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Posters



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The AAZK Behavioral Husbandry Committee Enrichment Notebook: 4th Edition

Presented by Amanda Ista¹, Thea Etchells², Rachel Vass³
¹Milwaukee County Zoo, ²Denver Zoo, ³Woodland Park Zoo

Abstract:

The American Association of Zoo Keepers' Behavioral Husbandry Committee would like to present the 4th edition of the Enrichment Notebook. Enrichment is an important part of daily husbandry for all animals under human care; while there is a plethora of information available on enrichment, many times it can be daunting to sort through this information to find exactly what is desired to meet the goals of specific enrichment programs. The purpose of this notebook is to continue to provide AAZK members with a resource to easily access specific enrichment ideas or guidelines, and introduce innovative ideas to take behavioral husbandry programs to a higher level.

This long awaited update builds on the wealth of information already shared in the previous editions, while adding more details and an enhanced list of species in a user friendly format. The seven chapters include an extensive discussion on safety considerations, suggested guidelines for fourteen groups of animals, a browse guide, specific ideas including how-to instructions for devices, samples of enrichment forms and documentation, recipes for various enriching treats and a resource guide to enrichment suppliers and other enrichment information. This poster will give a taste of what can be found in the newest edition of the Enrichment Notebook so members can rediscover this amazing resource offered by the AAZK Behavioral Husbandry Committee.



Discussion:

An innovative and well-planned enrichment program may be one of the most powerful and cost effective tools available to maintain the physical and psychological health of animals in human care. Benefits may include decreased in stereotypic behavior, increased in breeding success, increased visitor engagement, and increased job satisfaction for zookeepers. This notebook is intended to be a guide to help zoological institutions achieve these goals.

- The notebook is easy to use and navigate in a digital form.
- It comes as a USB flash drive so it is easy to carry and access.
- It is available now at the AAZK merchandise table in the exhibitor hall or online in the AAZK shop at aazk.org.



Contents of the Notebook:

The notebook is divided into easy to navigate chapters covering the following:

Safety

Providing enrichment to an animal's environment can provide many positive aspects but can also pose potential risks. This chapter outlines possible risks and scenarios to consider when developing enrichment plans as well as providing assessment tools to use in the approval process.

Suggested Enrichment Guidelines

- The notebook focuses on goal-based enrichment, which is providing an item with the intent to elicit a particular behavior.
- These guidelines are to be used like a "Choose Your Own Adventure" book. We have listed behavioral goals for each group and once you have chosen your goal, pick a category or enrichment that will lead you to an item to use to achieve that goal.
- Categories of enrichment are broken into food, sensory, environmental, novel, social, and training.
- The guidelines are broken into the following groupings: Fishes and Aquatic Invertebrates, Birds, Reptiles and Amphibians, Terrestrial Invertebrates, Bats, Rodents, Elephants, Primates, Bears, Carnivores, Small Carnivores, Other Mammals, Marine Mammals, Ungulates

Browse

This chapter includes extensive lists that includes plants commonly used as browse at zoological institutions as well as species that are avoided due to toxicity.

Enrichment Ideas

Ideas on how to make various toys using PVC and firehose are presented.

Forms

Samples of enrichment approval and evaluation forms as well as enrichment plan templates are provided.

Recipes

Recipes for various food items, ice treats, gelatin treats are outlined.

Resources

Links to enrichment resources, organizations, companies, and a bibliography are given.



Introduction:

The AZA Behavioral Advisory Group defines enrichment as "a process for improving or enhancing animal environments and care within the context of their inhabitant's behavioral biology and natural history. It is a dynamic process in which changes to structures and husbandry practices are made with the goal of increasing behavioral choices available to animals and drawing out their species appropriate behaviors and abilities, thus enhancing animal welfare."

Enrichment is intended to encourage behaviors that are appropriate for the species and that satisfy an animal's physical and psychological needs. An enriched environment should also offer an animal some sense of control, resulting from its ability to make choices for itself, such as whether or not to hide, what kind of temperature and weather to experience, and when and how to acquire their food, etc.

According to the 2017 AZA Accreditation Standards, institutions must follow a formal written enrichment program that promotes species-appropriate behavioral opportunities. An enrichment program should be based on current information in biology, and include the following elements: goal-setting, planning and approval process, implementation, documentation/record-keeping, evaluation, and reassessment. This enrichment notebook is a tool to help guide institutions to an optimal enrichment program for all species under their care.



Acknowledgements:

This edition of the AAZK's Enrichment Notebook was a collaboration between many industry professionals whose aim it was to provide a resource to facilitate excellent well-being to all animals under human care. Many thanks to all the editors, contributors and the AAZK Board of Directors and all the members of the 2017 AAZK Behavioral Husbandry Committee: Bill Steele (Board Oversight), Paul Brandenburger (Board Oversight), Megan Wright Walker (Chair), Kaitlyn Wiktor (Vice-Chair), Beth Ament Briggs, Diana Cartier, Heather Dunn, Thea Etchells, Heather Gibson, Amanda Ista, Stephanie Turner and Rachel Vass.



Target Audience: Anyone who needs some level of animal record-keeping knowledge



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Training Red Pandas to Stand for Abdominal Ultrasound

Lissa Browning

Cincinnati Zoo & Botanical Garden, Cincinnati, OH, USA

Background

- Pregnancy detection in red pandas (*Ailurus fulgens styani*) is challenging due to the inability of fecal progesterone analyses to distinguish pregnancy from pseudopregnancy.
- Ultrasonography is a minimally-invasive approach to pregnancy detection.
- In order to achieve this without immobilization, females need to be desensitized and habituated to allow examination.

Methods

- Trained 7 pandas since 2008 (16 total potential pregnancies).
- Desensitized to abdominal palpation and the application of ultrasound jelly.
- Used operant conditioning with positive reinforcement.
 - Food rewards
- Two ultrasound position approaches were evaluated:
 - Standing bipedal with front feet on T-stand (Fig 1)
 - Standing quadrupedal with four feet on the ground (Fig 2)



Results

- All pandas were trained successfully.
- Pregnancy (n = 10), pseudopregnancy (n = 5), and lost pregnancy (n = 1) were diagnosed with 100% accuracy.
- There were no differences in ultrasonography success in either bipedal or quadrupedal positions.
 - Some females appeared to have preferences.



Conclusions

- Ultrasonography was an effective, feasible method of pregnancy status determination.
- Unlike fecal hormone monitoring, ultrasonography allowed discernment of true pregnancy from pseudopregnancy.
- Allowed appropriate adjustments to management plans.

Acknowledgments

- The author thanks Drs. Erin Curry, Terri Roth, and Kristi Delaski for assistance with ultrasonography examinations.
- The author would also like to thank the staff and volunteers at Cincinnati Zoo's Wildlife Canyon for their training assistance.

Contact: Lissa.browning@cincinnati-zoo.org

A Tale of Two Tails



Theresa Clyatt-Larson
Primate Keeper
Cincinnati Zoo and Botanical Garden

At the Cincinnati Zoo and Botanical Garden, we pride ourselves on going above and beyond for the care and wellbeing of the animals that live at our zoo. In the Jungle Trails area of the zoo we are currently addressing two very different tail issues.

Andy Northern Greater Galago (*Otolemur garnetti*)



Not Food Motivated
Aggressive At Times
Does not Respond to Training
Holding not conducive for hands free treatment

On-going Inflammatory/self-mutilating problem

Bald patch on tail appeared – Jan 1, 2017
First Biopsy – Feb 10
Second Biopsy – July 21
Laser treatments and bandaging start – Sept 2017
First Amputation – May 17, 2018
Second Amputation – July 12



Special Thanks
CZBG and my boss, Ron Evans for allowing me to attend CZBG Veterinary Staff, Dr. Levens for answering all of my questions
My Jungle Trails Co-Workers for taking pictures
Jon for helping with the training

The staff at CZBG, both Veterinary and Keepers, have tried an array of things:
Standard Oral Medications – Anti-Fungals, Antihistamine/Prednisolone (easy to mask), Antibiotic (tastes bad and hard to mask), Diazepam (easy to mask), Allergy (kind of easy to mask), Pain (easy to mask), Meloxicam (tastes great, take without masking), Fatty Acid (tastes great)
Bandages – wraps, stockinette, spray on
Topical Treatments – ointments, cleaning agents
Biopsy and Surgery
Laser Therapy Treatments – lasted from 1:30 minutes to 5 minutes, Andy was restrained for the treatments, Dakota would sit in overhead run for the treatments

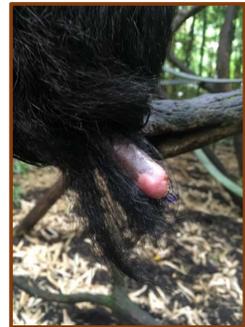
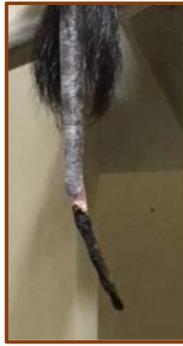
Dakota White-Faced Saki (*Pithecia Pithecia*)



High Food Motivation (Slow Eater)
Responds Well to Training
Holding Conducive for hands free treatment

Desiccation of tip of tail

First noticed the change in his tail Dec 15, 2017
First Amputation – Feb 22, 2018
First Laser Therapy – March 21 (22 total)
Second Amputation – April 16
Case Closed – June 14
Fully Healed – July 2



Photos L to R:
Tail in Jan 2018, After 2nd Amputation, Fully Healed

Photos L to R:
Tail in Jan 2018, Tail after 1st Amputation, Tail Aug 7th



Management of 2.2 warthogs: Can two adult males coexist with females present?

Kim Compton & Aubrey Hughes, Giants of the Savanna, Dallas Zoo

Introduction

In 2011, two male warthogs were born at the Dallas Zoo and were successfully managed together for six years. Because the warthogs were valued highly by the zoo and SSP holding spaces were full, the zoo decided to try housing the two males [A] with two females [B] acquired in March 2017. Despite adult males normally living in solitude, the zoo wanted to find a solution that would help the SSP and expand the collection. The initial plan was to house each female with one of the males in adjoining exhibits and barn stalls.

Primary Concerns

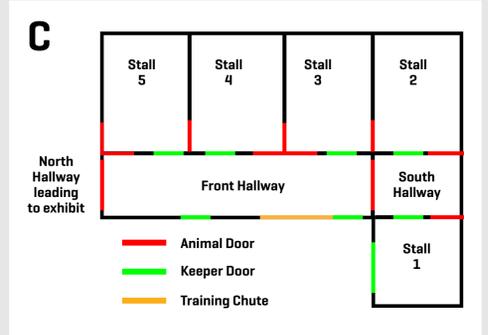
- Visual access in barn stalls and during shifting [C]
- Males separated in the past, difficult reintroduction
- Exhibit visual access between two groups
- Choosing male to introduce to females first



Male warthogs Toby (left) and Teddy (right).



Female warthogs Amina (left) and Weela (right).



Method and Results Timeline

09.12.17
Successful introduction of Toby to females.

08.23.17
Decision was made to first introduce females to Toby, the subordinate and potentially less aggressive male. Females transferred to warthog barn for howdy with Toby; Teddy transferred to another barn.

10.03.17
Teddy returned to warthog barn.



10.09.17
Visual barrier constructed, separating exhibit into two sides.

11.12.17
Silver sulfadiazine cream applied to males' warts due to excessive scent marking from hog exhibit rotation.



11.16.17
Toby displayed damaged hoof condition due to digging at shift doors attempting to access other individuals; Teddy displayed damaged hoof condition two days later.



11.05.17
Teddy weight loss recorded, diet increased.

10.12-10.17.17
Toby and Teddy howdies on exhibit unsuccessful. Decision made for Teddy to be transferred to another facility, placement delayed.

10.16.17
Teddy and female howdies successful; began rotation of exhibit time between Toby/females together and Teddy/females in a howdy arrangement.



11.22.17
Males prescribed hoof soaks to strengthen hooves.



11.26.17
While Toby was shifting, he showed increasing aggression to Teddy. Procedures were changed to shift Teddy first, providing less time for interaction.

11.28.17
Vitamin E administered to both males due to shifting challenges; suspended Teddy and female howdies due to Teddy's pacing on exhibit.



12.17.17
In addition to treatment, rubber mats placed in males' stalls due to continued digging at shift doors; proceeded with Teddy and female howdies; Toby weight loss recorded.

01.09-01.25.18
Teddy introduced to females, still no placement found; resulted in minor injury to Weela.

01.26-04.15.18
Rotation of exhibit time between Teddy alone and Toby with females.

04.16.18
Teddy relocated to facility in California.

Conclusion

- Even though Teddy was relocated to Safari West, California, we managed 2.2 warthogs and improved health concerns such as: Toby and Teddy weight increased; hoof soak frequency decreased; Vitamin E and sulfadiazine cream discontinued.
- MAIN ISSUE: not enough visual barriers.

Acknowledgments: Supervisor, Lisa Fitzgerald; Assistant Supervisor, Allison Dean; Curator, Karen Gibson
Team North Savanna [a.k.a. Team Exhausted Pigeon]
Veterinary Staff
Nancy Scott, Jeremy Proffitt and Karen Hamilton
Safari West

Little Dragon, Big Problem: A study of poop and pancreatic enzyme deficiencies in a Komodo dragon

Jenny Eischen¹, Brenna Romig²
Akron Zoological Park



INTRODUCTION

- A six-year-old Komodo dragon presented with increased activity level, lower than average growth rate, abnormal fecal output and coprophagia.
- Diet increases had little to no effect on appetite or growth rate, which led staff to consider several health issues that have been documented in wild dragons engaging in coprophagia including malabsorption (Hide, 2016).
- Diagnostic testing revealed exocrine pancreatic insufficiency, so a pancreatic enzyme replacement, pancrelipase, was added to the diet.
- A study was designed to systematically monitor behavior, weight, fecal output and coprophagia over a six month period.
- The goal was to determine if the addition of the enzyme replacement moved this animal's behavior and health markers into a normal range.
- Reptile disease is often hard to detect and diagnose, and less is documented about treatment for exocrine pancreatic insufficiency in reptiles vs other species (Stahl, 2003). Results of this study may assist other institutions in early identification of pancreatic deficiencies in other reptile species.

METHODS

Behavioral Variation Study

- Performed on ZooMonitor program twice a day, once in AM, once in PM (Figure 8).
- 5 minute time span with 1 minute intervals; choosing a behavior and location at each interval.
- Study took place in holding and exhibit.

Fecal Tracking

- Documented date, location, number of fecal outputs, and amount consumed on a daily basis
- Each fecal was scored according to the chart below



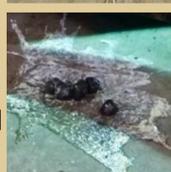
Score 1
Watery,
No solid,
pieces



Score 2
Mostly
soft,
formed
pieces



Score 3
Gelatinous,
some texture
but no defined
edges



Score 4
"Normal"
feces, soft
but defined
edges

Score 5: Unknown due to consumption/smearing

Weight Tracking

- Weights were taken at least 3 times per week

RESULTS

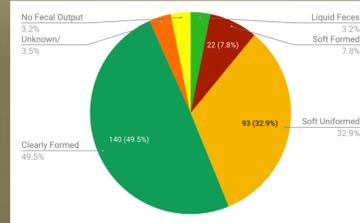


Figure 1. Overall fecal consistency percentages during the six month study period (12/28/2018 - 7/8/2018).



Figure 3. Overall weight gain of 1.0 male Komodo dragon during and two weeks prior to the study period (12/28/2017 - 7/8/2018).

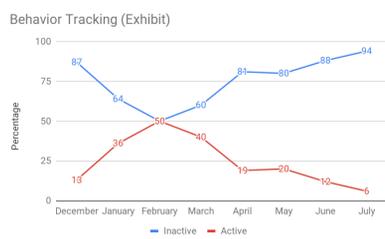


Figure 5. Percentage of active versus inactive (inactive alert, basking, or sleeping) behavior on exhibit during and two weeks prior to the study period (12/28/2017 - 7/8/2017).

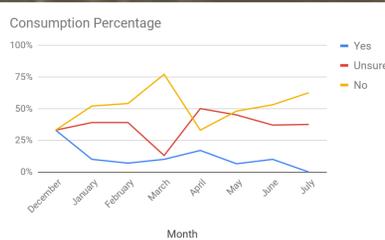


Figure 2. Fecal consistency percentages of pre-supplement versus during supplementation of pancrelipase.

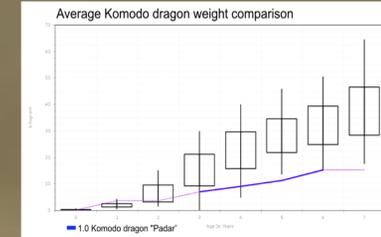


Figure 4. Average Komodo dragon weight comparison of pre-supplement versus during supplementation of pancrelipase.

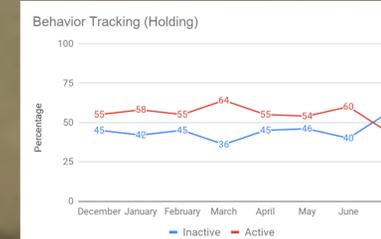


Figure 6. Percentage of active versus inactive (inactive alert, basking, or sleeping) behavior in holding during and two weeks prior to the study period (12/28/18 - 7/8/2017).

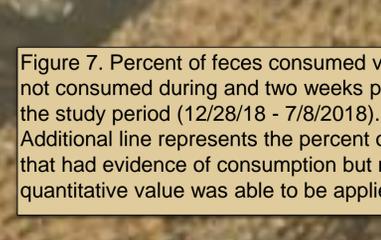


Figure 8. Heat map showing activity dispersal throughout exhibit. Red zones indicate highest usage, blue zones indicate lowest usage.

RESULTS/DISCUSSION

- Throughout study, fecal consistency was largely made up of soft unformed and clearly formed pieces, with small amounts of varying consistencies between those extremes (Figure 1).
- The addition of the supplement moved the majority of his feces from soft and unformed to clearly formed pieces during the study period (Figure 2).
- Weight increased over the six-month study period from 13.8 kilograms to 17.5 kilograms, a 27% weight gain (Figure 3). This is an increase from the six months prior, in which the dragon gained 1.9 kilograms, a 16% weight gain. The dragon remains lower in weight against the population average of male Komodo dragons in his age range (Figure 4).
- On exhibit, inactive behaviors (inactive alert, sleeping, or basking) increased, and active behavior decreased (Figure 5, Figure 8). Behavior in holding remained largely the same, likely due to the influence of our presence (Figure 6).
- Coprophagia decreased during the first 3 months of the study, then had a dramatic increase over the last two weeks of March. Upon analyzing his weight change, the supplement amount was increased allowing for greater absorption of nutrients. This diminished the coprophagic behavior and by the end of the study this behavior has almost entirely been extinguished.
- Throughout the study period the diet stayed constant. It was not adjusted for increasing body weight, and began at 12% BW/week and ended at 9.5% BW/week. Despite this weight gain was relatively consistent.
- The data supports our hypothesis that the addition of pancrelipase moved the subject's behavior and health markers into a more normal range.
- Long-term monitoring will continue and will give additional insight in determining if our subject continues moving into a more normal weight range, and what to expect during this specific treatment in monitor species.
- Future studies are warranted to determine the effects of different doses of pancrelipase as well as different diet makeups (i.e whole prey vs. ground meat).

ACKNOWLEDGMENTS

Thank you to Akron Zoological Park's: Stephanie Miner, Behavioral Husbandry Manager; Dr. Kimberly Cook, Sr. Director of Life Sciences; Shane Good, Director of Collections Management; Pete Mohan, Director of Animal Operations; the veterinary staff, and Komodo Kingdom keepers for your support, guidance and assistance.

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Contact

Jenny Eischen
Wild Animal Keeper I
Legends of the Wild
Akron Zoological Park
J.Eischen@akronzoo.org

Brenna Romig
Wild Animal Keeper I
Komodo Kingdom
Akron Zoological Park
B.Romig@akronzoo.org

Akron Zoological Park
330-375-2550
akronzoo.org

Keepers Who Compost: A Keeper Driven Initiative

Sydney Fitzpatrick
Houston Zoo

Composting Materials

- ❖ Food scraps from Natural Encounters food prep kitchen
 - Produce, animal kibbles and biscuits (no meat-based items), hard boiled eggs,
- ❖ Coffee grounds
- ❖ Approved paper items and shavings
 - Could be from old enrichment from certain animals approved by veterinarian (small non-primate mammals)
 - Paper had to be non-glossy and the less colored ink, the better
- ❖ Dead leaves
- ❖ Hay (small amounts)
 - *There is a scientific ratio of carbon to nitrogen (30:1) that should try to be achieved for ideal decomposition. For ease of use for keepers adding materials: dry items made up 5-10% of compost and were added as compost looked “wet”*



Composting Results



Discussion

- ❖ 4 compost bins in rotation between Natural Encounters and Children’s Zoo
- ❖ A total of 11 batches of compost have been started between 2014 and 2018
- ❖ 6 batches have been completely done and processed, the others are in various stages of decomposition
- ❖ Dry material was added as needed and differed for every batch
- ❖ The final product average about a 90% reduction in weight from the total material added
 - The exception was CZ Batch 1 due to a change in final processing
- ❖ Finished compost has been used in a variety of locations at the Houston Zoo, including the Natural Encounters and Children’s Zoo browse and herb gardens, farm area, and the zoo’s pollinator gardens.
- ❖ Problems that occurred with project:
 - Minor construction issues
 - Leaking bin
 - Pest
 - Keeper Error and Neglect
- ❖ Surveys sent to involved keeper staff showed an increased interest over time with the project and a desire to be more involved
- ❖ Next steps
 - Increase the participation of the Natural Encounters and Children’s Zoo teams with the project
 - Apply for more funding to build more tumbling bins
 - Problem solve leak and building issues with other zoo staff
 - Engage with other animal teams and increase teams composting their kitchen waste
 - Create an educational exhibit in the Children’s Zoo for guests

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- ❖ <https://aggie-horticulture.tamu.edu/earthkind/landscape/dont-bag-it/chapter-1-the-decomposition-process/>
- ❖ <http://www.compostjunkie.com/compost-tumbler-plan.html>

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Houston Zoo, Inc
Ariel Sklar
Natural Encounters supervisors Amanda Daly and Kamryn Suttinger
Curator Hannah Bailey
Staff Conservation Fund
Natural Encounters Staff
Children’s Zoo Staff

Introduction

Compost is plant matter or other organic material that has decomposed through natural means and can be recycled as a fertilizer and soil amendment. It is a naturally occurring process that allows for nutrient cycling within the soil environment. What is left after the decomposition process is soil rich in nitrogen and phosphorus, perfect for plants. Zoo keeper Sydney Fitzpatrick began researching small scale waste management in 2014 after observing large amounts of food waste from the kitchens being thrown away.

Due to the zoo’s location in the middle of the city of Houston, there is no room to do large composting on grounds. The zoo is moving towards more sustainable large scale waste management methods in the future, but as of now almost all waste created by the zoo is taken to a landfill. Department curator and supervisors encouraged Sydney to move forward with a compost project at the end of 2014 and included a budget.

The program was expanded in 2017 when Sydney partnered with Houston Zoo horticulturist Ariel Sklar. They were awarded funds from the Houston Zoo’s Staff Conservation Fund to increase the amount of barrels to four and include waste material from the Children’s Zoo kitchen.

Tumbler Bin Benefits

- Closed system
- Small space requirement
- Reduces pests
- Reduces smell
- Easy to use
- Easy to oxygenate
- Durable

To Buy Or To Build

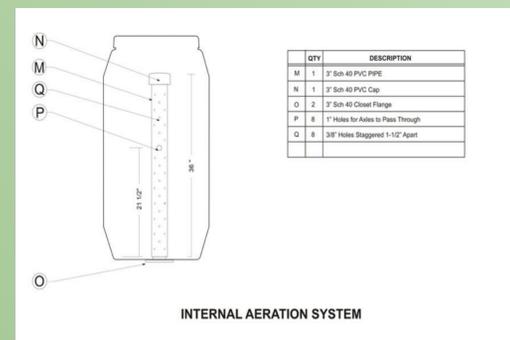
Premade bins were on average \$125 to over \$200. Many had poor reviews on quality, with rust and thin plastic being the most prevalent comments. Using compost tumbler plans found online, a tumbler could be built for \$110 with a much higher chance of long term durability and quality. The budget for first bin came from Natural Encounters department funds

Materials such as lumber, PVC, and hardware were purchased from Home Depot. The bin itself was purchased from a bin and barrel recycler in Houston.



Composting Method

- ❖ Food waste weighed and recorded and placed in the bin
- ❖ Bin rotated every day
- ❖ Dry products (paper, shavings, hay) added as needed when compost looked “wet”
- ❖ Stopped adding new waste once ~50-80kg of waste was added
 - Whenever bin became too heavy to turn
- ❖ Bin rotated only 2-3 times a week
- ❖ Bin monitored for end of decomposition (2-6 months)
 - Decomposing waste often balled up so larger balls were broken apart by hand
 - Signs to look for when it is done:
 - No heat production (one bin measured in 70 F inside bin while ambient air temperature was 40 F)
 - No rotten food smell
 - Uniform color and no pools of liquid
 - No obvious waste items still visible
- ❖ Material either sifted or broken apart by hand to remove unwanted material
 - Stickers or large amounts of seeds from produce
 - Plastic (often came from shredded paper)
 - Waste that did not fully break down such as nut shells (could be used to start new compost bin)





Acupuncture in Penguins

African and Humboldt species



African Penguin (*Spheniscus demersus*)

Dancer is a 26-year-old penguin. She suddenly developed a limp and a change in her gait in 2015. Initial radiographs were inconclusive and a soft tissue injury was suspected. A course of Meloxicam and Tramadol did little to improve her symptoms. Her Tramadol dose was increased significantly with little improvement. Dr. Bonnie Wright started performing acupuncture twice a month on Dancer in 2016. In the days and months following acupuncture, Dancer was moving around much better, and her Tramadol dose was lowered. Radiographs in 2017 showed moderate arthritis of the right stifle joint.

Humboldt Penguin (*Spheniscus humboldti*)

Pita is a 15-year-old penguin that arrived at the Denver Zoo in 2010 with a presumed history of osteoarthritis. She was being treated with Cosequin at her previous facility. Radiographs during her quarantine exam showed degenerative changes within the right hock joint, tendon calcification, and an increased joint space in the right hip. She later developed lameness and was prescribed Glucosamine and Chondroitin tablets as well as Meloxicam. Her medications were sometimes discontinued when raising chicks during cooler months. Since cold weather made her symptoms worse, we needed to find an alternative treatment. Dr. Bonnie Wright started performing acupuncture in 2016 and continues treatment twice a month. After two treatments, Pita was observed swimming, bathing, and porpoising in the pool, which had been extremely rare for her previously.



Dancer with 0.2 gauge needles in. Needles can be placed with almost no restraint.



Pita with 0.16 gauge needles in. She requires a little more restraint because she is more aggressive than Dancer.



Needle Placement

- 10 needles – Seirin Accupuncture Needle, silicon-coated, 0.2 or 0.16 gauge, 30 mm
- 4 para-spinal points modulate nerves from spine and down legs
- 3 sacral points for calming
- 1 in the Cervico-Thoracic Junction for calming and sympathetic nervous system modulation
- 2 in the muscles and peripheral nerve in the affected leg.

The needles stay in for 10-15 minutes based on behaviors and when they become more active (the calming effect has worn off). Use minimal restraint and let the penguin walk around while the needles are in. This lets the nervous system relax and uses the body's own healing potential. The needles are collected if they fall out and are not put back in.

Poster by Stephanie Hollister
Bird Keeper, Denver Zoo

Acknowledgements

Dr. Bonnie Wright DVM DACVAA
Dr. Gwen Jankowski DVM
Dr. Jen Hausmann DVM
Katie Vyas



To Shift or Not to Shift: A Binturong's Question

Stephanie Hull, Naples Zoo at Caribbean Gardens, Zoo Atlanta



Introduction

Binturongs (*Arctictis binturong*) are the largest member of the viverrid family and a charismatic member of any zoo collection. They are, however, notorious for bouts of inactivity and reluctance to shift on or off exhibit. We all accept that this is just part of the "charm" of working with these amazing animals, but why are binturongs like this? Is it because they want to torture their keepers? Or maybe it has to do with seasons, or even an internal drive to do nothing? Timber, Zoo Atlanta's Binturong (0.1), would refuse to shift outside for days to weeks at a time, and there was no explanation as to why. This study was initiated to document shifting behavior to detect any predictable patterns and perhaps answer the unasked question of "Why aren't you shifting?"

Methods

Data on her response to the opening and closing of access to a separate area was collected twice daily by keepers using a Likert scale.

1. Not Moving, Not Interested in keeper
2. Moving around and/or vocalizing, but not shifting
3. Shifted after several attempts or in the afternoon
4. Shifted slowly, but at first attempt
5. Shifted well and quickly

Data recorded included how well she shifted, diet consumed, weather, and any notable events that could affect behavior.

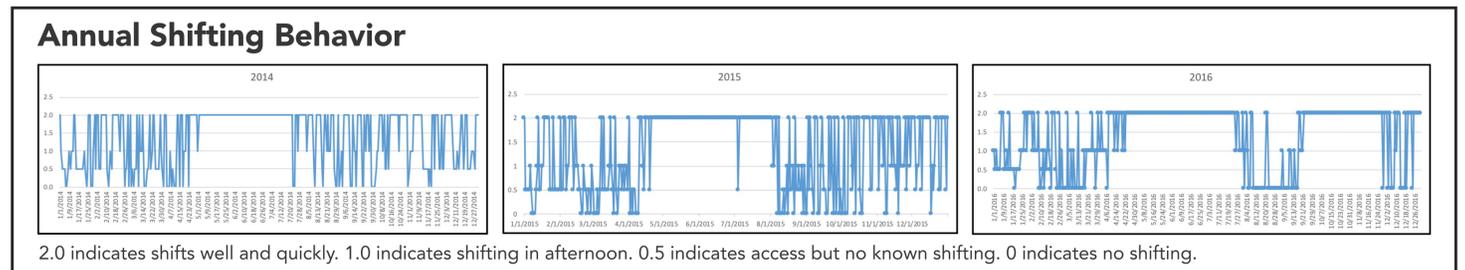
Newly collected data was enhanced with historical data reconstructed from daily reports starting from her arrival. This expanded the dataset to encompass 6 years. Excel graphing was used to analyze data.

Acknowledgments

Zoo Atlanta | Naples Zoo | Carnivore Keepers at Zoo Atlanta | Joe Mendelson, PhD at Zoo Atlanta |

Results

A pattern of non-shifting was found. On average, Timber had the greatest levels of non-shifting behaviors from November to March/April. During the warmer months, Timber exhibited a greater level of interest in shifting.



Discussion

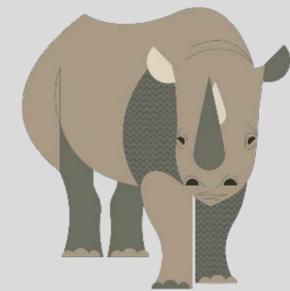
This noted pattern may be indicative that the reluctance to shift may correlate to seasonality or yet unknown hormonal fluctuations. Future studies including more individuals of both sexes including monitoring hormone levels as well as representing diverse climates could prove useful. It's also notable that binturongs tend to give birth around the time of Timber's inactivity. Results from this expanded research could lead to modifications of environmental factors to encourage shifting or planning for exhibits and viewing to accommodate this predictable behavior if it is determined to be hormonal.





Adapting Large Volume Phlebotomy to Denver Zoo's Black Rhinoceros

Caitlin Jacokes, Denver Zoo
cjacokes@denverzoo.org



The Background

- Denver Zoo's Veterinary team and Pachyderm team have been working together for the past year to combat iron storage disease in Rudisha, our 24-year-old black rhinoceros
- Through routine blood draws, we discovered an increase in Rudy's iron levels in July 2017
- Large volume phlebotomy was used after the issue could not be resolved with diet changes alone
- Goals:
 - Voluntarily collect 2-3 L of blood within 1 month
 - Collect and save the blood for plasma banking

Training Methods

- Rudy's voluntary routine blood draw behavior was solid, but needed to be revamped into a phlebotomy behavior by:
 - Standing steady for long durations
 - Desensitization to equipment/noises
 - Desensitization to larger needle size
- Training sessions occurred twice a week on average
- Training Successes (after 7 months):
 - Increased session duration from 3 min. to 17 min.
 - Increased collection volume from 5 mls to 750 mls
 - Increased needle size from a 21 gauge to a 16 gauge

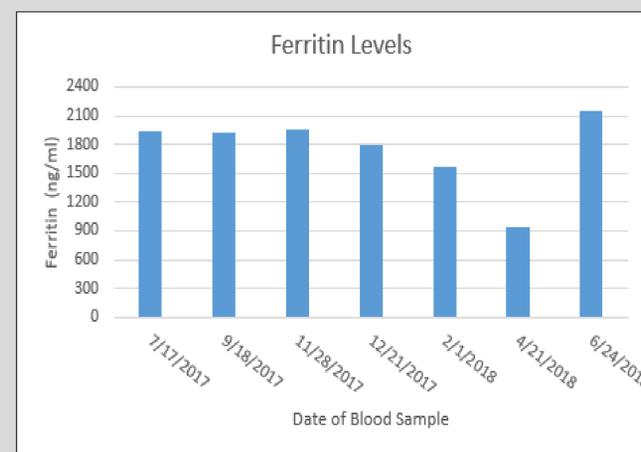


Discussion

- After seeing a decrease in Rudy's iron levels, we decided to collect only 1 L every other month for maintenance
- Rudy's iron spiked after decreasing the phlebotomy from 3 L to 1 L, instead of staying at a steady rate as we had hoped
- This spike could also be correlated to increasing grass intake from his exhibit yard in the early summer months, which tested high in iron content in a study done by nutritionists at the zoo



Results



- From July 2017 to April 2018 Rudy's ferritin levels gradually decreased by 1008 ng/ml
- From April 2018 to June 2018 his ferritin levels increased by 1,213 ng/ml (228%)

Conclusions

- Although there have been challenges along the way, each session has allowed us to:
 - Strengthen our knowledge of large volume phlebotomy
 - Refine our methods to increase our chance of success
 - Build strong relationships within our animal care teams
 - Contribute to black rhino research and plasma banking
- The teams will continue to work together to collect 3 L every other month and continue to monitor Rudy's iron levels

THAT CUP IS FULL OF MAGGOTS:

Feeder Insects at Omaha's Henry Doorly Zoo & Aquarium

Sarah Jenkins, Senior Keeper Butterflies & Insects

Crickets, mealworms, fruit flies and waxworms are standard zoo feeder insects. The insect crew are providing more options to our carnivorous insects while helping to reduce the amount the zoo spends on feeder insects. We currently have flighted & wingless fruit flies, crickets, house flies, black soldier flies, mealworms, and waxworms in culture.

Growing your own feeder insects saves money, reduces waste, and produces more nutritious feeders for your animals.



WAXWORMS

Galleria mellonella

WHAT THEY EAT: bran, honey, and waxpaper or beeswax

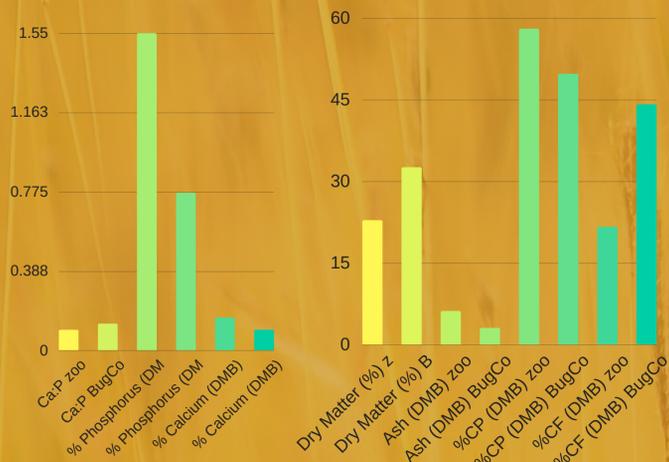
DID YOU KNOW: waxworms are waxmoth caterpillars and are honeybee colony parasites.

Zoo produced waxworms are more active than commercial waxworms and produce silk.

WHAT EATS THEM: birds, bears, etc. Fluttering wax moths are a favorite food for mantids

NUTRITIONAL ANALYSIS

- BugCo waxworms had about twice as much fat, slightly less protein, and had lower mineral content.
- Zoo waxworms had more calcium & phosphorus (and other minerals)
- Both have a skewed Ca:P ratio, so diets would need to be balanced with higher calcium items
- Dry Matter Basis (DMB)=nutrient concentrations without water content



WAXWORM NUTRITIONAL ANALYSIS - AUG 2015



MEALWORMS

Tenebrio molitor

WHAT THEY EAT: oatmeal and fruit
DID YOU KNOW: mealworms are the larval stage or darkling beetles. Mealworms are different sizes depending on age making them ideal for feeding smaller animals.

WHAT EATS THEM: insectivores



PINHEAD CRICKETS

Acheta domesticus

WHAT THEY EAT: Zeigler cricket powder
DID YOU KNOW: adult crickets will lay eggs if offered substrate. Eggs will hatch after 26 days at room temperature or 10 days at 30°C. Crickets are "pinhead" size until their first molt around 7 days.

WHAT EATS THEM: perfect size to feed small spiders, tiger beetles, poison frogs



BLACK SOLDIER FLIES

Hermetia illucens

WHAT THEY EAT: any non-meat food waste

DID YOU KNOW: native insect is low maintenance and easily cultured with self-harvesting pupae. Balanced calcium:phosphorus ratio.

This fly is a wasp mimic.
WHAT EATS THEM: insectivores like mantids, tarantulas, assassin bugs, birds, frogs, small mammals and more!



HOUSE FLIES

Musca domestica

WHAT THEY EAT: mix of dry dog chow, powdered milk and sugar
DID YOU KNOW: low odor and low maintenance

Indoor culture will provide year-round, reliable source of flies
WHAT EATS THEM: mantids, spiders, lizards, and frogs



RECOGNIZING UNINTENDED FOOD INTAKE IN A PREDATOR'S DIET: A SCATALOGICAL APPROACH

Celi Jeske¹, Roberta Boczkiewicz² and Robert J. Jeske²

¹Milwaukee County Zoological Gardens

²University of Wisconsin-Milwaukee



Figure 1. Wolf with rabbit.

The resulting wolf scat was then recovered by zookeepers over the next two consecutive days (Figure 2). All scat was taken to the UWM Archaeological Research Laboratory and washed through a 6.3mm mesh. The cleaned bones and bone fragments were then collected from the screen and analyzed.

Results: Boczkiewicz, a zooarchaeologist, identified bone fragments (Figure 3). A total of 450 bones were identifiable to species, while 546 were only identifiable to class or indeterminate. The 2003 scat contained the expected bones of Norway rat (*Rattus norvegicus*) and Eastern Cottontail (*Sylvilagus floridanus*), but it also included Eastern Chipmunk (*Tamias striatus*), Meadow Vole (*Microtus pennsylvanicus*), Canada Goose (*Branta canadensis*) and an undetermined bird (Table 1). The 2009 sample also yielded rabbit, but included chipmunk, goose, squirrel (*Sciurus carolinensis*), as well as mouse (*Peromyscus sp.*). Multiple fragments of bird bone were recovered, but could not be definitively identified as chicken (*Gallus gallus domesticus*).



Figure 2. Wolf scat.

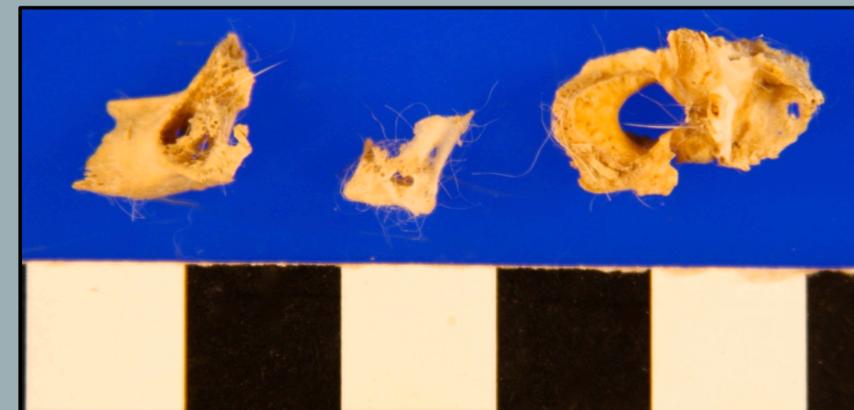


Figure 3. Rabbit bone recovered from wolf scat.

Table 1. Animal bone recovered from wolf scat.

Element	Mouse	Rat	Chipmunk	Vole	Rabbit	Goose	Squirrel	ID	Total UNID	Total
teeth		4			69		1	74	2	76
mandible					1			1		1
cranial					11	3		14	14	28
vertebra		3	1		16			20	4	24
caudal vert.		16			8			24		24
innominate		31						31		31
sacrum					1			1		1
lower limb		39	7	1	68	2		117	5	122
rib								0	3	3
scapula					1			1		1
humerus		2			2			4		4
radius/ulna		2	1	1	18			22	2	24
carpal/tarsal	2		2		22.0	2	3	31	2	33
metapodial			5					5		5
astragalus				3	4			7		7
phalange			4	5	51		1	61	7	68
limb	1				34			35	8	43
UNID					2			2	499	501
Totals	3	102	19	2	239	7	4	450	546	996

Conclusion: Scat-based dietary studies of wolves are common in the literature. These studies typically are designed for ecological management (e.g., predation effects) rather than wolf health and behavior in zoos. Our study demonstrates that captive wolves in zoos eat a regular and non-trivial number of animals in addition to their keeper-provided diets. This work has implications for wolf health including:

- 1) Scat can provide zoo staff with accurate information on the true diets of their animals.
- 2) Biomass analysis from scat can provide estimates of total dietary intake beyond just species ingestion.
- 3) The presence of potential disease vectors can be inferred from animal remains in scat.
- 4) Scat analysis can provide information on non-food ingestion, useful for monitoring general health.

Partial Bibliography:

Floyd, Theodore J., L. David Mech, and Peter A. Jordan 1978 Relating Wolf Scat Content to Prey Consumed. *The Journal of Wildlife Management*:528-532.
 Gable, Thomas D., Steve K. Windels, John G. Bruggink and Shannon M. Barber-Meyer 2018 Weekly Summer Diet of Gray Wolves (*Canis Lupus*) in Northeastern Minnesota. *The American Midland Naturalist* 179:15-27.
 Spaulding, Rick, Paul R. Krausman and Warren B. Ballard 2000 Observer Bias and Analysis of Gray Wolf Diets from Scats. *Wildlife Society Bulletin*:947-950.
 Weaver, John L. 1993 Refining the Equation for Interpreting Prey Occurrence in Gray Wolf Scats. *The Journal of Wildlife Management*:534-538.

Introduction: In this project, the pack of five gray wolves (*Canis lupus*) at the Milwaukee County Zoological Gardens underwent two episodes of controlled feeding to provide better insight into the wolves' diet. Rather than assume that the wolves only ate the meals provided by the zookeepers, the project was designed to recover evidence for all animal food that the pack consumed. This work was one part of a larger cooperative research program undertaken by the Milwaukee County Zoo and the Program in Midwest Archaeology (PIMA) at the University of Wisconsin-Milwaukee (UWM).

Methods: Scat experiments were conducted in 2003 and 2009. In both years, keepers fed the five wolves boneless meat (frozen ground beef) for a minimum of two days, after which they removed all scat from the enclosure. Actualistic prey was then offered to the pack. In 2003, each wolf was fed one rabbit and one rat on consecutive days. In 2009, the prey was one rabbit and one chick (Figure 1).

Acknowledgments:
 Nijiji original alpha male
 Nemat alpha male
 Nikan omega male
 Hickororo alpha female
 Koda omega female
 Milwaukee County Zoo Wolf Team and Large Mammal Curators
 UWM Archaeology Students



Quarantine and Geriatric Animal Management

Jenifer Joseph, Hospital Assistant Supervisor/Keeper III, Dallas Zoo

Abstract

Quarantine can be a time of great stress on animals. Not only will they need to conform to new sights, smells, and sounds, but they also are often presented with new dietary and enrichment items, training routines, and conspecific groupings. All of these can be exacerbated with geriatric individuals.

While there is no specific definition of a geriatric animal, an individual can be classified as such based upon functionality rather than chronological age, which can be applied at any time to any individual [Davies 1996]. Three areas of specific concern for geriatric individuals undergoing quarantine at the Dallas Zoo are medical, husbandry, and nutritional care. Individual case studies will include small mammals, primates, prosimians, and a variety of large avian species.

The Dallas Zoo has set quarantine procedures for all acquired species. The hospital keepers are charged with adapting its three quarantine areas to fit the specific needs of each individual animal.

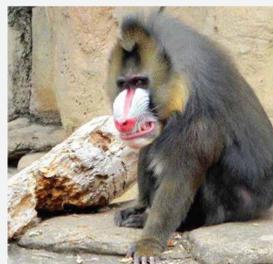
Quarantine Criteria

All animals entering the collection minimally undergo a 30-day quarantine.

Quarantine is typically carried out in one of three available locations:

- Great Ape and Carnivore Ward – dangerous animal ward, A/C and heat, indoor and outdoor holding areas
- Quarantine I – small birds and mammals, A/C and heat, indoor holding only
- Quarantine II – large birds and hoof stock, heat, indoor and outdoor holding

Case Studies



1.0 Mandrillus sphinx
14P366 "Savuti" 22 yrs old
Spondylosis, arthritis management, poor dentition, social dynamics



0.1 Mandrillus sphinx
13M088 "Saba" 23 yrs old
Mobility, arthritis management, overweight, social dynamics



0.1 Mandrillus sphinx
13M111 "Kumi" 25 yrs old
Mobility, arthritis management, overweight, poor dentition, social dynamics



2.0 Lemur catta
14P318 "Leo" 16 yrs old
14P319 "Leif" 16 yrs old
Mobility, overweight, excess skin, social dynamics



0.3 Trachypithecus obscurus
16T017 "Melaka" 18 yrs old
16T018 "Tanah Dara" 18 yrs old
16T019 "Jelek" 14 yrs old
Severe dental disease, excess skin, social dynamics



1.0 Anonyx cinereus
15Q532 "DJ" 9 yrs old
Geriatric companion



1.0 Harpia harpyja
12M264 42 yrs old
Advanced age



0.1 Leptoptilos crumenifer
10K659 25 yrs old
Mobility, poor vision in low light



0.1 Bucorvus leadbeateri
15Q553 26 yrs old
Cataracts with suspected far-sighted vision, mandibular misalignment

Medical Considerations

The health of the animal is the primary consideration. The age, current medical status, nutritional needs, as well as disposition and social dynamics of the animal are all considered during the quarantine process.

● Physical Restraint and Anesthetic Risk:

The current medical status of an individual can determine how it will be handled for diagnostic testing. If an individual's age puts it at too high of an anesthetic risk, then alternate forms of testing or elimination of certain tests may become necessary.

● Quality of Life Assessments:

Although quarantine is stressful in itself, we begin quality of life assessments as soon as animals arrive. We watch their level of mobility and hygiene levels, monitor for any necessary pain management for both known and unknown medical conditions, and determine baseline BCS. Although primarily a medical consideration, BCS can apply to husbandry and nutritional considerations of geriatrics as well.

● Zoonosis:

The added stress of quarantine can weaken an animal's immune system. Combined with previous medical conditions and advanced age, zoonosis can become a major concern, reinforcing the need for PPE protocols.

Husbandry Considerations

● Mobility:

Perching choices and placement are very important factors when it comes to the mobility of an individual. Place sturdy perching with easy access to shift doors or feeding platforms while not blocking pathways with ground stumps or water bowls, especially in areas of low lighting.

● Training:

Training is often limited due to stress levels and duration of quarantine. However, we frequently target, shift, or crate train animals. Making targets bright, contrasting colors; adding lights to areas around shift doors and crates; even making reinforcers louder or larger are some easy changes that are made for our geriatrics. Remember that older animals can easily train keepers instead of keepers training them.

● Enrichment:

We have found that older animals can be difficult to enrich for a number of reasons. Frequently they are either bored with items that they have seen too often or they have learned, therefore, tend to destroy routinely given items. The weight of an item and its ability to injure an individual is of particular concern.

● Temperature Guidelines:

While all species have temperature, geriatrics tend to have a more restrictive range both hot and cold. Offering ice treats and changing out hot water in the summer and offering plenty of bedding and alternative heat sources in the winter is a must.

Nutritional Considerations

● Body Condition Scores and Mobility:

BCS is vital in assessing an individual's body condition without having to restrain or handle the animal. As a geriatric individual's mobility decreases, the BCS will typically increase if nutritional accommodations are not made.

● Poor Dentition and Vision:

Although the proper nutritional balance is a priority in good husbandry, if an individual cannot see food items, pick them up, or chew; proper balance is obsolete. Being creative with item preparation and presentation can simply mean cutting produce to a certain size, cooking hard root vegetables to a softer consistency, or being creative with diet presentations.

● Drug Administration:

Older animals have more experience with finding hidden medications. Keeping in mind the above mentioned diet considerations can make drug administration very difficult. Being aware of what individuals consider high value food items and creating a quick relationship with individuals become key. Sometimes non-traditional food items are necessary.

Photo credits: Audra Cooke, Annie Birdsong, Cathy Burkey

References: *Canine and Feline Geriatrics*. Mike Davies. 1996 Blackwell Science LTD.

How to Excel:

Using Easily Accessible Software to Manage a Small Program Animal Collection

Chelsie LaFountain, Program Animal Coordinator – The Wild Center

Paper Log System

The Wild Center relied on paper logs for many years. There were a number of challenges with the paper log systems, including a lack of clarity about what information to record, inconsistencies amongst the handwritten entries, limited space to write concerns, and the challenge of archiving 10 years of physical logs. In addition, there was a lack of accountability amongst animal care staff to check the logs, and data couldn't easily be extrapolated from the entries

Date	Animal	Time Out	Time In	Initial	Comments
8/13	SPOTTED TURTLE	11:25	11:55	EW	GOOD TURTLE! A LITTLE SHY, BUT STILL COOPERATIVE!
8/13	HELLOS	11:55	2:13	HC	HELLOS WAS VERY OBVIOUSLY UNCOMFORTABLE - HE DID NOT STOP BEING THE "SPOOT" AND WAS WHIPPING REALLY HIGHLY WITH HIS TAIL AND VERY VERY GOOD GIRL, LOVED BY EVERYONE
8/14	STICKLEY	4:15	5:00	YH	GOOD FOR FIRST 25 MINUTES, THEN GOT TENSE
8/14	CUS SPOTTED	1:50	2:35	BT	CUS CALM NOT SHY! SPOTTED HIS IN SHELL WHITE TAIL
8/14	JAY + NIGHT	4:20	4:55	MS	VERY CALM AND ENTHUSIASTIC ABOUT STAYING OUTSIDE IN THE WEATHERING YARD
8/15	STICKLEY	10:25	11:10	SS	VERY WELL-BEHAVED, HAPPILY MUNCHING THE ENTIRE HOUR
8/15	CLEO	1:52	2:35	MS	WAS UNDER SUBSTRATE WHEN I WENT TO GET HER, BUT WAS TOTALLY COOPERATED GREAT AS USUAL!
8/15	TURTLES	11:15	12:30	EW	WENT FINE



Digital Log System

In fall of 2017, The Wild Center transitioned to a digital logging system utilizing Microsoft Excel. Entries were standardized using drop-down menu options, and the system was set up to automatically extrapolate usable data from the logs. The Excel log was based on a design shared by the Roger Williams Park Zoo. It took around 16 staff hours to format Excel to fit our institution, but after the initial start-up it has required minimal maintenance.

The Wild Center Collection

The Wild Center has a program animal collection of roughly 60 individual animals, representing 25 native New York species. Animal program frequency varies with the season, from 6 animal programs per week in the winter to 20+ animal programs per week during the summer. Most of the animals are removed from their home enclosure for a 30 minute program, and presented to upwards of 200 visitors.

There are 4 animal staff who care for the collection and while they may occasionally lead programs, the 9 person education team (which is bolstered by 16 interns each year) leads the majority of programs.

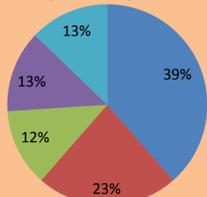


Results

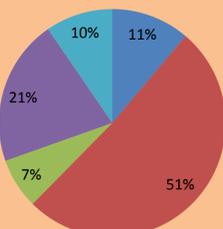
Switching to the digital log system required a higher level of accountability from Animal Care Staff. As a result, staff were more proactive in addressing behavioral and health concerns for program animals. We found that the representation of animals in our programs was not indicative of the makeup of the collection. Several animals were doing the bulk of program work, even though some of those individuals were more sensitive and prone to stress behaviors if overused.

After our first analysis in April 2018, we were able to institute new schedules and guidelines for program animal use that took some of the pressure off of our most-used animals and let some of our under-represented animals have a chance to come out on programs, resulting in better animal welfare and a better experience for our visitors.

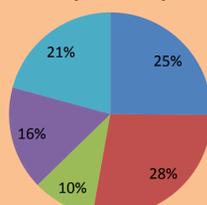
Animal Use By Taxa Sep 2017 - Mar 2018



Goal Program Representation (July 2018)



Animal Use by Taxa May - July 2018



■ Birds ■ Turtles ■ Snakes ■ Amphibians ■ Mammals



A lot goes into formulating one line of data extrapolation. Pull the tab to see what it takes!



Ethogram Studies: Anyone Can Do Them

Janelle Murphy
Moody Gardens, Galveston, Texas

How to start:

1. Make a testable research question
2. Choose your sampling type
3. Choose your recording type
4. Create an ethogram
5. Create a data sheet

Research Design

- Always start with a baseline study and include more baselines as needed to ensure that it is your independent variable that is effecting your dependent one.
- Decide who you want to study, one animal or a group.
- Decide how long each data collection session is going to be and how often.
- The reliability of your data, which is the degree to which your measurement is repeatable and consistent, is important. It can vary between people and even between sessions. It can be tested by having all observers watch and collect data on the same video. This can be done multiple times throughout the study to ensure the reliability for the entire study. You want at least 80% agreement.

Types of Variables

A variable is a measurable factor, characteristic, or attribute.

Dependent: what you measure, evaluate, or observe (time grooming)

Independent: what is manipulated or changed (enrichment)

Controlled: things that are kept the same (humidity, light cycle)

Uncontrolled: things that can't be controlled that could interfere with an experiment (weather, guests banging on glass). Keep a record of these.

Keep the research question short and to the point. It should be expressed as a relationship between one **dependent** and one or more **independent** variable(s). It needs to be stated in a way that is either testable or answerable through data collection.

Does enrichment effect how much the jumping rat grooms?

What causes the male porcupine to pace ?

Make your question into a Hypotheses

It should be a statement that can be refuted or supported.

The jumping rat grooms more with no enrichment present than with enrichment.

The male porcupine paces more after a failed attempt to copulate with the female.

Sampling Types

There are 3 sampling types: focal, scan, and behavior.

Focal: observes one animal.

Scan: observe all animals; one after another, at regular intervals, where the behavior of each animal is recorded.

Behavior: observe the entire group for a particular behavior.

Not all recording types can be used with all sampling types.

Continuous cannot be used with **Scan**.

Instantaneous cannot be used with **Behavior**.

Recording Types

There are 3 recording types: continuous/all occurrences, instantaneous, and one zero.

Continuous/all occurrences: Record all instances of a behavior including start and stop times. It gives a complete account of behavior unless an animal stops after the session ends or moves out of sight. It is difficult to achieve reliability between observers and sessions with this recording type.

Instantaneous: Record behavior of animal at set intervals on the "beep." Easy to use but misses rare/short behaviors. Only record what the animal is doing at the exact moment the timer goes off.

One-Zero: Good for behavior patterns that are hard to capture through the other two types, like brief behaviors that start and stop repeatedly/rapidly. However it also introduces error since it overestimates duration and underestimates bouts. It has been said to never use it.

Creating the ethogram: a list of behaviors with descriptions

Only include the behaviors that are relevant to your question.

Define the behaviors in a way that anyone can recognize the behavior.

Do not use the behavior in the definition.

The behaviors should be mutually exclusive and exhaustive.



Porcupine SCAN ANIMAL Instantaneous SAMPLING

ETHOGRAM

L	Locomotion	Porcupine is in the process of moving from one place to another, in a calm matter
A	Attempting	Bono is in the process of trying to get Bobby Sue to copulate
C	Copulating	Bono and Bobby Sue are copulating
P	Pacing	Bono is in the process of going to the ground and walking back and forth in front of the glass with quills raised
E	Eat	Porcupine ingest and chews food
IN	Inactive	Porcupine is sitting/standing in one location and isn't investigating, eating, or manipulating an object
I	Investigate	Porcupine is manipulating enrichment or browse
U	Urinating	Porcupine is down on the ground urinating

B Bono
S Bobbie Sue Larger
Please write date and start time for each column.
Put the letter for each behavior that the porcupine is doing at the 15second mark.

Date	Start time		
	Time (sec)	Bono	Bobbie Sue
	0:15		
	0:30		
	0:45		
	1:00		
	1:15		
	1:30		
	1:45		
	2:00		
	2:15		
	2:30		
	2:45		
	3:00		
	3:15		
	3:30		
	3:45		
	4:00		
	4:15		
	4:30		
	4:45		
	5:00		

One-Zero Data Collection

Put an X if the Bono is engaged in each behavior in the last thirty seconds.

Put a Y if the Bobby is engaged in each behavior in the last thirty seconds.

Minute	Locomotion	Attempting	Copulating	Pacing	Eat	Inactive	Investigate	Urinating
0:30								
1:00								
1:30								
2:00								
2:30								
3:00								
3:30								
4:00								
4:30								
5:00								
total								

Bono FOCAL ANIMAL CONTINUOUS SAMPLING

Date: _____ Observation time: _____ Observer initials: _____

Crowd size: 0 - 1 - 2 - 3 - 4

Ease of visibility: 0 - 1 - 2 - 3 - 4

ETHOGRAM

L	Locomotion	Bono is in the process of moving from one place to another, in a calm matter
A	Attempting	Bono is in the process of trying to get Bobby Sue to copulate
C	Copulating	Bono and Bobby Sue are copulating
P	Pacing	Bono is in the process of going to the ground and walking back and forth in front of the glass with quills raised
E	Eat	Bono ingest and chews food
IN	Inactive	Bono is sitting/standing in one location and isn't investigating, eating, or manipulating an object
I	Investigate	Bono is manipulating enrichment or browse
U	Urinating	Bono is down on the ground urinating

Record the abbreviation and start time of each behavior.

Behaviors are exhaustive and mutually exclusive, so stop times do not need to be recorded.

Calculate durations and an activity budget after data collection.

Behavior	Start time	Duration	Behavior	Start time	Duration	Behavior	Start time	Duration

Results

Use a statistical program to analyze and graph your data: Observer, CyberTracker, JMP
vassarstats.net is an online calculator.

czaw.org/projects has a database of ethograms that have already been done.

Keepers Making an Impact to Reduce Bird Collisions

Kim Roth Nelson¹ & Lindsay Jacks²

¹San Diego Zoo & San Diego Audubon Society

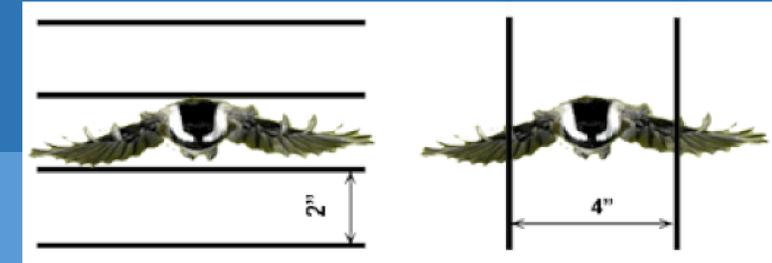
²National Aquarium & Lights Out Baltimore

Introduction

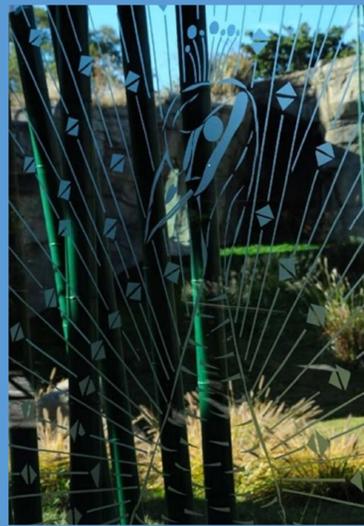
- Birds are unable to detect glass and often fatally injure themselves attempting to fly to habitat reflected in or seen through glass paneling
- Scientific research has estimated that between **365 million to 1 billion birds** die from window collisions in the U.S. each year
- Collisions at zoos and aquariums are becoming more frequent due to the increased use of glass in exhibit design

Ways to Prevent Collisions

- The best way to prevent collisions is to add a visual marker on glass panels every 2 inches horizontally and every 4 inches vertically
- There are many effective and relatively cheap methods that keepers may apply to glass



ABC Bird Tape



Chalk Paint Markers



Acopian BirdSavers



CollidEscape



3M Feather Friendly



- Other inexpensive temporary solutions include hanging tarps on windows overnight until the public enters grounds or using tempera paint with stencils

Importance of Monitoring & Documenting Collisions

- Keepers should encourage colleagues to monitor and document collisions at their institutions in order to pinpoint problem areas and assess the effectiveness of the prevention methods used
- When documenting collisions, it is vital to record the **date, time, location, and species** of each individual victim whether they are deceased or injured
- Zoos & aquariums already tracking collisions include San Diego Zoo, National Aquarium, Virginia Zoo, National Zoo, Detroit Zoo, Akron Zoo & Philadelphia Zoo

Public Outreach

- Keepers can promote, as well as assist, Lights Out, which is a citizen science-based program monitoring collisions in twenty-three North American cities
- Keepers can also educate the public by promoting preventative treatments, writing articles, conducting workshops, and distributing informational flyers

References & Resources

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- American Bird Conservancy: www.birdsmartglass.org
- Lights Out: <https://www.audubon.org/conservation/project/lights-out>

Acknowledgements

- Thanks to San Diego Zoo, National Aquarium, Lights Out Baltimore, American Bird Conservancy, Fatal Light Awareness Program, & Virginia Zoo for their assistance and photo permissions





Changing Priorities:

The Experience of Creating a Regional Symposium Event

Russell Pharr, Dallas Zoo

Background

- “Regional Symposium” model developed by other chapters, we thought it was a good fit for Texas
- Our chapter was very focused on conservation fundraising and wanted to expand our scope
- The goal was to create an accessible, low-cost, and informative event for keepers in our region



Making It Happen

- A lot of different elements, but most of the work was accomplished with a three-person team
- Work with AAZK national for branding and insurance
- Institutional support is critical, approach it as a showcase for the zoo
- Create a theme (what do you want to know more about? What can your institution highlight?) Ours was “*Caring for Geriatric Animals*”



Challenges

- Registration and advertising process
- Coordination of talk and tour schedule
- Delegating roles during the planning process
- Assigning clear roles for volunteers
- Streamlining the check in process



End Results

- Over eighty attendees, from sixteen institutions in seven states
- Eleven paper presentations and six poster presentations, all on geriatric animal care
- Thirteen behind-the-scenes tours and training demonstrations
- Fantastic response, and we are already discussing bigger and better events for the future!

FOOD FOR THOUGHT

Mirzza Salinas
Moody Gardens, Galveston, TX

Introduction

In the fast paced world of zoo keeping it's easy to fall into a rut. This is especially true when it comes to enrichment. Zookeepers can become dependent on things such as plates, boxes, PVC pipes, balls, etc... Moody Gardens Commissary Keepers wanted to step outside of the box (or away from the box) and challenge themselves to make enrichment solely with food items. The goal was to find new more organic ways to enrich the animals in the collection. They began by making themed treats for holidays such as Christmas, Easter, and First Day of Spring. As Thanksgiving 2016 approached, a plan was made to create a special enrichment menu for the day. It was clear from the start this would not be a one person task, so keepers teamed up with Galveston College Culinary Arts Students (GCCAS) to execute their vision.



Acknowledgements

A very special thanks to Galveston College, its Culinary Arts Department, the students, and Chef Mirta Salinas. I would also be remiss if I didn't thank Moody Gardens Curatorial Staff for supporting this fun and kind of crazy experiment.

Thanksgiving Weekend

- Food and other materials were donated by Galveston College.
- 14 students, 1 instructor and a keeper prepped the enrichment the day before the event.
- GCCAS delivered the food the next morning
- Keepers distributed the treats to the animals.
- The students were toured through the exhibit to see the animals enjoying their creations.
- Moody Gardens Marketing took pictures and posted them on social media.

Goal Accomplished

Teaming up with GCCAS allowed Commissary Keepers to learn how to prep food in a more creative manner, and it left an open door for future interactions.





A Change of Pace: Utilizing systematic monitoring to address stereotypic behavior and create permanent husbandry changes

Kristen Scaglione, Wild Animal Keeper II, Stephanie Miner, Behavioral Husbandry Manager
Akron Zoo, Akron, Ohio



Introduction

Stereotypic behaviors, such as pacing or head-rolling, can be indicators of frustration, attempts to cope or even defects in the central nervous system². Research shows that stereotypic behaviors may suggest a need that is not being met. These deficits can be in areas such as space, diet, a place to retreat or stimulation. Pacing is often seen in bears and other large carnivores in human care and many studies have examined the effects of offering the animals “choice”, as it is thought that an animal with control over its environment may have a greater well-being¹.

Research looking at providing off-exhibit access has been done with polar bears, sun bears and giant pandas, but none have looked at the effect on using choice to deter pacing observed in grizzly bears during torpor. This study focused on the stereotypic behavior of 0.1 grizzly bear who has a history of pacing. This pacing could be considered habitual. The goal was to determine if a change in husbandry management, such as introducing a choice of where to spend her time would deter the pacing behaviors. An additional component was to evaluate visibility of the bears in regards to guest experience. Low visibility can have a negative impact on a facility’s impact to educate visitors about wildlife and conservation.⁴

Past studies have shown a relationship between stereotypic behavior and management techniques³. We hypothesized that changing our historical husbandry management to include the choice of entering the building during the day would reduce the amount of pacing seen in our female grizzly bear.

Methods

- 1.1 grizzly bears live at the Akron Zoo
 - This study focused on 0.1 grizzly bear Cheyenne
- The grizzly habitat is a 17,000 square foot natural substrate exhibit. Their overnight holdings consist of three 152 square foot indoor cement pads with full access to two 1,250 square foot natural substrate off-exhibit holdings



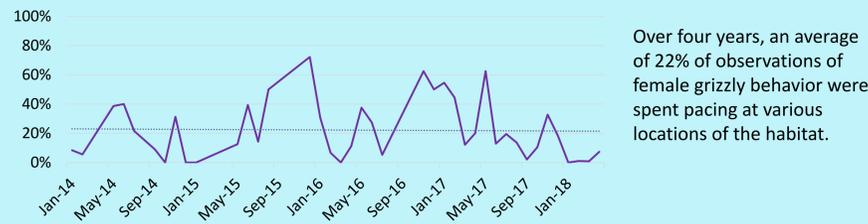
- Random sampling of the bears activity throughout the day was used to track the pacing
- Example of original data sheet

Date	Keeper	Time	Cheyenne		Cheyenne				If "Pacing Other", please note specific location
			Active	Inactive	Pacing		Pacing Type		
					Behind Cave	Other	Distractable	Mindless	

Historical Husbandry Management (2013-2017)

- Standard husbandry procedures consisted of locking bears on to exhibit after AM servicing. Bears would have minimum of one enrichment shift during the day and were then shifted off exhibit at end of day
- Both bears have been observed pacing since their arrival at the Akron Zoo in 2013, Cheyenne more so than Jackson

% of Observations Recorded as Cheyenne Pacing



Over four years, an average of 22% of observations of female grizzly behavior were spent pacing at various locations of the habitat.

A few strike outs along the way...

- Several adjustments were made throughout the years to address the pacing challenge
 - Changes in diet ratio
 - Adjustments in shifting schedules
 - Differing substrate
 - More occupational enrichment
- These adjustments were an attempt to fulfill any possible deficits but proved to be unsuccessful

A New Management Strategy – November 2017

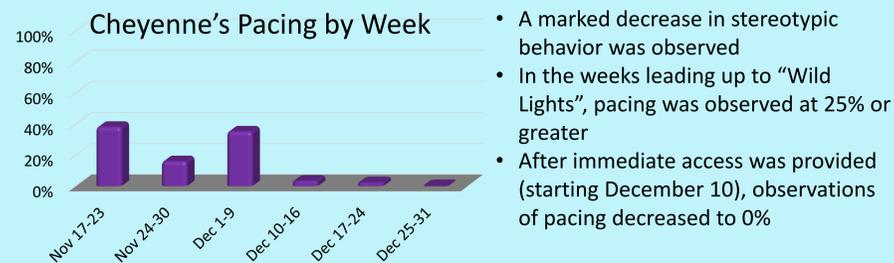
Throughout the first four weeks of the 2017 Wild Lights event (as well as one week prior), various combinations of access to off-exhibit spaces and shifting management were implemented and modified, based on changes observed in Cheyenne’s pacing:

- November 17-23: Given immediate access to training wall area only
- November 24 - December 9: Locked on exhibit for 2 hours then given access to a holding
- December 10: Given immediate access to one full holding

At the outset of this new management plan, activity level (including pacing) and location within accessible space were tracked via random sampling throughout the day

"Date (mmddyyy)"	Time of obs	"Access to?" (TW, TW and scale, TW scale, l, No access)	Cheyenne location (exh, TW, scale/l)	Jackson location (exh, TW, scale/l)	"Cheyenne location on exh: (in/near TW, in/near cave, in/near pool, elsewhere, not on exh)"	"Jackson location on exh: (in/near TW, in/near cave, in/near pool, elsewhere, not on exh)"	"Cheyenne behavior (Active-Not pacing, Active-pacing, inactive)"	"Jackson behavior (Active-Not pacing, Active-pacing, inactive)"	comments

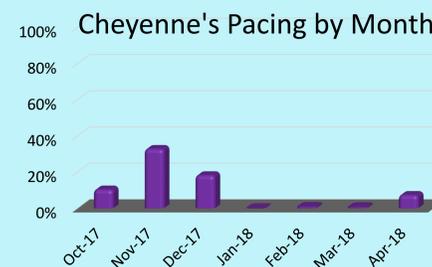
Outcomes from 2017 changes



- A marked decrease in stereotypic behavior was observed
- In the weeks leading up to “Wild Lights”, pacing was observed at 25% or greater
- After immediate access was provided (starting December 10), observations of pacing decreased to 0%

Providing access beyond the winter event

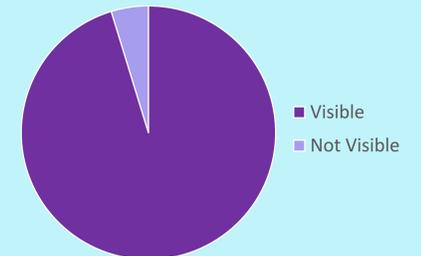
- Providing access to an off-exhibit holding space during the 2017 winter event time period seemed to make such an improvement that the method was continued through the first quarter of 2018
- Pacing remained at a minimum until spring when increased appetite and hormones commenced



Were guests still able to see the bears?

- Cheyenne’s visibility remained at 89% throughout the late event period, including non-event days and the week before the event began
- Visibility was assessed from the time of initial access in November 2017 through April 2018
- The percentage of visibility of at least one bear, while still having access to an indoor holding, was 95%

% Visibility of at least one Bear While Having Access



High visibility rate determined guest experience could be maintained despite having access to an off exhibit area

Conclusions

- These findings suggest an improvement in Cheyenne’s well-being. Her ‘deficit’ appeared to be a lack of control over accessing her entire available environment as the results showed a vast decrease in stereotypic pacing after being provided the option of choice. Her desire to be in a holding may have stemmed from hearing keeping staff in the building without being able to see them or possibly being restricted from a known and comfortable space
- Extensive monitoring over long periods of time gave us a large amount of data to make informed management adjustments. Tracking these activity levels, pacing and bear visibility resulted in long-term husbandry changes
- Using the information provided, we were able to provide an improvement in animal welfare while still maintaining guest experience

Future Studies

While this study was considered a success for these two bears, particularly Cheyenne, it was only a sample size of two. Assessing these same management changes on a larger sample of animals could draw more conclusions for this method of addressing stereotypic behavior. While it can be assumed that offering this new “choice” improved welfare, we need to conduct additional assessments to know for sure. Future studies could also compare cortisol levels to levels of pacing as well as seasonal changes, such as torpor, hyperphagia and hormone cycling. This study focused on behavior changes in response to management adjustments over one season – which means it could just be a snapshot of a multi-year study.

Acknowledgments

Special thanks to the Akron Zoo’s Valley Team who have been collecting data for five years and continued collecting even more data during these changes. Also, thanks to Akron Zoo Management for viewing this topic with an open mind and being supportive of our endeavors and the changes we tried.

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LIFE AFTER MINING

Comparing ground preparation techniques and tree shelter use on seedling growth and survival on reclaimed mine land.

Elizabeth Sautter, Alexys Nolan, and Rebecca Swab. The Wilds Restoration Department. Cumberland OH.

INTRODUCTION

The Wilds landscape was historically part of the Appalachian forest; however, after strip mining it was largely turned into cool season grasslands. Reforesting these grasslands is important for increasing native wildlife abundance and diversity, and for boosting carbon sequestration; however, it is also an incredibly challenging feat due to the lasting effects of mining and reclamation, including:

- Heavily compacted soils
- Low nutrient presence/availability
- Competing cool season vegetation

The combination of these factors create a highly hostile environment for young seedlings, meaning that special efforts must be made to ensure their long term survival.



Fig. 1—The sign in front of the planting site advertises the tree survival project and its importance to the Wilds.

METHODS

Native Trees

The 5 species selected for this project were the white oak (*Quercus alba*), northern red oak (*Quercus rubra*), black oak (*Quercus velutina*), yellow poplar (*Liriodendron tulipifera*), and the persimmon (*Diospyros virginiana*). These trees were treated with 10N-10P-5K fertilizer tablets during planting.

Tree Tubes

Half of the plots had tree tubes applied to them in order to compare their health and survival with those trees which did not. On the plots with tree tubes each seedling was given a 2-ft tall thin-walled plastic tube which was perforated with ventilation holes and attached to a 3-ft tall stake.

MONITORING

An initial survey was conducted on approximately 800 of the planted trees in the spring immediately following planting in order to determine a baseline status. Further surveys will be conducted annually in the fall. Measurements recorded in each survey includes height, root collar diameter, survival, and vigor. Growth and survival data collected over time will be analyzed in order to determine which planting techniques have the most and least positive effects on seedlings. Discovering a link between a particular technique and the survival of these native trees will be vital to future research here and in other areas impacted by surface mining.

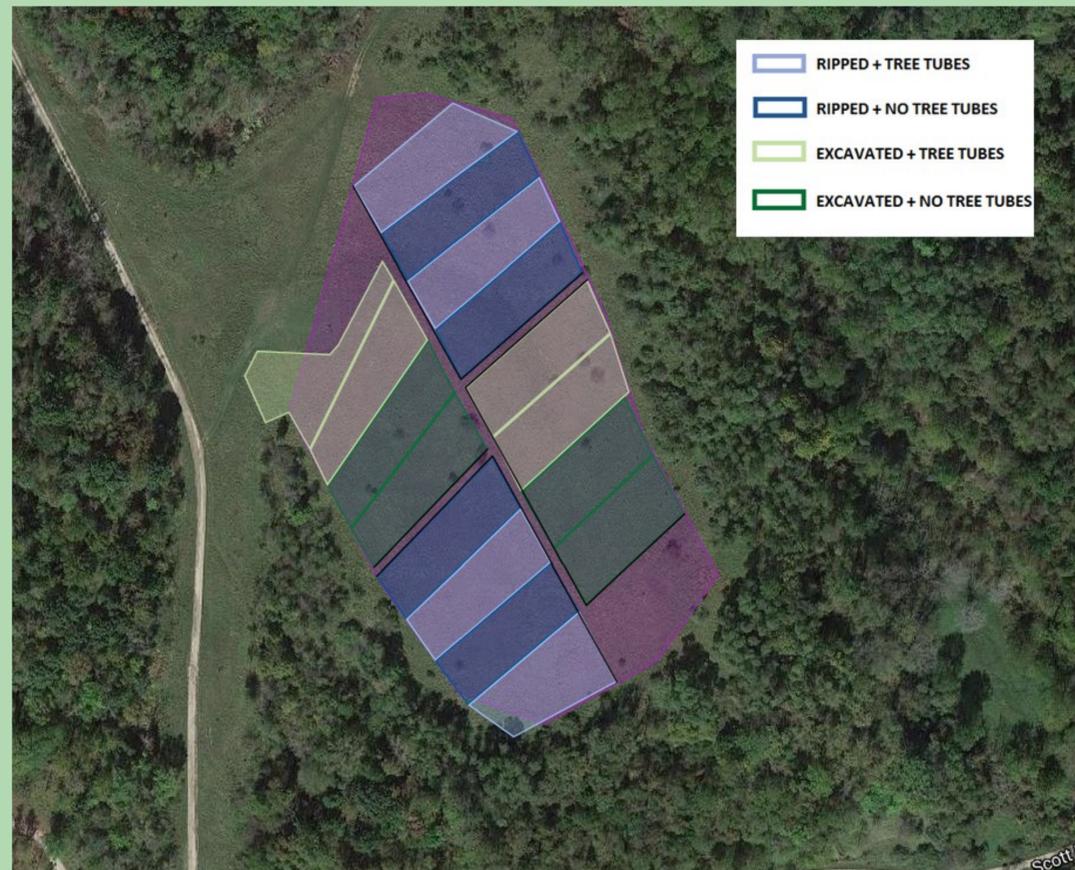


Fig. 5—This map displays the 16 experimental plots used in this project. Half are ripped, half are excavated, half have tree tubes, and half do not have tree tubes. This creates 4 seedling preparations to compare.



Fig. 2— This experimental plot tests both the presence of tree tubes and the excavation method described below.



Fig. 6—Here you can see a track hoe preparing one of the excavated plots in March 2018. Notice the difference between the initial preparation and the result 4 months later in July 2018, as seen in Figure 2.

SITE PREPARATION

In order to have successful reforestation efforts, the site must be prepared in a way that alleviates compaction and competition with existing vegetation. The two ground preparation techniques used on site are the ripping method and the excavation method.

Ripped

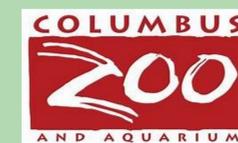


Fig. 3— Here you see the result of the ripping method. Developed by the ARRI as part of their Forestry Reclamation Approach, this method involves carving shallow crosshatches into the soil, then planting a tree in the center of each crosshatch.

Excavated



Fig. 4—Here you can see the result of the excavation method. Developed by David Polster, this method involves a track hoe digging a 3-4 ft deep hole, then emptying the bucket half next to the hole and half back inside the hole. A tree is planted in the side of the resulting pile.





At Sedgwick County Zoo, keepers created a Build-your-own Puzzle Feeder Kit with clear PVC pipe and fittings. It has different lengths of tubes (some with holes, some without), and various tees, fittings and endcaps. Keepers can make their own treat mazes for their animals depending on the animals' abilities. After use, they can be disassembled and cleaned and stored for the next use. The storage case was found in a craft supply store. They are like tinker toys for zookeepers!

BENEFITS TO USING CLEAR PVC FOR PUZZLE FEEDERS

ANIMALS They can SEE what treats are inside.
VISITORS THEY can see what treats are inside too! Makes a great demonstration tool for keeper chats—for example, show how an anteater uses its tongue to get mealworms from the bottom of a foot-long puzzle.

KEEPERS We can see what treats are left inside when it is time to clean them. Since the pieces aren't glued together, we can clean them WAY better than our typical PVC tubes with caps glued on. (Baby bottle brushes work great to clean inside the pipes.) No more stinky, rotten mouse pinks dried inside hard-to-clean feeders!



MANAGEMENT Clear PVC items meet requirements for naturalistic enrichment items thus preventing the need for painting or scorching PVC puzzles.

Clear PVC is not readily available at your local hardware store. It is typically used in food, beverage and chemical industries as well in laboratories, aquariums and for building furniture. It is generally MUCH more expensive than regular PVC (4-8 times the price), but the two websites listed below do have more reasonable prices. Duraclear pieces are about 37% higher than standard PVC, but they have offered AAZK conference attendees a discount (see below).

<https://duraclearplastics.com/clear-fittings.html?pp=2> Has the best prices overall
https://formufit.com/collections/1-1-4-in-size-pvc/available-colors_clear-uv
 Has a few fittings that Duraclear doesn't have

My suggestion is to purchase a large quantity of one size of pipe and fittings, so they are interchangeable. I went with 1 1/4", known as the "Goldilocks" size—not too big, not too small, but just right! I thought it would be the most versatile with the various species in our area. Large enough for peccaries and maned wolves to roll, but small enough for lemurs and coati to manipulate too.

AAZK CONFERENCE SPECIAL

10% off

Clear PVC fittings & Pallet prices for clear PVC pipe

Discount code:

CODE AAZK

Expires: December 31, 2018

863-455-1581

www.duraclearplastics.com



Price Sheet

CLEARLY BETTER PVC PUZZLE FEEDERS



Micala Teetzen
 Sedgwick County Zoo
 Wichita, KS



Contents of our Clearly Better PVC Puzzle Feeder Kit



Our 10' of pipe was cut as follows: (8) 4" pieces
 (10) 6" pieces
 (2) 12" pieces.

	PRICE	QTY	TOTAL
1-1/4" DURACLEAR 4-WAY FITTING	\$3.48	1	\$3.48
1-1/4" DURACLEAR 3-WAY FITTING	\$2.88	1	\$2.88
1-1/4" DURACLEAR TEE FITTING	\$2.88	1	\$2.88
1-1/4" DURACLEAR END CAP FITTING	\$1.17	6	\$7.02
1-1/4" DURACLEAR 45 FITTING	\$2.55	2	\$5.10
1-1/4" DURACLEAR ELL FITTING	\$2.52	8	\$20.16
5' 1-1/4" DURACLEAR PIPE SCH 40	\$11.55	2	\$23.10
SHIPPING			\$15.92
This is the regular price (does not reflect 10% discount)	TOTAL		\$80.54

Working with Clear PVC

Clear PVC is "softer" than traditional pipe so it is slightly more difficult to cut smoothly. Here is some advice from the Duraclear Plastics website for cutting it:

We have found good results with a 90T blade (finishing), and although some residue gets inside, a quick wipe on the inside pops the "remainder" off clean. The end cut has been extremely smooth. We have also used a 24T wood blade, and this has come off free of any buildup. However, the blade must be dropped slower or it will result in chipping that we do not see at any speed on the finishing blade.

Use a miter saw and make sure to drop the blade VERY slowly, approximately 10-15 seconds per cut. Then release the trigger switch and allow the blade to come to a complete stop in the down position before lifting the blade. This prevents the teeth from catching on the cut pipe piece and throwing it as a projectile. Cutting too fast or lifting the saw before it comes to a stop can lead to jagged edges like in the photo below. Go slow and don't waste your pipe!



When drilling holes in PVC, start with a small drill bit to make a pilot hole. Then use a bit a few sizes larger and enlarge the hole. Continue using increasingly larger bits until you reach the hole size you desire. Drilling holes in the clear PVC makes some large burrs, but they are fairly easily removed with the blade of your pocket knife.



Adaptations for different species

The puzzles can be made easier to manipulate for certain species (like peccaries or pigs), by making them 3-dimensional. Do this by choosing certain fittings or by twisting the elbows so one of the pipes sticks up. This gives the animal a pipe that is easy to flip with their snout or grab with their mouth.



For a giant anteater, you could put a cap on one of the longest tubes and make them use their tongue to get some mealworms from the bottom. This is a great method to show visitors how long the anteater's tongue is during a keeper chat.

Complexity

The beauty of this kit is that the keeper can make the puzzle as simple or as complex as needed, depending on the animal's skills. Once the animal has solved a simple puzzle, add some more pieces to make it more difficult. With an unlimited number of combinations, the maze can be different every time!

Complexity can also be increased by adding "sleeves" of a larger diameter of PVC to slide back and forth, covering treat retrieval holes as they do so. These could be clear PVC (if you ordered some of a larger size) or could be regular white pieces.

The advantage to this kit is that pieces can be added as budget allows and you can integrate scraps leftover from other projects. You can mix in regular colored PVC pipes and fittings too, if desired.

Examples of puzzles that can be made with the kit



Clear capsules

Clear capsules can be made by putting caps on the ends of a tube and filling them with visually interesting items.



Colorful beans, rocks or small candies make a rattle that is visually stimulating in addition to providing auditory enrichment



Sand and seashells



Check out a video of them in action!



Glitter is added to the tube filled with water to make a snowglobe-like wand (add some clear glue or corn syrup to make the glitter take longer to settle). Intended for use under supervision only.

Notes

- Since the caps are not glued on, the capsules are NOT watertight. The fit is fairly tight so the water leaks out pretty slowly. The glitter wand is recommended for use under supervision only or to be used outside of the enclosure. Speaking from experience—if it drops, the cap will likely pop off and you will have a glittery mess to clean up! If desired, order some extra caps and go ahead and glue caps onto the capsules filled with liquids, so you don't have to worry about leaks.
- Just to be on the safe side, make sure the items placed inside are non-toxic and not a choking hazard to your animals (i.e. don't use beads, marbles, etc.). Our capsules have been dropped from 4-5 feet and haven't broken yet, but the cap can pop off if it falls just right.
- Also, don't push the endcaps on too hard. They fit quite snugly and can be difficult to get back off.



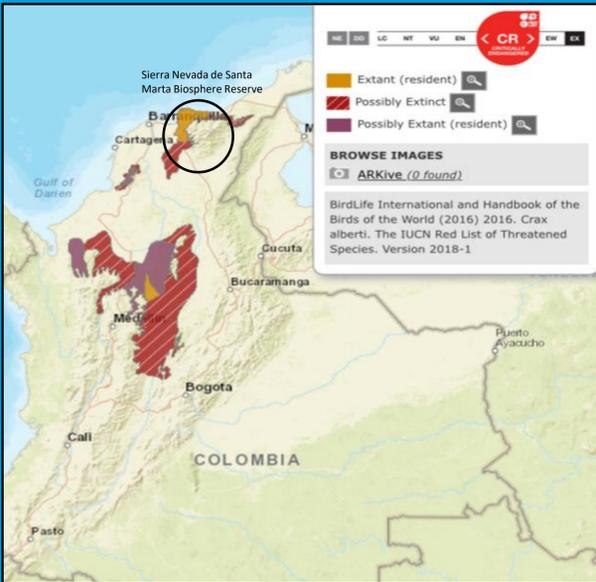
In Pursuit of El Pajuil: A Camera Trap Study On the Critically Endangered Blue-billed Curassow (*Crax alberti*)

Kyle Waites
ARIZONA CENTER for NATURE CONSERVATION

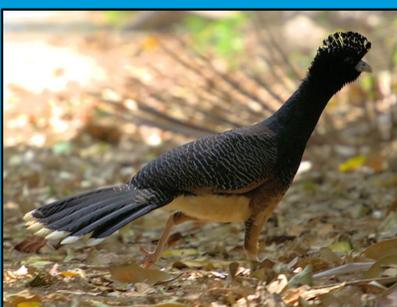
Introduction

The Blue-billed Curassow (*Crax alberti*) is a large, cryptic, terrestrial species endemic to Colombia. Along with indigenous hunting pressures, it is primarily threatened by continued deforestation of its native habitat for mining, logging, agricultural expansion, and rapid urbanization. It is estimated that the species has lost a staggering 98% of their original natural habitat and, due to this tremendous loss, their range is currently limited to several remnant forest patches in northern and central Colombia. This species is listed as 'Critically Endangered' on the IUCN Red List with a rough estimate of 150-700 individuals remaining in the wild. These numbers reveal the lack of knowledge on the current population status of this species.

Recently, camera trapping has become a popular method for surveying cryptic, ground-dwelling species due to it being a highly effective and non-invasive approach. To obtain a greater understanding of their population dynamics I proposed utilizing trail cameras to conduct comprehensive surveys of a population of Blue-billed Curassows that inhabits the Sierra Nevada de Santa Marta Biosphere Reserve in northern Colombia, which is one of the most biodiverse places on Earth.



Methods

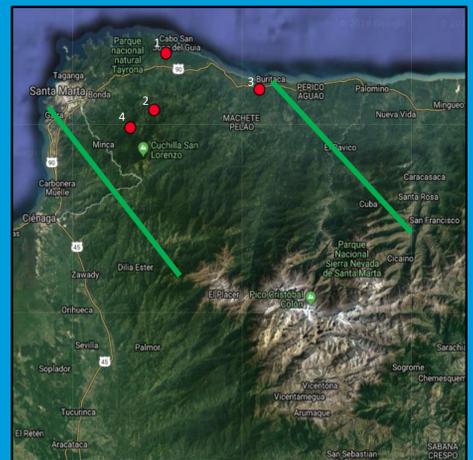


Wild Blue-billed Curassow, female



Wild Blue-billed Curassow, male

- In April 2018 a total of 10 Browning Strike Force 850 HD trail cameras were installed at various field sites near the city of Santa Marta, Colombia
- Focus was on a conservation corridor connecting Parque Nacional Natural Tayrona and Parque Nacional Sierra Nevada de Santa Marta (see map below)
- Cameras were installed at four field sites (Table 1) that contained suitable habitat for *C. alberti*
- Local field assistants were trained in installation, retrieval and basic operation of camera traps
- All field sites were located on private land owned by local farmers
- Sampling locations were chosen at random however, to increase the success rate of each camera, all were installed along game trails or near a water source
- The cameras collected data for 4 months, taking 5 photographs in 2 second intervals, with a delay of 5 minute between detection events



Map of field sites (conservation corridor shown in green)

Site Number	Site Name	Elevation (m)	Habitat	Number of Cameras Deployed
1	Calabazo (Peublito)	450	Humid Forest	4
2	Finca Santa Fe	1000	Cloud Forest	2
3	Quebrada Valencia	200	Lowland Forest	2
4	Finca Onaca	1100	Cloud Forest	2

Table 1: Field site details



Trail camera photo of the pair of Blue-billed Curassows housed at the Phoenix Zoo

Discussion

The results obtained will be used to help direct future surveying efforts, further contributing to the in-situ conservation of the species. Future comprehensive, long term camera trap surveys of the Blue-billed Curassow population inhabiting the Sierra Nevada de Santa Marta are necessary in order to gain a crucial understanding of their population dynamics and movement patterns. Understanding the population trends of this critically endangered species is vital to the protection of not only Blue-billed Curassows, but the entire ecosystem they inhabit. The data from the camera traps was collected by local field assistants in August 2018 and is currently being analyzed for:

1. Presence/Absence of *C. alberti* at each sampling location
2. Occupancy of *C. alberti* at each sampling location
3. Species richness at each sampling location

An integral component to ensure the survival of this species for future generations is to involve the local community. Local field assistants, students, and guides have already been trained and incorporated. The hope is to continue this capacity building by training, educating, and integrating locals into the project to assure continuation of this research far into the future.



Field team after installing a trail camera at Finca Santa Fe

Acknowledgements

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My Time at the Cheetah Conservation Fund

Amanda Westerlund, Marine Mammal Keeper



The Conservation Centre



- CCF is located in Otjiwarongo, Namibia
- Working model dairy goat farm and creamery
- Livestock guard dog breeding program
- Full genetics laboratory and hospital
- Gift shop and café
- Classrooms for local school groups and visitors
- Museum about the natural history of the cheetah and conservation
- Bushblok production and distribution
- Guesthouses for visitors and staff/intern houses on site



Husbandry and Rescue



- CCF cares for over 30 rescued cheetahs and other carnivores
- Daily care is different for each group:
 - Centre cats can be free contact with staff only
 - Retired Centre cats are in quieter areas with small visitor tours in raised vehicles
 - Rewild cats are 10+ minutes from the Centre with minimal human contact
- Diet is local horse/game meat prepped by staff with bone in
- Crate training is done with all Centre and non-releasable cats for stress-free procedures
- Daily cheetah runs with the Centre cats for exercise



Pup feed prep



Fynn, scat dog training



Boomerang pack, 5 weeks old



Zebra Legs, 14 weeks old



Morning cheetah run with lyre system



Phil physical

Daily Life at CCF

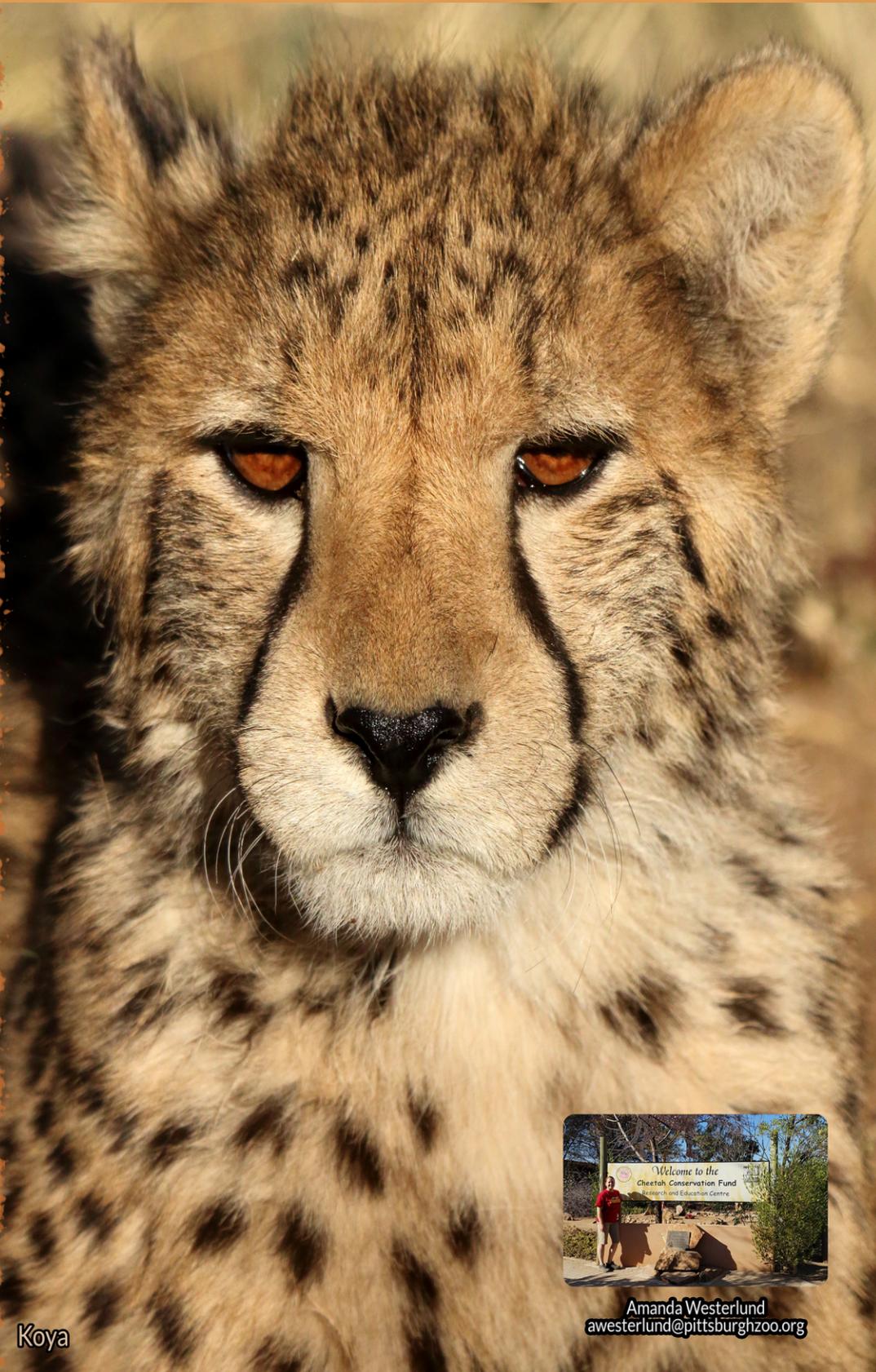


- My primary responsibility was the care of nine newly rescued African painted dog pups:
 - Zebra Legs and White Neck, 1 - 14 week olds, 2.0
 - The Boomerang Pack, 7 - 5 week olds, 4.3
- The goal was to introduce the two packs and re-wild
- Feeds were frequent with organ meat, milk powder, and predator powder
- Weights were recorded daily on the Boomerang Pack
- Play sessions were done multiple times per day
- The two packs were introduced after a week of "howdies" and went extremely well!

How You Can Visit Too!



- Visit cheetah.org
- Under the "Volunteer" tab, look for "Working Guest - Zoo Keeper Application"
- My cost was \$500 per week, food and housing included
- Flights land in Windhoek and then a 4 hour drive to CCF.
- Working guests and visitors come from around the world, so sharing knowledge and making new friends is easy!
- Be a part of active conservation efforts and see what it is like in the field!



Amanda Westerlund
awesterlund@pittsburghzoo.org

Koya