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“You’re Killin’ Me Smalls” The Successful Hand-Rearing and Re-Introduction of an Infant *Colobus guereza*

By: Megan Buecher, Tracy Campbell, and Bridget Ring
Dickerson Park Zoo



Notice the abnormal amount of black on head, arms and legs less than 24 hours after birth.



Scotty being introduced to all of the adults in the service area of the colobus building in a controlled setting.



Introduction: Our Colobus Family Group

The original group of colobus monkeys at Dickerson Park Zoo consisted of three individuals. There were two females, Lucy and Macari. Macari, Scotty’s mother, was born and parent raised at Utah’s Hogle Zoo in May 2003. We received Macari in 2010, and she was housed for a short period of time with two other males. Lucy was born and parent raised March 2009 at the Memphis Zoo. When Lucy arrived at Dickerson Park Zoo, Macari was the only other colobus. Morgan, the father, was born in January 1995 at the Oklahoma City Zoo. After being housed at two other AZA zoos he eventually arrived at Dickerson Park Zoo in 2012 with a breeding recommendation. While the group was not aggressive, the females did not appear to bond. Morgan was seen breeding the females almost immediately after his introduction to the group.



Keepers made a climbing structure out of PVC pipe to build motor skills and strength.



Set up of the colobus building with keeper-made transition enclosure. Scotty had full visual access to the adults at all times.

Feeding the Monster

Staff pulled from a variety of sources to get the ideal recipe for hand-rearing an infant black and white colobus monkey (*Colobus guereza*). The American Association of Zoos and Aquariums and Cheyenne Mountain Zoo’s hand-rearing protocols were our main sources. We also pulled from the hand-rearing successes from the San Diego Zoo, Audubon Zoo and Colobus Conservation in Kenya. Utilizing these sources and coming up with a few things on our own, we were able to successfully hand-rear and re-introduce our infant colobus.

Milk Formula:

- Boil 10oz of distilled water and add a herbal fruit-flavored tea bag and a green tea bag; let steep for 5 minutes
- Mix 120ml of tea with 120ml of evaporated milk
- Add 1 tsp of rice flour

Stir gently. Do not shake as it will produce bubbles and give the infant gas.

“Poop Shake”:

- Mix a pea-sized volume of adult colobus stool with 10ml of formula

Give to infant orally once a week. This will help establish normal GI flora in the infant’s stomach.



Gruel:

- Soaked Mazuri low-starch banana biscuits.
- Add baby food (assorted flavors), cooked sweet potato, cooked white potato, cooked carrot, or mashed banana.

Mash biscuits and mix with baby food or produce.

The Birth of Scotty

Macari gave birth to a male, later named Scotty Smalls, in the exhibit yard. She did not attempt to catch the infant while giving birth to him, which resulted in him falling a short distance to the ground. Macari immediately jumped away but did approach and smell him eventually. However, she would not touch him or stay near him. Morgan and Lucy showed similar behavior. After an hour of no interest by Macari the decision was made to sedate her to check for milk production and allow Scotty an attempt to nurse. At this point he was too weak to nurse and was given a small amount of corn syrup to elevate his blood sugar. Staff then placed him on Macari and expressed some colostrum directly into his mouth. He briefly suckled on his own during the 30 minutes she was sedated. Macari was then given a reversal and transferred to a crate with the infant still attached in a final attempt for her to accept him. She was left for an hour before staff returned. Scotty was being dragged as he clung to her tail. As a result, the decision was made to remove Scotty to be hand-raised.



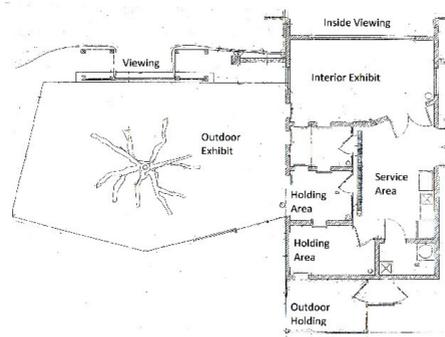
Weights were recorded everyday for the first two months. Afterwards, they were recorded once a week, then changed to twice a month at 7 months.



Scotty with tactile access to Morgan and the rest of the adults. Morgan was very protective of him. We tried to expose him to the adults as much as possible.



Keeper feeding a bottle through the fence when we switched to hands-off feeding.



Layout of the colobus building, corral and exhibit yard

Key Moments in Scotty Smalls’ Life

- | | |
|--|---|
| <p>7/24/2013 – Scotty was pulled from his mother and was given a bottle of formula by keepers. He was housed in an incubator and fed a bottle every few hours.</p> <p>7/25/2013 – Scotty was taken into the colobus building with keepers daily while they fed the adult monkeys.</p> <p>7/27/2013 – A routine bottle feeding schedule is established-8 bottles/day</p> <p>7/28/2013 – Started offering gruel</p> <p>7/29/2013 – Offered grass- he mouthed it</p> <p>8/1/2013 – Started spending the day in the colobus building and overnight with keepers
Given 1st “poop shake” – they are given once a week.</p> <p>8/3/2013 – Started being taken outside daily (weather pending) for fresh air and sun shine</p> <p>8/7/2013 – Seen chewing on grass and ate a couple of small pieces of banana</p> <p>8/18/2013 – Started receiving regulated amounts of gruel</p> <p>8/20/2013 – Started offering a variety of produce items daily</p> <p>8/24/2013 – Started offering browse/greens and soaked Mazuri Browse and Mazuri Low-Starch Banana biscuits daily</p> <p>8/26/2013 – Decreased feedings to 6x a day</p> <p>8/29/2013 – Started regularly eating all of the produce and greens/browse that were offered on his own.</p> <p>8/30/2013 – Started staying in the colobus building overnights</p> <p>9/13/2013 – Moved cage into stall. Started letting him explore stall outside cage</p> <p>9/16/2013 – Started feeding bottle and gruel through fence to limit hands-on contact. Started leaving him with access to stall and outside corral during day with a double layer howdy between him and adults.</p> | <p>9/19/2013 – Received regulated amount of produce daily
Decreased feedings to 5x a day</p> <p>9/30/2013 – Started eating biscuits consistently enough to add a regulated amount daily</p> <p>10/15/2013 – Decreased feedings to 4x a day</p> <p>10/18/2013 – Single layer howdy between Scotty and adults. They can now have tactile contact</p> <p>10/25/2013 – Removed produce from gruel</p> <p>10/20/2013 – Scotty is given access to all the back stalls in the building during the day</p> <p>11/1/2013 – Started giving small amount of rice</p> <p>11/18/2013 – Introduced to adults. Separated for feedings and overnight.
Discontinued gruel</p> <p>11/26/2013 – Scotty was given a routine diet established through the commissary</p> <p>12/1/2013 – Decreased feedings to 3x a day</p> <p>1/9/2014 – Decreased feedings to 2x a day.
Locked in with adults during the day except for feedings</p> <p>1/23/2014 – Started reducing formula amount to start weaning</p> <p>1/30/2014 – Decreased feedings to 1x a day</p> <p>2/20/2014 – Last bottle</p> <p>2/27/2014 – All monkeys have access to each other all day and overnight</p> |
|--|---|

Pairing Up for the Zoo's First Anteater Birth

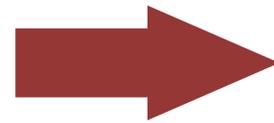
Zoological Programs Team

Integrating Animal Care, Veterinary Programs, and Conservation & Science to advance animal welfare and scientific knowledge



Opportunity for Collaboration:

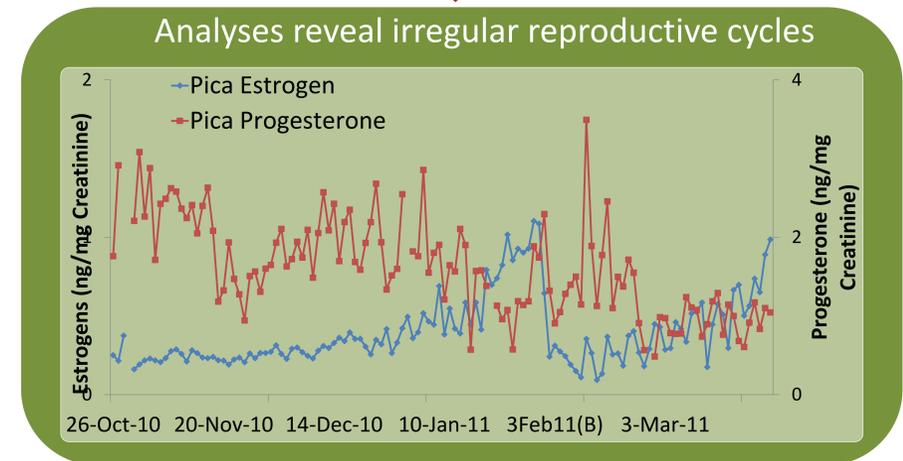
Giant anteaters were not reproducing. Animal Care Staff observe aggression between the pair.



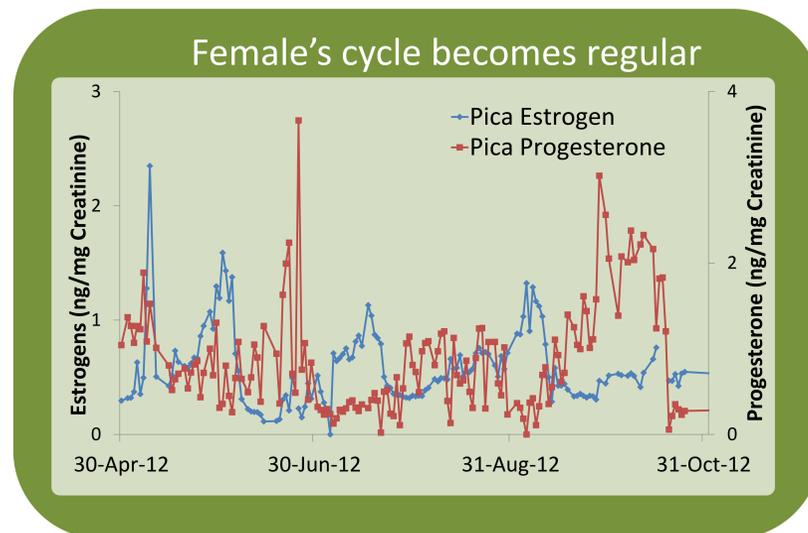
Animal Care seeks assistance from the Zoo's Endocrinology Lab.

Does female, "Pica," have a normal reproductive cycle?

Female is trained for daily urine collection for hormone analysis



Based on hormone analyses and that Giant Anteaters are solitary in the wild, decision is made to separate the male and female



Using hormone monitoring, male and female are paired only when she enters estrus. Pair is left together day and night.



Along with continued hormone monitoring, female is trained for weekly weights to track pregnancy



Voluntary Radiograph Training to Assist with Okapi (*Okapi johnstoni*) Management

Brandy Coffin

Ituri Forest Animal Keeper

Disney's Animal Kingdom®

Introduction

Training animals to voluntarily participate in medical procedures through operant conditioning can be beneficial for both the animals and the staff. Chronic conditions that need ongoing monitoring can be stressful for both animals and staff if repeated immobilizations are necessary. In order to reduce this need for a female okapi with an injury to her lower jaw, keepers at Disney's Animal Kingdom® used operant conditioning principles to train her for radiograph monitoring of the injury.

Nafuna – One-year old female

- Injury to left side of jaw
- No issues eating
- Swelling continued to grow larger
- Immobilization revealed swelling was a hematoma resulting from soft tissue damage
- Radiological monitoring of area requested in case of further complications



Training Advantages

- Nafuna extremely comfortable in existing chute; cached there when young
- Nafuna had solid experience with chute training
- Highly food-motivated okapi
- Digital radiograph machine allowed instant viewing of images and immediate adjustments of equipment and repetition of image if necessary



Training Challenges

- Desensitization to: radiograph cassette, machine, bibs, gloves; computer screen and cords; ladder/other equipment; increased number of people in chute area
- Radiograph required complete immobility of head for a minimum of 4 seconds
- Proper timing with bridging of immobility (no chewing) in conjunction with obligatory food reinforcement
- Training from alternate location due to machine positioning
- Determining appropriate angles and settings for the radiograph



Methods

- Desensitized Nafuna to individual items
- Trained required immobility through targeting to a small buoy with a long auditory whistle
- Achieved optimal positioning by primary trainer standing offset in front of the open chute
- Trained with a mock radiograph cassette attached to the chute with Velcro and mock radiograph machine (plywood box)
- Suspended actual digital cassette over the side of the chute
- Trained Nafuna to recall to the chute multiple times in a single session to allow for equipment adjustments

Results

- Nafuna trained in one month
- Radiograph techniques successful within two months
- There was no strong aversion to any of the equipment
- Took multiple radiographs on 4 different days to perfect the technique
- Digital radiograph unit was instrumental in establishing necessary adjustments of equipment
- Lateral and oblique views of lower jaw revealed no continued or permanent concerns



Acknowledgements

I would like to thank Roxane Losey, Nafuna's trainer; Julia Sweet, veterinary technician; and Kristen Wolfe, manager/procedure assistant for allowing me to present the results of their outstanding efforts in accomplishing this procedure. I would also like to thank the Ituri team for being flexible with their daily routine to allow time for Nafuna's training.

We're on a Roll!

Hand rearing efforts with Elegant crested tinamou (*Eudromia elegans*) chicks

Hilary Colton

Smithsonian National Zoological Park

Introduction

Due to poor incubation behavior of the male Elegant-crested tinamou (*Eudromia elegans*), keepers at the Smithsonian National Zoological Park (NZP) needed to hand rear chicks. The male in question exhibited refusal to eat or drink when incubating clutches, so the decision was made to not allow him to rear chicks. Eggs were pulled halfway through incubation period, and placed in incubators until hatch. Post-hatch there were problems with splay-leg and dehydration of chicks with multiple clutches. Minor changes were made to protocols to remedy these issues and mortality rates decreased. These changes required minimal increases in work and were very cost-effective for the unit.

Species

Elegant-crested tinamou (*Eudromia elegans*) are terrestrial birds endemic to South America. Classified within the Tinamiformes, males of this species incubate clutches of eggs and take the primary parental role in raising offspring.



Methods

We used Grumbach incubators set at 37.5°C and a relative humidity of 50-55%. Eggs were candled as they approached hatch date, and were moved to hatcher at internal pip. The hatcher was set between 31-32.5°C, and humidity was increased to 60-65% to aid in the hatching process. Upon hatch, the umbilicus would be gently dabbed with Betadine.

Once the chicks had dried, they were moved to the brooder. Setup in the brooder was to have a heat bulb on one side, with dusters on both warm and cool sides of the space. A mirror would be placed on the warmer side, and a water dish with marbles was put on the cool. Pelleted food was scatter on the floor evenly. Avian benebac would be offered every other day, mixed into both greens and pelleted food mix.

It had been observed that chicks should not be housed in groups of more than 3 for hand-rearing due to aggression issues arising. Our clutches were not more than 7, which allowed us to use 2 brooders for the rearing process. Once chicks had reached a size when we moved them to a larger area, the groups would be combined and observed closely for social interactions.

Problems

What we saw were issues with some of our newly hatched chicks developing splay-leg within 72 hours of hatch. Splay-leg (or spraddle-leg) is typically thought of as resulting from chicks being unable to get food footing and not training the muscles to hold legs under the body in normal posture. This would result in unnatural posture, poor consumption of diet, and increased bullying from clutch mates who were not afflicted.



Initially to counter this problem, hobbling was attempted. Hobbling allows the chick sit on its hocks while allowing it to get adjusted to sitting upright by taping the legs together. Chicks would be hobbled for 2 hour periods, with checks every 30 minutes to see if legs stayed in position or if adjustments needed to be made. While this helped train the legs to be held under in proper positioning, we encountered the issue of the chicks attempting to peck off each others hobbles. Often this would result in them sitting on their sides after being knocked over by clutch mates, or abrasions from the pecking behavior.

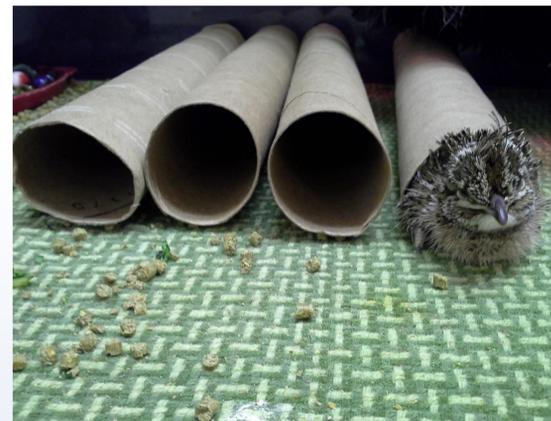
Feeding and drinking also stopped during these periods, which was another concern as we still wanted our chicks to gain weight. Additionally, what we found needed to occur would be that chicks who did not need hobbling had to be separated from the others, which caused some social aggression when reintroduction occurred.



Changes

The first thing that was changed was the material chicks were hatching upon. Originally, hand towels had been used in the hatcher but we saw that those could be pushed to the side, leaving the chick on the slick surface of our hatcher. We changed to store-bought Con-Tact Solid Grip shelf liner which we could cut to fit both our hatcher and brooders. This material was cost-effective (\$5.97/roll) and easy to disinfect between uses.

To try to counter the aggression observed while chicks were hobbled, we initially built a chute system where chicks were placed. A cardboard box was modified to have slats every 3.5cm, which obstructed both view and access of chicks from each other. The box was approximately 25cm long, and the chutes allowed the chicks to move up and down the length and build muscles. During hobbled sessions, the chute was placed in the brooder to allow chicks to stay warm and limit the potential for escape. However what was found was that often chicks would attempt to jump while in the chutes and would fall onto their backs during this process.



Our solution was to use paper towel rolls. Tinamou chicks fit well inside of these, and it allowed them to continue moving forward and backwards to build muscle. The full round shape of the rolls eliminated the jumping potential for chicks, and no additional signs of stress were observed when compared to the plain hobbling or chute durations. Time in the tubes continued for on average 4 days, with 2 hour sessions. We gave the chicks an hour break when doing multiple sessions a day. Overnight they were not hobbled and allowed to socialize together.

An additional problem that we had was that our hand reared chicks exhibited a much higher rate of diarrhea and dehydration than chicks that were parent reared. After conferring with our Department of Nutrition and St. Louis Zoo staff, we changed the offering of vegetation to be kale only, where it had previously been a finely chopped romaine or red leaf lettuce.

Results

Changing the substrate on which chicks hatched decreased the incidences of splay leg post-hatch. When it did arise, the cardboard paper towel tubes were extremely effective at helping us treat splay-leg without the problems seen with plain hobbling.

Combined with the diet change of lettuce to kale, we saw a decrease in our chick mortality rates from 60% to 43%. Some of the mortalities with each clutch were due to infection, in which we worked with our veterinary staff to decide the best treatment options.

Conclusion

With cost-effective changes, the Bird House team of the Smithsonian National Zoological Park were able to improve upon their hand rearing techniques for Elegant-crested tinamou. Although these changes were simple, it was a process that had allowed us to help with the captive breeding of this species and offer options in treating problems that are known to arise with other groundbird species.



Limitations

As all of our clutches were from the same breeding pair, genetics can not be ruled out as a possible determining factor in the challenges of hand rearing these chicks.

It was also discussed but never tried to reintroduce eggs at internal pip under the male to see how being reared by parent in the exhibit would help with mortality rates.

Acknowledgements

Thank you to Sara Hallager, Kristen Clark, Steve Sarro, the National Zoo veterinary staff and St. Louis bird team for their support in the difficulties of raising tinamou chicks.

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Zoo ALIVE: Raising, Releasing and Regarding the Endangered American Burying Beetle

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Abstract

The Saint Louis Zoo is involved in a five year project to raise and release the endangered American burying beetle back into the wild, the first reintroduction of a federally endangered species in Missouri. 2014 marked the third year of this project. For the first time, Zoo ALIVE teen volunteers and Zoo Education Department staff assisted the project, providing daily care of beetles and helping with the release. In June 2014, the teens joined Zoo staff and other volunteers to release 344 adult American burying beetles in Wah'Kon-Tah Prairie, near El Dorado Springs. Larvae counts indicated that 2,862 beetle larvae may have been produced by the released pairs, and the teen volunteers gained a better understanding of conservation science, field work, ecosystem functioning, and their ability to contribute in conservation efforts.

Meet the Beetles



Figure 1: The endangered American Burying Beetle

Nicrophorus americanus, the American burying beetle (figure 1), was once found in prairies and forests in over 30 states, but has vanished from 90% of its original range, and was listed as endangered in 1989. The exact cause of the species' decline is unknown. Proposed causes include light pollution, pesticides, habitat loss and fragmentation, or possibly the extinction of the passenger pigeon. ABB populations exist in a few Midwestern states and Rhode Island. Efforts have been made to reintroduce them to their natural habitat in Ohio and now Missouri.

Their Conservation Heroes



The Center for American Burying Beetle Conservation is one of the Saint Louis Zoo's twelve Wildcare Institutes, entities that aid with conservation efforts worldwide. The Center performs genetic work to ensure that optimal pairs of burying beetles are placed in mating pairs for release. The Center's release program is aided by the Missouri Department of Conservation and the U.S. Fish and Wildlife Service.

And Zoo ALIVE

Zoo ALIVE is the Saint Louis Zoo Education Department's teen volunteer program. Over 60 area youth, ages 15 to 18, make up the program and educate Zoo visitors at various Zoo programs, summer camps, and events. Ten Zoo ALIVE volunteers assisted with the beetles' release. The ZAs, additional volunteers and Education Department staff aided with rearing the beetles in the spring (figure 2).



Figure 2: Ten Zoo ALIVE volunteers and two leaders at Wah'Kon-Tah Prairie

Methods

Throughout April and May, the ZAs reported to the Insectarium to provide routine care for approximately 600 beetles housed in individual habitats (figure 3). The volunteers removed and replaced the damp paper towels used as substrate and shelter for the beetles, wiped out each container and added meal worms and wax worms for food (figure 4).



Figure 3: Hundreds of captive American Burying Beetles kept in individual habitats



Figure 4: Each beetle received care (cleaning and feeding) twice per week.

June 13-18, the volunteers traveled to Southwest Missouri to help with the project. On June 14, ZAs witnessed the brood check at one of the sites from the June 3 release, and helped remove and replace the protective chicken wire. On June 17, the ZAs split into three teams to release ABBs at three sites at Wah'Kon-Tah Prairie. They dug plugs 20-25 cm deep with a fist-sized brood chamber off to the side, approximately 6 cm above the bottom of the hole (figure 5). A dead quail was placed in each brood chamber. After each plug was checked by Insectarium staff, the beetles were released (figure 6). A pre-selected male and female were placed on the quail, the plug was placed over the hole, and dirt was replaced around the edge to fill the gap. Chicken wire was staked over the release sites to deter predators. Ten days later, Insectarium staff returned to the site to check 1/3 of the broods, count the larva, and note the presence or absence of the adult beetles.



Figure 5: Ten Zoo ALIVE volunteers digging plugs for American Burying Beetles



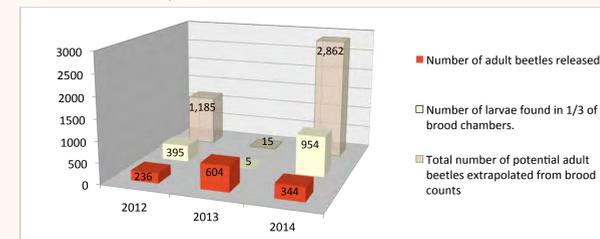
Figure 6: Placing a captive reared American Burying Beetle into its newly dug and provisioned brood chamber

On the way to the release site, ZAs were asked to complete a questionnaire about their attitudes and feelings toward animals, nature, conservation and animal careers. They completed a similar survey on the way back to St. Louis after the release. During the trip they were asked to write a reflection answering the question "How has this trip or other Zoo ALIVE trips impacted you?"

Results

2014 was the third summer to release ABBs at Wah'Kon-Tah Prairie and arguably the most successful (figure 7).

Figure 7: American Burying Beetles released and larva found in brood checks



2013's low larva count was due to a storm that hit the prairie shortly after the beetles were released, which washed the adults out of the brood chambers. Despite the low larva counts in 2013, an un-notched female was found with a notched male during the brood check on June 17, 2014. This female is most likely a surviving and overwintering offspring from the 2013 reintroduction.

Table 1: Larva counts from each ABB release in 2014

2014	1 st Release larvae counts (1/3 of broods)	2 nd Release larvae counts (1/3 of broods)	Totals larvae counts (1/3 of broods)
Site #1	93	173	266
Site #2	145	144	289
Site #3	152	247	399
Totals	390	564	954



Figure 9: An adult American Burying Beetle (largest beetle in the photo) trapped on August 16, 2014. Various other carrion beetles are also in the trap.

Follow up surveys at Wah'Kon-Tah Prairie resulted in an un-notched ABB found on August 16, 2014 (Table 1). This beetle was likely an offspring of the adults released in June 2014.

ZAs reported many impacts as a result of their participation in this project (Table 2). They wrote about how this project and other ZA nature experiences have influenced their attitudes and awareness about nature and animals and their desire to do more. This project in particular was valued as an opportunity for real, field science experience, and the chance to work alongside conservation professionals.

Table 2: What is the impact of this and other field experiences on the ZAs?

# of ZAs out of 10	Self-reported impacts from surveys about the trip and free writing reflection
9 of 10	Strengthened love of animals and relationship with nature.
9 of 10	Want to learn more, do more, spend more time in nature.
8 of 10	More observant in nature and aware of the little things.
8 of 10	More conscious of my affect on the environment, ability to make a difference.
7 of 10	Learned more about science, careers, field work.
3 of 10	Want to encourage others to spend time in nature, teach others.
1 of 10	More appreciative of modern conveniences (after going without!)

Conclusion (in their own words)

As Zoo ALIVE volunteers, participating in the raising and release of the American Burying Beetles (ABB) was, and still is, very heartwarming and exciting. The experience really opened our eyes. We learned so much about these fascinating beetles and how much work and determination goes into a project like this. The Saint Louis Zoo continues to survey the release site to look for adult offspring, and will raise and release ABBs for at least two more years and ZAs are eager to participate again.

Beyond this project, it became clear to each and every one of us that this is only the beginning, not the end. We helped the environment and the ABBs that day, but there is so much more for all of us to do. The generation before us has done what they can do; they are now leading us in the path that we are supposed to go. We are not to stop here at the ABB release, we must continue to help the environment and educate others.

That's Some Pig!

Erin Haycraft, Senior Keeper/Ungulates; Kim Downey, Senior Keeper/Ungulates; Christy Poelker, Senior Keeper/Ungulates; Amy Alexander, DVM, Veterinary Resident; Martha Fischer, Curator of Mammals/Ungulates and Elephants, Saint Louis Zoo



Introduction

In September 2014, a female babirusa (*Babyrusa celebensis*) at the Saint Louis Zoo gave birth to a single female piglet. The sow initially showed appropriate maternal behavior but developed mastitis approximately 36 hours post-parturition, leaving her unable to adequately care for the piglet. Managers, veterinarians, and keepers agreed that it would be best for the sow and the piglet to begin the process of hand-rearing. While our team has many years of experience hand-rearing ungulate neonates, raising a babirusa piglet was a first for us. In fact, there has only been one other previous hand-reared piglet in North America at the Los Angeles Zoo. Within five months, our thriving piglet was reintroduced to her mother and has become an integral part of our babirusa family.



Next Steps

The Antelope team began supervised howdy to sow (named Pebbles) at day 24 and they continued to have howdy access daily until introduction.

Brook was introduced to Pebbles at day 50.

Brook showed interest in pellets, hay, and produce once introduced to Pebbles.

At day 59 we began howdy with the rest of the babirusa family which consisted of 0.2 adults and 0.2 juveniles. Brook remained with Pebbles at night beginning on day 59 as well.

Between days 77 and 103, the total number of feedings decreased to 3 per day.

Between days 135 to 150 Brook received 2 feedings per day and the total volume of milk offered was also reduced.

By day 151 Brook received only one feeding per day and the total volume offered was decreased.



The Early Days

36 hours after birth, our keeper team began hand rearing the piglet we named Brook.

Brook was housed primarily in an incubator in order to keep her body temperature stable.

We began offering 8 feedings per day, consisting of a 50:50 ratio of goat milk and water.

Beginning on day 5, Brook began spending short periods of time out of incubator under keeper supervision.

Keepers began offering solid food at 1 week of age; however, she did not show significant interest in solid food until reintroduction to sow at day 50.

By day 25 of age, she was appropriately thermoregulating and no longer was housed in the incubator.

Growing Up

Once out of the incubator, Brook was primarily housed in a "Pack 'N Play" which was set up in our keeper office.

As she continued to thrive and gain weight, she was often given space to run and play in a small holding stall (with and without supervision).

Keepers spent time with Brook during this period to provide important socialization and playtime prior to her introduction to her babirusa family.

While total volume of milk offered was adjusted daily, the number of feedings per day decreased from 7 to 5 by day 47.



On Their Own

Brook was completely weaned at day 165.

Brook and Pebbles were introduced to the rest of the babirusa family at day 131.

While Brook and Pebbles were housed with the family during the day, we continued to house them separately at night until Brook was older and larger in size.

By the time Brook was 8 months old, the entire babirusa family was housed together during the day and the night.

Over the course of the hand rearing process Brook grew from a 1.45 pound piglet to a 32 pound piglet!

Acknowledgments: We would like to thank the Saint Louis Zoo Antelope Area management and team, and the Saint Louis Zoo Department of Animal Health for all the time and dedication it took to make this effort a success.

We would also like to thank the Los Angeles Zoo and the AZA Babirusa Species Survival Plan® for providing helpful information that allowed us to successfully hand-rear our first babirusa piglet.

Photos taken by the authors.

Ex-situ Conservation of Markhor (*Capra falconeri heptneri*): A Genomic Analysis to Enhance Captive Breeding Standards



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Why Do We Care?

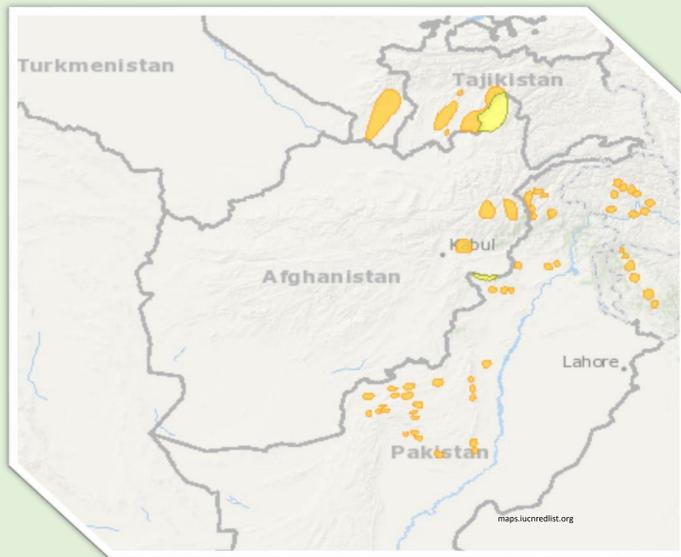


Figure 1: Fragmented populations in Uzbekistan, Afghanistan, Turkmenistan, and Tajikistan

- ❖ Endangered, living in small, fragmented populations within Tajikistan, Uzbekistan, Afghanistan, and Turkmenistan
- ❖ Michel et al.'s 2012 population survey in Tajikistan identified ~ 1,000 markhor, with at least 180 different herds present
- ❖ Markhor are often victim to poaching for their large, corkscrew horns and meat in a state of poor economy
- ❖ As domestic herding practices expand upward on mountain ranges, markhor are forced to move outside of their range, north, where food sources become less abundant and living conditions decline



Figure 2: Local families in Tajikistan help combat poaching. This family confiscated markhor skins and horns from Afghan poachers

What We Want to Do About It

Objectives

Phase I

- ❖ Identify single-nucleotide polymorphism (SNP) within the markhor genome

Phase II

- ❖ Produce a more accurate studbook for mating pair selection by identifying individual relatedness and allelic diversity of individuals and populations within North America
- ❖ Determine paternity for 6 markhor kids to address pedigree gaps within the North American studbook
- ❖ Identify potential founders to introduce into the North American population to increase/maintain current genetic diversity
- ❖ Compare North American and European captive populations while providing a foundation for the markhor breeding program in Europe
- ❖ Compare North American and European populations to wild populations from Tajikistan to aid in future markhor conservation, both *ex-situ* and *in-situ* efforts.



Figure 3: Captive adult male



Figure 4: Captive adult female



Figure 5: Dried blood spots for DNA extraction

Methods

Phase I

- ❖ Extracting RNA from three markhor of the North American population, their genome was sequenced utilizing Next Generation Sequencing at the Cornell Biotechnology Resource Center to identify expressed SNP markers, creating a SNP map in preparation for Phase II

Phase II

- ❖ Dried blood and hair samples from the North American, European, and wild, Tajikistan populations, will be used to extract DNA for sequencing via genotyping by sequencing (GBS)
- ❖ The SNP map generated from Phase I will be used to evaluate the data generated from GBS, allowing for Phase II objectives to be completed

Acknowledgements

- ❖ Rosamond Gifford Zoo's American Association of Zoo Keepers Chapter as a partner in aiding project funding and management of finances
- ❖ Los Angeles Zoo and Botanical Gardens for financially supporting this research effort
- ❖ Rosamond Gifford Zoo, NY, Los Angeles Zoo and Botanical Gardens, CA, Columbus Zoo, OH, Stoneham Zoo, MA, Hogle Zoo, UT, Hemker Park Zoo, MN, Patio Ranch, TX, and Helsinki Zoo, Finland, for blood samples to evaluate captive populations
- ❖ Jean DuBach with Bronx Zoo, NY in providing hair and blood samples and their collaboration in determining markhor paternity
- ❖ Stefan Michel in Tajikistan for providing tissue samples to evaluate wild populations

Literature Cited

Michel, Michel, Saidov, Karimov, Alidodov & Kholmatov. (2014). *Oryx*, 1-8

Evaluating for Success

Stephanie Richmond, Keeper/River's Edge, Saint Louis Zoo



Evaluation of enrichment is an essential component of all enrichment programs. In 2014, a welfare-based enrichment evaluation program was created and implemented at the Saint Louis Zoo. This program has enhanced animal welfare since its inception and is applied to a variety of species in the zoo's River's Edge area, including black rhinos, Asian elephants, dwarf mongoose, Egyptian geese, and more. Utilizing Microsoft Excel, the program combines an Enrichment approval form, Enrichment Catalog database, Enrichment Evaluation database, Enrichment Calendars, and Enrichment Quarterly reports. This system can be adapted for use for all species and institutions. Enrichment evaluation ratings are recorded and then computed into pivot charts, which are used to create quarterly Enrichment Reports. These keeper-produced reports are shared with zoo management and fellow keepers. Species-specific goals are generated for increasing enrichment effectiveness and welfare by combining behavioral goals with the data generated in the Enrichment Reports.

Enrichment Approval Form

For every new enrichment item an enrichment approval form must be filled out. Each form contains boxes for keepers to insert photos of the item, behavioral goal for the species, and a written description. The forms are also password protected. Only the zoological managers, curators, and veterinarians have the password for ease of simply checking a box to signify if the item is approved or not.



Indirect Evidence Scale (I)

This occurs when the keeper indirectly observes how the enrichment item may have been interacted with by the animal. This would be a delayed observation of the enrichment item ONLY.

Rating

- I1** = No Evidence of Interaction of Enrichment Item (i.e. Untouched Box, Nothing Moved etc.)
- I2** = Moderate Evidence of Interaction of Enrichment Item (i.e. Box moved, Scent marked etc.)
- I3** = Significant Evidence of Interaction (i.e. Box completely destroyed and scattered etc.)



Evaluation ratings are recorded in the River's Edge Enrichment Calendar and Evaluation Database.

- If an item is evaluated at a 0, a re-adjustment will be suggested before its next use.
- If an item is evaluated at a 1, three times in a row, a re-adjustment will be suggested.
- If an item is evaluated at a D5 more than 10 times, the item will be considered a "high-ranking enrichment item" and will no longer need to be evaluated every third use.

Enrichment Catalog Database

Once an item has been approved it is entered into the Enrichment Catalog database. If the item was not approved it is entered into this same database, but under the "Disapproved items" tab.

Each disapproved item listing also includes the reason that it was not approved.

The Enrichment Catalog database is easily searchable with the use of built-in filters. Each enrichment item listed is hyperlinked back to the approval form for ease of access for keepers and managers.

Enrichment Calendar

Calendars are made one month at a time for each species. At this time, the keeper making the calendar will change the fill colors in the excel file in order to track the usage of the items in the calendar.

It is important to track the usage of items so each enrichment item is evaluated frequently.

Enrichment Evaluation

All enrichment items are evaluated via direct observation the first time the item is given to a species. Each enrichment item will then be evaluated a minimum of every third use, either directly or indirectly. After an item has re-adjustments made to it, it will be evaluated via a direct observation at its first use.

During the evaluation process, each enrichment item's behavioral goals (found on that item's enrichment approval form) will be taken into account. Re-adjustments may be suggested in order to achieve these behavioral goals.



River's Edge Enrichment Evaluation Rating System

Direct Evidence Scale (D)
This occurs when the keeper directly observes the interaction between animal and enrichment item

Rating

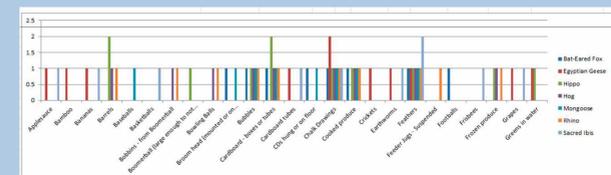
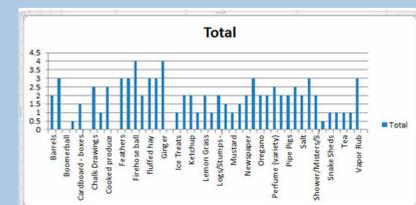
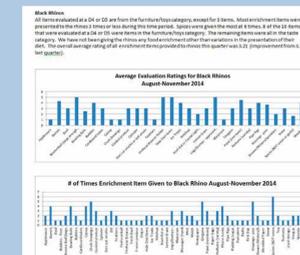
- D0** = Undesired Response (i.e. ingestion, device hazard, avoids item, interacts dangerously or aggressively with item, etc.)
- D1** = No Observed Interaction with Enrichment
- D2** = Animal Orients Toward Enrichment, but Has NO Physical Contact with Item
- D3** = Between 1 to 5 Visits or Minutes of Interaction with Enrichment Item
- D4** = Between 5 and 10 Visits or Minutes of Interaction with Enrichment Item
- D5** = Greater than 10 Visits or Minutes of Interaction with Enrichment Item



Quarterly Reports and Goal Setting

Quarterly (March, June, September and December), the River's Edge Enrichment Committee representative will examine the evaluation results and produce a report to River's Edge management and staff. At this time, a meeting with the River's Edge unit may be suggested and re-adjustments to our enrichment program may be recommended. During these meetings behavioral goals will be discussed for each species and a list will be developed for furthering the overall goals of animal enrichment in the River's Edge.

Pivot tables are used to illustrate the average evaluation rating each species in the River's Edge receives for all items given and the number of times each species received all items. This allows the River's Edge staff to set goals such as: suggest a re-adjustment for Sacred ibis paper bag enrichment or brainstorm new ideas or re-adjustments to heighten rhino scent enrichment.



Thank You!

Thank you to the Saint Louis Zoo River's Edge management and keeper staff for their continued support in undertaking this new enrichment evaluation program.

Documenting the Developmental Milestones of a Matschie's Tree Kangaroo Joey by use of a Borescope (*Dendrolagus matschiei*)

Sue Guyot & Shannon Santangelo, Saint Louis Zoo

Background:

- Keepers began training a voluntary pouch check behavior with Kasbeth, a female Matschie's Tree Kangaroo, in 2006.
- Over the years keepers introduced a flashlight and camera to improve visibility of the joey and document growth during later stages of development.
- At the Tree Kangaroo Workshop in 2013, keepers were encouraged to train a voluntary pouch check with the use of a borescope, which is a device with a small camera attached to a wire and connected to a small hand held screen.
- This would allow keepers to record footage of the joey at various stages of development starting early on.



Training Procedures:

Daily voluntary pouch checks with flashlight and camera conditioned up to a week prior to the joey's estimated birth date.

- Introduced borescope when the joey was 3.5 weeks old.
- Voluntary pouch check with the borescope was done once a week.
- Keepers worked on finding the best location and reinforcement for this behavior.
- Referred to developmental stages listed in the 2007 Tree Kangaroo Husbandry Manual as a guideline.
- Physical Characteristics (Recorded in weeks)

› Claws pigmented: 7	› Fine fur-dorsum or forelimbs: 11
› Lower incisors: 20	› Fine fur-rhinarium: 15-16
› Upper incisors: 30	› Fine fur-cloacal vibrissae: 16
› Ears free from head: 11-15	› Fine fur-face: 24
› Ears becoming upright: 24	› Darker fur on arms/legs: 26-31
› Ears fully upright: 26	› Dark pigmentation on tail: 26
› Eyes open: 20-21	› Fully furred: 22-29
- Used the computer program, Power Director, to capture stills from the video footage.



Conclusion:

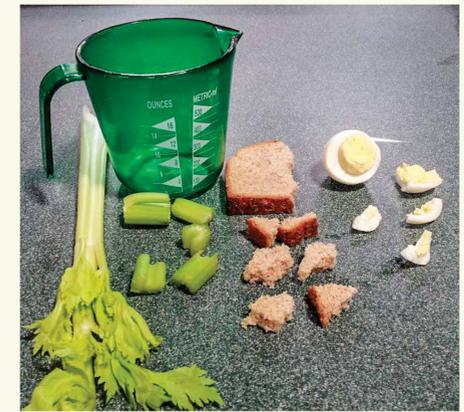
Challenges:

Perfecting the technique with the borescope to get a clear image. The light on the camera area got warm to the touch—wrapped with electrical tape.

Finding the best location and position for Kasbeth (posture, tail positioning).



Finding the best reinforcement and size.



Training Outcome:



Arm at 3.5 weeks of age



Legs and tail at 3.5 weeks of age



Face and arm at 4.5 weeks of age



Claws pigmented at 8.5 weeks



Eyes closed at 8.5 weeks of age



Nursing at 9.5 weeks of age



Foot pad at 12.5 weeks of age



Grooming claw at 10.5 weeks of age



Grooming claw at 16 weeks of age

Benefits:

Keepers were able to document joey developmental milestones including identifying the gender of the joey at 4 weeks of age.



4 weeks of age



9.5 weeks of age

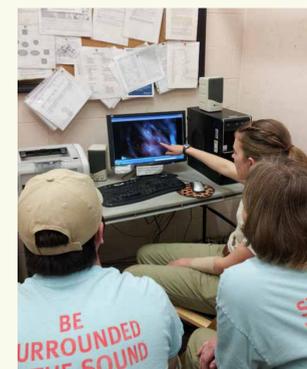
It also created an opportunity to share this experience with coworkers and connect with and educate visitors about positive reinforcement training, behavioral management, and the natural history of Matschie's Tree Kangaroos.



18.5 weeks of age



25 weeks of age



References: Tree Kangaroo (*Dendrolagus* spp.) Husbandry Manual, 3rd Edition 2007, Tree Kangaroo Species Survival Plan©, Edited by Jacque Blessington & Judie Steenberg

Acknowledgements: Alice Seyfried, Fred Saigh Curator/Emerson Children's Zoo, Saint Louis Zoo; Animal Division, Saint Louis Zoo; Christy Childs, Public Relations Manager, Saint Louis Zoo

Management of a Diabetic Caracal (*Caracal caracal*) through Voluntary Injection Training

Amanda Ista Milwaukee County Zoo, Milwaukee, WI amanda.ista@milwaukeecountywi.gov

Abstract:

In the winter of 2014, a fourteen year old female caracal (*Caracal caracal*) at Milwaukee County Zoo was diagnosed with diabetes following observations of lethargy and inappetence. Initial treatment using oral medications failed to be successful when the caracal refused to take pills and eventually refused all food. Although she was accustomed to being managed free contact, she was not tractable and would avoid keepers during cleaning and feeding.

Through the development of special pole syringe and the use of operant conditioning, keepers were able to train her to accept twice daily insulin injections and monitor her glucose levels through daily urine samples.

This poster will outline the diagnosis and treatment methods as well as the training program used to manage her diabetes successfully.

Diagnosis:

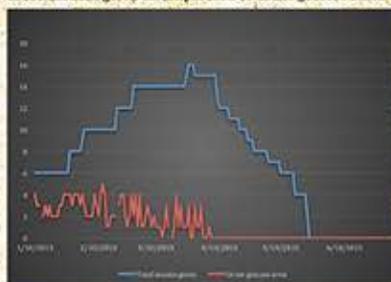
- Quarantine exam revealed no evidence of diabetes or any other medical concerns
- December 8, 2014 - started refusing fluoxetine
- December 19, 2014 - started refusing normal diet, would eat other items but eventually started refusing these
- Mid-December - fecal output became more erratic
- December 22, 2014 - urine sample revealed glucose and ketones
- Late December - tried various laxatives to help with fecal production and food refusal and plucking increased
- December 31, 2014 - Anesthetized for full exam which revealed high blood glucose levels in the blood. Diagnosed with diabetes and a minor urinary tract infection
- Stayed at Animal Health Center for treatment but would not eat well or allow injections
- January 8, 2015 - Moved back to Big Cat Country to attempt insulin treatments free contact
- January 10, 2015 - Received first voluntary free contact insulin injection



Discussion:

- Due to the need to get insulin in Camelia and the lack of motivation to eat on her end, classical conditioning techniques were initially employed. Positive reinforcement operant conditioning techniques were then phased in to minimize any regression in the behavior.
- Squeeze cage training was attempted but Camelia seemed more comfortable receiving injections when not confined.
- Camelia still continues to pluck intermittently but not to the extent we have observed in the past. With most steps down as we were weaning her off insulin, she increased plucking then stopped. We continue to monitor her plucking but are not treating it with medication, just increased enrichment and training opportunities.
- Camelia's sister, Magnolia, also was diagnosed and treated for diabetes around the same time at Audubon Center for Research of Endangered Species. She responded well to an oral medication.
- We still continue to train Camelia and would like to eventually be able to collect blood voluntarily to test blood glucose levels.

Total insulin given in comparison to urine glucose level



Background:

- O.1 Caracal (*Caracal caracal*) "Camelia"
- Born May 24, 2000 at Audubon Center for Research of Endangered Species
- Hand reared
- Arrived at Milwaukee County Zoo June 5, 2014
- Moved on exhibit in Big Cat Country July 12, 2014
- Managed free contact in an approximately 1000 sq. foot indoor exhibit across from lions or hyenas
- History of intermittent plucking treated with fluoxetine

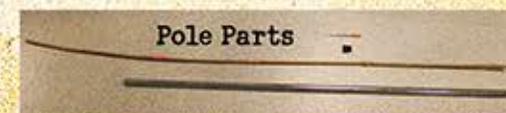


Training Process:

- Minimal history with positive reinforcement training. She was not very food motivated and would spit out food when keepers presented it on a food stick. We suspect the fluoxetine for plucking was depressing her behavior.
- With no appetite and no opportunity for other times of reinforcement she would respond to (tactile, verbal, etc.) keepers employed classical conditioning methods initially to simply get insulin into her.
- A pole syringe was made after several prototypes. Keepers wanted the ability to control the injection and have a gentle, smooth process to deliver the insulin without interfering with her personal space.
- The pole syringe was made from a hollow metal tube with a stick that was movable inside of it. The syringe was placed in a rubber stopper with a hole drilled in it to keep it in place. Keepers could control the rate of delivery of the insulin as the stick pushed the plunger once she allowed for the injection.
- For the first week, one keeper only did both morning and afternoon injections. Camelia would allow the injection and then eat after. Her appetite increased almost immediately after the first injection. Urine glucose levels were monitored daily.
- More keepers were slowly added but only four total keepers were trained on the behavior to ensure consistency.
- Eventually, Camelia began to regress and try to avoid the injection so keepers adjusted training from a classical conditioning method to a positive reinforcement schedule. Camelia was bridged verbally and rewarded with a mouse after the injection.
- Camelia learned to tolerate injections twice a day but did not ever seem to accept them fully. She still hissed and watched keepers closely as they were injecting her but continued to line up and allow treatments twice daily. Her diet was presented in front of her during injections but she would pause mid-consumption to watch the keeper inject her and then continue to eat after the injection.
- Early April 2015, urine tests were negative for glucose and she was slowly weaned off insulin.
- May 24, 2015, insulin injections were stopped and urine glucose level continue to be negative. Her appetite is still good and fecal output is normal. Plucking has slightly increased but is being managed by enrichment and training opportunities instead of medication at this time.



Pole Parts



Acknowledgements:

Thank you to all the hard work and help from the veterinary staff at Milwaukee County Zoo as well as the keepers who helped with injections, training and interpretation. Also, thank you to staff at Audubon Center for Research of Endangered Species for their information on treatment of Camelia's sister as well as all our other colleagues in the zoo field who helped us along the way.



IMPACT OF DIFFERENT CAPTIVE ENVIRONMENTAL CONDITIONS ON BEHAVIORS OF AFRICAN LION AND THEIR WELFARE

Bushra Nisar Khan^{1*}, Zulfiqar Ali², Shahid Mehmood³, Hassan Raza⁴ Rida Ahmad⁵ and Muhammad Azhar⁶

^{1, 3, 4, 5} *Centre for the Undergraduate Studies University of the Punjab, ²Department of the Zoology University of the Punjab, ⁶ Lahore Zoo Safari

*Corresponding Author, bushrank@yahoo.com & bushrank2007@gmail.com

Introduction

- ❖ African lions are highly social and their pride normally consists of 14 members.
- ❖ A comprehensive study on attitude of these animals in different captive sites provided information about captive variables that have impact on their behaviors.
- ❖ In general fields have vast natural home ranges in the wild which lacking at most of Zoological Gardens and Safari Parks
- ❖ The primary driving force behind this study was to observe the different behavior categories with reference to size of enclosure.

Hypothesis

It was considered that size of enclosure and exhibit complexities has great impact on captive lions' behaviors.

Materials & Methods

- ❖ The Instantaneous Point Sampling Technique was used to record the behaviors displayed by Lions at Lahore Zoological Gardens and Lahore Zoo Safari, Lahore.
- ❖ Ration Scale is same for both study sites i.e. . 5-6 Kg Beef + 1 Litre Milk , One Whole Chicken and Tuesday Off.
- ❖ The Abnormal Behaviors observed were Food Refusal, Pacing Abnormal, Aggressiveness, Auto Mutilation Feces Licking , Grooming and Head Tossing.
- ❖ The normal behaviors observed were Playing, Climbing, Roll over/ stretch, Scent marking, Use of Water pool, Digging, Stalking, Sleeping, Laying on back, Grooming and Mating.



Experimental Animals

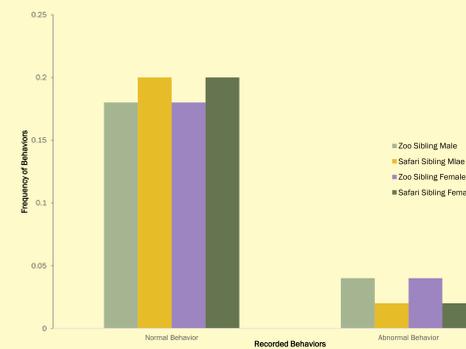
Study Site	Experimental Animals
Lahore Zoological Gardens	Solitary lion (Male) 19 years
	Breeding pair (Male) 16 years (Female) 18 year
	Siblings (Male) 2.5 years (Female) 2.5 years
Lahore Zoo Safari	Solitary lion (Male) 17 years
	Breeding pair (Male) 19 Years (Female) 18 Years
	Siblings (Male) 3 Years (Female) 3 Years

Enclosure Size & Variables

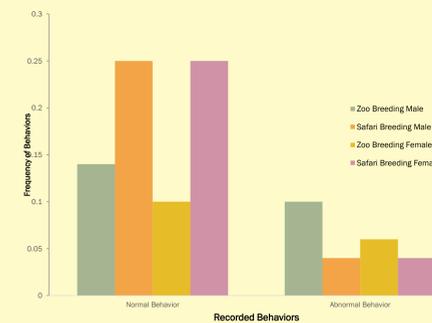
Study Site	Enclosure size	Substrate	Vegetation	Pool	Shade
Lahore Zoo	Small 27400 sq. ft. (1 acre)	Unnatural	Not present	Small	Improper
Lahore Zoo Safari	Large 653400 sq ft (15 acre)	Natural	Present	Large	Proper



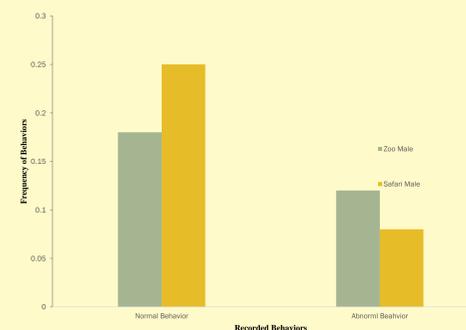
Results



Frequency of Behaviors of Siblings



Frequency of Behaviors of Breeding Pair



Frequency of Behaviors Solitary Lion



Conclusion & Recommendations

Abnormal behavior in captive animals has been the provoking signal of indigent welfare. There is need to develop protocols to address these problems. The present study indicated that area of the captive site is major element of animal welfare. The more complex and natural habitat ensured the wellbeing and livelihood of the wild animal. Proper collection and enrichment plan could improve living standards of these felids even in small housing areas.

Acknowledgements

Special Thanks to Management of Lahore Zoological Gardens & Lahore Zoo Safari



2.0 peccary



1.1 rhea

Can We All Just Get Along?

(adventures of a mixed species exhibit)

Kelsey Kuhn

Sequoia Park Zoo ♦ Eureka, CA



1.1 rhea



1.2 rhea

Method:

- Added hog panel dividing exhibit, added 2 smaller pens
- Lined fence lines with shade cloth for 2 weeks
- Peccaries had access to E10, rheas moved into E11

Results:

- Visual intro- Both species wary but not overly fearful
- Physical intro- No issues
- Male rhea became aggressive to peccaries a year after intro. Added "creeps" to fence line to restrict rhea access to pen areas



2.0 peccary



3.0 peccary

Method:

- Plywood used to eliminate visual access around E10H
- Small howdy in night house for 2 weeks
- Removed 1 plywood panel from fence, replacing with 1"x2" mesh for 2 weeks
- Removed mesh leaving hog panel for 3 days then removed 1 plywood panel every two days

Results:

- Visual intro- Subordinate of 2.0 group postured and charged fence often during first week with aggression decreasing steadily thereafter
- Physical intro- TBD

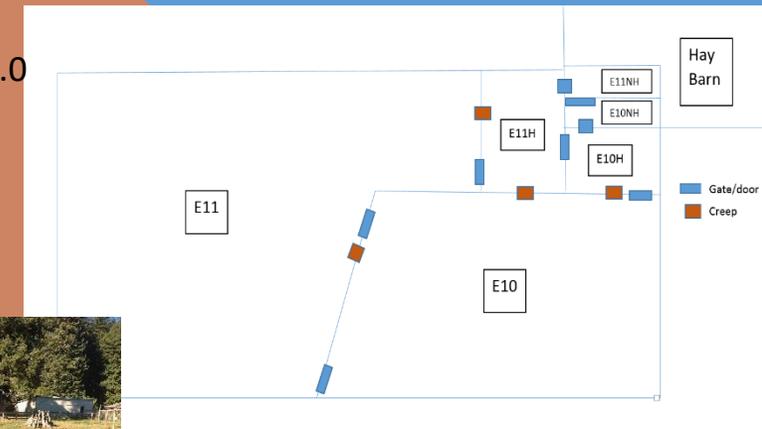


Method:

- 1.1 rhea had access to E10, 1.2 rhea moved into E11

Results:

- Visual intro- older female aggressive towards younger rheas through fence
- Physical intro- older female continued to displace younger rheas though less frequently
- Male rhea wing displaying together
- Male rhea became aggressive during breeding season- short beak fights until dominance established. Mild chasing occasionally thereafter



Fundamental Properties of Hoof Care

Jennifer LeBeau

Disney's Animal Kingdom® Theme Park

Introduction

Understanding the fundamentals of hoof care leads to better health and quality of life for the animals in your facility. Hooves are very important to overall care; expanding your knowledge and skill level is beneficial to your animals. Hoof trimming is a skill developed over time, and the best way to learn is by doing. At Disney's Animal Kingdom® Theme Park, we have developed practices to make hoof work a safe & effective task.

Methods

A variety of methods exist for keeping hoof work a manageable task: a calendar schedule for each animal, utilizing tools to make the job safe and efficient, knowledge of hoof anatomy and application of that knowledge when problems arise.

Tools



Having the best tools will make any job easier! We have experimented with a number of hoof trimming tools over the years. Starting with the most commonly used: hoof rasp¹ and shears², as well as safety glasses & gloves. With these tools we were able to achieve basic hoof trims. Next we added in a hoof plane rasp³ and dremel tool⁴; with the addition of these, it was easier to correct problems. Most recently, we have added an electric hoof knife⁵. This has made a world of difference in our hoof care and efficiency.

What tools are best for your team?

Low budget: hoof rasp, plane rasp and shears

Moderate budget: addition of a dremel tool

High budget: addition of an electric hoof knife



At various times throughout the year, we invite our guests to view hoof trimming sessions.

Hoof Anatomy

It is important to understand hoof anatomy in order to maintain healthy hooves. With this knowledge, you will know how and why one should keep hooves in good condition, as well as how to prevent lameness with proper hoof care.

Goat and sheep hooves function to maintain traction. The hoof consists of two digits and two dewclaws. The goal of trimming their hooves is to restore or maintain the natural shape of the hoof so the weight is distributed evenly [see figure 1].

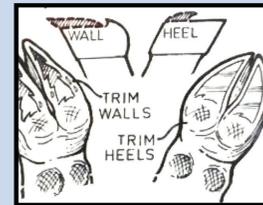


Fig. 1

Figure 2 illustrates a portion of the heel that commonly has excess growth. Trimming back this part of the hoof assures there is proper conformation of the digits.

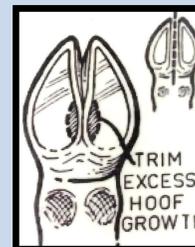


Fig. 2

Interested in viewing hoof work in action? Use your phone to scan the QR code below.



Acknowledgements

Jamie Barnard - Zoological Manager, Disney's Animal Kingdom® Theme Park

Elisabeth Wojton & Maria Hernandez - Animal Keepers, Disney's Animal Kingdom® Theme Park

Corrective Hoof Work

There is the occasional need for corrective hoof work:

1. Cracks in the hoof wall - repaired by creating a 'stop' line perpendicular to the top of the crack, and using the dremel or hoof knife to work away the bad portion of the hoof wall.
2. "Pockets" in the hoof wall - typically accompanied by a foul odor; repair by using the dremel or hoof knife to work away the bad portion of the hoof.

It's important to make sure all of the bad spots are removed; this ensures healthy hoof regrowth and you have properly corrected the problems.

Soaking hooves in Epsom salt water can be beneficial to help dry out those problem spots.



Results & Conclusions

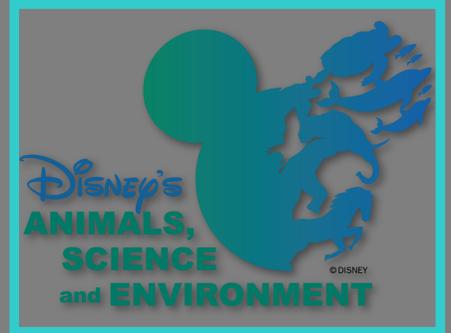
We have seen many positive results from the changes we have made in our hoof trimming practices. Tracking our monthly hoof trims allows us to easily manage the task as well as easily monitor any problems that arise. With the additional learnings and techniques, our animals have much healthier hooves.



Animal Training=Efficient Animal Husbandry

Do You Really Have Time Not to Train?

Angela Miller
Behavioral Husbandry Zoological Manager
Disney's Animal Kingdom®



How much time do you currently spend on these typical animal husbandry tasks?



Successful Animal Training Programs

Provide

Increased Efficiency to These Tasks

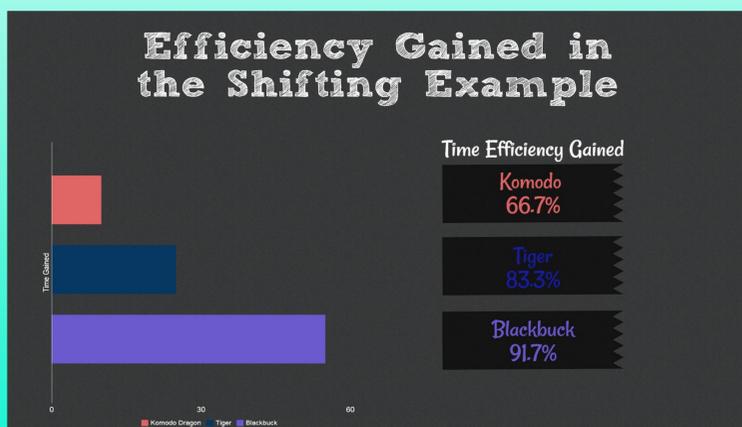
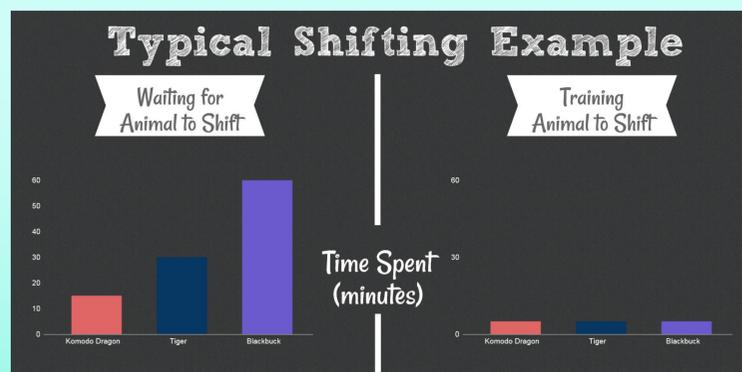


Initial Time Investment Continued Time Investment

2 Hours

10 Minutes Per Day

- Set Goals
- Write Training Plan
- Revise Training Plan
- Get Training Plan Approved
- Gather Supplies
- Implement the Plan
- Document Progress
- Communicate with Team
- Evaluate Success
- Readjust



BIG IMPACT
little effort

Let's Look at the Tiger Shifting Example

Time Gain = 25 Minutes
— Effort = 10 Minutes
—————
Extra Time = 15 Minutes

What Difference Will An Extra 15 Minutes Make?

Tip Start with a task that currently takes a long time.

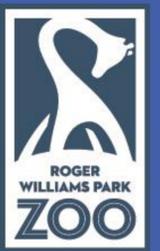
15 minutes a day
105 minutes a week
5460 minutes a year

How will you use your extra time?



With careful planning, goal setting and prioritization, huge training successes can be gained with a minimal time investment and these successes ultimately free up time in our busy daily routines. Spend a few minutes training your animals today, the investment can make a huge impact to your daily routine!

Saving A Species: Captive Breeding and Release of a Local Endangered Rabbit The New England Cottontail (*Sylvilagus transitionalis*)



Becca Phillips
Roger Williams Park Zoo

Introduction

The New England cottontail (*Sylvilagus transitionalis*) (NECT) is the only species of rabbit native to New England and has lost most of its habitat in the last one hundred years. The introduction of the eastern cottontail has also negatively impacted their survival. Since 2011 Roger Williams Park Zoo (RWPZ) has been working with federal and state agencies to breed and release this endangered rabbit to augment existing populations and to create new populations within its historic range.



Pairing and Breeding

Rabbits are held off-exhibit and are housed individually in racks. Beginning in March, breeding pens are set-up and pairings for the season are determined.



- The breeding pens are set up with multiple hide boxes, various hay covered nests, food, and water.
- Pairs are put in the pens for a total of 3 nights and 4 days, and checked on daily.
- On the 4th day the female is brought inside to a holding rack, where she is labeled as potentially pregnant with the expected due dates.



Pairings are determined by the sex ratio of each given season. Every fall, many of the adult rabbits are released by the project partners, while some remain for breeding the following year. Each spring, project partners set traps throughout New England to capture new founders for the program. Those founders are then brought to RWPZ for a 30 day quarantine period and veterinary processing.

Once the new founders are processed, pairing for breeding can begin, taking care to not repeat pairings throughout the season.

Birth of Kits



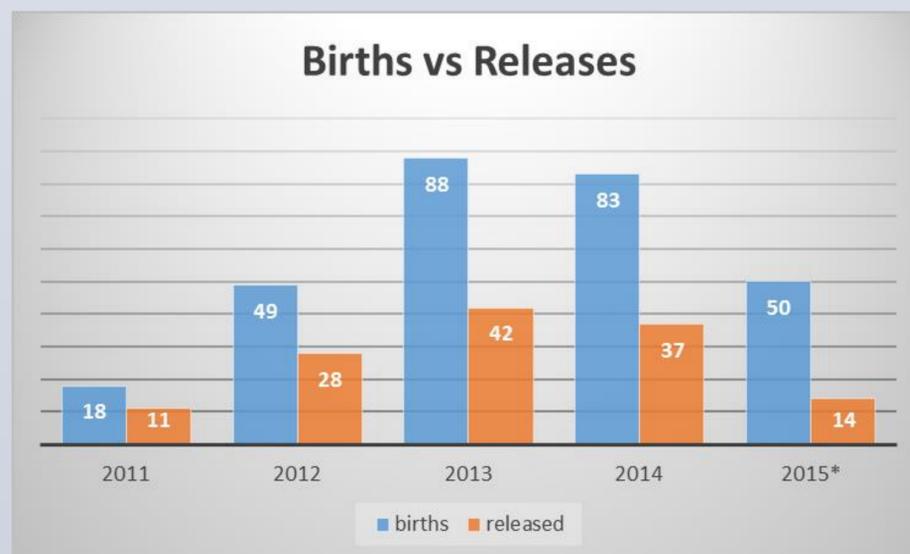
Processing day includes:

- Basic exam
- Weight
- Sexing
- DNA collection for
 - Database
 - Genetic verification
 - Sex verification
- Microchipping
- Ear tag
- Topical flea treatment



Results

A mortality rate of approximately 50% among NECT births has been found to be the norm within the collection at RWPZ, with the majority being due to parental neglect or infanticide. The average litter size in our collection is 4 kits while the range has been from 1 kit to 8 kits.



*2015 Breeding season still in process at time of publication

Release



Photo Credit:
US Fish and Wildlife Service

Rabbits are housed at RWPZ until they are old enough to be released. At that time, the various state agencies will pick them up and release them to their designated location.

If large enough, rabbits are fitted with a radio collar and released into 1 of these locations:

- Patience Island, RI
- Great Swamp, RI
- Great Bay, NH

Rabbits that are not large enough will be placed in a hardening pen until optimal size is reached.

- Ninigret Hardening Pen, RI (see photo above)
- Great Bay Hardening Pen, NH

Hardening pens are used as a transitional area to allow for the rabbits to acclimate to a natural life style, while still being safe from predators. The pens are generally 1 acre. Ninigret has a covered roof, Great Bay does not.

Radio collared rabbits are then tracked by their respective state agencies to determine successful survival and natural breeding.



Photo Credit:
Lou Perrotti

Project Partners



Acknowledgements

Contact

Many thanks to:

Lou Perrotti¹, Director of Conservation
New England Cottontail Keepers:
Kimberly Warren¹, Amanda Carey¹, Jennifer Hennessy¹
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Evaluating for Success

Stephanie Richmond, Keeper/River's Edge, Saint Louis Zoo



Evaluation of enrichment is an essential component of all enrichment programs. In 2014, a welfare-based enrichment evaluation program was created and implemented at the Saint Louis Zoo. This program has enhanced animal welfare since its inception and is applied to a variety of species in the zoo's River's Edge area, including black rhinos, Asian elephants, dwarf mongoose, Egyptian geese, and more. Utilizing Microsoft Excel, the program combines an Enrichment approval form, Enrichment Catalog database, Enrichment Evaluation database, Enrichment Calendars, and Enrichment Quarterly reports. This system can be adapted for use for all species and institutions. Enrichment evaluation ratings are recorded and then computed into pivot charts, which are used to create quarterly Enrichment Reports. These keeper-produced reports are shared with zoo management and fellow keepers. Species-specific goals are generated for increasing enrichment effectiveness and welfare by combining behavioral goals with the data generated in the Enrichment Reports.

Enrichment Approval Form

For every new enrichment item an enrichment approval form must be filled out. Each form contains boxes for keepers to insert photos of the item, behavioral goal for the species, and a written description. The forms are also password protected. Only the zoological managers, curators, and veterinarians have the password for ease of simply checking a box to signify if the item is approved or not.

Enrichment Catalog Database

Once an item has been approved it is entered into the Enrichment Catalog database. If the item was not approved it is entered into this same database, but under the "Disapproved items" tab.

Each disapproved item listing also includes the reason that it was not approved.

The Enrichment Catalog database is easily searchable with the use of built-in filters. Each enrichment item listed is hyperlinked back to the approval form for ease of access for keepers and managers.

Enrichment Calendar

Calendars are made one month at a time for each species. At this time, the keeper making the calendar will change the fill colors in the excel file in order to track the usage of the items in the calendar.

It is important to track the usage of items so each enrichment item is evaluated frequently.



Enrichment Evaluation

All enrichment items are evaluated via direct observation the first time the item is given to a species. Each enrichment item will then be evaluated a minimum of every third use, either directly or indirectly. After an item has re-adjustments made to it, it will be evaluated via a direct observation at its first use.

During the evaluation process, each enrichment item's behavioral goals (found on that item's enrichment approval form) will be taken into account. Re-adjustments may be suggested in order to achieve these behavioral goals.



River's Edge Enrichment Evaluation Rating System

Direct Evidence Scale (D)
This occurs when the keeper directly observes the interaction between animal and enrichment item

Rating

- D0** = Undesired Response (i.e. ingestion, device hazard, avoids item, interacts dangerously or aggressively with item, etc.)
- D1** = No Observed Interaction with Enrichment
- D2** = Animal Orients Toward Enrichment, but Has NO Physical Contact with Item
- D3** = Between 1 to 5 Visits or Minutes of Interaction with Enrichment Item
- D4** = Between 5 and 10 Visits or Minutes of Interaction with Enrichment Item
- D5** = Greater than 10 Visits or Minutes of Interaction with Enrichment Item



Indirect Evidence Scale (I)

This occurs when the keeper indirectly observes how the enrichment item may have been interacted with by the animal. This would be a delayed observation of the enrichment item ONLY.

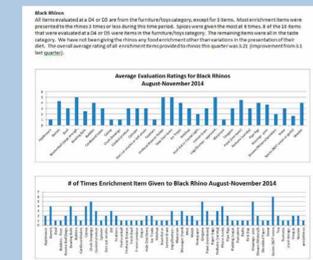
Rating

- I1** = No Evidence of Interaction of Enrichment Item (i.e. Untouched Box, Nothing Moved etc.)
- I2** = Moderate Evidence of Interaction of Enrichment Item (i.e. Box moved, Scent marked etc.)
- I3** = Significant Evidence of Interaction (i.e. Box completely destroyed and scattered etc.)



Evaluation ratings are recorded in the River's Edge Enrichment Calendar and Evaluation Database.

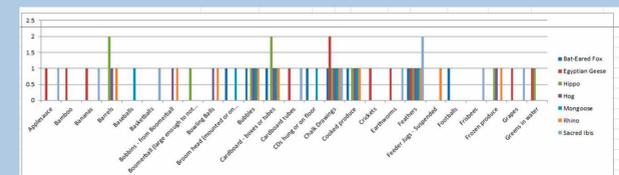
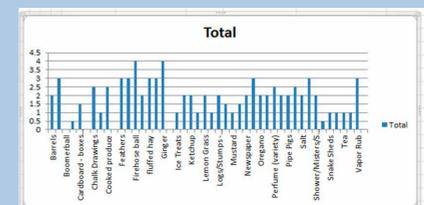
- If an item is evaluated at a 0, a re-adjustment will be suggested before its next use.
- If an item is evaluated at a 1, three times in a row, a re-adjustment will be suggested.
- If an item is evaluated at a D5 more than 10 times, the item will be considered a "high-ranking enrichment item" and will no longer need to be evaluated every third use.



Quarterly Reports and Goal Setting

Quarterly (March, June, September and December), the River's Edge Enrichment Committee representative will examine the evaluation results and produce a report to River's Edge management and staff. At this time, a meeting with the River's Edge unit may be suggested and re-adjustments to our enrichment program may be recommended. During these meetings behavioral goals will be discussed for each species and a list will be developed for furthering the overall goals of animal enrichment in the River's Edge.

Pivot tables are used to illustrate the average evaluation rating each species in the River's Edge receives for all items given and the number of times each species received all items. This allows the River's Edge staff to set goals such as: suggest a re-adjustment for Sacred ibis paper bag enrichment or brainstorm new ideas or re-adjustments to heighten rhino scent enrichment.



Thank You!

Thank you to the Saint Louis Zoo River's Edge management and keeper staff for their continued support in undertaking this new enrichment evaluation program.

INTRODUCTION

The clouded leopard, *Neofelis nebulosa*, is elusive and requires scrupulous captive management. Many zoos struggle to balance provision of a comfortable enclosure while ensuring the clouded leopard remains visible. The Brandywine Zoo (BZ) experienced this struggle with their 0.1 clouded leopard.

Several areas in her enclosure allowed the her to remain partially concealed, as clouded leopards need hiding places for their well-being³. Clouded leopard's need to hide increases when exposed to loud noises, predators, and other stressors¹. This was taken into account over the course of the study. Shortly before the beginning of this study, building construction nearby started.

Clouded leopards have distinct temperaments, just like humans². These temperaments are correlated with certain personality characteristics.

- Shy and timid temperaments are correlated with females, mother-rearing (as opposed to hand-rearing), and being reproductively unsuccessful.
- In her early days, the BZ clouded leopard was especially timid when working with keepers and in the presence of visitors.
- She fit two of the three personality characteristics correlated with timid clouded leopards.

Primary Objectives:

- Determine how visible the clouded leopard is in her exhibit
- Examine factors that may affect her visibility and/or shifting latency

Long-term Goal:

- Develop a comprehensive exhibit space that:
 - Allows utilization of their entire enclosure
 - Offers visitors the opportunity to see and learn about their natural behavior

Hypotheses:

- The clouded leopard will be visible 40% of the time.
- Building construction noise will negatively affect her visibility and shifting latency

OUR SUBJECT, KICHING

- ▶ 1999 – Born, housed with 1.0 littermate until 2002(?)
- ▶ 2003 – Arrived at BZ
- ▶ Summer 2014 – Building construction began nearby
- ▶ August 20 – November 30, 2014 – Visibility study period

Exhibit

- ▶ Enclosure was 35m² and height sloped from 3.7m – 4.3m.
- ▶ Den was 4.5m² and height sloped from 1.5m – 1.8m.
- ▶ Lush plants for hiding
- ▶ Four elevated pallets, one of which is mostly hidden by bamboo. Training pallet on ground at front of enclosure. Concrete patio with nest box in back of enclosure. Den doorway on side of patio
- ▶ Olfactory auditory, and visual access to Amur tiger
- ▶ Olfactory and auditory access to binturongs, serval, and red pandas

Daily Management

0830 – locked onto exhibit*, given access to enrichment
1600 – given access to exhibit and den, given access to enrichment
Daily Training: 0820-0840 & 1530-1600
Diet was offered through enrichment and/or training
*Den access given during hazardous weather



METHOD

- ▶ Daily survey of the clouded leopard's location within the exhibit
 - Observations were not taken at regular intervals or for a specific duration. As staff passed her enclosure throughout the day, they marked her location and locomotion.
 - These areas were further broken down into:
 - Four areas where she would be highly visible (50% or more of her body was visible)
 - Three areas where she would be less visible (less than 50% of her body was visible)
 - We also recorded if she was not visible
 - Data recording sheet was broken down into 15 minute intervals from 0800 to 1600
- ▶ Recorded daily level of construction noise on a scale from 1-5 (1 = no noise, 5 = maximum noise)
- ▶ Recorded daily shifting latency on a scale from 1-5 (1 = immediate, 5 = most difficult to shift)

RESULTS

Correlation of Construction Noise and Shifting Latency

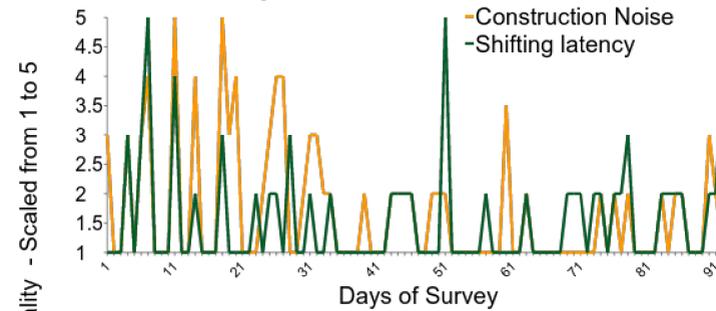


Figure 1. There is a strong positive relationship ($r = 0.457$) between the amount of construction noise and the clouded leopard's shifting latency.

Mean Number of Times per Day The Clouded Leopard Was Visible or Not Visible

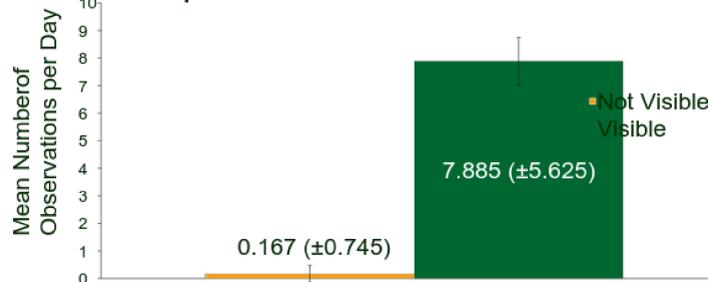


Figure 2. There is a significant difference ($t = -10.751$; $DF = 106$; $p < 0.001$) in number of observations when the clouded leopard was not visible and when she was visible.

Mean Number of Times per Day The Clouded Leopard was Observed Partially Visible or Fully Visible

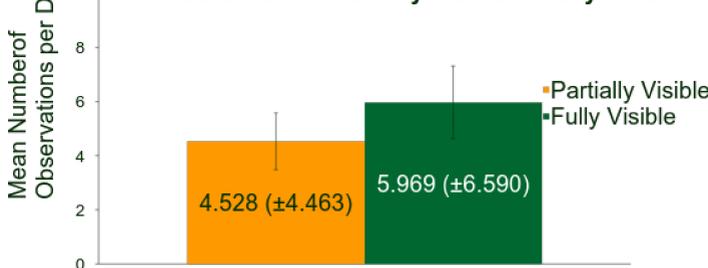


Figure 3. There is a significant difference ($t = -1.765$; $DF = 166$; $p = 0.040$) in number of observations when the clouded leopard was less visible and when she was highly visible.

DISCUSSION

Noise:

- ▶ Construction noise was positively correlated ($r = 0.457$) with shifting latency (Fig. 1).
- Construction increases levels of stress in clouded leopards¹.

Visibility:

- ▶ Kiching was visible 97.93% of the time. She was visible significantly more often ($p < 0.001$) than she was not visible (Fig. 2).
- ▶ Kiching was highly visible 56.86% of the time. She was highly visible significantly more often ($p = 0.040$) than she was less visible (Fig. 3).
- ▶ Our findings support our hypothesis that Kiching would be visible at least 40% of the time.

CONCLUSION

This study, the first of its kind at Brandywine Zoo, enlightened keepers on the effects of construction noise on shifting latency as well as the concept that the clouded leopard may have been more visible than she seemed. Our results show that she was highly visible for more than half of the observations, and at least partially visible nearly 100% of the time. These results show that she was truly hiding in plain sight. This was much higher than anticipated, however, we understand that with different parameters in the study, our results could have been lower. If we were to repeat this study, there are several areas we would like to explore and improve upon.

- ▶ The baseline for "visible" in the present study was the visibility of any body part. This was done with a discerning eye – keepers knew where to look and what to look for.
 - The average visitor does not have the same knowledge as keepers.
 - We could record percent of body visible or we could rate visibility on a scale of 1-5 (1 = easiest for the public to find, 5 = most difficult), to get a better idea of what the public actually sees.
- ▶ How would visibility have changed if there were not ongoing construction?
- ▶ Does proximity to predators have an effect on behavior?
 - Does estrus of the tiger housed nearby effect behavior of the leopard?
- ▶ More rigorous data recording; the number of observations per day was variable, with no set minimum. As a result, some days had no observations.
 - We thought our method of observing in a casual basis was the best fit at the time due to limited staffing.
 - However, we could have recorded once every 15 minutes for a small block of time, or have one person sit for 2 hour blocks and collect data for that period, then vary at what times those blocks fell over several days.
- ▶ We kept several hiding places in her exhibit because she was prone to stereotypic behavior and hiding was likely a form of self-soothing, so this would be an important aspect to maintain in future studies but a consideration for her ultimate visibility.
- ▶ Other factors we considered after the study that could have affected her visibility, that we may or may not have been able to control for included: age, health (she was arthritic), presence of other species nearby, season, weather, amount of daily training, keeper interaction, daily enrichment, and, of course, construction and visitor noise.

Unfortunately, Kiching passed away, at the age of 16, before the findings of this study could be applied.

SUGGESTIONS FOR FUTURE EXHIBITS

The following are suggestions for keepers who have shared in our struggle:

- ▶ **Construction** is largely unavoidable – during loud days, allow access to holding or den or add nest boxes.
- ▶ **Proximity to predators:**
 - ▶ Clouded leopards should not be housed in proximity to potential predators because it increases level of stress⁴.
 - ▶ Keepers observed an increase in Kiching's visibility after the death of a tiger housed nearby.
- ▶ **Signage**
 - ▶ Include information about camouflage and "hiding in plain sight". A picture of the exhibit with arrows pointing out common hiding spots could be helpful.

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ACKNOWLEDGEMENTS

The Brandywine Zoo – for affording us this opportunity for research
Gene Peacock, Director and Lynn Klein, Curator of Animals – for motivating us to investigate a better management plan for Kiching
Donna Evernham, former Asst. Curator of Animals – for being a driving force in the creation of this project and for keeping us focused on the reasons behind it
Jacque Williamson, Curator of Education – for guidance and technical assistance
Keepers and other staff – for data collection

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Is CFC the New BFR?

Four Years of Climbing for Clouded Leopards

Ali Striggow

Children's Zoo Keeper, Houston Zoo

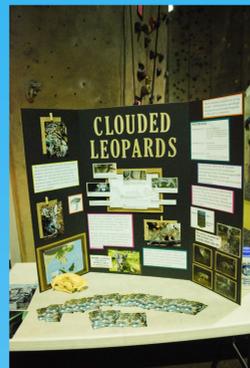
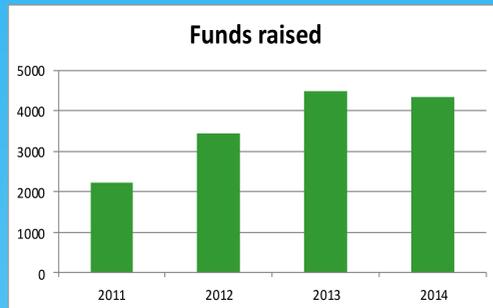


So what is CFC?

- *Climbing for Clouded Leopards (CFC) is a fundraiser similar to BFR where participants rock climb at a local climbing gym and the proceeds go to clouded leopard research and conservation.
- *2015 will be the fifth year that Greater Houston Chapter of the American Association of Zookeepers (GHCAAZK) has organized this event.
- *We have raised almost \$15,000 in the four years that we have done this event.
- *The first year funds were sent to the Clouded Leopard Project for distribution. The last three years we have partnered with the Bornean Clouded Leopard Programme to fund their research and conservation efforts directly. We have funded camera trap equipment, an on-site vet, and radio collar recovery efforts.



Carnivore and Children's Zoo Staff helping out at the education table (2013)



Education table (2014)

By our powers combined...picking a good partner

- *The key to our success has been that we have an amazing partner for this event, Texas Rock Gym (TRG)!
- *They donate 50% of their climbing revenue from the night of the event.
- *In 2014 they also ran a membership drive and donated 20% of new membership sales.
- *In addition they donate a year long membership (worth \$750), several one month unlimited passes (\$75 value), and several individual day passes with equipment (\$35 value) for our silent auction and raffle.
- *As the event has grown TRG has assigned a staff member to help with planning and running the event.
- *TRG provides staff to help with set up, with directing traffic, and with parking the night of the event.



Climbing at the event (2014)

Branding and Publicity

- *We put posters in all the local sports stores.
- *Facebook is our friend! This has proven to be our biggest resource in informing people about our event.
- *Reaching out to the Houston Zoo's young adult support groups, Flock and Asante.
- *Utilizing TRG's email list and Facebook page to reach out to the climbing community.
- *Banners on zoo grounds and keeper chats the week before the event.
- *We have a logo! And we put it on everything!



Primate and bird staff take a fun picture in our photo booth. Photos are posted on Facebook after the event for everyone to enjoy.

Silent Auction vs. Raffle: Why We Do Both

- *We do both a silent auction and a directed raffle.
- *Directed raffle = each raffle package has a jar in front of it which people can place their tickets into for the packages they are interested in winning.
- *We can charge more per raffle ticket this way because the packages are larger and people only win prizes they are interested in. The average value of our raffle packages in 2014 was over \$100.
- *Silent auction is for highest value items. These include the year long gym membership and items with no set monetary value, such as animal paintings and hand knit hats.
- *Most popular raffle items involve beer and outdoor goods.
- *Local breweries and small businesses have been our best donors but in 2013 and 2014 Whole Earth Provisions was a major sponsor.



Our silent auction and raffle set-ups

Hindsight is 20/20: What we've learned

- *People want food! We work with small food trucks or mobile carts that don't have a sales minimum.
- *People want beer! So far we've stayed away from this for liability reasons but it comes up every year.
- *Rock climbing is not as accessible to the general public as bowling. We struggle with attendance because people are intimidated by the idea of rock climbing.
- *We don't get any money for climbers with memberships that attend the event (unless they buy raffle tickets or bid on silent auction items).
- *Ideas we're working on:
 - Making CFC a private event and charging a small admission fee. If members still want to climb they are welcome to but they would have to pay to get into the event.
 - Offering other activities during the event such as games (giant Jenga, twister, board games), yoga classes and slack lining demonstrations.
 - Ask me about what we're doing different this year!

We couldn't do it without you, Houston Zoo!

- *The graphics department designs all of our posters and print them for us.
- *The marketing team helps us promote our event online and through the members magazine.
- *The development team helps us with donation contacts.
- *Animal departments make us awesome animal paintings for our silent auction.
- *Supervisors volunteer their time to bring handling animals the night of the event.
- *Carnivore department staff volunteer at the event educating people about clouded leopards and the conservation work we support.
- *Overall the staff, supervisors, and the senior management team at the zoo have been incredibly helpful and generous with resources and we couldn't do it without them!



Supervisor Amanda Daly shows off a rainbow boa to a group of climbers



Purple Martins “We’re going to Disney World”

Carlos Torrez and Chris Rogers
Trails/ Tree of Life & Oasis Team
Disney’s Animal Kingdom®



Introduction

Every year at Walt Disney World we entertain guests from all over the world, with a large percentage of those guests coming from Brazil. For the past ten years we have also hosted some special Brazilian avian guests; Purple Martins (*Progne subis*). The purple martin is the largest North American swallow which migrates from Brazil to North America every year to nest and breed. Several years ago we looked for a project that would inspire our own cast members to conservation action. Through the persuasion of some very passionate cast members in 2005, Disney’s Animal Kingdom® approved the installation of a few Purple Martin houses in off exhibit areas of the Park. The birds arrive in Florida in early January, having traveled approximately 3,000 miles from Brazil to nest and breed at Walt Disney World.

Data Recovery

- Tagged birds were recaptured the following year to retrieve the tracking devices. New birds receiving GPS or Geolocators are also given leg bands, measured, and have blood and feather samples taken.
- The GPS units and Geolocators were sent to researchers at York University and the University of Manitoba for data analysis.



Collecting a blood sample



Leg banding

Results

- With the data collected we have been able to learn more about the natural history of purple martins and find answers to questions such as migratory paths, feeding sites, times, and speed, as well as site and mate fidelity, genetic population distribution, and the drivers of migratory behavior.



Releasing Purple Martins

Disney’s Project

- Disney’s Animal Kingdom’s® Purple Martin Project was started in 2005. We installed 5 purple martin houses and in that first year attracted 6 pairs of birds which produced 35 chicks.
- In the last ten years we have enlarged our purple martin colonies to include eight colonies throughout the Walt Disney World Parks and Resorts and are now hosting over 150 breeding pairs that produce hundreds of chicks annually. All of these colonies are checked twice a week and data is collected on all breeding pairs, eggs and chicks.
- We share this information with the Purple Martin Conservation Association and our guests through educational backstage tours.



Purple Martin colonies

Geolocation/GPS program

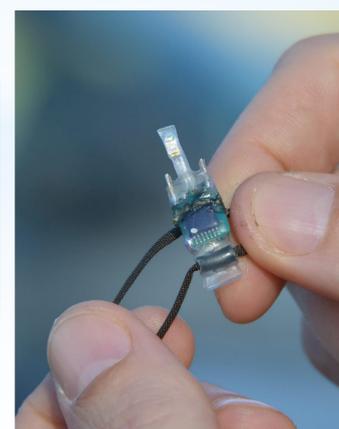
- In 2013 Disney’s Animal Kingdom® began a partnership with the Purple Martin Conservation Association and York University in Toronto with Dr. Bridget Stutchbury and the University of Manitoba with Dr. Kevin Fraser.
- The project was to attach Geolocators to the purple martins at Disney’s Animal Kingdom® and track their migratory path. Geolocators are a lightweight electronic archival tracking device that consists of a microchip, a clock, a light sensor, and a battery that weighs less than a gram and are attached to the bird’s back. Light levels are recorded and the times of sunrise and sunset are used to determine the geo-coordinates of the bird each day.
- Our conservation and aviary team captured and attached geolocators to 40 birds in 2013. Out of the 40 birds, 28 were recovered in 2014.
- In 2014, small archival GPS units were incorporated into the program. The units were programmed to record GPS coordinates 9 to 11 times during their migration.



Migration map of a single Purple Martin using a geocator.



Male Purple Martin with geocator and leg band



Geo-locator Unit

Conclusion

What began as a limited adventure for a few staff has blossomed into a significant research and conservation project that everyone at Disney’s Animal Kingdom® can be proud of. Citizen science projects are practical and rewarding for any zoological facility and can involve your education programs, zookeepers, volunteers, and research team. We hope to encourage our readers to start similar conservation projects at their zoos. For more information on purple martins and starting a purple martin project at your facility please go to www.purplemartin.org