous times before falling asleep. The male, on the other hand, appeared to sleep much easier and much longer than the female and did not indicate restlessness. The male slept for longer periods of time than the female \((male \ n = 3,472\ minutes; female \ n = 1,628\ minutes)\) and more frequently \((male \ n = 64\%\) of
his activity budget; female \( n = 30\% \) of her activity budget; refer to Figures 4 and 5).

Swimming

Both otters were observed to swim in the pool. The female swam for longer periods of time than the male and took less breaks than the male did (female \( n = 1,499 \) minutes; male \( n = 159 \) minutes). The female exhibited stereotypical swimming behaviors (refer to “Observed Behaviors Specific to Female” section), whereas the male did not.

Scent Marking

Both otters displayed scent marking, often urinating and defecating over a previous fecal pile in the exhibit (Figures 3 and 4). Before using the latrine, the otters would pick up their back legs and waddle in place, indicating they were about to release. The female used the latrine on top of a fecal pile more than the male (female \( n = 22 \); male \( n = 7 \)). Another form of scent marking the otters revealed was rolling in sandy areas of the exhibit (female \( n = 48 \); male \( n = 16 \)), known as dust bathing. These sandy areas usually contained sand from another zoo animal’s exhibit, used as enrichment for the otters. The female urinated and defecated on the daily enrichment items, such as branches or leaves from another animal’s exhibit, to cover the animal’s scent (\( n = 5 \)), while the male did not. Altogether, the female displayed more occurrences of scent marking than the male.

The female otter used the latrine on land for every observation (\( n = 54 \)), but the male used the latrine on land (\( n = 14 \)) and in water (\( n = 3 \) times).

Digging

Both otters were seen digging holes in their enclosure. The female (\( n = 8 \) times) was observed digging holes more than the male (\( n = 6 \) times). The male also displayed a unique behavior by laying in the holes and sleeping.

Grooming

The otters were observed grooming themselves (male \( n = 53 \) minutes; female \( n = 60 \) minutes) and each other, known as allogrooming (\( n = 18 \) minutes). Generally, this occurred at the edge of the pool. On four occasions, the female initiated social grooming, by joining the male on the pool ledge as he was already grooming himself. The time the male and female spent grooming themselves comprised approximately 1% of their activity budgets, while grooming each other comprised approximately 0.3% of their activity budgets.
Foraging and Feeding

During designated feeding times, the otters moved to the feeding door to gain access to the holding area. Occasionally, they did not come to the feeding door when called by the zookeeper, and the zookeeper would either have to excessively call for their attention ($n = 3$) or both had to be fed at a later time ($n = 3$). During many observations, the otters participated in physical activity and then slept anywhere between 30 minutes to 2 hours. Additionally, the otters had access to the pool at all times, which had algal growth and tadpoles present during the time of the observation. The otters ate these organisms (female $n = 9$; male $n = 6$), which may have lowered their hunger at feeding times. The female ($n = 101$ minutes) foraged longer than the male did ($n = 68$ minutes). The zookeepers occasionally put food in the pool (i.e. lettuce and apples) and both otters held the food in their paws and ate it while laying on their backs in the pool (female $n = 6$; male $n = 5$).

Both otters were observed taking their food to the pool. The female was observed to bring some of her food to the water before eating, indicating food washing behavior ($n = 3$). During feeding times, the male took some of his food with him to the pool ($n = 3$). He would eat the food in the pool, holding it in his paws, while lying on his back.

Both otters could identify the zookeeper and associated the sound of her keys with feeding. Upon seeing the keeper and/or hearing her keys, they would wait at the feeding door until it was opened ($n = 10$).

Observed Behaviors Specific to Female

The female performed stereotypical behaviors which are defined as repetitive behavior patterns with no apparent function or goal (Philbin n.d.). The female swam two stereotypical swimming patterns daily: the first pattern involved swimming between the back of the pool and the viewing window (i.e.; the width of the pool, $n = 939$ minutes) and the second pattern involved swimming between the two sides of the pool (i.e. the length of the pool, $n = 560$ minutes). Swimming accounted for 28% of the female’s activity budget. During both of these patterns, she started at one end and pushed off the side, then would reach the other side of the pool and pushed off upside down underwater. She used her back legs to kick and tucked her front paws in when she swam upside down. Both swimming patterns were prevalent in the female’s swimming, however, she swam the width pattern for 360 more minutes than the length pattern.

Another behavior the female exhibited was a body twitching movement which she displayed daily ($n = 60$ total occurrences, $x$ = average 3 times per day,
The female’s body twitches (which appeared to be her hiccupping) were paired with a chirping noise, as described by the zookeepers (M. Grimes, personal communication, 2019). Due to the thick walls of the exhibit, the noise was inaudible and only “hiccup-like” movements could be observed. The female demonstrated this behavior when the male was sleeping for long periods of time and did not wake up, or if she waited at the feeding door and the zookeepers did not arrive to feed her. When the male slept for long periods of time, the female usually attempted to wake up the male by laying on top of him, sniffing at him, grooming him, and pecking at him. Whenever the male did not respond to these behaviors, she made the “hiccup-like” movements. The zookeepers had also observed the “hiccup-like” behavior in the female previously when they were not quick enough with feedings (E. Bossum & M. Grimes, personal communication, 2019).

Overall, the female spent 1,628 minutes sleeping, 1,499 swimming, 60 self-grooming, 18 allogrooming, 101 foraging, 33 off-exhibit and 1,761 doing other activities (refer to Figure 4).

Observed Behaviors Specific to Male

The male was observed dragging a palm frond (daily form of enrichment) into the tree trunk with him ($n = 2$). In both observations, the male slept on top of the frond after dragging it into the tree trunk.

The male produced various responses when the female attempted to wake him. These responses ranged from not moving, going to the pool with her, going to the feeding door with her, and aggressive behavior. The male violently bit the female in two observations, following her attempts to wake him. These two instances were the only observations where the male showed aggression towards the female, so it is likely that these instances were the result of waking him.

Overall, the male spent 3,472 minutes sleeping, 159 swimming, 53 self-grooming, 18 allogrooming, 68 foraging, 404 off-exhibit, and 1,226 doing other activities (refer to Figure 5).
**Figure 4.** Female's activity budget in percentages. Activities include other, sleeping, swimming, off-exhibit, foraging, self-grooming, and allogrooming.

**Figure 5.** Male's activity budget in percentages. Activities include sleeping, other, off-exhibit, swimming, foraging, self-grooming, and allogrooming.
DISCUSSION

Mating Behaviors

This study aimed to determine whether the river otters were still displaying mating behaviors a few months after the male was re-introduced to the habitat. Prior to this study, the otters were observed to participate in mating behaviors after the male was re-introduced; including forceful mounting, extensive grooming, and intercourse. Since female otters have delayed implantation that lasts 8 months or longer, it is possible that the female could become pregnant from intercourse that occurred before this study (Lariviere & Walton, 1998). In this study, all mating behaviors were observed and recorded to determine if the female was still receptive to the male’s mating behaviors. Throughout the duration of the observations the otters were not observed to have intercourse. The male bit at the female’s neck 20 times, likely in an attempt to mount her. The female never demonstrated receptivity to the male’s attempts at mounting and her response was to swim away from him consistently. The male mounted the female twice, but the female immediately swam away afterwards. The observations in this study indicate that future mating between the otters is unlikely, due to the female’s lacking receptiveness to the male. Additionally, it cannot be determined if the female is pregnant from previous intercourse without medical involvement, and the success of the males mounting observed during this study cannot be determined.

Changes in mating behavior after the removal and reintroduction of an animal in a captive environment has previously been documented in other species. A research study on the breeding success of captive red-tailed amazons (Amazona brasiliensis), found that pair bonds were formed after amazons were removed and after amazons were introduced (Waugh & Romero, 2007). Another study following captive flamingo populations found that adding new individuals promoted breeding success; the addition of the birds stimulated group display activity which promoted reproduction behaviors (Stevens & Pickett, 1994). It can be concluded that removal and reintroductions within zoos have an impact on the dynamic of mating behaviors. In this study, it is likely that when the male otter was reintroduced to the habitat, the female otter was initially stimulated by the male’s presence, which declined over time.

Behaviors Similar to Wild Otters

This study also focused on understanding the welfare of the male and female river otter in captivity by observing their interactions and individual behaviors. Observed behaviors were compared to documented behaviors of wild river otters. Behaviors observed in captivity but not in the wild, can indicate that residing in captivity produces these behaviors, which may reveal poor welfare. The observed, captive river otters exhibited behaviors documented previously in wild river otters. Scent marking was observed, which is a normal behavior of wild river otters. Latrine sites have been documented as being used for releasing urine and feces as well as social hubs for meeting (Farzan, 2017). The otters in this study were observed to pick up their back legs and waddle in place before releasing urine and/or feces, which is a behavior seen by wild river otters who lift their tails at high angles and stomp their feet a few times before urinating or defecating (Farzan, 2017). Digging was observed, which is a behavior of wild river otters that serves to move dirt, leaves, and other materials (Green et al., 2015). The male was also observed to lay within these holes. It is possible that the male laid inside the holes because the dirt beneath the surface was cooler; the weather during this study reached high temperatures of up to 94 degrees Fahrenheit.

The otters groomed themselves more often than they groomed each other, which is consistent with a study of wild river otters, who were recorded by wildlife cameras to groom themselves more frequently than participating in allogrooming (Green et al., 2015). The otters spent most of their time in solitude and therefore, spent more time self-grooming. The otters foraged in the pool, which is similar to the behavior of wild river otters who generally forage in the water where there is slow moving water with deep pools, abundant fish, and shoreline vegetation (Trani et al., 2007). The male was observed to bring palm fronds with him into the tree trunk, which represents behaviors documented in the wild. In the wild, otters use hollow trees or logs, flood debris, and various structures for protection and seclusion. When the male dragged the palm frond with him into the tree trunk, it mirrored the behavior of wild otters who use debris for security (Lariviere & Walton, 1998). Concerning the mating behaviors, the male bit the females back while foraging, which is a behavior of wild river otters. Latrine sites have been documented as being used for releasing urine and feces as well as social hubs for meeting (Farzan, 2017). The otters in this study were observed to pick up their back legs and waddle in place before releasing urine and/or feces, which is a behavior seen by wild river otters who lift their tails at high angles and stomp their feet a few times before urinating or defecating (Farzan, 2017). Digging was observed, which is a behavior of wild river otters that serves to move dirt, leaves, and other materials (Green et al., 2015). The male was also observed to lay within these holes. It is possible that the male laid inside the holes because the dirt beneath the surface was cooler; the weather during this study reached high temperatures of up to 94 degrees Fahrenheit.
than on land (Liers, 1951). Furthermore, wild river otters use the same dens, resting sites, latrines, and perform allogrooming (Lariviére, 1998). All these behaviors were observed by the otters in this study, which suggest the river otter’s captive environment successfully provides the stimulation necessary to induce wild behaviors of river otters.

Captive Specific Behaviors

Although the river otters exhibited behaviors similar to wild otters, they also demonstrated behaviors that have been documented previously only by captive otters. This indicates that otters behave differently in captivity than in the wild. Some of these behaviors included food washing behavior. Food washing behaviors by North American river otters have not been recorded in the wild but solely in captivity. This behavior was recorded with a captive river otter who picked up a sandy fish off the ground, carried it to the pool, submerged it in water, and then ate it. The otter could differentiate between a clean and a sandy fish, since he would wash a sandy fish more frequently than a clean fish (Neunteufel, 2007). Eating food in the water, as observed by the male, has been documented in other captive river otters, who held their food while swimming in circles or rolling in the water (Neunteufel, 2007).

Another behavior that has been previously observed in river otters, was the lack of motivation to eat. On multiple occasions, the river otters in this study did not wait at the feeding door when the zookeeper arrived to feed them, indicating that they were not motivated. In a previous study, it was found that the river otters may not eat food if they are not hungry and choose to conserve energy that would be used on food handling (Neunteufel, 2007).

Captive Behaviors Specific to Female

An observed behavior specific to the female was daily vocalizations. The female would vocalize when waiting by the feeding door, wanting/expecting to be fed, or when the male was asleep for extended periods of time. Research has discovered that vocalizations in river otters have served many purposes, such as expressing fear or anger, maintaining a consolidated group, signaling alarm or danger, and avoiding aggressive interactions, so they are essential to river otter’s survival (Melquist & Hornocker, 1983). This indicates that the female uses vocalizations in times of stress or when she did not receive an anticipated response (i.e. the male’s attention or food).

In addition to the female’s vocalizations, she swam stereotypical swimming patterns daily, whereas the male did not. After unsuccessfully attempting to wake the male or after waiting by the feeding door and not being fed, the female would get into the pool and swim one of her patterns immediately to reduce stress. As the female swimming repetitively every day, a solution needs to be made to reduce these behaviors. The usage of enrichment in captive environments have been tested to reduce stereotypical swimming in otters (Nelson, 2009). Environmental enrichments in zoos can reduce stereotypical behaviors by providing various stimuli needed to reach primal physical and physiological wellbeing. Enrichment changes the environment that the animals live in and allows for new stimulation (Swaisgood & Shepherdson, 2005). The zookeepers at the Central Florida Zoo provide daily enrichments in the otter enclosure, which were observed to be successful based on the otters’ interactions with them. Although enrichment engaged the female otter, the enrichment has not reduced stereotypical behavior. Scientific evidence suggests that intrinsic factors can aid in the development of stereotypical behavior (Philbin, n.d.). The intrinsic factors for the female are the stress that she develops from the male and from not being fed. In conclusion, the female may use her swimming patterns as a displacement behavior, rather than a stereotypical behavior. Displacement behaviors occur in situations involving social tension and are used to provide autonomic arousal (Troisi, 2009). Displacement behaviors in primates have been found during times of negative emotional states, such as stress, anxiety and frustration (Aureli & Whiten, 2003). If these behaviors are displacement behaviors rather than stereotypical behaviors, it would explain why enrichment has not reduced the frequency of her repetitive swimming.

Furthermore, previous research on captive river otters has found that repetitive behaviors often precede feeding, which is consistent with the findings of this study. In one study, a catapult was used to launch food into an otter exhibit at random times, which reduced pacing and begging (Hawke et al., 2000). Another study found that adding hiding spots and visual barriers for the otters, made the feeding times less predictable and reduced repetitive locomotive behaviors (Grann, 2000). These strategies be implemented at the Central Florida Zoo to see if they reduce the female’s swimming patterns.

Captive Behaviors Specific to Male

The male spent substantial time sleeping in comparison to the female; therefore, reducing his opportunity to display non-sleeping behaviors as frequently as the female. In the wild, extensive periods of rest among river otters would decrease survival because there would be less chances to mate, forage, and limited predator vigilance; wild river otters are known to be very active, moving up...
to 42 km in one day (Lariviere et al., 1998). The time the male spent sleeping (3,472 minutes) is noteworthy and it is possible that the male’s extensive time spent sleeping could also be considered a displacement behavior. In nonhuman primates, sleeping is considered to be a displacement behavior as it is a “comfort behavior” that can reduce stress (Troisi, 2009). The motivation for the male’s sleeping as a displacement behavior could be due to many reasons, one being boredom. Previous research has found that boredom, diet, and visitor presence and behavior can be triggers for displacement behaviors in captive animals (Wallace et al., 2019).

Displacement behaviors have been recorded in many other animal species in captivity and there have been previous studies which link stressful situations and anxiety to displacement behaviors. For example, captive group-living chimpanzees have observed to scratch themselves in stressful situations induced by neighbors’ vocalizations and grooming behaviors have been recorded following aggression episodes in captive macaques to reduce their stress levels (Troisi, 2009). The observations in this study suggest that the displacement behaviors demonstrated by the female and male otter are due to external stresses, which can be a poor indicator of health.

CONCLUSION

This study monitored the mating behaviors of two captive river otters and found that mating did not occur between the otters. Although the male made attempts to mount the female by biting at her neck, future mating between the otters is unlikely, due to her lacking receptivity to his mounting attempts. Prior mating behaviors were likely due to the female’s initial stimulation from the males return to the exhibit, which decreased over time, therefore, making her unreceptive to mating.

The welfare of the captive river otters was also assessed by observing their interactions and individual behaviors and comparing them to previously documented behaviors. The river otters expressed behaviors similar to wild otters, which indicates that their captive environment provides stimulation to promote behaviors documented by wild river otters. However, the otters also expressed captive specific behaviors. These behaviors demonstrate that animals behave differently in captivity because the animals do not have complete control or choice over their lives (Watters et al., 2018). Such behaviors can reveal poor welfare as the captive conditions produce the behaviors. Both the female and the male elicited captive specific behaviors that may be an indicator of poor welfare; the female performed repetitive swimming and the male slept excessively. To reduce the females repetitive swimming behaviors, zookeepers can try making the feeding schedule less predictable and hiding the food around the exhibit. The male’s motivation for his displacement behavior may be due to a variety of reasons, such as boredom or anticipation of food. Further research should investigate the motivation for the male otter’s displacement behavior; this will help when determining how to increase the male’s physical activity.

Using all the observations and data gathered in this study, it can be applied to other animals in captivity. By understanding the otter’s behaviors, we can apply it to the behaviors of other captive animals, which will lead to the best care of animals under human care. This information and the findings in this study can be shared among other zoos, the science community, and the general public to educate on the behaviors of captive animals in a zoo environment.

LIMITATIONS

There were some limitations to this study that restricted the extent of the observations. This study could only be conducted during the zoo’s daily hours of operation, between the hours of 9 am and 5 pm. The otters were fed at the same time but in separate locations, with one inside the enclosure and the other inside the holding area. The zookeepers alternated which otter was fed inside the enclosure and which was fed inside the holding area every day, although the male was generally fed inside the enclosure and the female was fed inside the holding area. The holding area of the exhibit was out of view, so not all feeding behaviors could be observed. Additionally, in the evening feedings, the zookeepers would leave the feeding door open so the otters could move freely between the enclosure and the holding area. When the otters chose to stay in the holding area after feedings, their behaviors could not be observed.

ACKNOWLEDGEMENTS

I would like to thank my mentor, Frank Logiudice, for providing me with this research opportunity. I would also like to thank my mentor, Eric Hoffman, for his assistance through the writing process and his continual support. I also give thanks to Stephanie Williams at the Central Florida Zoo for allowing me to conduct this research study, and Mary Grimes and Erin Bussom at the Central Florida Zoo for supplying background knowledge on the observed river otters under their care.


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