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Papers

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NCAAZK
National Capital American Association of Zoo Keepers

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2017 AAZK's Bowling For Rhinos
"A Partnership in Conservation"
Presented by Carol McCallum
Bowling for Rhinos Program Manager

Introduction: A New Chapter for Bowling for Rhinos

In 2017 we began a new chapter in the Bowling for Rhinos story. With the retirement of long time BFR Program Manager Patty Pearthree in 2016, a new AAZK committee was formed. The Bowling for Rhinos committee consists of six members dedicated and driven to work hard to keep BFR successfully moving forward. Each member has taken over a specific responsibility to ensure that BFR continues to grow and that each year we see increased participation from our membership. Of course, we also strive to see an increase in funds raised each year. We are here to serve and assist you in making your events successful. Questions and comments are always welcome.

Carol McCallum is the BFR Program Manager. She has been a keeper for over 15 years of everything from frogs to big cats. Currently, the Conservation Education Coordinator at Jenkinson's Aquarium in New Jersey, she is also assistant supervisor of their herp collection and owl keeper. A lifelong passion for wildlife and the environment keeps her busy. Carol is involved with many conservation organizations and initiatives such as Polar Bears International, NNOCCI, AZA's Aquarium Conservation Partnership, EPA's Trash Free Waters, Frog Watch, AZA SAFE program and AAZK's Conservation Committee. Called a crazy cat lady by her friends, she also works with Joa's Arc, a special needs animal rescue. She is currently Mom to 5 kitties, two of which are special needs, and one cranky bearded dragon.

Kym Janke is the BFR Program Vice Manager. Kym is the lead keeper in Animal Connections - Children's Zoo at the San Diego Zoo. She has been involved in AAZK and BFR for over 10 years and also volunteers for the Cheetah Conservation Fund. She is happily married and has two four legged kids, Skyla (cat) and Sierra (dog), but can often be found with a foster dog from a great local rescue organization. When not caring for animals she enjoys travelling and spending time outdoors. Camping and hiking are some of her favorite activities.

Lisa Haggadone is your Event Coordinator. She is responsible for communicating with AAZK chapters to get important information such as BFR contact information and event dates. Born and raised in Brookfield, WI, Lisa has always had a love for animals. She graduated from Coastal Carolina University with a Marine Science Degree and a Biology Minor. She has worked with animals for over 9 years, however working with hoofstock was where her obsession for rhinos began. She began working for Natural Encounters, Inc. in 2014 with the Winged Encounters show in Orlando and in February 2017 became a certified professional bird trainer. She became an active member of AAZK in 2016 and was excited to get more involved in the organization after attending her first conference. In her free time she enjoys reading, running, relaxing at the beach, trying new restaurants and spending time with her cats. She is also a member of the Association of Zoos and Aquariums (AZA) and International Association of Avian Trainers and Educators (IAATE).

Kate Clemens is our Communications Liaison. She is responsible for sending out BFR announcements and reminders through AAZK's social media as well as emails. Throughout her life Kate has always had a growing passion for animals. That passion inspired her to pursue a degree in Animal Science focusing on Human and Animal Interactions from the Ohio State University. She continued to gain experience in all aspects of the animal industry from domestic to livestock. Her career path eventually led her to a life in exotic animal care and conservation. Kate's current position at the Birmingham Zoo includes focusing on rhino conservation. Kate also serves as a board member for the Rhino Man organization. Due to Kate's experience in animal care, and understanding of the poaching crisis, she strives to make a connection between people and rhinos. She believes that the more people care, the more we can accomplish together.

Kevin Shelton is the Conservation Coordinator. He is liaison to our BFR conservation partners - LEWA, International Rhino Foundation (IRF) and Action for Cheetahs (ACK). Kevin spent 16 years in the zoo and aquarium field until becoming a consulting ecologist 12 years ago. He now works performing wildlife surveys, wetland restoration, and habitat evaluations. Kevin has been an AAZK member for nearly 30 years and was very active while a zookeeper serving on the Board of Directors for 6 years and as President for 2 years in addition to various chapter positions. He also served as an accreditation inspector for AZA. Kevin has been supporting BFR activities for 25 years and is happy to be a part of the BFR Committee. He has been to Lewa 8 times, leading trips there to support their efforts. He has been married for 11 years and has a 7-year-old son. They enjoy playing board games, camping, fishing, and travel (especially to Lewa).

AND... she just couldn't leave us! Patty Pearthree is the Trip Coordinator. She is responsible for communicating with all the trip winners and making arrangements for those trips. Patty is a Michigan State, Santa Fe Teaching Zoo & Indiana University Graduate. She was a Senior Keeper in the forest biome at the Indianapolis Zoo for 10 years before becoming a full time parent. With both boys now in college, Patty continues as a professional pet sitter but after 15 years is seeking a more full time position. Patty now voluntarily leads zoo group safaris to Kenya to show others how their BFR dollars are put to work in the field. This year she lead her 32nd group to Lewa.

Why do we bowl for rhinos?

The black rhino is on AAZK's logo. That obligates us to help save them and all rhino species from extinction. In 1990 Bowling for Rhinos became national AAZK's signature fundraiser. Through our collective efforts we have helped secure a future for not only rhinos but their habitats and all the animals that share those habitats. Commitment is key to forming and strengthening the partnerships we make with conservation organizations, and to the saving these animals.

Our Accomplishments

The most successful conservation programs involve long-term commitment. That type of commitment is ongoing with our conservation partners : Lewa Wildlife Conservancy (LWC), International Rhino Foundation (IRF), and Action for Cheetahs (ACK). The AAZK Bowling for Rhinos (BFR) fundraiser has raised over $6.6 million since 1990 through the hard work and dedication of AAZK chapters and other volunteers. 2016 proved to be yet another record breaking year with just over $600,000 raised. AAZK had 110 chapters in 2016 - 78 had BFR events and 8 made donations separate from an event. The funds from 2017 are just starting to come in. So far this year BFR events have raised almost $29,000. 100% of funds

raised through BFR events go directly to conservation programs. Our two primary rhino conservation partners, Lewa and IRF each receive a 45% share of the total funds raised. Action for Cheetahs receives 8%. The final 2% is set aside to fund the BFR Conservation Resource Grant.

Our Conservation Partners

Anna Merz went to Kenya seeking a serene retirement but became so appalled by the slaughter of black rhinos that she helped start a reserve with Ian Craig and his family to protect them. What started out in the 1980's as a 5,000 acre rhino sanctuary on the Craig family cattle ranch has now become one of Kenya's most successful private wildlife conservancies and a model for community based conservation worldwide. The Lewa Wildlife Conservancy is now over 72,000 acres and as of January 2017, is home to 83 black rhino and 74 white rhino. That is approximately 15% of Kenya's entire rhino population. Lewa is also home to yet another critically endangered species, the Grevy zebra. The approximately 300 Grevy zebra living on Lewa represent a significant proportion of the remaining global population. Lewa is home to the Big Five as well as other commonly occurring species such as the giraffe, ostrich, impala and over 400 bird species. Having now partnered with other private lands, conservancies and surrounding communities Lewa's conservation initiative is working and is globally recognized.

In 1993, in response to the escalating crisis facing all five rhino species, the International Rhino Foundation (IRF) was founded. The IRF is involved in programs both in the wild and in captivity, both of which IRF believes are critical for the survival of rhinos. Sumatran and Javan rhinos are likely the world's most critically endangered land mammals. AAZK's Bowling for Rhinos program has helped to conserve these two Indonesian species since 1996. Javan rhinos now number about 60 animals and Sumatran rhinos number no more than 100 in four sites in Indonesia. Sumatran rhinos have had a decline of more than 70% of their population over the last 20 years – but not in the areas in which AAZK supports their conservation. AAZK's BFR supports the Indonesian Rhino Protection Units, the backbone of protecting both species. AAZK's hard work to raise funds through Bowling for Rhinos ensures that AAZK plays a critical role in the long-term survival and recovery of Indonesian rhino populations. By the beginning of the 20th century, hunting and habitat loss had reduced the Greater one-horned or Indian rhino to fewer than 200 individuals in northern India and Nepal. Thanks to strict protection implemented by Indian authorities, the population has rebounded to more than 3,345 today. Despite these successes, however, Indian rhinos are still threatened by poaching, habitat loss and more. As 70% of the world's population of Indian rhino live in one park their numbers could be decimated by disease or a natural disaster. In 2010 and 2011, IRF received what was known as the AAZK Conservation Resource Grant. These funds provided radio collars for Greater one-horned, or Indian rhinos, that were being relocated as part of the Indian Rhino Vision 2020 Program. Launched in 2005, Indian Rhino Vision 2020 is an ambitious effort to have a wild population of Indian rhinos spread over seven protected areas in the Indian state of Assam by the year 2020 which will create a larger, safer and more stable population.

Action for Cheetahs in Kenya's (ACK) mission is to promote the conservation of cheetahs through research, awareness and community participation. The cheetahs historic range has been reduced by about 89%. The future of the cheetah is threatened by land fragmentation, loss of critical habitat, loss of prey species and conflict with people. Cheetahs encounter conflict with farmers when the loss of their natural prey compels them to kill livestock. Farmers often kill the cheetah in retaliation. Habitat loss presents a

major threat to cheetahs. As human populations grow they infringe on the open grasslands that cheetahs need by building new communities, roads and agricultural needs. In 2009, AAZK BFR started supporting Action for Cheetah's efforts.

Sponsor Support

Bowling for Rhinos supports these deserving organizations but BFR has committed sponsors as well. In 2004 the Blue Rhino gas company became the national sponsor for Bowling for Rhinos. The company is extremely conservation minded and uses the white rhino as their logo. They have supported BFR with approximately $135,000 to date. They maintain a Save the Rhino page on their website as well. Zarraffas Coffee of Australia became a sponsor in 2013 having supported BFR with approximately $86,500 in contributions so far. They have held BFR events in Australia over the years as well.

We wish to extend a heartfelt THANK YOU to both companies for their continued support and look forward to continuing to save rhinos together.

It's Not Just Bowling Anymore!

Bowling remains the number one fundraising event for BFR but over the years chapters have become very creative. New events have included family friendly, adult only and even "no attendance necessary" fundraisers. Picnics, animal art auctions, coin collections, curling, sailing, dancing, trivia nights, wine tastings, rummage sales, candle and candy bar sales, 5k walk/runs, and more! So many ways to raise money for BFR! Of course, if your chapter cannot hold a BFR event you can still help by making a donation. Back in 1990, 35 chapters raised $138,000. Today over 80 chapters participate and we have surpassed the $600,000 mark. That is an amazing accomplishment but we must keep moving forward towards the next goal of $750,000 annually with 100% participation from all AAZK chapters.

BFR Event Guidelines

Once you have decided to hold an event you must have your event sanctioned by AAZK. There is a $25 registration fee (payable to AAZK) to receive a sanction from AAZK to hold a BFR event. Once your fee is received you will be emailed a BFR Event Kit which contains all the guidelines and forms required to hold a BFR event. The $25 fee covers a portion of the administrative costs so that 100% of all donations can go directly to rhino conservation. Please do use the "DONATION" button on the AAZK website to forward the registration fee or event monies. If needed, chapters can call the AAZK office to pay the fee by credit card at (520) 298-9688 or contact ed.hansen@aazk.org. Please forward all BFR registration fees (payable to AAZK) and BFR event monies (payable to AAZK/BFR) to:

AAZK-BFR
8476 E. Speedway Blvd.
Suite 204
Tucson, Arizona 85710-1728

Trips to Lewa and Indonesia!

AAZK, in conjunction with Lewa Wildlife Conservancy (LWC) and the International Rhino Foundation (IRF), continues to support the Bowling for Rhinos conservation program by coordinating overseas trips to LWC sanctuaries in Africa and IRF sanctuaries in Indonesia each year. Trip winners are the **top four** fundraisers of an annual Bowling for Rhinos event as identified by each chapter on their BFR financial statement. To be eligible to win the trips BFR event funds and financial statement must be turned into AAZK by the September 1st deadline. The **top two fundraisers** get the choice of a trip destination - Africa or Indonesia. The third trip winner then chooses from the remaining two destinations. The fourth trip winner will be awarded the remaining destination. Trip winners to each destination need to travel together. For Africa, travel is typically scheduled for February or March of the following year. For Indonesia, travel is typically scheduled between May and July of the following year.

The Anna Merz Champion Award (AMC Award)

There is one more way to win a trip! The purpose of this award is to randomly select an individual AAZK member whose passion and drive for the AAZK signature conservation project, Bowling for Rhinos, reflect the values of the late Lewa Co-founder and Rhino Champion, Anna Merz. This individual may have mastered "the power of one"- where the ideas, passion, and drive of one person can reach out to others and inspire them to save a species from extinction. This individual, who will be nominated by their chapter, may be the highest fundraiser within the Chapter's BFR event, an individual who coordinates a Bowling for Rhinos event year after year, or be an ever-present, reliable AAZK Chapter member always ready to volunteer and fundraise.

Nomination Procedure

- Each qualified AAZK Chapter may nominate one (1) individual for the AMR Champion Award.
- Nominations open 1 January and close at midnight 1 August of each calendar year.
- Chapter nominations may be sent by electronic mail to the Conservation Committee at Conservation@AAZK.org or by US Mail to the AAZK Administrative Office.

Qualifications for the AMC Award

(1) The Chapter nominee shall be an AAZK member in good standing involved with Bowling for Rhinos for at least three (3) years.
(2) The Chapter nominee shall be nominated by his or her peers who have witnessed their dedication to Bowling for Rhinos through the same AAZK Chapter, zoo, aquarium or related facility.
(3) The nominee may not be a previous recipient of the Anna Merz Rhino Champion Award (formally – AAZK Honorary Trip) or have been awarded a previous BFR Lewa or IRF trip as one of the highest fund raisers.
(4) The nominee shall not be Committee Chair or Vice Chair, Program Manager or Vice Manager, members of the AAZK Conservation Committee or a current member of the AAZK Board of Directors.

As this conference is taking place in August, the 2017 Top 4 fundraiser trip winners have not been determined. They will be announced at a later date.

2015 Indonesia Trip Winners
Ann Knutson (San Diego) and Allycia Darst (Lincoln Park Zoo) traveled to Indonesia in July 2016.

2016 Trip Winners
Damian Lechner (Los Angeles) and Jenny Tibbott (San Diego) were the Lewa trip winners. They traveled in March 2017.
Angie Snowie (Toronto) and Melissa Vindigni (North Carolina) were the Indonesian trip winners. They travel in July 2017.

Bowling for Rhinos Conservation Resource Grant
Application deadline is June 1st **of each calendar year.**

This competitive grant is designed to fund projects focused on rhino conservation and research. The total funds available in a given year is dependent upon the funds raised by the BFR Program in the year prior to the award. This competitive grant is designed to fund projects focused on rhino conservation and research. Successful proposals will reflect AAZK values and meet award criteria in one of four categories:

Category I – In-situ Rhino Conservation and Research-
Short-term (less than one year), specific, field research projects on African or Asian rhino species conducted by an individual or organized group of individuals working under the auspices of a zoological facility, educational entity or AAZK Conservation Partner.
Category 2 – In–situ Community, Educational or Medical Programs (Africa or Asia)-
Community education, school support or medical programs developed or administrated by an individual working under the auspices of a zoological facility, educational entity or AAZK Conservation Partner restricted to the continents of Africa or Asia. Preference may be given to local programs established and/or administrated by LWC (Lewa Wildlife Conservancy), IRF (International Rhino Foundation) or ACK (Action for Cheetahs in Kenya) endorsed partners.
Category 3 – In-situ Species Conservation-
Short-term (less than one year), specific, field research projects on any species that shares the exact same ecosystem as: Asian, Java, Sumatran, and African Black or White rhino.
Category 4 – Ex-situ Rhino Conservation and Research –
Short-term (less than one year), specific, zoological research projects on African or Asian rhino species conducted by an individual or organized group of individuals working under the auspices of a zoological facility, educational entity or AAZK Conservation Partner. Researcher(s) must be able to demonstrate evidence of partnership with a rhino conservation entity operating in Asia or Africa combined *with* a tangible benefit to an in-situ conservation project.

Eligibility
Affiliation or partnership with AAZK is not required, but preference may be given to AAZK Members or Conservation Partners.

The BFR-CRG application and instructions can be found at www.aazk.org/bowling-for-rhinos/bowling-for-rhinos-conservation-resource-fund-grant/

Lewa Wildlife Conservancy – Pioneering Technology In Conservation And Conservation-led Development

By
Geoffrey Chege
Head of Conservation and Wildlife
Lewa Wildlife Conservancy
Kenya

July 2017

Introduction to Lewa Wildlife Conservancy

Situated in the northern foothills of Mount Kenya, The Lewa Wildlife Conservancy is globally recognised as a UNESCO World Heritage Site. Lewa's mission is to work as a catalyst and model for the conservation of wildlife and its habitat. It does this through the protection and management of species, the initiation and support of community conservation and development programmes, and the education of neighbouring areas in the value of wildlife.

Lewa serves as a safe refuge for rhino, elephant, Grevy's zebra and other iconic species of global conservation significance. The Conservancy is home to 14% of Kenya's rhino population, provides landscape connectivity to 6,500 elephant that migrate from the high altitude areas of Mount Kenya in the south to the expansive, low-lying wild lands of northern Kenya. In addition, Lewa provides refuge to 14% of the wild global population of Grevy's zebra as well as healthy populations of predators, ungulates and over 440 bird species.

What makes Lewa unique is our long-term commitment to partnering with our neighbours to care for the delicate ecosystem on which we all depend. To local people, Lewa represents much more than the wildlife it protects. Lewa provides neighbouring pastoral communities with an opportunity to maintain their traditional way of life in a modern and sustainable context through progressive and innovative livelihood initiatives. Lewa offers families living near its boundaries improved economic opportunities with our comprehensive education and women's microcredit programmes, community-managed water projects, and access to health care within four health clinics. Lewa benefits thousands of children in local schools by opening doors to a future with more possibilities than those available to their parents and grandparents.

The use of technology to support conservation on Lewa Wildlife Conservancy

Lewa collaborates, through technical partnerships, with other like-minded players in strategic programmes to sustain many conservation, livelihood and tourism programmes while securing the land for wildlife and people. Gathering updated data is vital in ensuring informed and timely decisions are made to support these programmes. Today, we have continued with some of our traditional conservation and environmental education strategies. However, we have also invested heavily in modern technology to address escalated threats facing wildlife and the environment in Kenya. These technologies can be scaled and replicated across other similar landscapes across the globe. Some of the technologies we use consist of:

1. GPS-GSM and Satellite tracking our communication radios, vehicles, aircrafts and wildlife to provide users with a real-time dashboard that depicts the wildlife are being protected, the people and resources protecting them, and the potential illegal activity threatening them. In the past, some of these

technologies were hosted in different reactive platforms. They were minimally used and rangers sometimes relied on their dedication and good luck. However, today, these technologies have been advanced and integrated in a singular visualisation platform known as the Domain Awareness System (DAS). This system alerts teams to threats instantaneously and supports immediate tactical decision making to efficiently deploy resources for proactive management. DAS is a brainchild of the Vulcan Inc. USA team, Save The Elephants and the Lewa Wildlife Conservancy.

The DAS system's impact on anti-poaching and conservation efforts includes:

- Creates a single operational picture for a protected area with an integrated data platform
- Allows real-time tactical decision making using algorithmic analysis of data
- Team field operations are more effective in distributing more accurate and targeted information to rangers
- Provides data to inform strategic intelligence and trafficking analysis
- Provides a platform for a scalable and extensible system deployable within protected areas across Africa

2. Using camera traps to better understand the lives of some key wildlife species to inform ecosystem health. Lewa is home to several indicator wildlife species including Grevy's zebra, giraffe, lion and hyena. In the past, these species have been monitored using different methods. To understand their status, demographics, survival, reproductive success, behaviour, as well as how they utilise the range, we have created databases to individually identify animals using their natural body spots and stripes. Images are captured using camera traps and other digital enabled cameras.

   Grevy's zebra are digitally photographed every month and the information stored in stripe-based identification databases. Data derived from the system include individual identities, population performance, recruitment and survival rates of the young, and movement patterns. Overtime, our understanding of the predator guild was limited only to the lion population. However, recently, we started monitoring the understudied hyena to elucidate their impact on the environment as well as their dietary and spatiotemporal patterns in relation to the lion. We deployed GPS tracking collars on individuals from six clans. In addition, we identified the hyena using photographs from camera traps fixed at all the dens. So far, we have identified almost 150 hyena in the landscape. This is vital information that is shaping our effective, long-term predator management strategies.

3. Lewa on Virtual Reality. Lewa has partnered with Virry VR to become the first wildlife area to feature on Virtual Reality. This is an experience that takes players on a virtual safari in the African savannah represented by the landscapes and wildlife at Lewa. This is the first virtual reality experience of its kind where players literally and virtually interact with real animals in their natural habitat. Earlier in the year, Virry partnered with Sony PlayStation and this is the vehicle in which the public can experience Lewa in VR form. Footage is derived from three live cameras installed in strategic areas on Lewa.

   Virry VR immerses players in the lives of real animals, encouraging discovery, empathy, and problem solving, while helping them to better understand nature, conservation, and the world around them," explains Virry and Fountain Digital Lab CEO, Svetlana Dragayeva. Research has shown that positive interaction with non-threatening nature fosters empathy and caring. Interspersed with the gaming elements are important facts about the animals, as well as lessons about conservation and endangered species.

Indonesian Rhinos: Bowling for Rhinos is Conserving the Most Critically Endangered Mammals on Earth

CeCe Sieffert, International Rhino Foundation

Once found throughout southeast Asia, Sumatran rhinos (Dicerorhinus sumatrensis) and Javan rhinos (Rhinoceros sondaicus) are now found only in Indonesia and are likely the world's most critically endangered land mammals. Since 1996, AAZK's signature Bowling for Rhinos program has helped to conserve these two incredible species. Shy, secretive rainforest dwellers, Javan rhinos now number between 61-63 animals in only one site, and Sumatran rhinos number no more than 100 across four sites. The Sumatran rhino was declared extinct in the wild in Malaysia in 2016. Sumatran rhinos have had a precipitous decline of more than 70% population loss over the last 20 years, but not in the areas in which AAZK supports their conservation. New plans for both species include bold actions designed to reverse their decline and maximize the potential for population growth. This paper provides an update on these plans, as well as our progress on breeding the Sumatran rhino in captivity. AAZK support for the Indonesian Rhino Protection Units, the backbone of the two species' protection, has never been more critical. AAZK's hard work to raise funds through Bowling for Rhinos ensures that AAZK plays a critical role in their long-term survival and recovery.

Action for Cheetahs in Kenya: Range Wide Survey

Mary Wykstra
Action for Cheetahs in Kenya, Director / Principle Investigator

Sarah Omusula
Action for Cheetahs in Kenya, Senior Scientist

Address: PO 1611 Nairobi Kenya 00606
Phone: +254733997910
Email: info@actionforcheetahs.org

Abstract:

Action for Cheetahs in Kenya (ACK) is a grass roots research based project under the registered organization of Carnivores, Livelihoods and Landscapes. AAZK Bowling for Rhinos supported ACK's efforts since 2010 enabling us to develop a field base in northern Samburu. ACK is the only range wide cheetah conservation organization in Kenya. The project employs Kenyan community members and encourages the development of conservation leadership through training and higher education opportunities for our staff. From 2014, we have conducted pilot studies to implement our second national cheetah survey which will combine field surveys and interviews with community presentations and school visits on a range wide scale. Scat detection dogs have been trained to locate cheetah fecal material for cheetah health, diet and genetic evaluation. Additionally, our first Adventure Safari brought employees from three zoos to be a part of our project through participatory travel opportunity.

Photos: Samburu field team members – Learkeri Lbiteri, Soulh Lemutare, Sylvester Kinosi (left), Setting camera traps to monitor predator visitation - Kivoi Kitamii and Alysa Hansen (center), Student debate at Kima-Kiu Secondary School (right).

INTRODUCTION

ACK Mission: *Promote the conservation of cheetahs through research, awareness and community participation in Kenya*

Action for Cheetahs in Kenya (ACK) was launched in 2009 when it joined the Kenya registered company, Carnivores, Livelihoods and Landscapes (CaLL). ACK was the first project under CaLL meeting the objectives of CaLL to conduct research and community programs that will benefit the carnivores and livelihoods of the people living with predators. ACK operated as the Cheetah Conservation Fund (CCF) –

Kenya program from 2001 – 2008 and was co-founded by Dr. Laurie Marker. The project is still affiliated with CCF and works in collaboration with the Kenya Wildlife Service and the University of Nairobi along with other local collaborations.

In 2010, when Action for Cheetahs in Kenya (ACK) began receiving funds from Bowling for Rhinos we had just opened our Salama field site and had recently completed the first national survey of cheetahs across its entire Kenyan range. Today, ACK employs 13 Kenyans at two field sites, has three employees in higher education programs and supports between five and ten local and international university student projects. We work in two communities where over one-tenth of Kenya's cheetahs live within farming communities. In 2016, we launched our second national survey after completing pilot occupancy modeling studies in our two field bases. In 2017, we successfully isolated genetic fragments from cheetah scat samples collected through detection dog identification. We have mapped out 25 locations across Kenya where we will be taking the dogs for scat detection in the next 18 months.

Throughout the cheetah's home range it is vulnerable to the threats that lead to wildlife population decline. Kenya holds a cheetah population that is central to the whole of eastern Africa and we estimate the Kenya population to be 1200-1400 based on studies completed in 2007. The trans-boundary issues with neighboring Tanzania, Uganda, Ethiopia, South Sudan and Somalia create a contiguous population facing similar threats (Durant 2016). The future of the cheetah is threatened by land fragmentation, loss of critical habitat and conflict with people. As with most predators, the conflict over resources and space results in decline of the species.

RESEARCH

In the Samburu study site we have focused on habitat monitoring and on testing deterrent methods to reduce losses to night time predators.

Wildlife patrols have shown a decline in prey species, but also a decline in the number of reported livestock loss to predators. Recent drought in this area resulted in poor quality grazing areas for both wildlife and livestock. Many of the local residents have moved into larger manyatta (homestead) where a few livestock, women, children and some young men remain while warriors take their livestock to other pastures. Prey distribution across the conservancy remains similar to what we found in 2010 when we first began the work, but the density of game has declined by more than 25%.

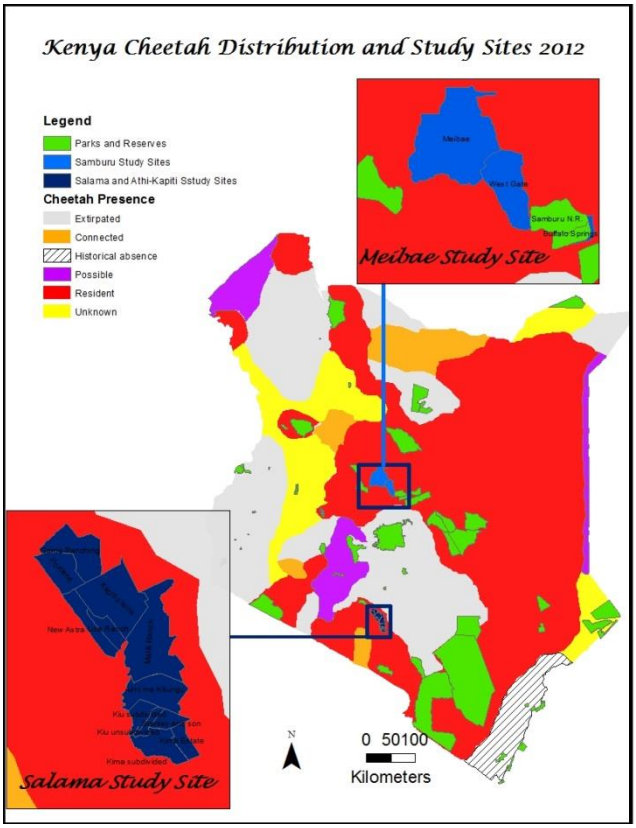

Figure 1: ACK research areas in southern and northern Kenya.

Deterrent testing in 2014 -2016 proved that the Lion Elephant Deterrent Light Systems (LEDS) were the most effective. However, these light systems require technical skills for assembly, maintenance and transfer when the boma is moved. Additionally, the technical skills needed to keep the system in good repair were over the level of the recipients and the ACK staff. The FoxLight system was moderately effective when used in higher quantity (3-4 per homestead) but were cost prohibitive.

The focus of our programs in 2018 – 2019 will be the completion of the second national cheetah survey. We work in collaboration with the Kenya Wildlife Service and several local and international partners in all aspects of the survey. Field staff collects data that assist in the survey and will accompany the team as they travel to other regions of Kenya. Fecal detection dogs will travel to 25 sites across the country to collect scat samples that will be used to evaluate cheetah genetics, health and diet. Interview surveys will be conducted to evaluate cheetah status, perceptions and threats to cheetah populations. Pilot surveys conducted in the Samburu and Salama field sites provide the model for the national survey.

AWARENESS

In 2016, ACK conducted an awareness campaign centered on International Cheetah Day in December. A football tournament and a school debate competition were among the new activities conducted in the Salama community. Our partner, Alive and Kicking, donated 50 footballs to schools affiliated with ACK. In 2017, our education outreach program reached over 5,000 students, teachers and community members with education materials and wildlife videos. At our Samburu field site we met with youth, women and elders (mzee) to develop programs which will raise awareness and improve livelihoods of the members while promoting harmony between predators and the people. Our teacher resource guide and student handbooks were tested in three schools using pre and post surveys to evaluate the effectiveness of our curriculum based materials for distribution to schools across the cheetahs range.

Rabies is a transmitted disease that kills more than 2000 Kenyans annually. The majority of the deaths are children under 15 years old. Rabies is also transmitted between domestic and wild animal populations. Dogs are recognized as the primary carriers of rabies. The vision for Africa is to eliminate rabies by 2030 through awareness and vaccination campaigns. ACK has partnered with several local institutions to conduct a rabies campaign and vaccination program in the Samburu region. We are using posters to raise awareness prior to the vaccination project in December.

DIGIATL DATA

ACK data collection forms have been turned into a phone application allowing ACK to go digital. By the end of 2017, ACK data will be collected paperless. The App will be used in the national survey, and has a citizen science component. Staff training began in 2016 with funding from Classic Escapes and Bowling for Rhinos funds.

Photos: Cheetah genetic work – Brian Mlamba (left), Vegetation survey across the Ewaso River – Kathryn Sippel, Chris Lentaam (photo by Jameson Weston) (center), Madi the Scat Dog (right).

FINANCIAL REPORT

The primary source of income for ACK activities in the Samburu study site is from Bowling for Rhinos. Funding through zoo grants and AAZK chapters support the long-term conservation efforts and other regions of ACK focus. Students and volunteers are self-funded or utilize funds through joint grants with ACK. Below is the income and expense for 2016 - 2017 for the Samburu project. The full operational budget for ACK in 2016 was $147,000.

INCOME 2015-2016

Received BFR 2016:	$45,517.29
Received BFR 2017:	$ 45,571.11
Total Available:	$91,088.40

Expenses 2016 (January – December)

Meibae Conservancy Fee	$ 500.00
Field Officer Stipend and training	$ 9,500.00
Transport (Fuel, Insurance, Public service)	$ 4,900.00
Accommodation (Camping fees, lodging, food)	$ 5,500.00
Camp Construction and Maintenance	$ 5,500.00
Office Equipment and Supplies	$ 3,500.00
Motorcycle Insurance	$ 500.00
Community Programmes	$ 4,500.00
Genetic and Occupancy modeling	$ 8,000.00
Expenses 2016	**$42,400.00**

Expenses 2016 (January – June)

Meibae Conservancy Fee	$ 250.00
Field Officer Stipend and training	$ 5,400.00
Transport (Fuel, Insurance, Public service)	$ 3,000.00
Accommodation (Camping fees, lodging, food)	$ 2,300.00
Camp Construction	$ 4,400.00
Office Equipment and Supplies	$ 5,000.00

Motorcycle Fuel & maintenance	$ 1,500.00
Community Programmes	$ 3,200.00
Genetic and Occupancy modeling	$ 5,000.00

Expenses to Date 2016 $30,050.00

Balance as of 1 July: $18, 638.4

Photos: Cheetah cub in Samburu National Reserve (left), Alive and Kicking football (center), Students in Masse community receiving football donation (right).

PROJECT GOALS AND ACTIVITIES 2018

The following goals will be achieved by ACK staff.
Goal 1: Identify factors affecting cheetah livestock predation and mitigate conflict.
a. Prey Distribution and Abundance: Data will be analysed for annual reporting and used as the baseline for continuing studies
b. Human Settlement Pattern: Satellite images from 2008 – 2016 will be used to evaluate changes in land use and human settlements across the cheetahs range based on pilot projects in Salama and Samburu field sites.
c. *Evaluate Livestock Depredation:* Conflict mitigation efforts include herder training, boma reinforcement, predator deterrent lights and livestock health improvements.
Goal 2) To understand cheetah health and habitat selection
a. *Monitor cheetah presence and movements through observation:* Monitoring methods include direct observations, camera trapping, spoor counting and verification of public sighting reports. Cheetah Scouts collect cheetah-sighting reports and verify predator spoor. Data is entered into an Excel database and mapped using ArcGIS for analysis and comparison annual and seasonal cheetah movements. Camera trap transects verify cheetah corridor use and provide positive ID for individual cheetahs in both the Salama and Samburu study areas.

b. *Determine habitat use of cheetahs in relation to vegetation and prey*: Boma monitoring, Vegetation surveys and highway monitoring will be included in regular cheetah field officer patrols

Goal 3: Influence public and administrative changes to positively affect cheetah conservation and management protocols.

a. Conduct community programs to disseminate findings, promote conservation awareness, and improve livestock management techniques (public meetings called baraza): Use natural resource planning to establish strategies for resource conservation and improved livelihoods.

b. *Raise environmental awareness through partnerships and internal education programmes for communities and schools*: Show wildlife videos at schools.

c. *Establish cheetah conservation protocol and the policy in collaboration with KWS and local stakeholders*: KWS and local administrative offices hold the power of prescription that guide procedures within the human-wildlife interface, thus the knowledge they receive assist in their decisions and actions. ACK provides quarterly updates to KWS and we present our research findings at an annual Carnivore Action Forum meeting. We submit updates to the National and Regional Wild Dog and Cheetah Strategic Plans to assist in the framework of cheetah conservation. Printed materials and digital submissions through our web site create awareness of activities and findings.

Biography

Durant, S. M., Mitchell, N., et. al (2016). "The global decline of cheetah Acinonyx jubatus and what it means for conservation." Proceedings of the National Academy of Sciences of the United States of America.

Trees for You and Me, Keepers Fighting Climate Change

Nicole Pepo

Trees for You and Me Conference Liaison

North Carolina Zoo

Asheboro, North Carolina

"Unless someone like you cares an awful lot, nothing is going to get better, it's not"

- The Lorax, Dr. Seuss.

Introduction

The rapid onset of Climate change is the biggest environmental threat that we face today. The largest observable effects are being seen in the Arctic with seasonal sea ice in some regions forming later and melting earlier each year. Research shows that each year brings a new record low sea ice level and record high temperatures in the Arctic. This is causing complications for many species of Arctic wildlife, especially for Polar Bears, who rely heavily on the sea ice for many aspects of their specialized lifestyle. Changes to our global climate system have also brought on extreme weather patterns like flooding, drought, dramatic heatwaves and freezing temperatures that are occurring outside of normal seasonal ranges. The effects impact both people and polar bears alike, and will likely continue to escalate unless we can work together to drastically reduce our greenhouse emissions (Polar Bears International 2017).

Greenhouse gases occur naturally in our atmosphere (the main gases being carbon dioxide, methane, water vapor, and nitrous oxide). They act as a heat trapping blanket around the earth. The warmth contained by these gases keeps the earth inhabitable and without them global temperatures would decrease to severe lows. On the opposite end of the spectrum, too much greenhouse gases in our atmosphere increases our global average temperatures to severe highs (nasa.gov 2017). Over the past 200 years, since the industrial revolution, humans have released rampant amounts of carbon dioxide into the atmosphere through use of carbon based energy sources. While progressing in varying types of technology, we must consider the consequences of our actions. We can move in a direction that not only continues progress, but also keeps us focused on sustainability while we do it.

Methods

The best way to combat carbon emissions is to reduce or eliminate our reliance on fossil fuels, but there are other ways to do it while we work towards that end goal (Polar Bears International 2017). Planting trees helps remove carbon from the atmosphere through the natural process of photosynthesis. Carbon dioxide is absorbed by the trees to create energy, and the trees emit

clean oxygen as a byproduct. According to the American Forests organization, a 10 year old tree removes up to 48 pounds of carbon dioxide per year, and 1 acre of forest can absorb two times the carbon dioxide produced by the yearly emissions of the average car. Deforestation produces up to 15% of the global emissions of greenhouse gases (americanforests.org 2017). The American Association of Zoo Keepers (AAZK) is the spear head for a grant program that helps combat climate change through promoting habitat restoration and tree planting initiatives.

The Trees for You and Me program (TFYM) began in 2009 as a zoo community driven initiative in partnership between AAZK National and Polar Bears International (PBI). From 2009-2015 AAZK chapters raised just under $80,000 for the TFYM program, which helped to plant 100,000-150,000 trees. The money raised has gone to the Arbor Day Foundation, the Polar Bear Forest with the Wisconsin Department of Natural Resources, to different chapters of AAZK participating in the Acres for the Atmosphere program (a tree planting initiative for areas local to individual AAZK chapters), and to other tree planting conservation organizations around the world. PBI also increases the amount raised by matching with a $500 donation in the name of the winning chapter. In 2016, TFYM evolved into a grant program that can be applied for by individuals seeking to fight climate change through habitat restoration. Going forward, chapters will work together to raise funds for the grant along with the fundraising efforts by the TFYM core team.

The 2016 grant money was awarded to two projects that received just under $15,000 split between them. The grant recipients were Cheryl Peterson of the Bok Tower and Gardens in Wales, Florida, and Lauren Starkey of the Akron Zoo in Akron, Ohio. Bok Tower and Gardens received $12,668.96 for their project at the Lake Louisa State Park that aims to restore the critically imperiled Sandhill community along the southeastern coastal plain. They plan to plant Long Leaf Pine, Turkey Oak, and to introduce the federally listed Clasping Warea. This is all in an effort to help restore an area that is high in species diversity that has been degraded by pasture land development. The Akron Zoo received $1,668.96 to go to a project called Cans for Corridors. Cans for Corridors is a project that raises funds through the recycling of aluminum cans to build tree corridors in the Atlantic Rainforest of Brazil. The corridors help protect Black Lion Tamarins, Jaguars, Capybaras, and Macaws from habitat fragmentation. The Akron Zoo's AAZK Chapter has supported this project since 2014 and plans to use the grant money to create a permanent drop off site with signage to help encourage more community involvement in the Cans for Corridors project.

Conclusion

The TFYM program has come a long way in its efforts to bring the zoo community together to combat climate change and habitat destruction. The hard work of many different animal care professionals across the country has made a big difference in the fight for our global climate system to function as we need it to. Hard work put into the TFYM program has also restored and/or created many acres of habitat for the wildlife we love and want to protect. Please help us continue these efforts by organizing your own event to support the TFYM grant, or having your chapter make a onetime donation to the committee. We also hope that we will see some of you applying for the grant in order to benefit a habitat restoration or tree planting project of your own.

Meet the Team

Christy Mazrimas-Ott

Christy is the Program manager and grant coordinator for TFYM. She started her zoo keeping career in 1986 at the Fort Worth Zoo in the mammal department. She started at the Brookfield Zoo in 1990 and has been a senior keeper for the large carnivores since 1993. She's been an AAZK member since 1985 and has been heavily involved in TFYM since its inception in 2009. She was a field ambassador for Polar Bears International in 2008 and 2009 where she traveled to Churchill, Manitoba. There she met Robert Buchanan, former president of Polar Bears International. "Robert inspired me to do something to help polar bears. We were talking about planting trees absorbing carbon dioxide and fellow Field Ambassador, Alicia Shelley of the Columbus Zoo and Aquarium, had an idea to have a competition amongst zoo keepers to raise money to plant trees. My goals are to get this program running smoothly so anyone can take over my baby. I would love to have all AAZK Chapters be involved and get as excited about TFYM as they do for Bowling for Rhinos."- Christy Mazrimas-Ott.

Anthony Nielsen

Anthony is the Vice Program Manager for TFYM and a part of the Social Media team for AAZK National. He has been a keeper at the Lincoln Park Zoo and an AAZK member for 17 years. There he has worked with a variety of animals including big cats, pinnipeds, and polar bears. He's been fortunate enough to go to Churchill, Manitoba twice, and most recently with Polar Bears International as part of their Climate Alliance program. While there, he learned how to communicate climate change in a way that promotes team work and community involvement. The Lincoln Park AAZK Chapter has participated in Trees for You and Me since its beginning in 2009. "This program means a lot to me because we can see the effects of climate change and we can do something about it if we act now. All it takes is a few changes in our daily routine to reduce our carbon footprint and save the wildlife we care for."- Anthony Nielsen

Tanya White

Tanya has been an animal keeper at the Maryland Zoo in Baltimore for 19 years. She works with Arctic animals, grizzly bears, and lots of African species. She became involved with TFYM in 2016 by helping with the grant proposals and became the social media liaison in 2017. She is responsible for writing all of the cool TFYM social media posts that you've been seeing! If you have any TFYM information that you'd like to see blasted on social media, then contact Tanya! She was privileged to attend the first zookeeper leadership camp through PBI in 2009 and was part of the original tree planting initiative, Acres for the Atmosphere. While there, she learned about using her position as a keeper to educate people about climate change, reducing their carbon footprint, and how we can all do our part for conservation. "I'm very passionate about conservation and love to educate visitors and anyone else who'll listen about conservation, climate change, and how to make a difference by changing their everyday habits"- Tanya White.

Krista Hyme

Krista is the Event Coordinator for TFYM and her job is to communicate with AAZK chapters about campaign updates, tally sales during the Tree Blitz and working to create official campaign documents for chapters to use when holding events. She is an affiliate AAZK member from the Columbus Zoo and Aquarium and has been serving as a docent there for 8 years. During that time, she has supported the keepers and the AAZK chapter by donating items for events, purchasing shirts, promoting events and attending as many as possible. By day, she is a teacher of 22 years, but outside of work her passion is helping animals in any way that she can. In her personal time she enjoys helping out at her local animal shelter. Her favorite animals are bears, moose, giraffe, and orangutans, but if she were honest she loves them all! "Supporting events like Bowling for Rhinos, Putt for Polar Bears and Trees for You and Me has become a bit of an annual tradition for me. Serving on this committee seemed like a natural next-step to me in supporting the conservation efforts of the National AAZK. Working with this committee and serving the AAZK has been an amazing opportunity for me. "- Krista Hyme.

Hardy Kern

Hardy is the TFYM Grants Coordinator and an Animal Programs Specialist at the Columbus Zoo & Aquarium. As the Grants Coordinator, Hardy is responsible for reaching out to individuals, institutions, and organizations doing carbon offsetting work that would potentially benefit from the TFYM Grant. Hardy has been interested in climate-positive work since high school and was lucky enough to visit Churchill, Canada in 2010 to see wild polar bears with Polar Bears International. If you have questions about how to apply for the grant send them his way! "TFYM is the perfect example of acting locally and thinking globally; it allows people all across the globe to raise funds that help mitigate climate change, pool their funds, and empower peers to achieve big goals in real time. It is conservation at its finest, and it helps us all work together to fight climate change"- Hardy Kern.

Nicole Pepo

Nicole has been a Rocky Coast keeper at the North Carolina Zoo since 2009. There she cares for a variety of Arctic mammals and birds. She has been an active member of her local AAZK chapter and AAZK national for 8 years, and the TFYM committee is the first national committee that she's been a core team member of. Her roll on the TFYM committee is as the Conference Liaison. Her job is to wow you at the national AAZK conference with all things TFYM and encourage you to participate in the cause! In 2015 she had the privilege of attending Polar Bears International's Climate Alliance workshop and the opportunity to observed wild Polar Bears in the breathtaking scenery in Churchill, Manitoba. While there, she learned how to effectively communicate about climate change and how to encourage working together to fight it as a community. "Combatting Climate Change is not just important to me as an Arctic animal keeper. It effects all of us globally and I care deeply about preserving a future for people and Polar Bears alike! I feel a great sense of accomplishment at the end of every day when presented with opportunities like participating in the TFYM program. I know we can do this together as animal professionals!"-Nicole Pepo

Mary Ann Cisneros

Mary Ann is the on the Board of Directors for AAZK National and is the oversight for the Conservation Committee, the TFYM program, and Bowling for Rhinos. She has been a keeper since 2003 and started her career at the San Antonio Zoo in the bird department. She then moved to Mesker Park Zoo in Evansville Indiana where she fell in love with giraffe and rhino! She also became heavily involved in the local AAZK chapter there and joined the Conservation Committee for National AAZK. She currently works at Disney's Animal Kingdom Lodge with her two favorites: African antelope and African birds! "What I love about the TFYM program is that it takes care of the natural environment in which all our animals live in. It addresses one of the fundamental problems that affect endangered species, habitat loss. It does this through the TFYM Grant which gives funding to reforestation projects. These projects not only provide habitats but they also clean the air that we breathe. I love this program because it allows keepers to contribute full circle to the care of captive and wild animals."-Mary Ann Cisneros

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Seuss, Theodor. *The Lorax*. Random House Publishing. 1971. New York.

Bear Rotation at the Glacier Run Exhibit of the Louisville Zoo

Tracy Unger, Keeper II

Louisville Zoo

Louisville, Kentucky

Abstract

The Glacier Run exhibit at the Louisville Zoo opened in 2010 to be the new home for polar (*Ursus maritimus*) and grizzly (*Ursus arctos horribilis*) bears, California sea lions (*Zalophus californianus)*, and fur (*Callorhinus ursinus*), harbor (*Phoca vitulina*), and grey (*Halichoerus grypus)* seals. The half of the exhibit that is dedicated to bears is set-up as a rotational exhibit to maximize the available space and time each animal has on exhibit. Keepers are able to shift the bears on and off the exhibits throughout the day while changing enrichment items and training session locations. The configuration of the holding building in a horseshoe shape increases the options for keepers to make the holding space different with multiple entrances and exits. This flexibility has had physical and mental benefits for the animals as well as benefits for the staff when managing maintenance projects, seasonal hormonal changes, behavioral issues, animal preferences, and weather changes.

Introduction

When Glacier Run opened in 2010, it was the Louisville Zoo's third rotational exhibit. (Islands Mammals was the first rotational exhibit ever built. It incorporates three outdoor exhibits, one indoor dayroom, and multiple holding spaces for five species of Indonesian mammals. Gorilla Forest was the second rotational exhibit built at the Louisville Zoo. It has two outdoor exhibits, three indoor dayrooms, and multiple holding spaces for the gorillas.) Half of the exhibit is dedicated to bears and the other half to the pinnipeds. The pinniped section opened first on 30 June 2010 and the bear section opened on 26 April 2011. With the theme of a mining town intersecting with an active glacier, Glacier Run gives the polar and grizzly bears access to two exhibit spaces with public viewing plus a holding building with off exhibit space. The two on exhibit spaces are called the Glacier Exhibit and the Bear Alley. The Glacier Exhibit is 1 acre and includes a broken road, grass and dirt area, creek, 333,000 liter (88,000 gallon) pool, ramp that leads up to the Bear Overhead, and front moat. The Bear Alley space is 1/4 acre and includes a pick- up truck bed, stairs going up to the Bear Overhead, and concrete loading dock space. The Bear Overhead is a 9.4 m long and 1.5 m wide transfer between the two public area exhibits. The Bear Holding Building (off exhibit space) consists of a den with a 13,589 liter (3,590 gallon) pool and 5 holding stalls set up in a horseshoe pattern. There is also a 13, 589 liter (3,590 gallon) pool in the third stall. Each stall has two or three entry/exit doors that can be opened or closed to create a different floor plan or direction for the bears to move around.

The Bears

The grizzly bears were the first bears to arrive in the fall of 2010. At the age of 5, 0.1 grizzly bear, Inga, and her 1.1 cubs Otis and Rita (age 6 months) were transferred to the Louisville Zoo after being labelled nuisance bears by US Department of Fish and Wildlife in Flat Head Lake, Montana in 2010. Inga was 124 kg (275lbs) and Otis and Rita were 22 and 18 kg (50 and 40lbs) respectively. Inga had been relocated twice after breaking into chicken and pig farms and on her third occurrence, she had Otis and Rita in tow. Since the cubs were so young, all three were made available for placement in a managed system. The decision was made to give these grizzlies a home at the zoo.

At the age of 26, 0.1 polar bear, Arki arrived at the Louisville Zoo in 2011 from the Brookfield Zoo in Chicago. Arki weighed 264kg (580 lbs) and was used to a mostly flat, one level exhibit and holding space that she did rotate on an off sharing it with a group of grizzly bears. Arki died in May 2013 at the age of 28.

At the age of 5 months, 0.1 polar bear, Qannik arrived at the Louisville Zoo from the Alaska Zoo in June 2011 after being deemed non-releasable by the US Department of Fish and Wildlife. She weighed 13kg (30lbs). Qannik was a wild cub who at approximately 4 months old, was separated from her mother and sister. Qannik, her mother, and sibling were known to the oil field workers and USFW agents on the North Slope of Alaska. On 26 April 2011, after Qannik had been on her own for almost 24 hours, she was taken in to the Alaska Zoo while efforts were made to find her mother and sibling. This was the same day that Glacier Run opened to zoo guests. The mother and sibling were eventually located, but both were underweight and too much time had passed, so the decision was made to give the mother a better chance of successfully raising one cub and to place Qannik in a managed system.

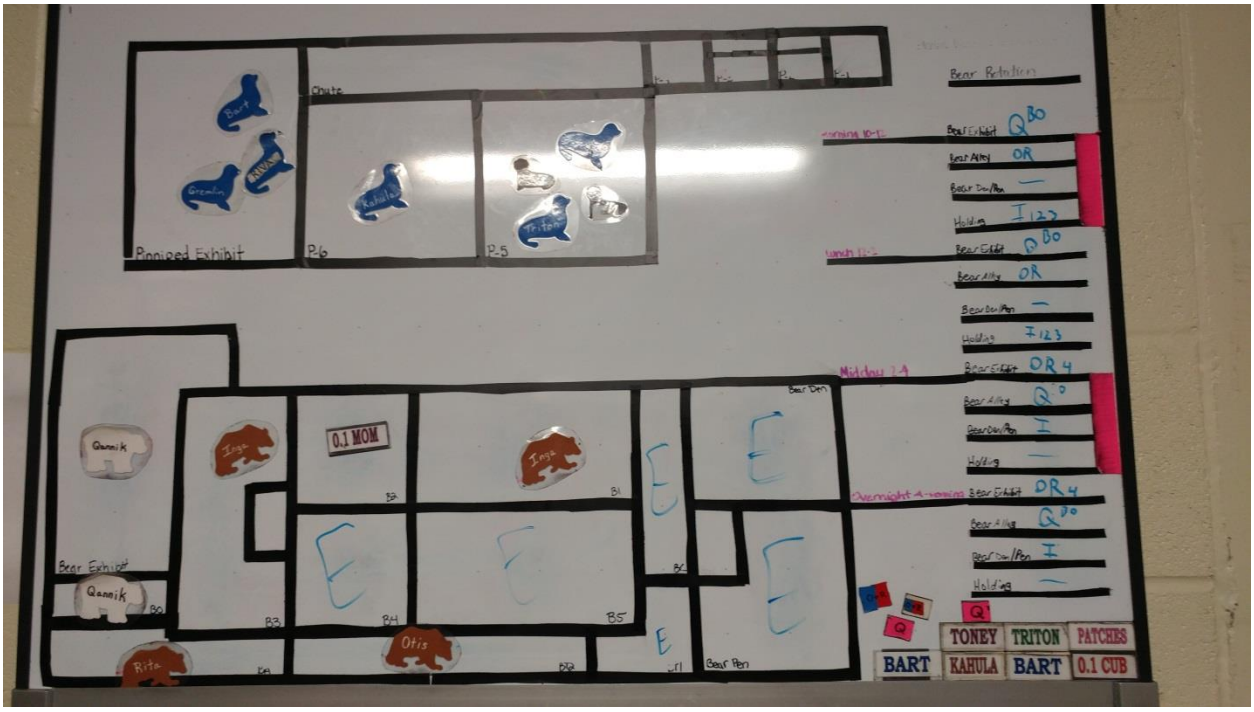
At the age of 21 months, 1.0 polar bear, Siku (grandson of Arki) arrived at the Louisville Zoo in September 2011 from the Toledo Zoo (where he was born). Siku weighed 238kg (525 lbs) and was used to a mostly flat, one level exhibit and holding space that he shared with his mother. In October 2016, Siku was transferred to the Lincoln Park Zoo in Chicago.

How the Rotation Works

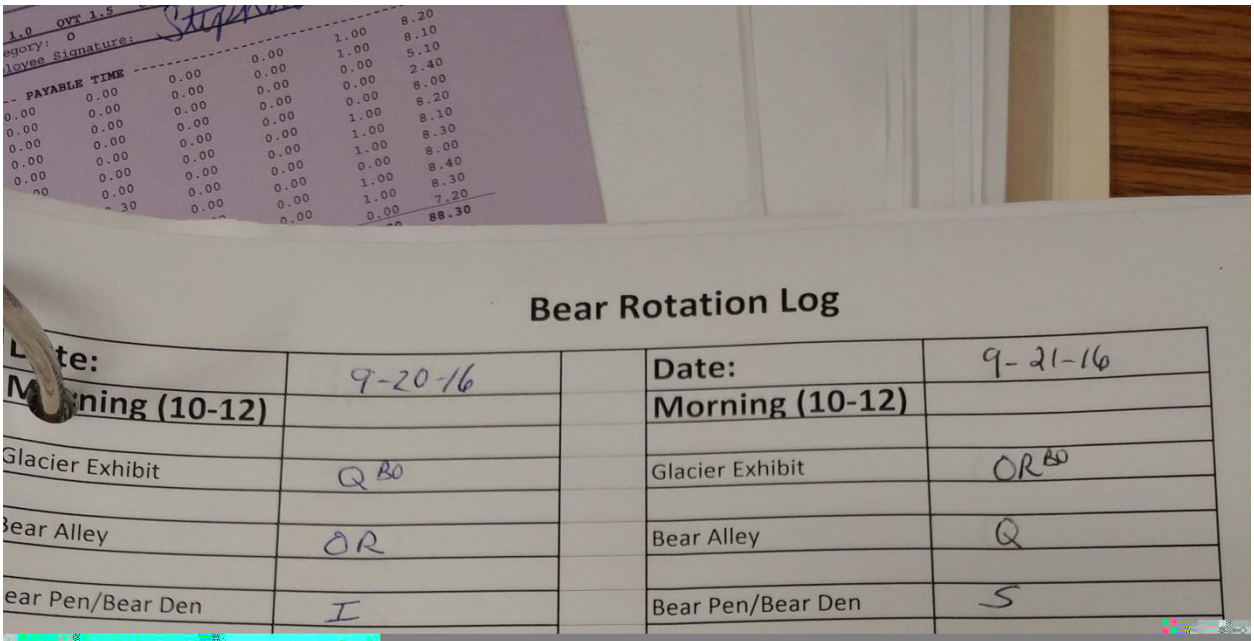
The first rule of rotating animals on and off exhibit at Glacier Run is to be consistently inconsistent. At the beginning of each day, the keepers make a rotation plan on a dry erase board with the understanding that the plan may change throughout the day based on a number of different reasons. The previous day's plan is recorded and every attempt is made to make the new plan as different from the last one as possible. Sometimes this is accomplished by just having a different keeper make the new day's plan. The idea is to simulate some consistent and changing patterns in nature such as sunrises, weather patterns, and the seasonal availability of food.

Depending on the total number of bears at Glacier Run, they are moved around as three, four, or five groups. (Arki as one group, Qannik as one group, Siku as one group, before 2013 Inga,

Otis, and Rita as one group, and after 2013, Inga as one group, and Otis and Rita as one group.) The number of moves per bear can be as few as two (on cold winter days) and as many as fourteen (the most on a very well-staffed day). A typical day involves three or four moves per bear. Moving the bears throughout each day gives variation in their schedule, environment, opportunities for control, changeable enrichment items, locations of food, and proximity to other bears. With increased opportunities for enrichment, there is focus on play, exploration, problem solving, training sessions, and exercise. Keepers at Glacier Run work essentially in one building for their entire shift keeping them close to the bears and pinnipeds which allows them to spend more time on building relationships with the animals.



This photo shows a day's bear rotation plan on the right side, the location of the bears at that given moment at the bottom of the board, and the location of the pinnipeds at that given moment on the top of the board.



Bear Rotation Log

Date:	9-20-16		Date:	9-21-16
Morning (10-12)			Morning (10-12)	
Glacier Exhibit	QBO		Glacier Exhibit	ORBO
Bear Alley	OR		Bear Alley	Q
Bear Pen/Bear Den	I		Bear Pen/Bear Den	S

This photo shows the recording of the previous days' bear rotations to be used for reference.

Typically, each exhibit with public viewing is used as one space and the holding building can be divided into three to five spaces. While on exhibit, the bears have access to an off exhibit space such as the Bear Overhead, the bear transfer hallway (that leads from holding to the Bear Alley), or a holding stall directly attached to the Glacier Exhibit or Bear Alley. This gives the animals access to quiet or warm/cool spaces to help manage their needs on large volume visitor days or extreme temperature days.

Results and Benefits

The oldest resident of Glacier Run to date, Arki showed noticeable physical benefits of living in this exhibit. A month after she arrived in Louisville, Arki went out onto the Glacier Exhibit for the first time and became part of the daily rotation. Because of that increased movement and use of the multiple staircases and ramps in the exhibits, Arki had increased muscle mass and strength. This strength was seen in the ease of her ability to perform certain training behaviors such as "up" (standing bipedially/vertical on the mesh). When she first arrived, Arki was only able to slowly stand ¾ of the way into the up position, but months later, she was able to stretch into the fully extended up position. A new training behavior was also added for Arki in 2012 to accommodate treatment for dermatitis. Keepers were able to shift Arki off exhibit and rotate another bear outside to set up a calm, quiet space for Arki to be treated in the afternoons.

Bears have a tendency to show abnormal repetitive behaviors while living in managed systems and polar bears are even more likely to show these abnormal repetitive behaviors (Shepherdson et al, 2013). Researchers studying the bears at Glacier Run have been able to monitor changes in their behavior and assess the absence, beginning, and/or decline of repetitive behaviors, object manipulation, and space utilization. Those researchers have used a combination of video recording, detailed keeper records, and direct observations to evaluate how the bears spend their time. In addition, daily fecal samples are tested to note changes in corticosteroid excretion levels.

While Arki was living at the Brookfield Zoo, she developed a behavior of repetitive walking. She would perform a patterned pace that is commonly known as "moonwalking." Attempts were made to manage this behavior such as different feeding times, enrichment in the pools, training, and switching exhibits. Arki did continue this behavior at the Louisville Zoo once she cleared quarantine and was added to the exhibit rotation. With increased training, enrichment, and rotation on and off exhibit, the amount of time Arki spent doing this moonwalking was decreased by almost half. The times during her pacing when Arki would pause to investigate enrichment was also watched and recorded. During the first six months of her time at Glacier Run, Arki would only pause about 40% of the time while pacing to explore her environment, but that number increased to 90% during the last six months of her life.

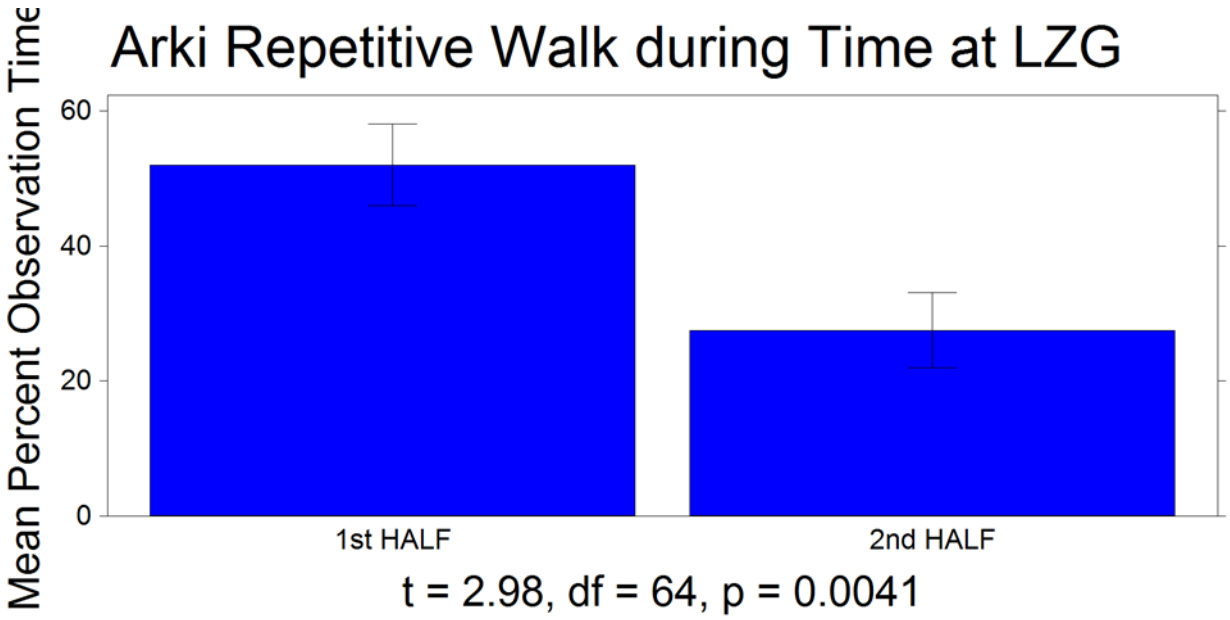


Figure 1 shows the reduction in 0.1 polar bear Arki's pattern walking as observed on exhibit. The behavior was reduced by about half due to increased enrichment, training, and rotating through the bear spaces.

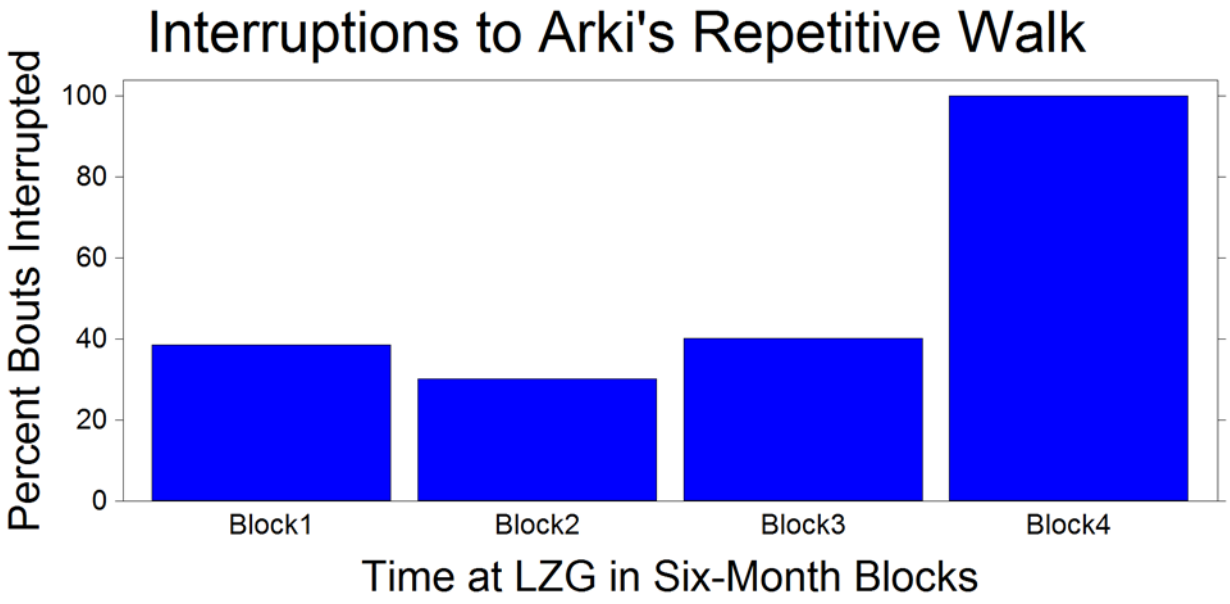


Figure 2 shows the increase in interruptions to 0.1 polar bear Arki's pattern walking due to enrichment, training, and rotating through the bear spaces.

Through the collection of daily fecal samples and observations, Qannik was able to be studied using those glucocorticoid levels. Qannik's cortisol numbers were high as expected when she was first shipped to Louisville, but gradually decreased as she became more comfortable with her new surroundings over the first fourteen months. Due to increased enrichment with a

variety of objects and spaces, Qannik spent more time manipulating objects and had lower levels of cortisol.

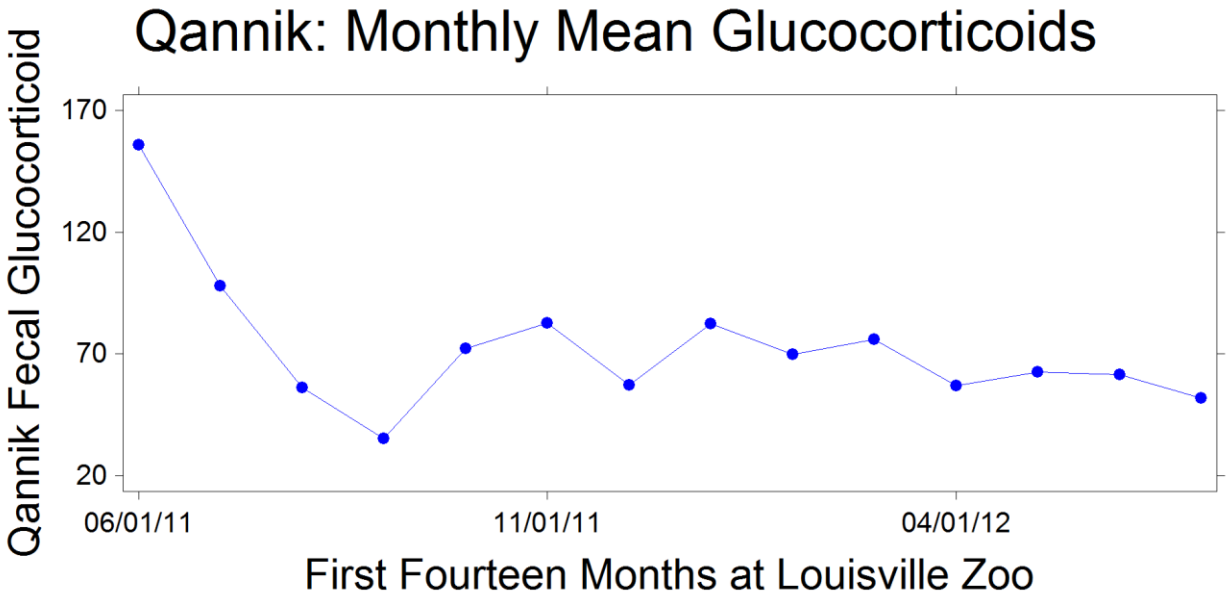


Figure 3 shows 0.1 polar bear Qannik's cortisol levels starting with her arrival from Alaska and continuing for the next fourteen months.

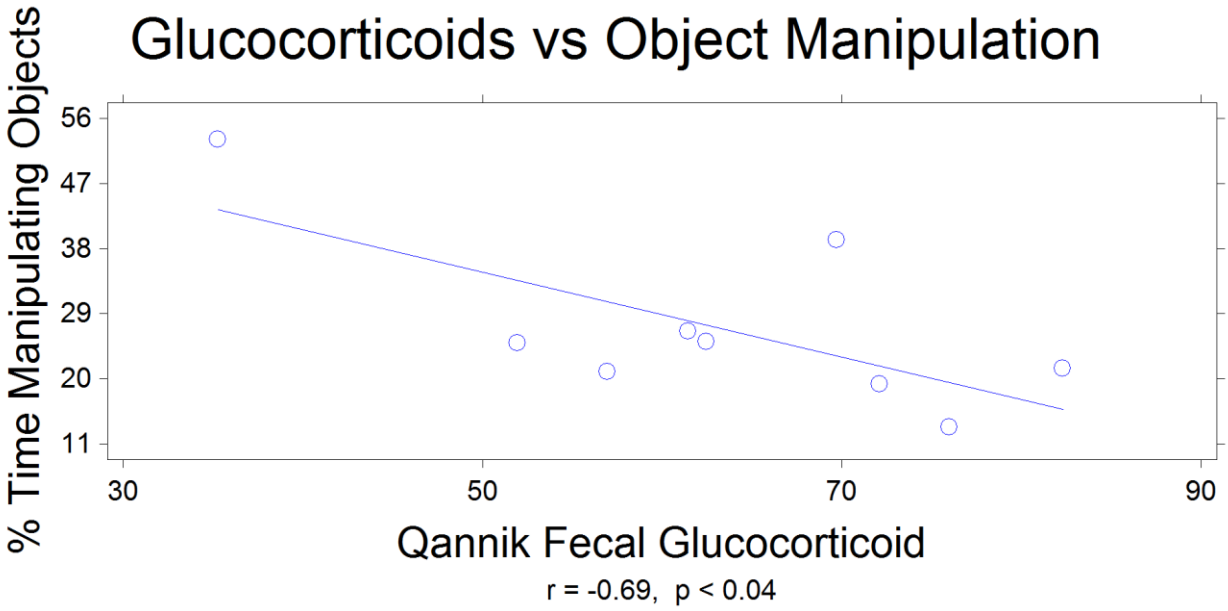


Figure 4 shows the amount of time 0.1 polar bear Qannik spent manipulating objects and her cortisol levels at the same time during her first fourteen months at the Louisville Zoo.

Observations of the bears at Glacier Run have shown what sections of the exhibit they spend the majority of their time in when they are in the Glacier Exhibit. For Inga, Otis, Rita, and Siku, those sections are the grass area in the middle of the exhibit, the area around the ramp to the overhead/indoor public viewing windows, and the pool. Those are the same areas that keepers routinely place enrichment items in the Glacier Exhibit.

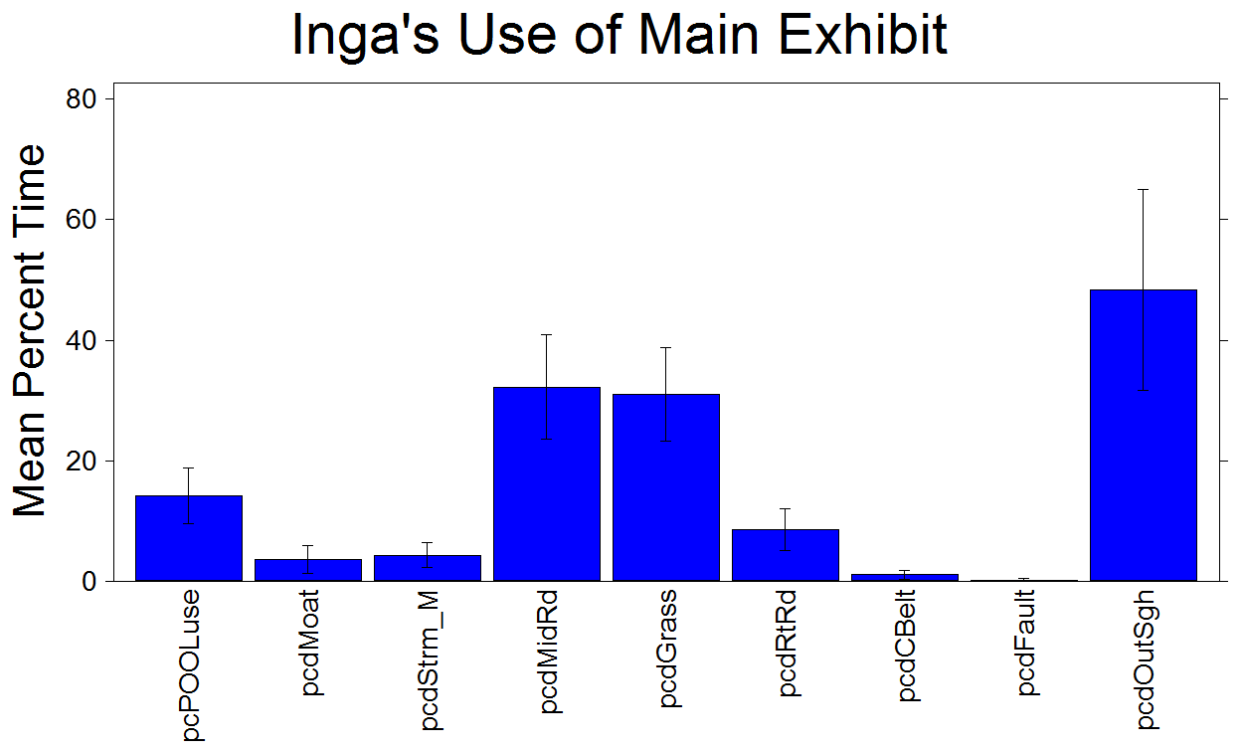


Figure 5 shows 0.1 grizzly bear Inga's use of the different sections of the Bear Exhibit. Her pool use has increased over the last two years (2015-2017), but that specific data was taken after this graph was produced.

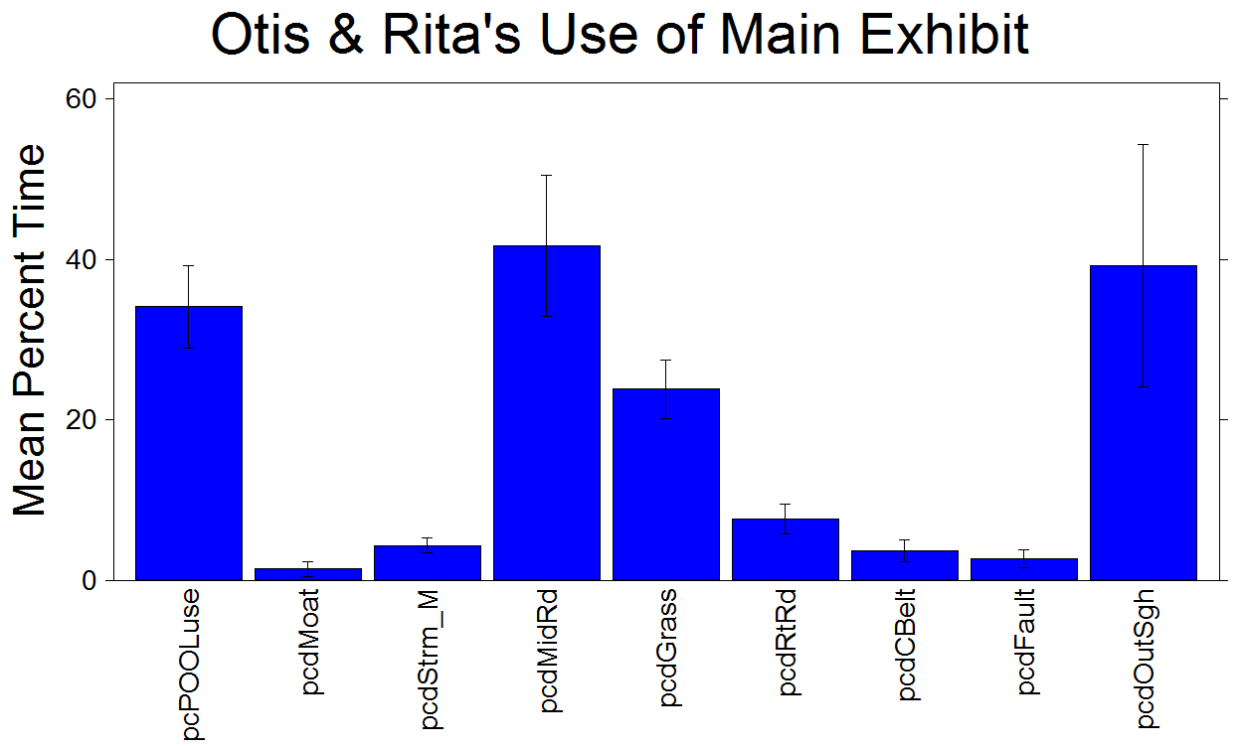


Figure 6 shows 1.1 grizzly bears, Otis and Rita's spatial use of the Bear Exhibit. Like their mother, they spend most of their time in the middle of the exhibit and in the pool.

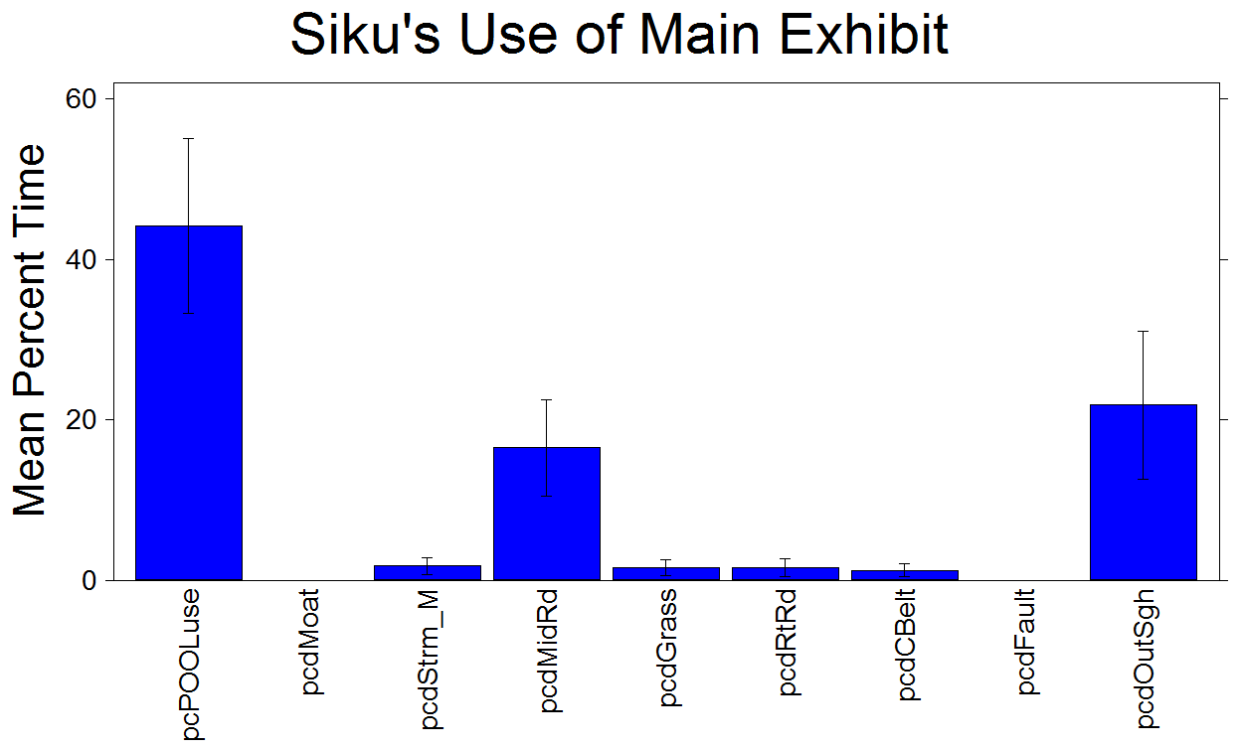


Figure 7 shows 1.0 polar bear Siku's use of the Bear Exhibit where he spent most of his time in the pool and around the ramp/viewing windows.

For the zookeepers at Glacier Run, the largest benefit of rotating the bears with an unpredictable schedule is increased flexibility. Since the bears are moved so frequently, they are usually easy to switch to a new space with a short training session. Staff members are able to schedule routine and special projects with our maintenance department while having some bears on exhibit or away from loud noises or irritating smells. We are able to plan our days around scheduled events or re-write the dry erase board in the event of an unplanned maintenance issue or request from the PR department.

Keepers plan the daily rotation while taking into account seasonal hormonal issues and behavioral issues/preferences. Some bears prefer the Glacier Exhibit while others prefer the Bear Den. Certain enrichment items (like boxes and bags) are a concern for the Glacier Exhibit (due to the filtration system) and are only placed in the Bear Alley or holding building. With rotation, the keepers can make sure all of the bears have access to that enrichment for the day. During the breeding season, the bears can experience behavioral issues such as aggression or unwillingness to shift past other animals and the daily rotation can be tweaked to lessen those issues. The rotation also reflects any incoming severe weather (if all bears need to be locked off the Glacier Exhibit) or thunder storms specifically since Qannik finds them stressful.

The style of daily rotation of the polar and grizzly bears at Glacier Run can only be accomplished with the support of keepers and management. Keepers have to be patient and able to roll with the punches since the bears themselves or other outside entities can have an

effect on the rotation. Management also has to be patient and understand that there may be moments when the bears are out of public view.

Acknowledgements

I would like to thank my co-workers and supervisors at Glacier Run, Jane Anne Franklin, Cindy Froman, Stephanie Green, Kevin Grizzle, Laura Rissler, Anthony Schneider, Amy Seadler, Anna Stradley, Steve Taylor, Beka Vaile, and Hunter Veeneman, for their incredible dedication and creativity with the daily care and enrichment of the bears, seals, and sea lions. Thanks also to Dr. Brent C. White of Centre College (Louisville, KY), his team of researchers and Steve Taylor of the Louisville Zoo for their hours of observations, data compilation, and the charts included in this paper.

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Forward Thinking in Elephant Husbandry:

Using Innovative Facility Adjustments and Veterinary Techniques to Aid the Aging Elephant

By

Kristy Eaker, Lead Caregiver-Africa Barn

The Elephant Sanctuary

Hohenwald, TN

Abstract

In an effort to provide the best possible care, The Elephant Sanctuary in Tennessee utilizes modern technology and works to develop innovative solutions to unique husbandry challenges specific to each elephant in our care. The Sanctuary is home to 0.10 elephants ranging in age from 33 to 69 years old, with an average age of 48. Arthritis, foot and joint disease, illnesses, and physical limitations may require facility adjustments in order for veterinary and husbandry teams to interact with the elephants safely. Collaborative efforts of The Sanctuary's husbandry, veterinary, and facilities departments allow for the greatest success with these specific modifications. This paper will outline challenges The Sanctuary has faced in caring for aging, captive elephants with individual needs and varying physical limitations, and will discuss some of the adjustments and techniques that have produced the most success in our program. The Sanctuary prides itself on continually improving geriatric elephant husbandry. We hope to share our best practices to work toward the common goal of improving captive elephant welfare.

Introduction and Brief History

The Elephant Sanctuary is a 501 (c) (3) non-profit organization that is licensed by the U.S. Department of Agriculture (USDA) and the Tennessee Wildlife Resources Agency (TWRA). It is accredited by The Global Federation of Animal Sanctuaries (GFAS). A total of 27 elephants have resided at The Sanctuary since its founding in 1995. Sixteen were retired by private owner's request, 11 transferred from a USDA prosecution, and two confiscated by the government and placed at The Sanctuary. The Sanctuary provides separate protected, natural-habitat environments for both Asian ***(****Elephas maximus)* and African (*Loxadonta africana)* elephants. Currently, seven Asian elephants and three African elephants reside at The Sanctuary.

Each of The Sanctuary's elephants have arrived with a host of physical conditions that compromise their well-being; and each elephant presents unique challenges for veterinary and husbandry staff. Physical ailments such as arthritis and foot and joint disease are common. Some residents have physical limitations such as trunk paralysis or abnormal bone alignment caused by old injuries. Illnesses such as Tuberculosis have also been a challenge that The Sanctuary has encountered. The Sanctuary dedicates itself to providing individualized care for each elephant based on their specific needs. Facility and veterinary adjustments are routinely made to increase safety and accessibility to work with each specific issue.

Facility Adjustments
The facility modifications at The Sanctuary are designed for the individual needs of each elephant in our care. Many of the modifications have been creative and collaborative designs for specific physical limitations of the elephants. Several of our residents have suffered from partial trunk paralysis and fractures or broken bones caused by old injuries prior to arrival at The Sanctuary. Our most successful modifications have been adjustments to our protected contact (PC) walls, new cameras in each of our barns, and retrofitted sand stalls for specific elephants. We have also made significant changes in the way we manage elephant husbandry within the habitats by adding PC wall corrals for training, new solar-powered "EleCams", and a warming hut.

<u>Adjustable PC walls</u>
Adjustable PC walls have been crucial to gaining maximum cooperation and safety with some of The Sanctuary elephants that have physical limitations. The majority of the bars on the PC walls are adjustable to fit heights, weights, and restrictions while adding additional safety for the staff. Most of the walls have been customized in-house by our facilities department so each wall is unique and measured out for each elephant it's being primarily used for. The walls include adjustable foot bars, ear presentation holes, and fire hose sections to assist with trunk washes on elephants with trunk paralysis. These PC walls also allow for safer veterinary procedures such as radiographs and foot soaks.

Figures 1-2. Shirley, age 69, suffers from several old injuries that left her partially crippled. She cannot perform several normal behaviors such as a "lean in". A PC wall was built specifically for her so she could get footwork done. Sissy, age 49, uses a fire hose design to help her learn to complete a trunk wash with partial trunk paralysis.

Stall Cameras
UniFi Video System ®
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In 2015, a new camera system was installed above every stall in each barn. This system improved The Sanctuary's ability to provide around-the-clock care for elephants. Staff members are able to log in to the system from home using an app on their smart phones or home computers. Performing overnight checks on elephants in need of close monitoring became much easier to do. The barn cameras record overnight behaviors when the elephants are kept inside during the cooler months. Staff regularly uses the recorded data to determine sleep and behavioral patterns while in the barn. The cameras are used to monitor older or sick elephants that may be on medications. Rosie, a 47-year-old African elephant, had a history of falling when arriving at The Sanctuary. She was unable to get up on her own and required a lift team to come in and support her. With the addition of these cameras, staff would rotate checking on her each night to see if she had fallen down and were able to respond very rapidly if she needed assistance.

Retrofit Sand Stalls
Sand is not a new concept, but it has proven to be a good substrate for older elephants. The Sanctuary was not set up for sand stalls in its original design. After seeing a need for it with some of the older elephants, a design was created to retrofit sand into the existing stalls for specific elephants with arthritis. Billie, age 55, has a history of fear and anxiety. She also suffers from arthritis. Her entire barn was converted into one large sand stall after seeing positive results with her lying down in sand piles out in the habitat. Rosie, as mentioned above, suffered from arthritis, chronic abscesses, and previous fractures to her front right leg and shoulder. With the addition of a sand stall and a sand pile, she was able to lie down for the first time in over 10 years and was able to successfully get back up over and over again. When she did require assistance, the sand proved useful in helping to get equipment underneath her. It also greatly decreased any damage or soreness that she may have experienced from falling.

Figure 3. The Sanctuary's maintenance department adding in a sand stall at the Africa barn.

Managing Space

The Sanctuary's property size is 11 square kilometers (2700 acres) and is divided into three separate habitats. A 0.9 squared kilometer (220acres) habitat dedicated to Asian elephants, a 1.2 squared kilometer (300 acres) habitat dedicated to African elephants, and a 6.8 squared kilometer (1700 acres) dedicated to a separate group of Asian elephants. The large natural habitats encourage foraging, facilitate seasonal movement and activity, promote physical fitness, and allow for social rehabilitation and introductions.

A common question for The Sanctuary is how elephant husbandry is managed when the elephants have access to all this space. Elephant caregivers travel out into the habitats using spatial or physical barriers (to remain PC) or along the perimeter fence using ATV's to track, feed, and provide care to the elephants.

EleCams

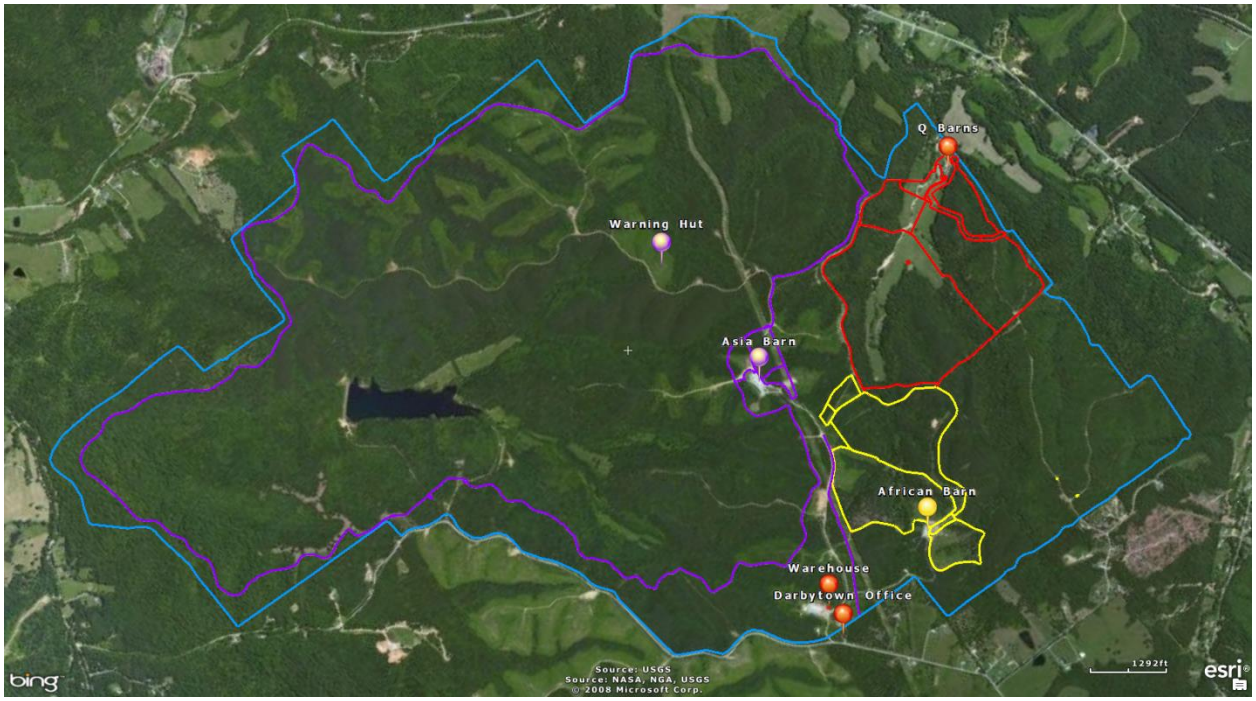
The Sanctuary has 13 solar-powered, live-streaming "EleCams" set up throughout the elephants' habitats. Each camera has a 360-degree rotation. These cameras are used for tracking and monitoring the elephants' movements and behaviors. These cameras also allow the public to view the elephants from home at any time. Caregivers and media staff monitors the cameras throughout the day and track the movements of the elephants. This, along with learning the elephants' normal travels and behaviors, allows them to be found relatively quickly in the large space.

Training Walls and Corrals

Throughout the larger habitats, there are corrals that protect the EleCam systems. PC walls have been added to the corrals so that training, footwork, and medical treatments may be performed in the habitats. Caregivers travel into the habitat on ATV's and are able to enter the corrals safely through ATV holes cut into the corral walls. The corrals are packed with target poles, medical treatment equipment, and training "to-go kits." Most corrals have a well pump or are fitted with solar powered drinkers and spigots for a water source. If corrals are not available in an area, PC walls have been added to the fence lines along the perimeter fence. Elephants can be called up to the PC walls from the habitat and training, foot care, and treatments may be completed there.

Warming Hut

The warming hut is a fairly new addition to The Sanctuary's habitats. It was designed to allow the elephants to remain out in the larger habitats for longer periods of time when the seasons change, if the elephants chose to do so. A warming hut allows the elephant to get out of the elements without having to travel several miles to get back to the barn. The warming hut also provides another location to add a PC wall so training and treatments can be completed. The warming hut has a green design, offering active and passive solar-powered heat in the walk through barn. The barn doorways have heat flaps to keep the warmth in. The flaps also allow the elephant to enter and exit whenever they choose. The warming hut is completed with a solar powered drinker and a cistern to collect rain water to clean the barn, give baths, and complete footwork.



Figures 4-7. Image of the entire property of The Sanctuary, highlighting the outlines of the separate habitats. Images of the varios training walls and corrals (with Elecams) out in the habitat. Image of the newly designed warming hut that provides an extra shelter from the elements.

Veterinary Techniques

The Sanctuary has an incredibly strong veterinary department that has greatly contributed to the care of the aging elephants. The vet department is made up of a part-time Director of Veterinary Services, a full-time Associate Veterinarian, and two on-site Registered Vet Technicians (RVT's). The mission of the vet department is to provide an individualized care plan for each elephant that is constantly re-evaluated and updated as the needs of the animal change. This can include their diet, medications, and therapies. The veterinarians are fully integrated into the PC management of The Sanctuary and participate in regular training sessions with all the elephants. This helps to eliminate the "white coat syndrome" that many animals may experience. The vet staff is also highly involved in hands-on training of the husbandry staff. The two departments are highly collaborative and have regular meetings and vet rounds. Vet rounds are conducted at each barn on a weekly basis. The vet department has incorporated many modern and advanced technologies over the past few years that have greatly increased the care of the geriatric elephants that call The Sanctuary home.

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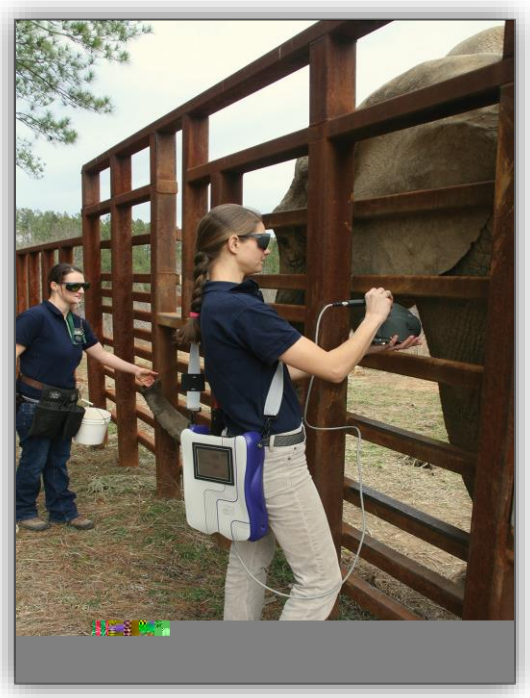

Figure 8. Veterinarian performing laser therapy on African elephant Flora, age 34 ©TES

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Used for Radiographs of:

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- Teeth
- Front and hind digits
- Joints
- Check for and monitor arthritis

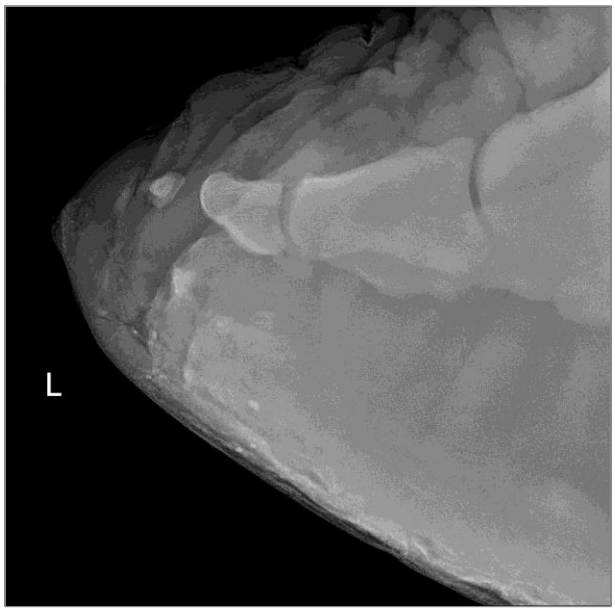

Figure 11. Digital radiograph of P1, P2, and P3 digits of a healthy African elephant foot © TES

Conclusion

The Elephant Sanctuary is dedicated to elephant welfare and strives to achieve ultimate wellness and provide life-long retirement care. A program that constantly adapts to the needs of the elephants as they age and adjust to sanctuary life is a daily goal. This is successfully achieved through highly collaborative efforts of all The Sanctuary's departments. Facility modifications are designed for the individual needs of each animal in our care. We pride ourselves on not allowing older designs to limit husbandry practices. Instead, finding ways to modify them or incorporate a small adjustment may be all that is needed to gain better cooperation or comfort for the animal. Our high-quality veterinary care program is key to successfully aiding these aging animals. The use of modern technology has significantly increased the ability to prevent and treat medical concerns. The additions of all the innovative techniques has helped us fulfill our mission of providing captive elephants with individualized care and the opportunity to live out their lives in a safe haven dedicated to their well-being.

Zoo Crew Abroad: A comprehensive renovation in captive elephant

By: Kayleigh Sullivan, Elephant Keeper

Smithsonian National Zoological Park

Washington D.C.

Introduction:

India is home to close to 60% of the world's remaining Asian Elephant population (Baskaran, N., Varma, S., Sar, C.K., & Sukumar, R., 2011). While there continues to be herds roaming India's forests, many elephants find themselves under human care. The Asian Elephant is very prevalent in Indian culture, representing wisdom in Hindu religion (Das, 2017). They are used for a variety of practices including prayer in temples, manual labor and street performances. Unfortunately, many of these elephants are lacking proper care and nutrition. Foot care is typically non- existent and they are subject to collisions with cars and mopeds on the busy, overcrowded streets.

Wildlife SOS steps in, with help from the Forest Department, and takes in many of these elephants in need to their center. Elephants taken into their center get to live out the rest of their lives receiving consistent veterinary care and a well-balanced diet. The elephants spend much of their time interacting with other elephants and going on walks in fields with natural vegetation to graze on. The center is in the process of transitioning the elephants to protected contact handling for most husbandry related training and also creating an enrichment program to challenge and mentally stimulate these very intelligent animals. This is where the "zoo crew" came into the picture. Many elephant facilities in India have poorly trained staff which results in programs unable to appropriately care for elephants. These programs tend to suffer from ineffective elephant handling practices and lack enrichment programs. In contrast to that, many western zoos have been very focused on improving the welfare of captive elephants. This focus has resulted in considerable effort being spent on developing advanced training techniques using operant conditioning and developing enrichment programs. Through these endeavors we can reduce stressful situations when performing routine care and we can help prevent stereotypical behavior while keeping elephants mentally stimulated. Wildlife SOS wants to create a similar set of standards for the care of their elephants so they sought out the help from western zoos.

The co-founder of Wildlife SOS, Kartick Satyanarayan, partnered up with Eric Peterson, the Elephant Manager for Utah's Hogle Zoo and Vice President of the Elephant Managers Association, to create a team of zoo-keepers from across the U.S. to travel abroad to assist the mahouts and veterinarians in developing an elephant care program similar to the ones we have at many of the AZA accredited zoos. Eric reached out to the local elephant community and put together a team of 5 elephant keepers, Robbie Clark- Elephant Manager at the San Diego Zoo, Nick Newby- Elephant Manager at the Oklahoma City Zoo, Rachel Emory- Lead Elephant Keeper at the Oklahoma City Zoo, Debra Bastin- Elephant Keeper at the Oklahoma City Zoo and me, Kayleigh Sullivan- an Elephant Keeper at the Smithsonian's National Zoo. We all travelled to Agra, India where, under the guidance of Eric, we spent two and a half weeks sharing our knowledge and experience in elephant care and becoming the group known to the Wildlife SOS staff as the "zoo crew" (Figure 1).

Challenges and Methods:

Upon arrival at the elephant center in Agra we spent our first day merely observing the facility and elephants. The elephants would go out on morning walks for exercise- these walks would last a few hours and then when they were finished they would be returned to their respective enclosures. The males were housed individually while the females were housed in small herd groups. After the elephants were returned to their enclosures the mahouts would bathe them and do their treatments. After a few days of observation, we began working on target training. Most enclosures contained a wall that would be used for training the elephants in a protected contact manner. When Eric Peterson had first flown out to Wildlife SOS he had begun to teach them the very basics of target training. He made them target poles using bamboo and duct tape and then showed the bull elephant's mahouts how to use them and how positive reinforcement worked. Since the bull elephant's mahouts had a basic understanding for how to use the target poles we planned on working on refining their skills and moving on to training for more advanced behaviors. The cow elephant's mahouts were not previously introduced to target poles and positive reinforcement training techniques so we began with a tutorial on both.

The "zoo-crew" decided to split up to cover more ground. Nick and I split the bull elephants. Debbie, Rachel and Robbie split up the females. We each worked with them on an individual level. We started off by teaching the mahouts how to use clickers. We played the clicker game, which was a fun way to break the ice, and also helped them understand the benefits of using a clicker. Even though the bull side did have the background with how to use a target pole and positive reinforcement, it was clear that they didn't fully understand how they worked. I focused on refining their skills, showing them the value of jackpots and working on more advanced behaviors (Figure 2). By the time we left, the bulls I was assigned to were laying down on command for participation in blood draw practices (Figure 3 and 4), presenting rear feet for footwork (Figure 5), and opening their mouths for oral examinations. The female elephants were trained for stationing to a target, moving their hip towards a target and raising their front feet. Our goal wasn't to jump in and train the elephants for everything, but rather to teach the mahouts how to problem solve new and more challenging behaviors so they could continue working with the elephants when we left. In addition to teaching training techniques we were able to do some foot care on the elephants (Figure 6). We showed the veterinarians how to use a power tool grinder to help raise their elephant's nails, which will help them to work on more elephant's feet at a faster pace.

Although, training provides an excellent form of enrichment the mahouts and veterinarians were concerned about their lack of mental stimulation and activity levels when they were not directly interacting with them. While they did provide them with pools, sand piles and a few tires, we explained to them about enrichment and how the elephants could benefit from something as simple as switching up the routine of their day or scattering around different scents in their enclosures. We were able to show them how to make hay nets so the elephants could exhibit foraging behaviors to simulate browsing from trees (Figure 7). The excitement shown by the mahouts upon giving the elephants their new browser was priceless. By explaining to them ways they can implement enrichment in their everyday routine, the mahouts and veterinarians were inspired to quickly integrate that into their program. We provided them examples of the enrichment calendars and records that we use in our programs and hopefully they will be able to utilize those to help create their very own.

Conclusion:

In just a short few weeks we walked away with the mahouts being more self-sufficient with training elephants in a protected contact setting. We helped install modifications to their enclosures to better assist with rear footcare, showed and provided tools to the veterinarians so

they can be more efficient with footcare and provided motivation and examples to help mentally stimulate the elephants on a daily basis.

Most of what we taught the mahouts was completely brand new to them. Even just seeing a woman handle an elephant was brand new to them so I was extremely pleased with how open minded and willing they were to learn new ways of handling and caring for elephants.

This was a hugely gratifying experience and I believe keepers of all different taxa have a vast amount of knowledge and experience that could help benefit animals across the world like we did. Not only does it benefit the facilities in need of help, but it is extremely rewarding for the keepers to showcase what we do on a daily basis. I was so fortunate to have met such extraordinary people who are truly dedicated to making a difference to Asian Elephants.

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Images:

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

My Name is No: Intended and Unintended Consequences of Giving Ambassador Animals Choices

By

Susie Semler, Keeper

Erin O'Brien, Keeper

Cincinnati Zoo and Botanical Garden

Cincinnati, OH

Introduction

The Cincinnati Zoo and Botanical Garden is home to an Interpretive Animal collection comprising of about 200 individual animals representing about 75 different species. On average, these animals participate in over 22,000 programs, on grounds and off, reaching about 3 million people per year. The overarching mission of the Interpretive Collection is to get zoo visitors "Close Enough to Care". To that end we work with about 100 different animal handlers, whose job is to connect the people of our community to the natural world through memorable experiences. With such a large and diverse program, clear communication between handlers and animals is essential in preventing the breakdown of trained behaviors and alerting keeper staff of any medical or behavioral problems. Choice-based training gives our ambassador animals a chance to say "no" to programs and points us to take a deeper look at the causes behind a behavior. On the flip side, an animal program without an animal can be quite uninspiring. We will examine a few animals who have exercised their liberty in choice and the consequent effects on keepers, animal handlers, zoo visitors, and our mission.

Case #1- Harvey the rabbit

Background

The Interpretive collection currently houses three domestic rabbits (*Oryctolagus cuniculus domestic)*. Harvey is a dwarf minilop, and came to us in 2012 from a private breeder. Harvey chooses to crate himself for programs, voluntarily hopping in and receiving a piece of produce once the behavior is complete.

We first started noticing a problem when keepers received several reports that Harvey was not crating for handlers. He was still crating daily for his keepers, who would crate him to clean his enclosure, during which time he was allowed to run in a puppy pen within animal holding or brought to an empty classroom to run around for half an hour or so.

Our initial thought was that Harvey trusted his keepers more, since they worked with him daily and were the ones to feed him the rest of his diet at the end of the day. Handlers started asking keepers to crate Harvey when they could not. After a few weeks of this, it was noted that Harvey stopped crating for keepers as well. This caused us to pause and really think about the situation from Harvey's point of view. Was Harvey able to recognize the difference between keepers

crating him for socializing and playtime and handlers crating him for programs and larger groups of people? If this were the case, we needed to focus on ensuring he had a good time after crating, no matter who asked him to enter it.

With that in mind, Harvey's handling procedure was changed to include:

1. Whoever is taking the rabbit on a program must be the one to ask him to crate. If an animal chooses not to participate with a specific handler, we respect that and work on the reasons behind it instead of taking the easy way out.
2. After crating and before the program appearance, Harvey must be allowed to run around an empty classroom, in animal holding or in a puppy pen for a little while.

Commented [1]: Take away point #1- Respect the animal. Honest communication.

Results

This seemed to help immensely. While he does still say no to us on occasion, all together he seems to have improved his relationship with his handlers and keepers alike.

Case #2- Moe the sloth

Background

Moe is a Linne's Two-toed sloth (*Choloepus didactulys)*. Born in 1999, he has lived in human care for most of his life. He is one of our highest-tiered animals, with only a handful of educators and keeper staff trained to handle him. Most of the programs Moe participates in are specially booked behind-the-scenes tours for donors. Our BTS season runs from April to November and we generally book tours Saturday and Sunday mornings.

Until the spring of 2016, Moe spent his days in the rainforest exhibit, which consisted of one tree with a wrapped trunk to prevent him from climbing down to the ground level, and his nights in behind the scenes holding. Moe would climb down a ladder that was presented to him at the end of each day and brought to a smaller enclosure for the night, then returned to his exhibit tree the next morning. In the process of expanding his exhibit to two more trees in the rainforest, the decision was made that in addition to expanding his exhibit, he was going to be allowed to live out there full-time, and his space in holding would be used for other animals instead.

While Moe's overall welfare was much improved by allowing him more room to roam during his active overnight hours, this presented his keepers with a challenge. He was so comfortable in his tree that he stopped coming down for programs and tours. We were spending upwards of 2 hours trying to persuade him to come down his ladder on each tour day, he was only coming down about a third of the time, and we were quickly expanding our list of frustrated and disappointed donors.

In an attempt to address these issues, we held a meeting with Moe's primary handlers, his keepers, and the head of the BTS program to figure out what to do moving forward. Not only did we have to figure out a way to get Moe to participate more frequently but how to manage the expectations of our donors, some of whom were coming to Cincinnati from several states away specifically to meet Moe.

The keeper staff took a closer look at Moe and tried to figure out why he was saying 'no' to us, then made the following changes to Moe's handling procedure:

1. We rearranged his diet so he only got his 'favorites' when coming down the ladder or during a tour.
2. We became more flexible in where we placed the ladder so he could more easily come down from any spot in his newly expanded exhibit.
3. We wrote a very specific SOP with what methods to try, and in which order, to ensure that he was getting consistent care and training.
4. We tried to get him to come down every single day (instead of just days when he had programs) to maintain that consistency.
5. We had a jungle gym built by our wonderful Volunteer Enrichment committee to help encourage him to be more comfortable and have a good time when he was out of his tree.
6. After the BTS season ended, we continued working with Moe every single day throughout the winter to maintain the consistency gained during the summer.

On the part of the BTS coordinator staff, it was decided that we should try to be as accommodating as possible to our paying guests without compromising the welfare of the sloth. The BTS coordinator calls each group the week before their tour and explains to them that it is Moe's choice to participate or not, and in the case that he says 'no', we can offer one of the following:

1. A reschedule to another date.
2. A behind the scenes visit of the Education building, which houses approximately 100 animals.
3. If neither of these options is suitable to guests, we give a partial refund, keeping the money for the tour that goes towards conservation efforts for sloths in the wild.

Commented [2]: Take away #2- Set the animals and visitors up for success by managing expectations (I've got the power-point in mind with these)

Results

Since implementing these changes a year ago, Moe has greatly increased his compliance in coming out of his exhibit for tours and programs. Keeper and handler staff are also experiencing better welfare, as they are not consistently having to disappoint donors when Moe chooses not to come out, nor are they spending several hours trying to get a sloth out of a tree in a 95+ degree rainforest exhibit. While Moe still says 'no' to us, it is far less often and there are even days when he's so excited to come down his ladder he is awake and trying to climb on it before it is completely set up. Donors are far more understanding when Moe declines to come down, having been warned before their visit that it was not a guarantee. Almost all of the donors have chosen to reschedule their tours when asked; we have traded in for 1 Education BTS and given 2 refunds.

Case #3- ChaCha the flamingo

Background

One of the most dynamic and recognizable species in the Interpretive Collection are our Greater Flamingos (*Phoenicopterus roseus)*. Our hand-reared flock delights guests daily as they walk the entire outer-loop of the Cincinnati Zoo, almost a mile long. The flamingos seem to anticipate these walks, waiting by their door and loudly vocalizing when a group of animal handlers enter holding. After the walk, the Interpretive flock spends the day on exhibit with a separate flock, sometimes stopping at our random encounter area along the way. The flock started small with three hatchlings in 2012. One female hatchling named ChaCha joined a year later in 2013. Last summer, 2016, two more hatchlings were added, rounding out the flock to six.

Despite some bickering the flock remained a cohesive unit, each member faithfully walking the zoo, until the spring of 2017. During this time, animal handlers noticed ChaCha saying "no" to walks and encounters. Handlers reported a growing number of incidents in which ChaCha would voluntarily leave the group on walks and instead stand in a pile of mulch or return home. This forced a handler or keeper to stay behind with her, leaving a smaller group (usually 2-3 people) to manage the remaining five flamingos, a difficult task at times. There were also an increased number of reports indicating that she was pacing in the random encounter area and was reluctant to come home from the exhibit, mingling with the other birds instead of her flock.

ChaCha's behavior became a regular topic of discussion at the weekly managers' meeting. The first solution was easy enough. If she wanted mulch, give her mulch! Although Greater Flamingos don't generally don't come of age until 5-10 years or older, ChaCha's obsession with mulch was thought to be a nest building behavior. Greater flamingos build tall nests out of mulch and mates take turns incubating their singular egg throughout the month-long incubation period. Greater Flamingos don't have a specific breeding season, but often breed after large amounts of rain. In Cincinnati that means late spring and ChaCha's behavior coincided with other flamingos at the zoo. ChaCha was flooded with mulch- pools full of mulch in her indoor habitat, mulch in the random encounter area, mulch in her exhibit. Although ChaCha did interact with the mulch and sometimes sit on it, this enrichment did not solve her behavior. It did however inspire us to encourage animal handlers to bring a variety of enrichment when they take animals to the same place for encounters, day in and day out.

Upon more inspection and incident reports, we realized there was another trend developing. Because the flamingos are so comfortable working as ambassador animals, they are often used all day during the summer. To give them a break, handlers may take two at a time, leaving the others in the exhibit. We noticed that ChaCha paced when she was with the younger two flamingos, but often was calm with the other three. She paced if she was with one of the original flock and could hear the other two calling (the exhibit was nearby). Although they operated as one flock, it became clear there were two distinct social groups- the young and the old(er). ChaCha associated with the latter and showed stress behaviors when her flock was separated. During the troubleshooting process, the following changes were made few changes to the flamingo handling procedure:

1. Chacha can choose to stand in the mulch during a walk or go back to holding by herself.
2. If the flock is separated for encounters, ChaCha remains with the older group.

3. If Chacha chooses to avoid her flock or fully integrate with the exhibit flamingos after a long period of time, a discussion will be had about her best welfare. She may choose to say “no” to being an ambassador animal altogether.

Commented [3]: Take away #3- Sometimes "no" just means "no"

Results

ChaCha is currently exhibiting more “normal” behavior and spending time with the group again. It is hard to say which of the changes made the difference, or if it was as simple as the seasons turning. We worked on each issue as it pertained to her and the rest of the group, varying our plan as needed. Although we are committed to our animals through attrition, we have to be open (as a last resort) to the idea that not all animals are comfortable with this lifestyle. Sometimes “no” just means “no”.

Case #4- Frankie the Fox

Background

Anyone who has ever worked with an ambassador fox knows their flighty and wary nature can be a challenge to a successful animal program. Frankie and her brother, bat eared foxes (*Otocyon megalotis)* were hand-reared for programs in 2012. During this time, over seven different people trained and socialized them. Frankie’s handling procedure consisted of one person picking up and holding her while the other person harnessed. The handler would then carry her to a good “walking” place and put her on the ground. Although Frankie explored the area on some of her walks, she commonly exhibited stress behaviors of biting, growling, running, hiding, and pulling hard on her leash. The biting especially was not only a clear sign of Frankie saying “no”, but also problematic because of our zoo’s Rabies policy. Any mammal that bites a handler and draws blood must automatically be taken off-use and put on a 14-day watch period. The biting incident reports quickly drew the eyes of upper management who were starting to doubt the foxes as interpretive animals. Before long Frankie would not even allow handlers to pick her up, running away as soon as they entered her enclosure.

Developments within the zoo eventually lead to the foxes temporarily filling in an empty exhibit while we waited for the intended animals to arrive. During this time, the foxes were taken off-use for programs and their handlers paired down to just three people. Over the next year, handlers continued to feed and work with Frankie, only without picking her up or using any restraining equipment. Deposits in the trust bank accumulated daily and trainers noticed Frankie’s behavior change from avoidance to acceptance. She greeted known people with a slight tail wag and anticipation at the door.

When it was time to return back to Interpretive holding for good, doubt hung in the air for the future of the foxes. Would they remain part of our Interpretive population? How would the foxes be used in a way that bolstered their confidence and protected handlers and visitors? Interpretive Keeper staff detailed a full training and demo plan to management and were given the blessing to “try it out” for another year. Frankie’s primary trainer opted to use a small but sturdy collar due to the negative associations with the harness. Phase one of the Frankie’s new training plan was as follows: Frankie was to “station” herself on a small platform and sit and wait until the trainer approached. The trainer would show Frankie the collar. Frankie would allow the

trainer to put her collar on, crate herself, and allow the trainer to attach a leash to her collar. At any point in the process Frankie could leave the training session. After six months of diligent work and much patience on both ends, Frankie allowed her trainer to clasp the collar around her neck daily.

Phase two addressed the problem of avoidance/aggression during encounters. Instead of walking on the ground, Frankie would be positioned on a long series of tables in a calm, outdoor area of the zoo, with full access to her crate. Handlers also brought a box of mulch to showcase the fox's natural digging abilities and live crickets to demonstrate how they hunt. In the beginning, Frankie fox was rewarded every time she chose to leave the crate. Though timid at first, she became used to her surrounding over several months. We now had an opportunity to educate zoo visitors with a fox who trusted her handlers and exhibited natural behaviors within a safe barrier.

In this case, Frankie's protocol was completely re-written. The essentials include:

1. The number of fox handlers was reduced from seven to three people.
2. Frankie must station and remain sitting while trainers attach her collar. If she jumps off the station, the handler may take a short break and then ask again, up to 3 times.
3. Handlers must spend time socializing with Frankie during which nothing is asked of her. It is just a time to bond and build positive connection through mutual grooming.
4. Handlers must commit to weekly, if not daily, training sessions.

Results

Frankie rarely says "no" these days. She travels all around the zoo, attending special events, media appearances, and random encounters. However, if she chooses not to participate, we have a list of "high-tier" animals that will be asked to go in her place. Instead of expecting only a fox, event guests are told in advance they may alternatively meet a Tamandua, a wallaby, or another equally impressive animal. Setting expectations with audiences relieves pressure on animal handlers, allowing them to deliver exceptional programs with the animals' best welfare in mind. Without the patience of our managers (both direct and indirect), this program would never have had a chance. Building relationships and re-shaping bad habits is a large but necessary time investment.

Conclusion

In each of these case studies, we learned valuable lessons: Establish mutual respect through clear and honest communication. Curb disappointment by setting expectations in advance. Don't force it. Good training takes time and management must be on-board with this. At the end of the day, our zoo visitors, donors, animal handlers and fellow keepers all want the same thing: for our animals to be happy, healthy and thriving. To that end, we offer as many choices as we can; in an ambassador animal setting, this generally begins with the choice of participating in a program or not. Our job is to make saying 'yes' the easiest, most convenient and highest rewarded choice available; when 'no' is all we have, we must learn how to adjust. Seeing the

world through the eyes, ears, and nose of our animals offers us perspective and motivates us to give control back to the ones who get us close enough to care.

Acknowledgements

We would like to thank our supervisors- Amanda Chambers, Sarah Swanson and Mary Abbott for supporting us as we prepared for this presentation. We'd also like to thank our fellow keepers, without whose determination, creativity and hard work our animals would not be living their best lives, and our wonderful animal handlers, who take on the large responsibility of connecting our visitors with the natural world every day. Lastly, we would like to thank our animals for saying "no" to us, and allowing us the opportunity to change their minds.

Thinking outside of the Box: Zookeeper Partnerships in Conservation

By
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Abstract

S.P.E.C.I.E.S. is a non-profit organization committed to holistic and impactful conservation activities focused on the world's carnivores. S.P.E.C.I.E.S. owes many of its initial successes to zoos in the U.S., support which continues today. As zoos and zookeepers provide a critical interface between wildlife conservation and the public, S.P.E.C.I.E.S. is proposing a program that further integrates zoological institutions into our mission to save carnivores and their habitats.

Fundraising is an opportunity for keepers to benefit conservation projects positively impacting the species they work with and care most about. Our goal is to re-imagine the model that has made Bowling for Rhinos so impactful, and apply it to other imperiled species. By utilizing alternative and creative peer-to-peer fundraising ideas and group events, keepers can help us develop recurring, sustainable sources of support for conservation initiatives matching their interests.

To further empower keepers, S.P.E.C.I.E.S. is planning to build a platform for in-situ participation and learning. Our goal is to get keepers into the field where they would work on conservation projects they have benefitted through fundraising. Such a platform would provide a unique and unparalleled opportunity to bring back the knowledge they acquire with renewed energy and enthusiasm that translates to docents and public alike.

S.P.E.C.I.E.S. trains, employs, and partners with local communities around the globe. Among others, our integrative activities aim to establish baseline data, enhance institutional and individual capacity, mentor emerging conservation professionals, resolve human-wildlife conflict, develop conservation strategies, and build participatory community conservation networks furthering the conservation of the world's carnivores.

Introduction

Zoos have been a constant presence throughout history. Zoos originally started as menageries, with unique and exotic species collected and displayed as living trophies or stamp collections. As time moved forward these menageries gave way to early zoos consisting of small exhibits, displaying one or two individuals where the public came to stare at wild animals. These zoos gave way to scientific institutions, and the modern zoo; modern zoos provide opportunity for recreation, but are institutions that are focused on animal care, education, research and conservation (Turley 1999; Tribe and Booth 2003). Zoos are experiencing a second renaissance, continuing to evolve and morph into conservation organizations that manage species instead of collections of wildlife (Turley 1999; Rabb 2004; Hance 2015). The modern zoo is persisting in the wake of criticism from the outside world, while serving to connect the general public with the world around them.

Modern zoos are playing a major role in conservation and education, with the stated goal of increasing their contributions in the years to come. Every year there are approximately 186 million visitors with an additional 12 million students who will visit an AZA institution (230+ facilities) on a class field trip(AZA 2017). Globally there are approximately 700 million visits to zoological institutions (Gusset and Dick 2011). These visitors represent education opportunities where the general public can be connected not only to the natural world, but the effort zoos are putting forth in the name of conservation (Hance 2015). A trip to the zoo is only part of the equation, what guest experience will directly influence what they take away from their visit.

Where do Zookeepers Fit?

The quality of a visitors experience is often as important as the visit itself when it comes to what the "take-away" is for a guest. Today the simple act of visiting a zoo is supporting conservation (Rabb 1994; Rabb 2004), but the guest's perceptions and knowledge retention will be shaped by their experience. Almost every zoo in the country has signs at their exhibits that are chocked full of useful information about the species, their natural history and imperiled status, but anyone who has worked in a zoo or an aquarium knows how often those are read. Even for the guests that stop to read a sign how many of them remember what they read at the end of the day? It is the opportunity to interact with informative staff that provides the most poignant and lasting opportunities for education. By receiving an informative narrative from staff members that are knowledgeable about the collection (interpretative staff or animal care staff) guests are more likely to retain the lessons learned. These talks (informal conversations or formal talks) provide multiple opportunities for a connection to be made, questions to be answered and learning to occur. The tangible and visceral experiences (sights and smells) that occur when live animals are involved is wonderful way to connect guests to the wonder of wildlife (Ham and Weiler 2002; Ballantyne et al. 2000); providing an experience that pictures, video and other multimedia experiences can never fully replicate when compared to the real thing. Staff that communicate well with meaningful stories makes the narrative spring to life in a way that the printed word will never be able to achieve. A living person talking about live animals (and animal artifacts) allows guests to interact while also connecting emotionally with the message being shared (Swanagan 2000).

Modern zoological facilities strive to manage their animals to the highest standards, educate their guests, and participate in conservation. All three of these activities are part of animal care staff's daily routine, making sure their charges are cared for, interacting with guests and insuring that their talks highlight the conservation efforts that exist for the applicable species. Institutions participate in conservation beyond educating their guests in a variety of manners. In some cases there are participating in conservation projects beyond their facilities with a budget dedicated to supporting field projects and conservation departments. This is not the reality for all facilities, many facilities have more limited budgets and staffing, where staff wear multiple hats to make sure that all of the facilities needs are met. Institutions support conservation through a variety of methods: financial contributions, shared expertise, capacity building, and in some cases managing research and conservation projects. Some of these methods are available to animal care staff through their perspective institutions, but for some facilities it may not be accessible. With all of this in mind it is important to remember that dedicated staff are able to contribute to conservation, even it is not directly through their institution. AAZK was originally born out of passionate zookeepers to promote professionalism, animal care, professional development and an increased role in conservation (AAZK 2017). Each AAZK chapter (or member) represents the opportunity to contribute to the conservation

Diversifying Conservation Partnerships

It is not a surprise to anyone that non-profits are open to support from anyone who is interested in helping. This can come in the form of in-kind services (skillsets that extend beyond being an animal care professional) and fundraising. Individuals donating their time and expertise is one way for a keeper to become more involved with conservation. Through practices like outreach, grant writing, and creating education materials an individual can greatly impact the work of an organization. Additionally, fundraising is a way that an individual or group can support a project that has a mission that you believe in. Zoo keepers as a whole are a passionate group of people with a vested interested in the large number of species that they work with. It is important to remember that an AAZK chapter is affiliated with an institution and their conservation efforts can act to supplement what their institution is supporting, but they are not obligated to do so, allowing them to go in a different direction entirely, increasing their involvement with conservation for a diverse array of species. By supporting an organization that has multiple projects with multiple species there are more opportunities for engaging keepers, and boosts the opportunity to recruit new keepers/volunteers/colleagues for membership.

The obvious tie in for AAZK and conservation is through fundraising. Fundraising is something that zookeepers have shown to be more than sufficient at, the overwhelming and continued success of Bowling for Rhinos is all the evidence required. BFR is hardly the only cause that AAZK chapters across the country are funding or supporting. As all of the official AAZK chapters participate in BFR, there are chapters all over the country that successfully fundraise for rhino conservation that do not manage rhinos in their affiliated collections. This means that AAZK chapters are successfully fundraising for a species that their public does not see in their institution, but through effective messaging there is public buy in. It is natural to think that if this sort of enthusiasm for conservation can be applied to projects that have direct links to managed collections can be successful as well. Additional events can be added to an AAZK chapter's calendar that can be effective in raising funds for other projects, without detracting from BFR. By utilizing a different type of fundraising event than the annual BFR an AAZK chapter can diversify the audiences that are being targeted, while increasing the total funds that are raised by the chapter. A quick Google search of AAZK fundraisers provides an amazing array of fundraising events that can be utilized effectively to support conservation projects for a multitude of species. Events range from trivia and paint nights, wine and beer events, recycling drives and organized road races.

Where do NGO's fit?

Zoos and zookeepers are an important interface between wildlife conservation and the public; AAZK is an interface between zookeepers and conservation. Increasing the integration between AAZK and conservation organizations is a logical step forward. The goal is to integrate zookeepers further into the missions of the organizations they support. This is where S.P.E.C.I.E.S. wants to play a role for you as an individual member or as an AAZK Chapter, to provide an opportunity to support conservation for carnivore species that chapter members are passionate about with established and emerging projects. S.P.E.C.I.E.S. is committed to creating a program that allows for us to develop recurring, sustainable sources of support for conservation initiatives.

The program that S.P.E.C.I.E.S. is proposing is designed to encourage continued engagement between individual AAZK chapters and S.P.E.C.I.E.S. The vision of the program will enhance the messaging that keepers and zoos are utilizing when it comes to engaging guests. Keepers will be able to share stories about the projects that S.P.E.C.I.E.S. is undertaking that directly connects to the carnivores in their collection. By further integrating keepers into our mission to save carnivores we are providing capacity building opportunities for keepers by getting them involved in our work. They will experience first-hand the research and conservation initiatives that S.P.E.C.I.E.S. is undertaking, both in range countries and managed collections. S.P.E.C.I.E.S. has two examples of how this will work is through an established relationship with Earthwatch™ and emerging community project (ConservationFit™). Currently

S.P.E.C.I.E.S. has an established partnership with Earthwatch™, where citizen scientists participate with a monitoring project for ocelots (*Leopardus pardalis*) on the island of Trinidad and Tobago. During the summer of 2016 a group of students from the Duttenhaver Conservation Field Study Program and staff members from the Los Angeles Zoo & Botanical gardens. This group participated in the camera trapping, ecological surveying and data input along with learning more the culture of the island and how ocelots fit into the ecology. S.P.E.C.I.E.S. wants to provide further opportunities like this for keepers from all over the country to participate in field projects, where they can support projects in person, supporting collaborators and conservation. We are exploring how we can expand this model to other carnivore projects in the future. A more immediate form of participation that we can engage keepers with is through ConservationFit™. ConservationFit™ is developing a database of footprints of several priority species to build field monitoring algorithm that will allow for a non-invasive surveying technique. By employing keepers to gather data points in well controlled environments from known species we can greatly increase the strength of the database. The technique requires a digital image and statistical analysis to identify the demographics of a footprint (species, sex, age-class and individual). Not only will keepers be contributing to the database but they will also be replicating the process that researchers will be undertaking in range countries. The direct connection will help to strengthen the message being shared with zoo guests.

It is through these opportunities, both at home facilities and beyond that will allow keepers to take stories home with them. These research opportunities, stories and experiences provide increased value to a keepers interactions; which enhances not only their professional experience, but allows them to connect with their colleagues and communities. The overarching mission is inspire conservation by improving conservation messaging by empowering staff (through direct and indirect participation).

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Chiropractor visits a neonate tiger

by
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On February 2, 2017, a four-year-old Malayan Tiger, *Panthera tigris jackoni*, gave birth for the first time to 0.3 cubs. Her initial reaction to the parturition event was something no one had seen before or expected; she was trying to move away from the cub emerging from the birth canal and in the process of flicking her tail, propelled the cub onto the floor. The pair were monitored on camera for thirty minutes, during which time the dam sniffed the cub, but refused to clean it, then abandoned it. During this same time, the cub was observed breathing but did not have normal movement for a neonate. The Curator of Mammals and Veterinarian made the decision that intervention was warranted for the safety and health of the cub.

When the cub ("Chira") arrived at the Nursery it initially looked good, just cold (core temperature 79.12°F) and wet, so we proceeded to tie the umbilical cord and begin to warm it up. In the meanwhile, the dam proceeded to give birth to two additional cubs and repeated her pattern of sniffing them, not cleaning them and then abandoning them. We decided to remove these cubs for hand-raising as well. The two (later) cubs were vigorous and had strong sucking response, however it was noted that the first-born cub could not hold up her neck. Upon closer examination, it was determined that "Chira's" neck was abnormally positioned at a 45°angle off her back, so we proceeded to start manipulating the neck slowly in an attempt to get it back into a "normal position". However, when she would lay on her side her neck would be over her back resulting in whining or screaming vocalization and the inability to move her head in a normal manner or hold normal position. The Veterinarian felt she had full rotation of her head but could not find any other cause of this discomfort. When she was fed, she would do so in a slow and steady manner and would assume an unusual posture of pushing her head into the palm of my hand. As feedings continued, her response was getting softer and she was not as vigorous as her littermates who were active or moving their legs during nursing. The CBC and I-STAT analysis results were all within normal parameters and the physical examination of heart and lungs were unremarkable, but she continued to be listless. Nothing was amiss except for the slight head tilt to the right; by the time she was 24 hours old we had been able to return the head to a normal position (90°angle) for a short time frame with only a slight head tilt to the right. Even though by all standards the cub appeared normal she was not thriving and meeting her physical milestones such as suckling and active movement. It appeared, from my experience, that "Chira" was "a failure to thrive baby" meaning that although we can't find anything medically wrong she is clearly not thriving.

As luck would have it, I had an appointment with my chiropractor, Dr. Mark Sperbeck, D.C. DACO, that afternoon, and we were discussing this unusual head positioning when he remembered a 6-month-old baby who was failing to thrive. His physicians did everything they could but the infant continued to deteriorate. The infant's father, a chiropractor, was holding his baby and began to check him out when he discovered that the C1 in his neck was out of alignment. Making an adjustment on his child, the father commented that the baby seemed to be reborn again, meaning he started to meet his physical milestones like a new born. He informed me that 95% of the nerve impulses travels through this small C1 vertebra to the rest of the body. Dr. Sperbeck is not only a licensed chiropractor, but has a historical background working on horses and dogs since 2003, under the supervision of a veterinarian. So, at 48 hours the cub was in obvious decline with no causative factors able to be determined, I went to our veterinarian with the information regarding

spinal alignment from my chiropractor and convinced him to try something new. Being willing to think outside of the box is how we ended up having a chiropractor come evaluate a tiger cub.

When Dr. Sperbeck arrived, I had him examine another cub first so he would have a point of reference before looking at “Chira”. He proceeded to manipulate her neck utilizing chiropractic techniques and he palpated restrictions in lateral bands on both sides. With the avitator, an instrument that chiropractors use to apply pin point pressure to a spot, he adjusted the C1 BL and C3 BR (meaning the body of the vertebra C1 and C3 to the left and right side*)* with 4 oz. of pressure from the avitator *see figure 1*. I noticed almost immediately that “Chira” appeared more relaxed and had stopped crying. In addition, at her next feeding she readily began to nurse and was even heard chuffing. We felt that her body needed to heal and not disturb the re-alignment, so we shifted her to an isolated area so any movement from her siblings could not jeopardize the process and for the next 24 hours all she did was nurse and sleep. Dr. Sperbeck informed us that the soft tissue that was damaged at birth might take six to eight weeks to heal. He felt she would probably take four or five adjustments within an 8-week time frame to maintain proper alignment. So, we continued to monitor her and contacted Dr. Sperbeck when her behavior and/or posture indicated that an adjustment might be needed. There is no written manual for this procedure. I am using my experience from being around neonates and good observation skills to monitor her. Neonates will tell us what they need if we just learn to listen to them.

After the adjustment, “Chira” was starting to be a little more mobile like a newborn cub, but obviously not as developed and strong as her siblings. We permitted her interaction and playtime with her siblings but when she became tired she was removed for sleeping. By the time she was six days old (three days after adjustment), she had a noticeable head tilt again, poor suckling response, was no longer chuffing, and had resumed crying. Dr. Sperbeck was notified and he came for another adjustment. This time he palpated restrictions in lateral band and extensions, meaning her neck did not have full range of motion and there has stiffness in her back. When he first examined her at 3 days of age he was primarily focused on the neck since that was her main source of discomfort. And, with any adjustment, you cannot proceed too quickly or make too many changes at one time, the body needs to relax, heal and renew before the next obstacle can be attacked. Since “Chira’s” body was growing at such a fast rate; he needed to make small adjustments at a time. The second adjustment was made to C1 and C3 both BR (body right side of vertebra) and T12 and L3. While he is doing his examinations, Dr. Sperbeck explained that you feel “resistance” or lack of mobility when you apply slight pressure to the vertebrae. This is where you make your adjustments. We questioned him about getting an x-ray of the area prior to, and after, an adjustment. However, we were informed that you could lay these images on top of each other they would appear the same since the picture is only a one-dimensional view. The area may appear to be in the correct position on the x-ray but does not take into account freedom of movement, a range of motion, only placement within the column. It would be like taking a photo of a door hinge. The hinge might appear shinny and gray in appearance, but there is no way to tell if it moves freely, much like the vertebra.

After the adjustments, we let her rest for a day and initiated some physical therapy. Her therapy involved scratching her behind an ear and/or under the chin resulting in her pushing into our hands thereby strengthening muscles as she grows. At this point, she was still behind her siblings in motor skills, such as weaker in crawling and not able to climb up on low, soft objects, etc. At 12 days of age, the head tilt resumed and she was observed sleeping in an abnormal posture in an attempt to get comfortable. While she was still nursing normally her behavior and demeanor had slightly shifted to the point I felt Dr. Sperbeck needed to be called again. During this visit, the

adjustments were SI R, T10 BL, T6 BR, T1, C1, BL, C2, and BR. All adjustments were based solely on the cubs' reaction.

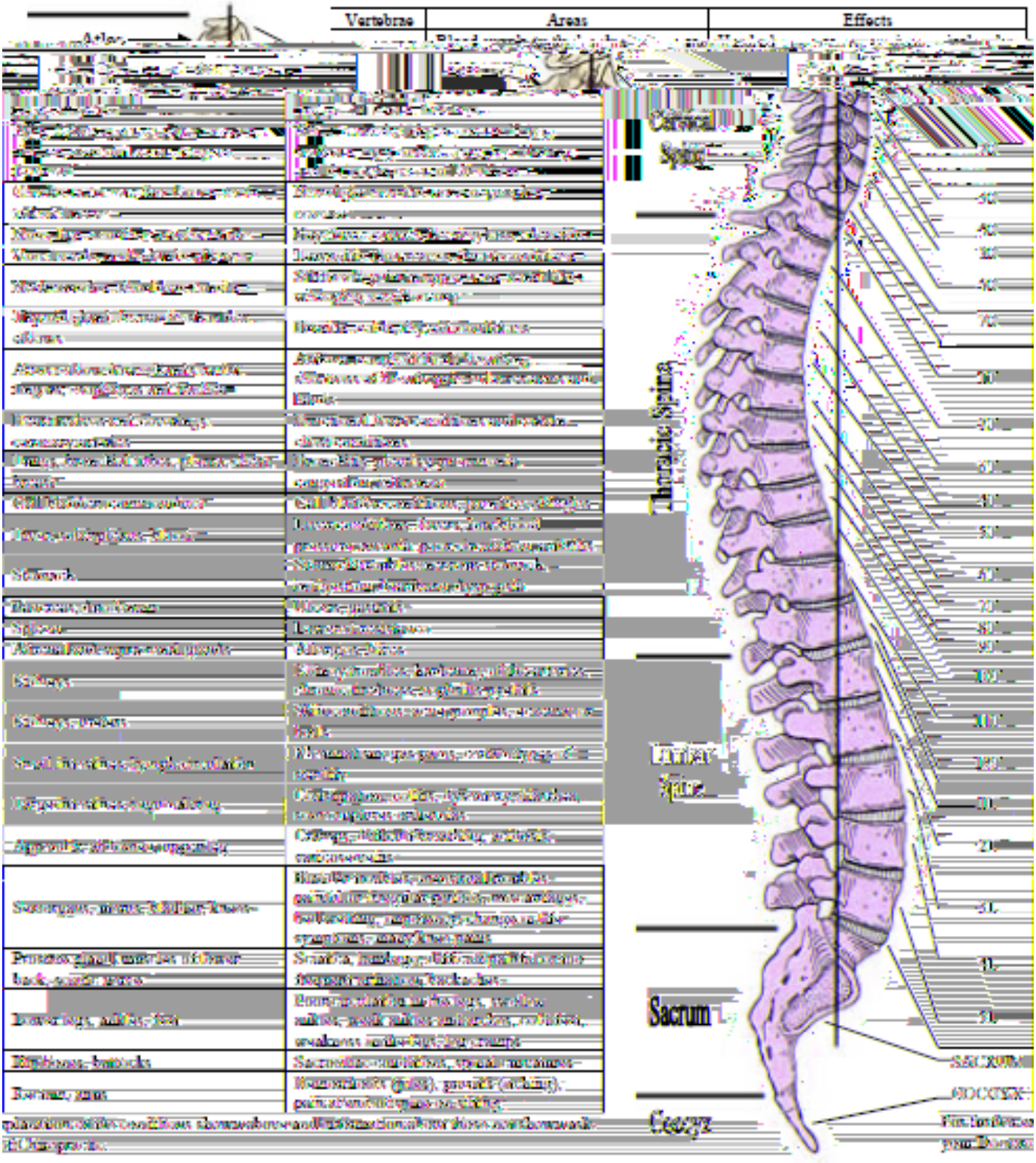
As "Chira" continued to grow and heal the adjustments did not need to occur as frequently (fourth adjustment was not required until after 8 days from her third adjustment). The fourth adjustment came after we observed a noticeable change in her locomotion and mobility. This adjustment was C1 BR and C2 BL. "Chira's" final appointment occurred at 11 weeks of age and required C1 BR, (L) SI adjustment. This was accompanied by a complete follow up by veterinarian at which time her case was released from active care.

"Chira" and her siblings were moved to a larger enclosure at twelve weeks of age and all are adjusting to the new area. To help building their confidence in this new area, "Blakely" (nursery canine) and I would spend time daily socializing and playing with them while in their new area. Of course, tiger cubs will be adventurous and on their fourth day in the new area "Chira" struck her head on the wall of the enclosure. She staggered briefly and went on her way in a somewhat normal manner but her behavior indicated something was wrong. As time progressed, the head tilt returned and Dr. Sperbeck stopped by to adjust this 25lb tiger. He had joked in the very beginning "how long you think we can adjust this 2lb cub" and my reply was "as long as we can". So this time, since she no longer fitted into the cradle of our hands, we used a favorite toy to distract her while she laid across my lap for what turned out to be her last adjustment.

Personally, I felt that Dr. Sperbeck's adjustments were integral to her well-being and if he had not made these adjustments to "Chira" she would not have been alive today, so for that I thank him.

CHART OF EFFECTS OF SPINAL MISALIGNMENTS

"The nervous system controls and coordinates all organs and structures of the human body." (Gray's Anatomy, 29th Ed., page 4). Misalignments of spinal vertebrae and discs may cause irritation to the nervous system and affect the structures, organs, and functions that may result in the conditions shown below.



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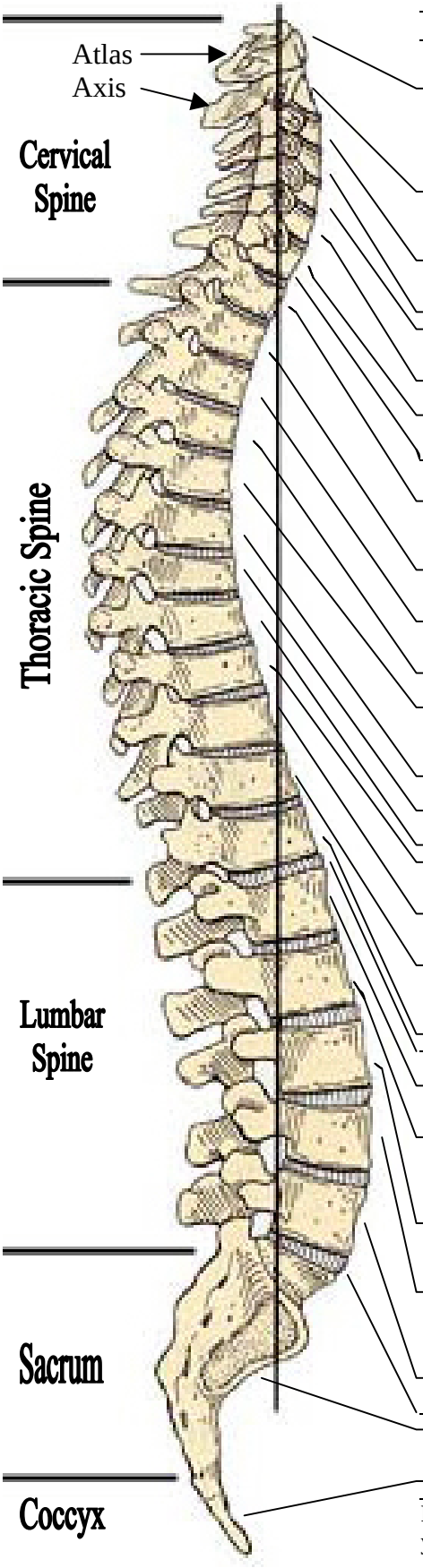
Strasser, Dawn A, and Dr. Mark J Sperbeck, D.C.,DACO. “Chiropractic Adjustment on Neonates.” 2 Feb. 2017.

CHART OF EFFECTS OF SPINAL MISALIGNMENTS

"The nervous system controls and coordinates all organs and structures of the human body." (Gray's Anatomy, 29th Ed., page 4). Misalignments of spinal vertebrae and discs may cause irritation to the nervous system and affect the structures, organs, and functions that may result in the conditions shown below.



Vertebrae	Areas	Effects
1C	Blood supply to the head, pituitary gland, scalp bones of the face, brain, inner & middle ear, sympathetic nervous system	Headaches, nervousness, insomnia, head colds, high blood pressure, migraine headaches, nervous breakdowns, amnesia, chronic tiredness, dizziness
2C	Eyes, optic nerves, auditory nerves, sinuses, mastoid bones, tongue, forehead	Sinus trouble, allergies, crossed eyes, deafness, eye troubles, earache, fainting spells, certain cases of blindness
3C	Cheeks, outer ear, face bones, teeth, trifacial nerve	Neuralgia, neuritis, acne or pimples, eczema
4C	Nose, lips, mouth, eustachian tube	Hay fever, catarrh, hearing loss, adenoids
5C	Vocal cords, neck glands, pharynx	Laryngitis, hoarseness, throat conditions
6C	Neck muscles, shoulders, tonsils	Stiff neck, pain in upper arms, tonsillitis, whooping cough, croup
7C	Thyroid gland, bursae in shoulder, elbows	Bursitis, colds, thyroid conditions
1T	Arms: elbow down; hands, wrist, fingers; esophagus and trachea	Asthma, cough difficult breathing, shortness of breath, pain in lower arms and hands
2T	Heart: valves and coverings, coronary arteries	Functional heart conditions and certain chest conditions
3T	Lungs, bronchial tubes, pleura, chest, breast	Bronchitis, pleurisy, pneumonia, congestion, influenza
4T	Gall bladder, common duct	Gall bladder conditions, jaundice, shingles
5T	Liver, solar plexus, blood	Liver conditions, fevers, low blood pressure, anemia, poor circulation, arthritis
6T	Stomach	Stomach troubles: nervous stomach, indigestion, heartburn, dyspepsia
7T	Pancreas, duodenum	Ulcers, gastritis
8T	Spleen	Lowered resistance
9T	Adrenal and supra-renal glands	Allergies, hives
10T	Kidneys	Kidney troubles, hardening of the arteries, chronic tiredness, nephritis pyelitis
11T	Kidneys, ureters	Skin conditions: acne, pimples, eczema, or boils
12T	Small intestines, lymph circulation	Rheumatism, gas pains, certain types of sterility
1L	Large intestines, inguinal ring	Constipation, colitis, dysentery, diarrhea, some ruptures or hernias
2L	Appendix, abdomen, upper leg	Cramps, difficult breathing, acidosis, varicose veins
3L	Sex organs, uterus, bladder, knees	Bladder troubles, menstrual troubles: painful or irregular periods, miscarriages, bed wetting, impotency, change in life symptoms, many knee pains
4L	Prostate gland, muscles of lower back, sciatic nerve	Sciatica, lumbago, difficult/painful or too frequent urination, backaches
5L	Lower legs, ankles, feet	Poor circulation in the legs, swollen ankles, weak ankles and arches, cold feet, weakness in the legs, leg cramps
SACRUM	Hip bones, buttocks	Sacro-iliac conditions, spinal curvatures
COCCYX	Rectum, anus	Hemorrhoids (piles), pruritis (itching), pain at end of spine on sitting

For further explanation of the conditions shown above and information about those not shown ask your Doctor of Chiropractic.

The Value of a Full Review of Husbandry Practices

By

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Smithsonian's National Zoological Park

Washington, DC

Abstract

Conducting a full review of an animal program can result in significant improvements to areas such as animal care, the visitor experience, and staff investment. With a goal of improving the program as a whole as well as addressing specific concerns, the giant panda team at the Smithsonian's National Zoo organized such a review which culminated in positive changes in husbandry practices, public engagement, staff development, and more.

The team identified two main elements of the program that they hoped the full review would improve: the female giant panda's reproductive uncertainty, and the pandas' use of the exhibit resulting in low public visibility.

Following the program's full review, changes were implemented in how the animals were housed during the day, artificial lighting, nutrition, enrichment and training, cleaning practices, and public access to the giant panda exhibit during female gestation. While there is no way to pinpoint which changes were the most impactful, the team saw major developments in both areas of concern. The female giant panda began to cycle normally and has since given birth to five cubs, and all the pandas began to use their exhibits in a manner that reduced stereotypic behaviors and allowed for better public viewing.

Leading a full review is a tool that animal programs can use to recognize and alleviate concerns in many aspects of animal care.

Background

One of the most important parts of being an animal keeper is providing the best possible care to the animals you work with. However, it is human nature to get complacent or "set in your ways," especially for those who have been in the field for a long time. Therefore, if you have issues with your animals, be it behavioral, reproductive, dietary, etc., you may benefit from doing a full review of your program. This is precisely what the keepers and curator of the giant panda program at Smithsonian's National Zoo did in order to correct some behavioral and reproductive issues with their bears.

The National Zoo has housed pandas almost continuously since 1972. The first two pandas, female Ling Ling, and male Hsing Hsing, were gifts from China to the United States. These bears mated and produced five offspring, but unfortunately none lived more than a week. In 1992, Ling Ling passed away, followed by Hsing Hsing in 1999. The National Zoo then entered a loan agreement with China, and in December of 2000, female Mei Xiang and male Tian Tian arrived.

Both pandas thrived, and in July of 2005, Mei Xiang gave birth to her first cub, Tai Shan. However, from the time of her first estrus after weaning Tai Shan in 2007 until 2011, Mei Xiang did not birth another cub. Even more concerning, her estrous cycle from 2009 to 2011 was irregular, happening out of the normal season. Giant panda females generally go through estrus between late February and early June.

However, during these three years, Mei Xiang entered estrus in January. Additionally, during this same period, the pandas began to exhibit some stereotypic behaviors. Both pandas' behaviors seemed to be anticipatory in nature, occurring most frequently when the pandas were looking for more bamboo or looking to get access to areas of their enclosure that they didn't have access to. These anticipatory behaviors were usually performed at the back of their outdoor yards, which meant that the public had more difficulty seeing the pandas.

Methods

In 2010 staff and an intern began looking at ways to try and lessen the stereotypic behaviors observed for Tian Tian, specifically an oral stereotypy. This was done by manipulating how and when bamboo was fed, and by adding different types of enrichment activities (Glendinning, 2011). These efforts had some effect, but did not significantly reduce the occurrence of his stereotypic behavior.

In the summer of 2011, the giant panda keepers and curator began having discussions about making more substantial changes to the management of the giant pandas. In August 2011, these talks culminated in a full and comprehensive review of the husbandry practices for the giant pandas. Different aspects of the animal care routine were discussed, including roles of the keepers, how the animals were fed, and what environmental factors might be at play, etc. Further, keepers and the curator wrote down what they would like to see changed/improved upon in aspects that went beyond animal care. Topics included staff development, public engagement, visitor experience, and more. While the team identified multiple areas for improvement, they ultimately agreed that Mei Xiang's reproductive success as well as the pandas' daily husbandry were two areas that would take precedence.

Reproduction

While lighting can be used to highlight or brighten exhibits, making animals more visible to the public, it can also be challenging for animals' natural lights cycles. After the complete program review, the team had discussions with colleagues in China who expressed their views on the effects of natural light cycles on pandas, specifically reproduction. Thus, one of the first changes made in hopes of regulating Mei Xiang's estrus was to reduce the amount of artificial light the pandas were exposed to during nighttime hours. First, the building's light timers were set to closely correspond to the natural light cycle. Second, lighting outside the panda exhibit was monitored and reduced. This meant that pathway lighting, as well as spotlights for special events were disabled.

Another factor that the team hypothesized could be affecting Mei Xiang's reproductive history was where the pandas were housed. Prior to 2011, keepers would routinely switch which overnight enclosures and yards the pandas had access to on a given day. After the meeting in 2011, keepers continued to switch which yards the pandas had access to during the day, but were restrictive about which indoor enclosures the pandas could have. Most importantly, the male Tian Tian, was no longer allowed access to indoor enclosures 2 and 3, which were now designated as Mei Xiang's home stalls. This was due to the fact that when Mei Xiang was at the end of a pregnancy, she historically denned up in a small area attached to enclosure 3. The team wondered if allowing a male panda into her den may make that space undesirable for giving birth.

Finally, keepers also discussed ways to improve Mei Xiang's comfort during pregnancy, with a particular focus on zoo visitors and their potential negative impacts on her during this sensitive time. Visitors are able to experience the pandas from three different viewing areas: from the front of the yard, through glass in the indoor enclosures, or from over the yards in an overlook area on top of the panda house. In an attempt to give Mei Xiang a quieter birthing environment, the panda overlook area was closed, preventing the public from walking on the roof of the panda house. In addition, the team decided to close the panda house earlier in her pregnancy, thus reducing the foot traffic in the indoor viewing area and furthermore

reducing the amount of noise Mei Xiang would experience in her den. The hope was that by creating a quieter environment earlier on in her pregnancy, Mei Xiang would find her den safe for birthing.

Husbandry

The most significant change made was how the animals were housed during the day. Prior to 2011, Tian Tian and Mei Xiang were locked in their outdoor yards unless certain weather thresholds were met. If temperatures were in excess of 80°F, if there was heavy rain or wind, or there was lightning in the area, keepers had permission to give the panda's access to their indoor space, otherwise, they were kept in their yards. Keepers had long felt that the pandas directed a lot of energy at the back of the yard where the shift doors to the inside space were located. Because the pandas were spending so much time at the back of their yards, the visitor experience suffered, as the pandas were hard to see through their large yards from the public viewing at the front. Additionally, when they were locked out keepers observed a higher level of stereotypic behaviors. On days when the pandas had access to both their outdoor and indoor exhibits, it was evident that the occurrence of their stereotypic behaviors decreased. These anecdotal findings were supported by a paper from the San Diego Zoo that looked at the prevalence of stereotypic behaviors and corticoid steroid levels (an indicator of stress) when giant pandas were locked in one part of their exhibit or had access to all of their exhibit space (Owens, M. 2005). In the study, giving the four pandas access inside decreased both stereotypic behaviors and corticoid steroid levels. Thus, the panda team at the National Zoo moved away from locking Mei Xiang and Tian Tian out, and instead gave them indoor/outdoor access all day.

Nutrition was also looked at as a way to decrease stereotypies and encourage natural behaviors. Since giant pandas spend anywhere from 13 to16 hours a day eating bamboo, the panda team and Department of Nutrition began to change practices to make sure that the bamboo being provided to the pandas was as fresh and palatable as possible. Bamboo was cut fresh on a more frequent basis and if the pandas rejected a particular delivery, nutrition would replace it with a different species of bamboo. Furthermore, nutrition also provided the pandas with a small amount of a rarer, preferred species, *Psuedosasa japonica*, to further increase the amount of time the pandas spent eating bamboo.

Commented [WU1]: Should you say species just to simplify things without going into the details of all our different cut sites?

Keepers also discussed how often they were disinfecting the enclosures, and made a significant change. Prior to 2011, keepers would bleach almost daily. However, there is evidence that bears prefer not having their scents cleaned away as frequently, since scents can be used to indicate "possession" of a space. Therefore, keepers moved to bleaching the enclosures only once or twice a week.

Commented [WU2]: Explain this a little further. Is this just a simple husbandry change, or do you think it was more repro related?

The panda team also decided to overhaul their enrichment and training program to improve the pandas' welfare. While enrichment was provided daily, the team began to use new enrichment items as well as provide it more frequently. This included new toys, feeding devices, and approved scents. Lastly, the training program was expanded to not only train the bears more regularly for routine and medical behaviors, but to also approve more keeper staff to participate in training sessions.

Results

After these changes were implemented, keepers saw immediate results. In 2012, Mei Xiang finally returned to a normal estrous cycle, reaching peak estrus in April and thus an artificial insemination procedure was performed. In September of that year, she gave birth to a female cub. Unfortunately, due to congenital issues, this cub only survived one week. Since 2013, Mei Xiang has continued to enter estrus at a normal time of year and has given birth to four more cubs, two of which survived (Bao Bao, a female, was born in August 2013, and Bei Bei, a male, was born in August 2015).

The team also noticed abrupt changes in the frequency of stereotypic behaviors as well as an increase in the overall welfare of the pandas. While the stereotypic behaviors have not been completely terminated, the husbandry changes in access, nutrition, and enrichment and training have caused a significant decline..

Also, by giving the pandas access inside every day, there is a larger portion of the day where the pandas are more visible to the public, because they are spending less time at the back of the yards, waiting to get access inside.

Conclusion

While this paper reflects the changes made specifically to the giant panda program at the National Zoo, it can be viewed as a case study for making critical assessments to any animal program. During the planning stage for these changes, no idea was considered off the table, and keepers and the curator were able to make suggestions without the fear of ridicule. As the changes were implemented, staff were given freedom to modify ideas and question the efficacy of any change. Ultimately, this led to a much more robust husbandry program and more importantly significant improvements in the lives of the giant pandas, both from a reproductive and behavioral standpoint.

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When Weight Loss is Everyone's Gain

By

Kelsey Barker, Animal Keeper

Denver Zoo

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The Village Hall section at Denver Zoo manages a variety of Southeast Asian species, including Asian small-clawed otters *(Aonyx cinereus)*, white-cheeked gibbons *(Nomascus leucogenys)*, fishing cats *(Prionailurus viverrinus)*, and clouded leopards *(Neofelis nebulosa)*. This section is part of a larger team called Toyota Elephant Passage and Predator Ridge. Within the larger team there are five sections: Village Hall, Predator Ridge, Rhino/Tapir, Pachyderms, and Elephants. Some keepers on this larger team specialize in one section, while others work in multiple sections. This team dynamic fosters frequent communication, brainstorming, and inspiration within a larger group of keepers caring for a variety of species.

When the Village Hall team found that managing the weight of Jilin Kalong, a male Asian small-clawed otter, through diet management alone showed little improvement, the keepers found inspiration from their teammates. Elephant keepers in AZA facilities are required to have a written exercise program in place for all individuals as well as the herd (Section 3.3.2.4). The Denver Zoo elephant keepers exercise each elephant in their care at least three times per week. The Predator Ridge team was working on encouraging exercise with social African carnivores by being innovative with space within their rotational exhibit. The collaborative nature of the Toyota Elephant Passage and Predator Ridge team led Jilin Kalong's keepers to start incorporating exercise into his daily routine in an effort to lower his body weight and improve his body condition.

The Village Hall team got creative in applying these ideas to Jilin Kalong's management because relying on diet management alone proved difficult with this social species. Although keepers often separate this group of six otters for training and feeding their allotted diet, social feedings are important as well for bonding and group cohesion. Including exercise in Jilin Kalong's weight management allows keepers to eliminate social stresses due to large diet imbalances amongst the group. Previously, the keepers had encouraged exercise through enrichment such as climbing structures and puzzle feeders, but they wanted to take this farther. The team started by using established behaviors such as 'laser target' and 'stand' to increase Jilin Kalong's mobility during training sessions. Thinking about exercise during sessions allows keepers to take previously trained husbandry behaviors and use them in new ways with new goals. A 'stand' behavior used to look at an animal's abdomen and paws is now also being used to strengthen muscles and encourage stretching. A 'laser target' behavior used to move an animal around a stall or exhibit is now also being used to increase cardiovascular activity. Keepers now use the 'laser target' to ask Jilin Kalong to travel further distances, climb on various structures, and jump.

After seeing the benefits of including regular exercise in training sessions, keepers began training new behaviors that focused on strength, cardio, and stretching. By using

the ‘laser target’ and then slowly fading it out, Jilin Kalong was trained to run on a cat exercise wheel (One Fast Cat ©, 708 Via Alondra, Camarillo, CA, info@onefastcat.com, www.onefastcat.com) to increase cardiovascular activity (Picture 1). He was trained to climb the mesh to increase upper body strength (Picture 2). Keepers also captured a digging behavior and used a target stick to approximate a jumping behavior that increased strength and cardio. Increasing the duration of these behaviors is also beneficial in maximizing their exercise potential.

Picture 1: Jilin Kalong, a male Asian small-clawed otter, running on One Fast Cat exercise wheel in back holding during a training session focused on exercise.

Picture 2: Jilin Kalong doing a “climb” behavior that develops strength.

Although the original goal was to improve Jilin Kalong’s body score and weight, Village Hall keepers now apply this exercise management technique to all of the Asian small-clawed otters in their care. This proactive approach strives to improve overall fitness of the otters and be included with diet changes in their weight management program. Although not all of the otters are trained a ‘laser target,’ the keepers are able to increase mobility within sessions with their standard ‘target’ behavior. Asking the animals to jump or climb to reach the target stick, or asking them to travel further distances across the stalls to reach the target stick accomplishes goals of stretching, strength building, and increasing cardiovascular activity. Keepers have increased frequency and duration of an established ‘stand’ with the new intention of stretching. All otters were quickly trained to ‘climb’ as well to improve strength. Some otters even began running on the wheel on their own after watching Jilin Kalong.

Increasing exercise within training sessions in the back holding space has had numerous benefits that have extended onto the exhibit. Keepers note that Jilin Kalong's activity on exhibit is increasing, and he is often running on the exercise wheel outside of sessions. Jilin Kalong is often observed running on his own throughout the day when keepers place the exercise wheel on exhibit for enrichment (Picture 3). Behaviors that were simple and quick to train like 'climb' also add variety and fun to medical and husbandry sessions. Training these exercise behaviors also creates a new and unique experience for guests and allows keepers to share about the husbandry practices involved in taking care of these species.

Picture 3: Jilin Kalong running on One Fast Cat exercise wheel on exhibit.

Realizing the success with the Asian small-clawed otters encouraged keepers to start thinking about exercise for the other animals in their section. Vinh, a female white-cheeked gibbon, was trained a 'let's go' behavior that allows keepers to ask her to follow them and brachiate around her exhibit (Picture 4 and Picture 5). Although she moves around her exhibit throughout each day, including this movement in training sessions increases the duration and repetition of her movements which promote cardio and strength exercise. Because her exhibit includes islands and ropes above guest pathways, this behavior and exercise routine also provides an unforgettable experience for guests.

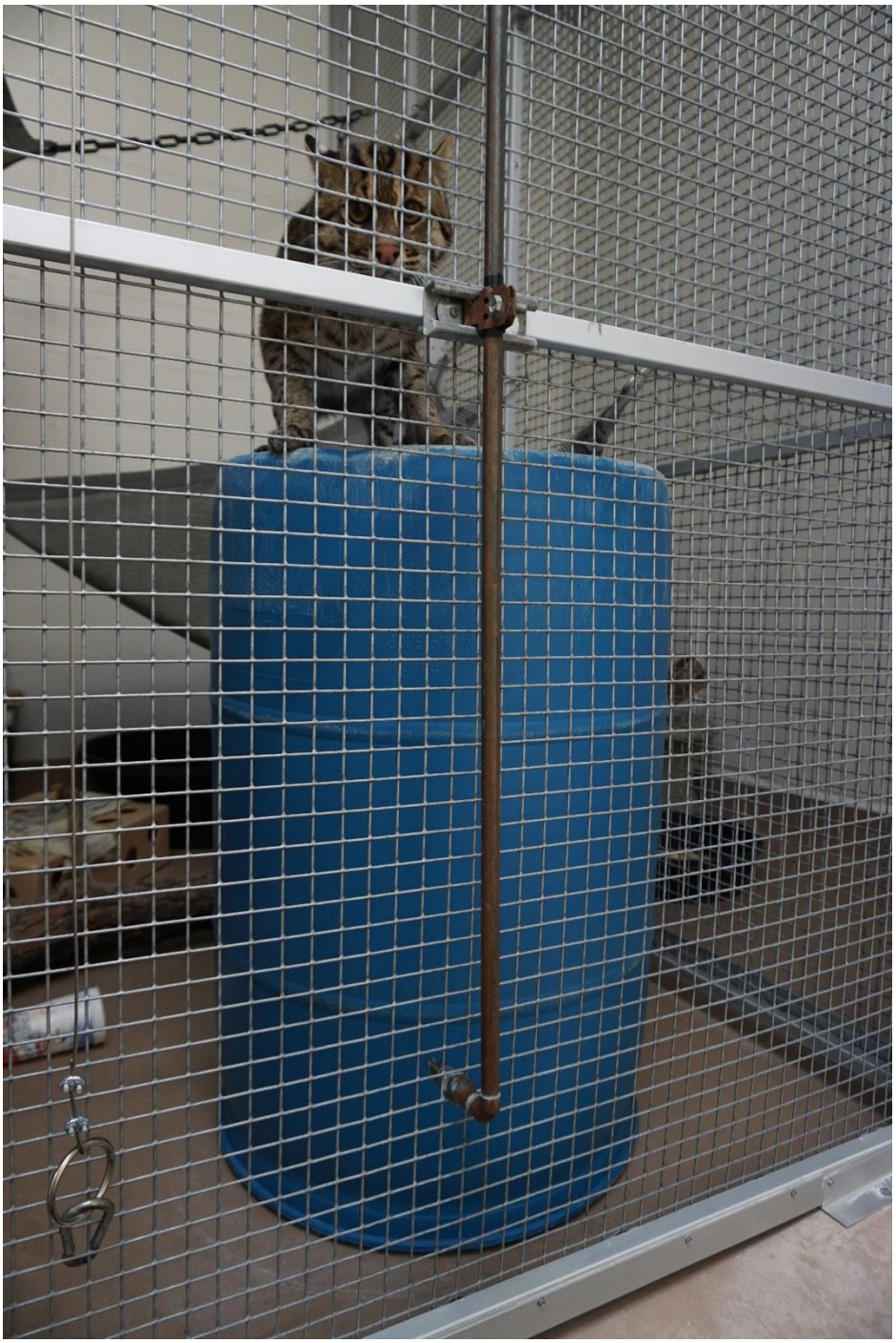
Picture 4: Vinh, a female white-cheeked gibbon, brachiating across exhibit ropes during exercise training session.

Picture 5: Vinh, a female white-cheeked gibbon, moving across exhibit ropes during an exercise training session.

This concept was also applied to Ronaldo, a male fishing cat. He was trained a ‘bench’ behavior which requires him to jump onto a platform that the keeper points to. Keepers choose different platforms such as a crate and a plastic barrel to vary the heights of his leap onto the bench (Picture 6). This behavior increases strength, but also supports cardio when he is asked for the behavior multiple times in a row. After the behavior was established and Ronaldo was able to ‘bench’ on various platforms and hold for duration, taller platforms or benches were introduced. Ronaldo would often barely reach the edge when first benching onto a tall barrel, preventing him from completely reaching the barrel’s top surface and holding for duration. With continued training and exercise, Ronaldo was soon able to successfully ‘bench’ on the tall barrel allowing him to hold for duration as well (Picture 7).Keepers observed an increase in strength with this training because Ronaldo had improved in his ability to leap onto taller platforms.

In addition to promoting exercise through the ‘bench’ behavior, keepers have increased the frequency and duration they ask for ‘stand’ to encourage stretching, and they have increased distance and repetitions of ‘point follows.’ Encouraging exercise during training sessions also became more important in increasing Ronaldo’s mobility because the birth of a fishing cat kitten changed his routine and decreased the space he has access to during certain times of day.

Picture 6: Ronaldo, a male fishing cat, performing a “bench” behavior on a trash can to increase strength.



Picture 7: Ronaldo, a male fishing cat, performing a “bench” behavior on a tall barrel to increase strength.

The three clouded leopards at Denver Zoo have benefited from being trained ‘bench.’ Not only is this great exercise for the older and less mobile female cat, Tenchi, but it also gives keepers a great tool to measure her movement when assessing her welfare. With the same idea in mind of encouraging exercise while monitoring mobility, keepers also began walking Tenchi up and down her exhibit transfer using her ‘target’ behavior. Keepers noted that since they have increased her mobility in training sessions, she is

more mobile outside of training sessions and seems to be more comfortable moving up and down the transfer on her own. She has been scoring higher on her welfare assessment mobility ratings, and now keepers will be able to quickly identify any signs of pain or decrease in mobility.

In addition to the exercise benefits the ‘bench’ behavior has for the clouded leopards, keepers have found this led to an easier way to weigh these animals. Placing the scale on the bench instead of the floor reduces the chance that their long tail rests on the floor. With this method, their tail just hangs down off the end of the scale and bench, allowing an accurate weight reading (Picture 8).

Picture 8: Clouded leopard, Tenchi, performing a “bench” behavior with the goal of exercise and strength building as well as weight collection.

Increasing exercise amongst the animals in Denver Zoo’s Village Hall section did not come without challenges. Although the team is excited about developing and improving this new program across their area, they have many other priorities for the collection.

The team has to balance training new exercise behaviors with other priority behaviors including voluntary injections and shifting. Keepers strive to include all aspects of each animal's husbandry including physical body exams, medical behavior training, as well as the newly implemented exercise into daily training sessions. Keepers were faced with creating new simple yet effective exercise behaviors that encourage natural behaviors.

Keepers continue to work on a simple and effective way to schedule and record the many aspects of this new program. As they continue to develop and formalize the program, they want to include exercise through training, space, diet, enrichment, and social dynamics. Once the team is able to track and document the animals' exercise with a simple and consistent method, they hope to look at its effectiveness in body condition, social dynamics, and activity level.

The collaborative nature of the Toyota Elephant Passage and Predator Ridge team sparked creativity in the Village Hall section. As the Village Hall keepers continue to develop ways to increase exercise in their collection, they are sharing their successes with the larger team as well. The Village Hall team continues to work with the Predator Ridge team to formalize implementation and documentation. Frequent communication is increasing creativity for new exercise opportunities despite differing animal species between the sections.

Advancing the fitness of the animals in our care also enhances guest experience and perception. Exercise and training benefit physical and mental health, improving overall fitness, which guests can see through body condition and behavior. Observing healthy and fit animals is a great way for guests to see that the collection is well cared for. Also, encouraging natural behaviors and exercise through training on exhibit provides a unique opportunity to talk with guests about the countless aspects of animal care and husbandry we provide for the animals.

The Village Hall team has observed many benefits since implementing these exercise management strategies. Although Jilin Kalong, an Asian small-clawed otter, has not yet shown a significant decrease in weight, he has exhibited an increase in activity and improved body condition. Ronaldo, a fishing cat, has shown an increase in strength through his ability to jump higher. The animals are experiencing better animal welfare as their keepers are encouraging natural behaviors through training and exercise. By focusing on cardiovascular activity, strength, and stretching, keepers are seeing improved body condition in many animals in the Village Hall section. Incorporating simple yet effective exercise behaviors into each animal's repertoire also allows keepers to increase variety within sessions. Medical sessions and learning sessions can be broken up with quick, easy, and fun behaviors. This program has led to improved management with weight collection and welfare assessment as well. Finally, developing this program and implementing exercise in daily training sessions has been fun and rewarding for both animals and keepers.

It Takes a community to Save Species

By

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Saving any species requires any number of tools, resources and most important people to create an environment that will allow the species not only to live but to thrive. Through the years we have learned that it is not only money but the community in which these species live to support and nurture the dream of keeping species in the wild. New Zealand is a country that has been devastated by the introduction of mammals into an ecosystem which had no prior mammals except for five species of bats.* New Zealand is made up of three large islands and many smaller islands that surround it and is second only to Hawaii in its diversity (Forest and Bird 2017) . It was one of the last large land masses to be settled by people, the Maori who originated from eastern Polynesia at some time between 1250 and 1300 CE (Wilmshurst, et al. 2008). With them the first of the mammal species were introduced, the kiore, Pacific rat, *Rattus exulans,* and the kuri, Polynesian dog, *Canis pacificus* which started the first wave of predation on the various naïve species existing in New Zealand. Until the Maori arrived New Zealand was in isolation from other land masses for about 85 million years ago, breaking off of Gondwana, the supercontinent (Orbell 2003). In the 19th century Europeans began settling on the islands, bringing the biggest wave of mammals into New Zealand (Campbell et al. 2007).

Several Acclimatisation societies were created to introduce various new species as long as they were considered "innoxious" (Walrond 2017). It was not understood how bringing in various species could devastate and upset the delicate balance of the ecosystem. Although some species never established themselves too many found ideal habitats in which they have thrived. The species deliberately introduced included various mammals, such as deer, rabbits, farm animals, insect eating birds, songbirds, cats, dogs, fish and plant species. The motives were diverse, some for hope of establishing industries, some for company, transport, and food.

Over 43% of New Zealand's bird species are considered extinct, along with two species of bats, several frogs and freshwater fish, skinks, geckos. This loss is second only to Hawaii in terms of proportion of species lost (Holdaway 2007). Although humans are the largest pest species introduced into New Zealand and have caused the extinctions through deliberate or unintentional acts we can also be the saviors to the remaining flora and fauna that remain. According to government estimates pests cost New Zealand 3.2 billion dollars a year in losses and eat about 25 million birds yearly (DoC 2017; Forest and Bird 2017). To that end New Zealand has developed one of the most comprehensive and intense pest control programs we see in the world.

*Discovery of a femur and mandibles of an extinct non-flying mammal in Otago (2006), dated at 16-19 million old has changed the view of New Zealand's evolutionary history, though they had been extinct for several million years before the arrival of man. Worthy, T., et al. 2006.

The Department of Conservation (DoC 2017) was formed from several different government agencies in 1988 due to the Conservation Act 1987. DoC has full control over about 30% of New Zealand's land including offshore islands, maritime reserves, and maritime parks which gives DoC the ability to pursue predator control throughout the country. DoC has many duties which they oversee not the least of which is preservation of native species. It is not enough to restore native habitats but imperative to remove the introduced pest species that are preying on the natives. But government agencies cannot do this alone. Like most agencies there is a lack of funding and personnel to carry out all the work that needs to happen. Conservation protection has a fairly long history in this country, even when various people were bringing in invasive species: Forest and Bird was formed in 1923 in which concerned individuals were already decrying the extinction of endemic bird species. In 1971 the Environment and Conservation Organizations of Aotearoa New Zealand (ECO) was created as a non-profit umbrella group and network of around 50 member groups and individuals to promote and strengthen community environmental actions. There are hundreds of community based conservation groups that work with DoC or working independently (DoC 2017) all with the aim of restoration and biodiversity recovery. Some of these groups have a particular focus on an endangered species; one of the most well-known of these is Kiwis for Kiwi.

Pest control is neither glamorous nor fun but it is essential if we want to save species. New Zealand is one of the leaders of destroying invasive pests whether it's a mammal, bird or plant species. How do they do it? They start by educating the public; but not just adults because they start in schools. Many of us that work in the zoo field recognize that the earlier you start getting people to care about a species or habitat the more "buy in" you will get, whether it's volunteering, donations and /or voting for conservation laws. How many of us talking with the general public have mentioned invasive species and need to take a moment and explain what that means? How much easier our job would be if visitors had some basic understanding taught in schools as they are growing up. In New Zealand thousands of everyday people give up their time to head into the bush to do pest control, I believe that they do this because they have been taught how important pest control is and that they can play an important role.

This paper is not meant to be comprehensive in the total number of pest species introduced into New Zealand. Instead, it is meant to take a look at some of the major pests and the controls that have been successful in either elimination or severely cutting back their numbers and subsequent emergence of natives.

Australian brush tailed possum *Trichosurus vulpecula* were brought from Australia in 1837 to form the basis for a fur industry. Possums compete with native birds for habitat and for food, such as berries and insects. They interfere with nesting birds, eating their eggs and chicks, and spread bovine tuberculosis. They have also been documented eating kea *Nestor notabilis* on the nests along with their offspring. Adult possums weigh between 1.4 to 6.4 kilograms and can live anywhere where there is shelter and a food supply and are now found across New Zealand. Most common methods used for eradicating are trapping and the application of 1080 sodium flouroacetate, The estimated population is 70 million and they eat their way through 21,000 ton of fruit, berries, leaves not including the insects, eggs and chicks (Hutching 2015; DoC 2017; Forest and Bird 2017).

There are three rat species that have a major impact on the endemic wildlife and each has its own specialty on what they are destroying. Ship rats *Rattus rattus* do the most damage; they are good climbers

so they can access most bird nests high in trees. Norway rats *Rattus norvegicus*, and the Kiore make up the last two species of rats. Rats also bring stoats into areas by being a fodder for them. Methods used in eradicating include trapping and 1080. Rodents and other predators have been eradicated from several offshore islands which are now safe havens for many native endangered and threatened species (DoC 2017).

Stoats *Mustela erminea* were introduced in the 1880's to control rabbits and hares (which were also introduced for fur and food) are now a fierce predator of native species (DoC 2017; Forest and Bird 2017; Kiwis for Kiwi 2017). They are implicated in the extinction of some of the endemic avian species (bush wren *Xenicus longipes*, laughing owl *Sceloglaux albifacies*, and native thrush *Turnagra capensis*) (Orbell 2003; Peat 2006). They are also responsible for serious decline of many other bird species, reptiles and insects. They are the number one enemy of kiwi chick's *Apteryx sp.* devouring 90% of chicks before the age of six months (Peat, 2006; DoC 201; Kiwis for Kiwi 2017). Stoats can live in any habitat where they can find food, including beaches, farm pastures, tussock and remote high country, as well as at any altitude up and beyond the treeline, native or exotic forests, but they are less common in open country. Individual juveniles have been known to travel over seventy kilometers in two weeks. Methods used for predator control are trapping and 1080 a widely used pesticide in New Zealand.

Cats *Felis catus* and dogs *Canis lupus familiaris* have contributed another stunning blow to native species, both species being brought by European settlers for companionship and for working animals (Clifton 1967). The unfortunate side effect was to bring two more predator species that have created havoc both on the mainland and offshore islands. Cats were responsible for eliminating the North Island saddleback *Philesturnus rufusater*, pied tit *Petroica macrocephala toitoi*, tui *Prosthemadera novaeseelandiae* and red-crowned parakeet *Cyanoramphus novaezelandiae* on Cuvier Island (Merton 1972). They were also introduced to Mangere Island in the Chatham's to control rabbits and wiped out at least two species of seabirds and most forest birds by 1950 (Aikman and Miskelly 2004). A very unfortunate story that highlights the cat crisis in New Zealand is Tibbles the cat who lived a hundred years ago on Stephens Island who was brought in by the lighthouse keeper. The Stephens Island wren was a nocturnal and flightless small passerine that was said to scamper along the ground like a mouse. All we have now is 15 individuals that were prepared by a lighthouse keeper who had a keen interest in birds; all of the specimens were delivered to him by his cat. They may have been eliminated within a year but we do know that none were seen after 1899 (Galbreath and Brown 2004). It took 26 years to return the island to the pre-feline condition (1925). Free roaming cats are killed by traps and 1080 which is perfectly legal.

Dogs are a huge problem for kiwi as they can easily kill adult birds and because these are breeding birds the population declines (DoC 2017; Peat 2006; Kiwis for Kiwi 2017). In the Northland (North Island) dogs have surpassed stoats, ferrets, and cats as the main kiwi killer (DoC 2017; Peat 2006; Kiwis for Kiwi 2017). All dogs regardless of age or size are capable of crushing the delicate bodies and organs of chicks and adults. Kiwi life spans in this area are about fifteen years compared to forty to sixty years in other areas of New Zealand (DoC 2017; Peat 2006; Kiwis for Kiwi 2017). Dogs are responsible for eighty percent of all kiwi deaths in the Northland. There are two important pieces of law that recognize that dogs and kiwi (and other natives) do not mix and to help protect kiwi-the Dog Control Act 1996 and the Conservation Act Amendment 1996. The gist of the Act's is that every dog owner has to make sure that his or her animal is kept under control and does not injure, endanger or cause distress to any protected wildlife. Any dog at large is an immediate threat to kiwi may be seized or destroyed by the landowner or

Animal control officer. Local authorities are also allowed to put additional controls on dogs, such as excluding them from areas or limiting their numbers. Dogs that have been proven to kill kiwi are usually destroyed. They located some dogs by the DNA from saliva that has been found on the carcass (Kiwis for Kiwi 2015)

Twelve species of marsupials were introduced into New Zealand between 1858 and 1870 but only the brushtail opossum and wallaby's became successfully established (DoC, Clifton 1967). The wallabies were listed as "noxious" in 1956 (Noxious Animal Act 1956) and needed to be extensively controlled. A review conducted on the status and taxonomy of the species present led to the rediscovery of the Parma Wallaby *Macropus parma* (Townsend et al. 2008) thought to be extremely rare or extinct in Australia. Some were rounded up and sent back for reintroduction. It is the only non-endemic mammal species that are given protection in New Zealand.

The Himalayan tahr *Hemitragus jemlahicus* was introduced for sport (DoC 2017; Clifton 1967) and occupy a portion of the Southern Alps. Since New Zealand had no large mammal browsers their native plants were particularly vulnerable to damage from introduced mammals. Herding browsers like the tahr cause two-fold damage: firstly by eating native plants and secondly by trampling large areas of vegetation and compacting soils. They are considered a pest but at this point DoC has conceded that eradication is not feasible due to where they live. As such the management policy is to control the numbers in critical sites of high conservation value. Recreational and commercial hunters as well as DoC contribute to tahr control.

1080 (sodium monofluoroacetate) is the most widely used pesticide in New Zealand (DoC 2017; Peat 2006; Forest and Bird 2017) and is used as metabolic poison. It occurs naturally in some plants as an anti-herbivore defense but it is produced synthetically. New Zealand is the largest consumer of 1080 (DoC 2017; Forest and Bird 2017) due to the fact that except for the two species of bats still found there, they have no native land mammals that need to be protected from it. It is highly water-soluble and will break down in natural water containing living organisms such as aquatic plants or microorganisms. Research conducted by National Institute of Water and Atmospheric Research (NIWA) showed that 1080 deliberately placed in small streams for testing was undetectable after eight hours. Every time 1080 is dropped, local waterways are always tested for residual effect and have never shown contamination (DoC 2017; NIWA 2017). 1080 is biodegradable and in warm moist conditions it breaks down within two weeks. 1080 drops are used in only 5% of public conservation land in a normal year. The target species are rats and possums whose populations tend to explode during beech masts, when beech trees produce prolific amounts of seeds. These dramatic increases of rats also increase the population of stoats which feed on them (Parliamentary Commissioner for the Environment, 2011). When the seeds decline the predators then focus on native species. Research has shown that when an areas predator numbers exploded during masts and 1080 was not applied native bird species fell as a result. Since the 1970's GPS systems have been used to ensure that the bait is distributed accurately from the air and as a result the quantity of bait has dropped from 40kg per hectare to less than 2 kg. When correctly applied one aerial application can kill over 95% of possums and close to100% of rats (DoC 2017; Forest and Bird 2017). 1080 can also kill stoats that feed on dead rats that have been killed by 1080. Most operations of 1080 are done in wet winter or spring season which encourages the rapid breakdown of the baits. One research project that looked at robin *Petroica australis* and rifleman *Acanthisitta chloris* nest successes rose from

7% to 50% and the robins produce seven times more chicks. Rifleman nesting success rose from 29% to 100% after one application of 1080 (Kilner 2012; Schadewinkel, et al. 2014).

There are hundreds of conservation groups working with DoC, or working independently around the country. Their work consists of restoring native forests, coastal areas, wildlife and pest control. Although volunteers through the years have spent countless hours doing various volunteer jobs of all types what really seemed to bring out the number of community volunteers, conservation groups and iwi (social units in Maori society) was the news that their beloved icon the kiwi was in terrible shape. The news that kiwi numbers were plunging was not known and it was widely thought that they were doing okay. Although many endemic bird species were already extinct or on the verge of extinction the kiwi had somehow slipped under the wire and something needed to be done. Once it was understood that kiwi were facing an uncertain future various research projects began to happen (Peat 2006) which has resulted in a better understanding of population dynamics and distribution. Many communities besides DoC began by taking steps to eradicate pests in their neighborhoods, keeping pets under control and reestablishing kiwi populations in areas that once abounded with them. The kiwi became the flagship species for New Zealanders and every other endemic has benefited from the support given to kiwi. When working with saving species most people realize it can be difficult to arouse the public to support insects and reptiles but all species have all benefited from the massive amount of time put into saving kiwi and their habitats. Thousands of people from all walks of life spend weekends, holidays and evenings going into the bush to set up traps and re-baiting stations with DoC or various local organizations. The government and DoC freely acknowledge they can't stand alone to save their native species (DoC 2017) and volunteers make significant contributions towards threatened species programs and ecological restoration. They offer training which they can utilize either with DoC or any of many organizations that support conservation efforts.

The number of crown lands that are officially protected conservation sites are listed as: thirty conservation parks, five mainland islands, seventeen island reserves, thirty-two marine reserves, thirteen national parks, four national reserves and six wetlands (DoC 2017). These numbers do not reflect the areas under regional protection. This amounts to thirty percent of total land area. Most of this land is in high country (main lands) and has the lower biodiversity numbers, which means that in the low country where there is higher biodiversity numbers the land is held mostly by private landowners (Lane 2000). It has become essential to assist these landowners to save species and habitats. The government has emphasized the encouragement and empowerment of landowners to voluntarily protect and manage biodiversity on their land. The government does provide some direct assistance to help cover costs of protection and management (Government of New Zealand 1997), such as fencing and pest control, because this is seen as public benefit. The government created a biodiversity advisory service (DoC 2017) to raise awareness, encourage biodiversity conservation and provide advice. A fund was established to ensure that the service is the most effective and efficient way possible. It is broken down to regional areas to help ensure that the funds and advice are pertinent to the areas in which they are applied. There are many landowners that have set aside areas in their land to either maintain natural bush or to restore it to native bush. Several of these areas have also implemented pest control so that they may qualify in time to reintroduce native species such as kiwi. These are long term commitments as it may take as long as seven years to ensure the pest population is under control or eradicated. One of the most well-known of these sites is Sanctuary Mountain Maungatautari located on the North Island. Although designated as a reserve in 1912 not much was done in the way of protection. A private trust was formed in the early

2000's by the surrounding private landowners to undertake fencing the entire mountain. In 2004 the fence was completed mostly by volunteers and is the longest pest proof fence in the world (Sanctuary Mountain Maungatautari 2017), excluding all mammalian pests (except mice), pets and livestock from getting over, under or through it. Fourteen mammalian species have been totally eradicated 270 km of tracking lines have been developed to create an intensive network of 2,700 monitoring tunnels which are regularly inspected by volunteers. Kiwi have been so successful in breeding there (after 100 years of absence) that offspring are now taken to other areas for reintroduction. There have been many species of birds that have successfully bred since the fence went up (Sanctuary Mountain Maungatautari website 2017) but a couple of surprising discoveries merit mention; one is that eleven Hochstetter's frogs *Leiopelma hochstetteri* in 2004 showed up, and a Pacific gecko *Hoplodactylus pacificus* was found inside the fence, the first gecko seen in over thirty years.

Predator Free 2050 (PF 2050)

A new government initiative was introduced in the fall of 2016 that states the goal of ridding New Zealand of possums, rats and stoats by 2050. A direct quote from DoC: "It will require new techniques and coordinated team effort across communities, iwi and the public and private sectors. Predator Free 2050 will deliver huge benefits across New Zealand-for the social and cultural links with our environment, for our regional economies through primary industries and tourism and for our threatened native species." (DoC 2017)

The government of New Zealand believes this will be possible due to the tens of thousands of already committed community volunteers and private landowners who are working on habitat protection. With the established community-led initiatives, including fence sanctuaries, large-scale predator control projects from National parks to whole suburbs that exclude pet ownership it is easy to see why being Pest Free is a possibility. Although there have been major new developments in predator control techniques, such as self-resetting traps and predator specific toxins, DoC admits they do not currently have the technology to achieve predator free status at this time. But by providing a focus and funding on developing breakthrough control tools and techniques and forging the networks needed they believe they can make this vision a reality. DoC has already demonstrated their expertise by having cleared all predators from more than one hundred islands and are currently undertaking trials to secure mainland islands The government has given PF 2050 a jump start and showed its commitment with an additional $28 million over four years and $7 million per year thereafter (Office of the Minster of Conservation 2016). This is on top of over $70 million already spent each year on predator control (Office of the Minster of Conservation 2016). This is also beyond what the government and individuals already spend on individual conservation programs such as $11.2 million investment from the government for four years starting in 2015 just for kiwi programs (Office of the Minster of Conservation 2016). An individual trust was set up in 2013 called Predator Free NZ, which is not a government agency but caring private citizens who have a vision of protecting their native species and to see them thrive. With the New Zealand government's announcement last year of being Predator Free in 2050, the ground swell support for destroying invasive species has become a united country effort from individuals, private trusts, landowners, zoos, corporations, schools and iwi all playing an important part.

Governments don't save species but people do.

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The Great Escape!

Rocky Mountain Goats Climbing Beyond Barriers

Patty Wallace (Lead Animal Keeper-Aquatics)

Cheyenne Mountain Zoo

In the fall of 2014, the renovation of our existing Rocky Mountain goat (RMG) barn was completed with the addition of a new side yard. The new additions included fencing around an existing concrete retaining wall for containment and a pergola structure at the front of the enclosure, as well as a training space for shows. The animal keepers for RMGs were asked to brainstorm ideas for a natural behavior show. The show would be a time for guests to not just see our goats, but to experience them in new ways—helping them to fall in love with a species that was close to their home. As part of this brainstorming two behaviors emerged; climbing on a ledge to demonstrate their amazing balancing skills and climbing onto the roof of the pergola, where they would be standing directly over guests' heads. Both of these behaviors are currently demonstrated to our guests in a daily show (weather permitting).

This paper will outline the process Cheyenne Mountain Zoo staff went through to successfully train these behaviors from start to finish, including antecedent arrangements, barriers we faced and overcame, lessons learned, and how these amazing animals' lives have been enriched and enhanced since the implementation of our Rocky Mountain goat training program.

In the fall of 2014, renovations to our existing RMG barn and yard were completed with the addition of a new side yard. This side yard was built with the intent to be an enrichment yard and potentially a yard for future kids. It was built against an existing concrete retaining wall and we thought it would be great to use this wall in a way that would demonstrate what a goat might look like climbing on the cliffs of their natural habitat. But why stop there? In the plans, a pergola structure was built for shade purposes but we wanted to make use of this structure in a creative way as well. "Let's get a goat on the roof!" No one is quite sure who to credit for this brilliant phrase, but as it goes with so many things, we were determined to make it happen.

Once construction was completed in the yard, all that remained was to construct a climbing wall and design some platforms over the pergola. This project was completed by our Animal Behavior Programs Manager (ABPM), Jeremy Dillion, with the help of our "Project Guy" and fellow Animal Keeper Anthony Nelson. They very carefully attached 4"x6" wooden beams of varying lengths and ranging from 1'-3' apart along the retaining wall, an angled platform in the corner between the wall and the barn, and placed a 2'x2' platform at the end that a goat could easily turn around on. We call this section "the wall". They used the same platform design and attached four of these platforms to the top of the pergola. The final platform was placed directly over the head of the trainer, giving our Zoo guests an amazing, up close perspective and unique photo opportunity. The next step was to construct a ramp that would allow the goats to access these platforms. As part of the exhibit landscaping, several boulders were placed just to the north of the pergola and could be utilized to support the ramp. The ramp was built and attached to the pergola with hinges so it can be dropped when animals are in the yard unsupervised. This part of the plan was now complete and we could start training goats in their new yard.

At the onset of this project we were paired with fellow animal keeper Rick Hester from our Training Mentor Program. Rick's role as a mentor was to come down and observe/coach training sessions. With his extensive training knowledge and background and his dedication to our animals Rick played a major role in this process. We spent many hours talking through training plans, problem solving and trying new things, all with the common goal of sharing information and learning from each other.

Our herd at the time consisted of 1.2 Rocky Mountain Goats, none of which had any prior formal training. We decided to start our training with the two youngest goats, Honovi and Yahzi, since they had been hand reared and we already established a positive relationship with them. The easy part was getting them to come close to us; the hard part was getting them to take food from our hands. As it turns out, those two goats were not interested in receiving food this way. We tried several different types of produce, hay cubes, fresh cut grass, browse, wheatgrass, even dandelions. They would not eat any of it. Somewhere along the way, Honovi and Yazhi decided that carrots and apples were pretty good and would take them from our hands, throw in some sweet feed and it was a recipe for success; this was the first victory in a project that was full of trial and error. We also found that during the summer months, motivation in the hot afternoon sun was lacking and even shifting was a struggle. Since we can't control the weather, we decided to adjust our training schedule. We chose to only train in the mornings when it is cooler, and we noticed the goats were more likely to train. We officially established 10:30 am as RMG training time and to this day, it is fixed into our schedule and weather permitting so is the RMG show.

Before we could let the goats into their new yard, more landscaping had to be completed. This included planting new grass and trees. While these improvements were aesthetically pleasing, they posed a challenge to trainers in the form of competing reinforcers. Carrots and apples couldn't always compete with fresh grass and a new environment. One solution we came up with was to give the goats access to the new yard to explore for at least 30 minutes before a training session. This allowed them to exhaust some of those competing reinforcers.

Now that we had created some motivation and laid some ground work for training sessions, we could start with the show behaviors. Yazhi showed more motivation by being the first one willing to shift over to the yard, so we started her on the wall first. The first ramp was well within the climbing capabilities of a RMG, but she refused to make the jump from the ground, so we adjusted our antecedents. We simply added a stump to the foot of the platform. Trial and error was key as the first stump was not quite tall enough and had to be adjusted twice more before she was comfortable enough to explore the ramp. However, we just couldn't get her to place her back feet on the ramp, and if she slipped at all she would jump down. After several sessions with no progress, we re-evaluated our ramp and platforms and agreed that if we extended these by a few inches maybe it would set her up for success and she would be more likely to reach the end. As it turns out, we were right. The platforms were adjusted from 6" to 10" and Yazhi was up on the wall. We decided to use a prompting strategy that included targeting and baiting to get her to walk along the platforms. The fence that was built on top of the retaining wall was 4"x4" steel mesh so she could see us walking next to her and we were able to reinforce by handing her food directly for more than half the distance to the final platform.

Another example of proper antecedent arrangement came when it was time for Yazhi to round the corner. The platform adjustments were good and Yazhi had no problems with the straightaway. When she got to the corner beam she lost all confidence and would jump off. The angle of the beam attached to each wall gave her little area to land on. We made a larger platform in the corner providing adequate landing space allowing Yazhi to confidently make the turn. Once this challenge was successfully worked out, we used our extendable target pole with a cup taped to the end to bait the final platform. Yazhi successfully completed the wall behavior, but we still had several hurdles to overcome before it would be

considered “show ready.” We’ve learned from past experiences with other animals that prompts can be both a blessing and a curse. They are a great way to get a behavior to occur but if they are not faded quickly they become part of the cue and can be difficult to get rid of. In the process of getting her to use the ramp system, we had been prompting her with our bodies by walking along the fence. It had become part of the cue as evidenced by her unwillingness to do the behavior without one of us there. Fading this body prompt was one of the biggest challenges we faced but with a lot of patience we were able to do just that. We took a few steps back in the behavior and started with one trainer at the bottom training panel to give the cue and the other along the wall. By using small approximations and moving the second trainer further out of view until eventually they were able to stay hidden in a keeper area; Yazhi now solely relies on her trainer for that information. Because the 2’x2’ platform at the end was a little crowded with a goat and a pile of produce, we placed a bracket on the wall just to the right of the platform that would hold a bowl and could be used for remote reinforcement. Practice makes perfect and Yazhi does this behavior during the show reliably and confidently and amazes guests with her energy and grace.

When we started training the pergola behavior, we had to realize there was the real possibility of creating a code green (our facility’s code for an animal being out of their enclosure) and we had to talk about safety. We took many precautions, including having tools ready, talking with other staff members about the best way to react if one of the goats decided to jump off the roof, and starting earlier in the day before the zoo was busy with guests. We also made sure to make a radio announcement to all animal units when we were starting the process for the day so they knew to be ready in case this happened. Another question that we needed to answer was if we were going to let our adult male (Honovi) make the climb. He was much larger than the females and we weren’t sure how he would react to people in a code green situation. We decided to take the risk, and both Honovi and Yazhi began the training process. We had to look back on the lessons we learned from the wall behavior and adjust our antecedents again. This time, the ramp was just too steep so we asked our horticulture department to help us problem solve. We landed on a plan to utilize natural logs to extend the climbing structure and make the angle for the ramp less severe. We cut notches out of the log that would allow for better traction and reduce the possibility of slipping thereby increasing the chances for success.

Training the pergola behavior was a two person job and our ABPM Jeremy Dillion was happy to help. He decided to take the primary trainer position for Yazhi and I took on that role with Honovi. We trained both goats 5 days a week working it into our daily routine and making it available for guests to watch the process if they chose. We started by leaving the ramp down and gave them free access to the yard with lots of treats on the “stairs” of the log to get them accustomed to the first section. Once they were both seen ascending the log on their own, we faded out the baits and began prompting the behavior with a target stick. We did this through the use of an extendable target pole with a cup very artfully duct taped to the end. One trainer was up front at the training panel and the other was along the wall using the target pole. We took advantage of their history with target training and used small approximations to move them farther away from us. The cup on the end was a useful tool to deliver reinforcers immediately when they reached the target. By doing this we were able to lead them up the log and deliver carrots, apples, and sweet feed all along the way. Sounds simple, but using a 25’ target pole is hard and really awkward and challenging. As the saying goes “What goes up, must come down”, at first they both jumped off the end of the log and onto the boulder pile that was about 3 feet below. This posed a problem since we didn’t want them to get used to jumping off; (that would not be an option once they got to the top), they had to be able to turn around. The target pole was deployed again and they had no problem turning around on the log. Repetition builds confidence and soon we had both goats up and down the log and back over to the training panel for high magnitude reinforcers. Our next step was to put the ramp in place and target them up towards the top. The original ramp was a structure that was designed by Jeremy

and built and mounted by our maintenance staff. It was approximately 18" wide with 1"x2" boards placed horizontally so the goats would have some foot holds. Trial and error came into play again as we soon learned that if they slipped at all on the boards, they would lose confidence and bail off to the safety of the boulder pile. Our solution was to replace these smaller boards with pieces of logs that still had the bark attached and place them closer together resulting in a ramp that gave them plenty of traction. We taught them to go to the top of the ramp, turn around and go back down to the training panel.

Teaching the goats to get onto the first platform on the pergola was our next step. We had learned by now that if we make things easier it will more likely occur. We added another, smaller platform that bridged the gap between the top of the ramp and the first platform and we had a goat on a roof! Yazhi was the first to get there and she looked so great, but, we weren't done yet. We still had three more platforms to go, no, make that six, as we made more adjustments to the structure based on the goats' behavior and willingness to keep going. We learned a hard lesson as we were training Yazhi one day. She actually made it to the second platform and then as we brought the target pole up through one of the gaps in the pergola to prompt her to keep going, the pole startled her and she jumped from the roof. Thankfully, she jumped into the exhibit and was not hurt but we made sure from that point on they could always see the target pole coming. Once these adjustments were made it took about three additional sessions to get the goats all the way to the final platform. We couldn't depend on having a second trainer there to reinforce with the extend-a-cup so we used another version with a bowl that the primary trainer could hold up for the goat to eat out of once they had all four feet at the final spot. There was something special about seeing a Rocky Mountain goat above your head against the background of blue sky. They had done all that we asked but it was not quite "show ready" yet, we still had to get them down and fade the prompt. Getting them down was easy, we utilized the target pole to get them turned around and headed back down the way they went up. We taught them that by doing such a high energy behavior their reinforcer for coming back to the training panel was huge.

The next step in making this a "show ready" behavior was to get rid of that awkward target pole. It was almost as if they told us they didn't need it anymore. Trying to maneuver a 25 foot pole around trees and climb up a ladder with it took some time and it wasn't long before they were going up so fast that we couldn't keep up with them. We simply presented the bowl at the end to deliver reinforcers once the behavior was complete. Peak show season was now upon us and we had two of the three RMGs prepared to show off some of their natural behaviors for guests. Honovi never did the wall behavior but he was really good at a few husbandry behaviors and when he would climb to the pergola at 250 pounds, he was always a fan favorite. Yazhi does not hold still for long so husbandry behaviors, at first, were a little harder for her but she sure liked the remote behaviors. She would offer them without being cued, and do them multiple times but we wanted to know: does she actually know the cues? We put her to the test by making sure the two cues were distinct from one another. One of the antecedents for the wall was that she always began on the left side of the training panel. The trainer would give the verbal cue "up" and side step to the left and out of her line of vision. When asking for the pergola behavior, the trainer made sure Yazhi was facing towards the right side of the training panel and then give the verbal cue "climb" sidestep to the right, grab the pre-loaded extend-a-pole, step back and raise their right arm. We started tracking how often she gave the correct response to each cue. If she was successful with the given order multiple times we would cue the other behavior. The evidence suggested that she was learning the order rather than the cues. She would start to be 100% correct after multiple trials of a given order but would offer the incorrect behavior if the order was changed. We ultimately relied upon a specific order in the show to get reliable behavior and follow a concept taught to us by Steve Martin; Start big end bigger.

Since we implemented the training program with the Rocky Mountain goats at Cheyenne Mountain Zoo, we have made significant changes in our management techniques and noticed an increase in all around quality of life. Previously, keepers had minimal interaction with the goats, if we needed them in the barn, we baited them in. If we wanted them out of the barn, we went in with a tool and chased them out. Their outdoor exhibit got cleaned only when we could opportunistically lock them all in the barn. Enrichment was very seldom and it was typically food related. Enrichment is now a daily occurrence and we have found that they will interact with many items. When we began training, we started with Yahzi and Honovi, the two goats that we already had established relationships with. Once all of the antecedents were in order, and we had proven success, we started training with our third goat, Twinkie. Fellow Aquatics Keeper Courtney Knapp was excited for the opportunity to be her primary trainer and soon we had Twinkie (a goat who was formerly labeled as “scary”, “mean” and “skittish”) doing show and husbandry behaviors. Not only do Rocky Mountain goats participate in a natural behavior show every day but all three are now hand injection trained and we are working on desensitizing them to tactile stimulation so we can help them with their annual molt. As a team, we also have a goal of being able to do hoof care without sedation or restraint. Through the process of positive reinforcement training, they are now some of the most reliable shifters in our area and will come into the barn together daily to allow keepers to clean their exhibit and place enrichment in their yard. Gone are the days of chasing goats around with a rake, darting them for vaccinations and wishing they would cooperate.

Hornbill Nest Box Checks While Keeping Your Fingers: Keeper Friendly Nest Box Design

By

Alexa Jansen, Birds Keeper I

Zoo Atlanta

Atlanta, Georgia

Introduction

Zoo Atlanta has two hornbill species under the care of the Bird Department: southern ground hornbills *(Bucorvus leadbeateri)* and wreathed hornbills *(Rhyticeros undulatus)*. Our former wreathed hornbill pair successfully hatched and reared multiple chicks. Our southern ground hornbills have incubated several eggs and have hatched one chick, but were unable to successfully rear it. Since implementing the use of these boxes bird staff has been able to monitor egg development in both these species, and in case of the wreathed hornbills have been able to monitor developing chicks as well.

While our nest boxes for both species are similar, different husbandry issues necessitated their design. Our ground hornbill nest box was designed because both hornbills at Zoo Atlanta are extremely aggressive, especially during breeding season. Our female's aggression towards keepers poses risk of egg damage during nest checks. Direct aggression to keepers was also something we wanted to minimize. The wreathed hornbill nest box came about because our pair had, on several occasions, hatched more than one chick in a clutch with only the oldest chick surviving. The main goal of that nest box was to facilitate the raising of two chicks simultaneously. One chick would be raised by female parent, the second chick by hand in the adjacent chamber, with the potential to switch out the chick under the female periodically.

Methods

The wreathed hornbill nest box was designed in 2011 by the Curator of Birds, James Ballance. The box is located in their holding building with the box positioned to allow the birds access from within the building and from the exhibit. The box is constructed of 2cm (3/4") plywood. The nest box features two adjacent chambers with a 1.2cm x 2.5 cm (½" x 1") mesh shift door between them (Fig. 1). Each chamber has a double layer keeper door; the solid outer door opens to an inner meshed door of 5cm x 5cm (2" x 2") weld mesh which allows the keeper to safely view parent and chick (Fig. 2). The inner mesh door can also be opened to allow the keeper to access the parent and eggs or chicks. The birds have a diamond shaped entrance to the nest box at the end of the box facing the exhibit that is approximately 15 cm wide by 33 cm high (6" x 13") (Fig. 3). This shape and the dimensions allow the pair to seal the entrance quickly. Vent holes were added at the top edge of the box to allow heat to escape, though these became unnecessary when air conditioning was installed in the building. The primary reason for designing a double chambered box was to allow keepers to hand-raise a chick adjacent to the female with another chick. Since the box was built, our elderly female has not produced two viable eggs and may now be post-reproductive as of this year. Despite this, we still believe the design has validity and would work as intended. Please note that the diagonal corner of the nest box was needed to fit our building, but for others it would be irrelevant to the design.

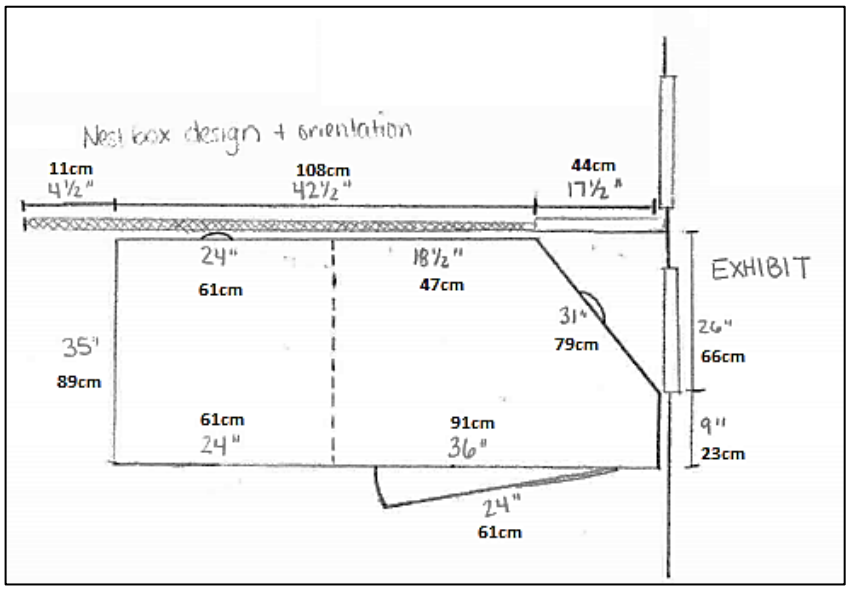

Figure 1. Top view of wreathed hornbill nest box blueprints.

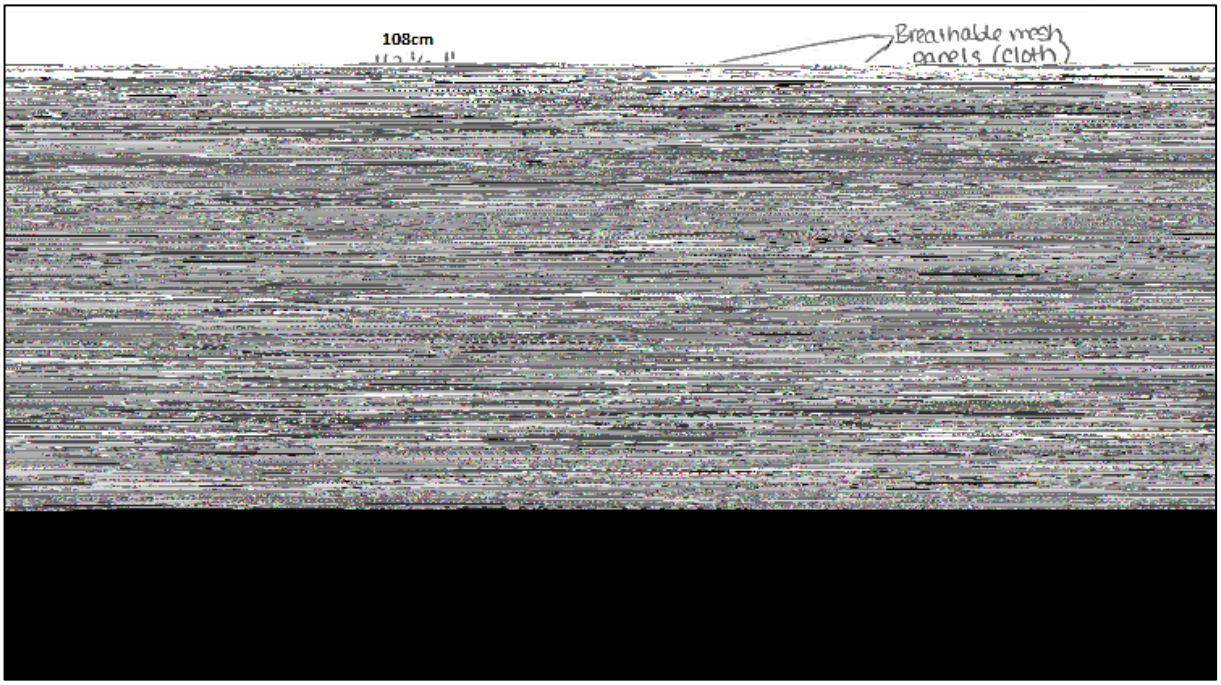

Figure 2. Side view of wreathed hornbill nest box blueprints with detailed view of double access door.

Figure 3. Front panel of wreathed hornbill nest box with bird entry point.

This design has been in use with the Wreathed hornbills since 2012 and during that time, they have hatched and reared multiple chicks. The pair is initially only given access to the front chamber via the entrance hole.

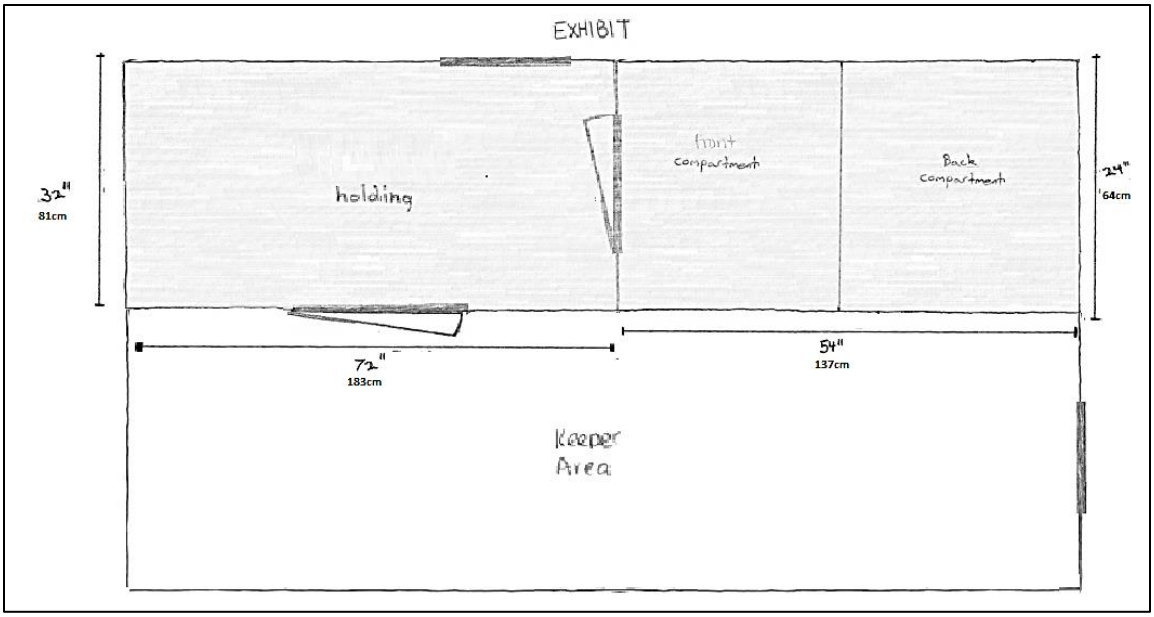

Figure 4. Top view of southern ground hornbill nest box and inside holding. Not to scale.

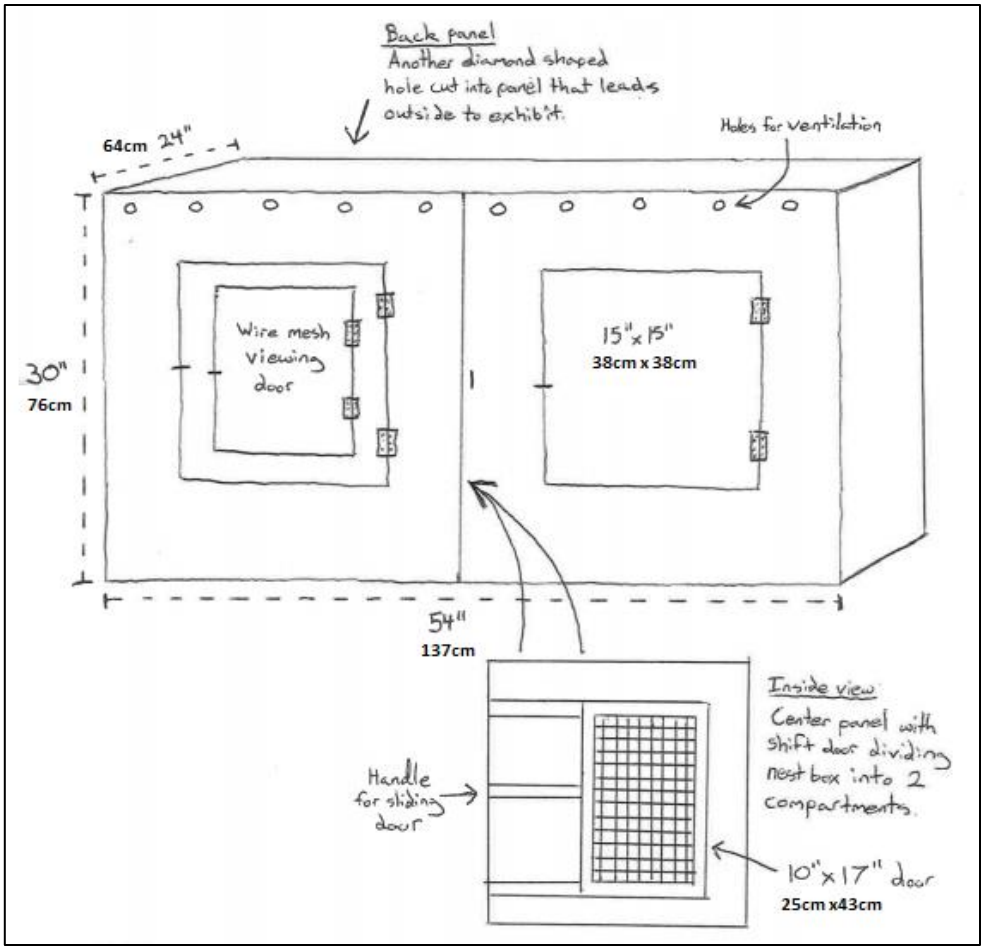

Figure 5. Southern ground hornbill nest box blueprints, side view.

Both birds have access to the nest box, as it is a part of their inside holding when not in breeding season. Once the female has laid, she is locked inside with full access to both chambers and the holding space. Diet is split and while the majority is fed on exhibit, a portion is fed inside for the female. The male is able to feed her through a pophole that connects the exhibit and the front chamber of the nest box. Our female is conditioned to shift off her egg into the outer chamber for nest checks. Her motivation to shift is primarily her to aggress toward the keeper. This allows us to monitor egg development and make any adjustments needed, such as adding substrate or adding humidity to the nest substrate. Our hornbill has successfully laid and incubated several times and as of this season hatched a chick though she has yet to rear one.

Results

Both hornbill species have used their nest boxes for multiple breeding seasons. The design has been successful in that the birds use the boxes as anticipated and keepers are able to safely maneuver around the birds to monitor egg and chick health and development. Keepers are able to work with the Southern ground hornbills while decreasing instances of aggression and lowering risk to the egg. This design has also allowed keepers to make adjustments as necessary during incubation such as manually increasing humidity or adding substrate under the egg.

Discussion

While the nest box designs have been largely successful, there are a few changes that would potentially be beneficial. Currently, neither box has a nest camera though they can be used when available. One possible improvement for the Ground hornbill nest box would be adding a small peephole in the back chamber so keepers could view the chamber without shifting the bird. These somewhat elaborate nest boxes may not be necessary with non-aggressive individuals who allow keepers to access their nests without incident, but for those of us working with less cooperative individuals these boxes have saved a lot of crushed fingers and potentially damaged eggs as well as allowing access without having to handle the parent birds.

Acknowledgements I would like to thank Zoo Atlanta for making this presentation possible through their support and funding. I would also like to thank my curator, James Ballance, and my lead keeper, Christine Talleda for their support and guidance in this process.

Connecting Keepers to Collective Knowledge:
The Digitization of *Animal Keepers' Forum* and the Promise of Open Access to Zoological Scholarly Communication

By

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Abstract

Animal Keepers' Forum (AKF) has been continually published for over 40 years, providing vital communication about best practices and research, as well as births and hatchings, to the zoological community. As a publication dating to 1974, accessing back issues of AKF has been primarily achieved through the print holdings of fewer than 30 libraries world-wide (only 3 outside of the United States – 2 in Europe and 1 in Australia). Pertinent and timely information about animal behavior, nutrition, and health, enrichment techniques, as well as the history of zoological organizations, personal career paths, and professional practice have been inaccessible to many.

AAZK has given permission for this title to be digitized and added to the Biodiversity Heritage Library (BHL), an online open access digital library supported by a global consortium. Inclusion in BHL provides numerous research possibilities, including a number of download formats and methods, as well as full-text and scientific name search capabilities, while also incorporating AKF into the larger scientific discourse on biodiversity, conservation, and related research.

This paper will discuss the importance of AKF to the zoological and biodiversity communities, the access limitations of the print holdings of AKF, and the research value of providing open access to AKF in BHL specifically, with its value-add tools and services. The paper will also discuss the use cases for digital access to AKF and the expected resulting impact on information seeking behavior. It will also explore areas of future work for supporting the research needs of zoological professionals world-wide.

Animal Keepers' Forum **as Research Content**

Published by the American Association of Zoo Keepers (AAZK), *Animal Keepers' Forum* (AKF) has been continually published for over 40 years. This publication has long served as an important communication tool among zoological organizations and animal care professionals, especially before the advent of electronic communications. AKF serves as an important vehicle

for sharing pertinent and timely information about animal behavior, nutrition and health, enrichment techniques, as well as the history of zoological organizations, personal career paths, and professional practice. Today, the back issues of AKF serve as both a historical record of these trends and activities, and a valuable source of information about the husbandry of the animals in zoo collections. Some species are so unique that information about their care is hard to find and AKF might be one of the only sources for this material.

Until 2017, access to the information contained in AKF was primarily achieved through consulting the print issues. AAZK estimates AKF "reaches about 2,800 members in the US, Canada and 24 foreign countries" (https://www.aazk.org/animal-keepers-forum). Access to recent electronic articles is only available to individuals with a membership, while back issues are restricted to the collections of individual members who chose to keep the copies of AKF that they received over time, or, more often, dependent upon the holdings of various collecting libraries worldwide.

One tool for determining which libraries hold copies of a publication such as AKF is WorldCat.org (known as WorldCat or OCLC). Libraries worldwide upload their catalogs to OCLC as a collaborative effort towards easing resource sharing through interlibrary loan services through the WorldCat service. In the case of AKF, held under OCLC number 647999504 (http://www.worldcat.org/title/animal-keepers-forum/oclc/647999504), WorldCat indicates that fewer than thirty libraries world-wide have issues of AKF in their collections. See Appendix A for a chart with the data from WorldCat and the listed libraries' catalogs at the time of writing.

It is important to note that many small libraries, including most zoo libraries, are not able to participate in OCLC due to limited resources. As a result, those holdings are not reflected. For example, the authors know that the San Diego Zoo Global Library has nearly complete holdings of AKF, but they are not listed under the AKF record in WorldCat. Additionally, WorldCat is dominated by North American libraries, so libraries from other continents are not as well represented. In this case, only three libraries outside of the United States – two in Europe and one in Australia – have any holdings of AKF listed in WorldCat, though there are likely more.

However, WorldCat is often a first-stop for library workers and users, and represents a fair sense of the ease of discoverability for a user who did not have a physical library collection at their disposal. It also serves as a sample of what the state of these collections might look like, insofar as completeness. Of the twenty-seven libraries indicated as holding AKF in WorldCat, nine have unconfirmed holdings (information about the volumes and issues held at these libraries were not readily available at the time of writing – this could mean anything from a full set of AKF at that library, to no holdings at all as a result of a data error). Of the eighteen libraries in WorldCat with confirmed holdings, all but one of them are missing volumes and issues. Only the Smithsonian Libraries (SIL) is both listed in WorldCat and has an easily discoverable, complete set of this periodical.

Recognizing the utility of AKF to the international zoological communities, the promise of open access and digital tools for furthering research, and the uniqueness of the AKF collection at the Smithsonian Libraries, the authors coordinated communications between AAZK and the Biodiversity Heritage Library (BHL) to explore the possibility of digitizing this valuable collection.

AKF in the Biodiversity Heritage Library

The zoological community has historically recognized the research value of access to information, and remains committed to this principle. This commitment is codified in AZA Accreditation Standards and Related Policies (2017):

> *4.2.4 Institutions should provide paid and unpaid staff access to informational resources with the goal of supporting excellence in programs, animal management, and exhibits. These resources may include a facility library, access to an offsite library or electronic access to internet resources. (*https://www.aza.org/assets/2332/aza-accreditation-standards.pdf)

It follows, then, that AAZK was a very willing partner in the effort to provide open access to the large body of knowledge within the AKF. Digitization allows these resources to be more readily available to individuals and zoological organizations that are not able to participate in interlibrary loan services. The full content of AKF is now accessible and discoverable on the open web, where it is likely to reach a larger audience.

Digitization of materials like the AKF allow researchers to access the digital images of each page of the book, but also to the full text of the pages. The individual words are made searchable through Optical Character Recognition (OCR), which algorithmically recognizes letters and puts together word strings for search purposes.

By partnering with the Biodiversity Heritage Library (BHL), AAZK was able to take advantage of BHL's over ten years of leading digital library experience and infrastructure, and leverage the existing relationships and workflows of the Smithsonian Libraries (SIL). SIL is a Founding Member Library of the BHL.

> *"The Biodiversity Heritage Library (BHL) is a consortium of natural history and botanical libraries that cooperate to digitize the legacy literature of biodiversity held in their collections and to make that literature available for open access and responsible use as a part of a global "biodiversity commons." The BHL consortium works with the international taxonomic community, rights holders, and other interested parties to ensure that this biodiversity heritage is made available to a global audience through open access principles. In partnership with the Internet Archive and through local digitization efforts, the BHL has digitized millions of pages of taxonomic literature, representing over 120,000 titles and over 200,000 volumes."* (http://biodivlib.wikispaces.com/About)

The BHL consortium boasts a truly global membership, with 18 Member libraries, 18 Affiliate libraries, and over 60 world-wide Partners on every continent (except Antarctica).

The BHL website has been viewed by visitors from 243 countries and territories world-wide, and averages nearly 200,000 unique visits each month, with over 12 million visits to the website to date. It boasts over 52 million pages of content. Additionally, the BHL has a strong commitment to open access materials and is committed to digitizing material that would otherwise be in-

copyright and legally impossible to digitize without permission. Over 600 in-copyright titles have been licensed for digitization and access through the BHL, from over 200 individual licensors. AAZK's AKF joins that number, and is now available in the BHL from v.1 to Present with a 2 year embargo period. Smithsonian Libraries will continue to add the next issues to the BHL each year, on its title record in the BHL: www.biodiversitylibrary.org/bibliography/125504.

The BHL interface offers more than just image hosting and discoverability for the AKF. The AKF is fully indexed in BHL using Global Names Architecture's Global Names Recognition and Discovery (GNRD), a taxonomic name recognition algorithm, which makes it possible to search across the BHL's holdings for a specific species. Over 176 million instances of taxonomic names have been identified in the pages of material on the BHL in this manner. Bibliographies are pre-populated using these scientific names, providing a unique research tool. This bibliography is also hosted on the Encyclopedia of Life, for each corresponding name. This Scientific Name search is one of the most powerful value-add options that BHL provides, and by having AKF within the BHL, its content now appears in these bibliographies, providing another avenue for discovery by new users, perhaps from different research areas.

Appendix B is a Quick Start Guide to using AKF in BHL that was created for training users at the Smithsonian's National Zoological Park and the Smithsonian Conservation Biology Institute as part of Smithsonian Libraries' digitization of AKF for the BHL. It covers the use of the Scientific Name search function, how to search the full-text of individual issues ("items"), how to download entire issues, and how to download specific pages as a PDF (for example, only one specific article or page). BHL also offers a host of informational guides on searching and downloading in BHL at http://biodivlib.wikispaces.com/Help.

By digitizing AKF and making it available to anyone worldwide, AAZK has opened the periodical to new researchers, and created opportunities for new research. For example, scholars can now search across the periodical for particular creatures, species, people, or places. And the knowledge within AKF is now available to anyone, allowing the best practices and lessons learned, this collective knowledge of zoo keepers, to be accessed without barrier to anyone. This will hopefully support capacity and knowledge building in institutions that have suffered from limited resources over time.

Preliminary analysis of the use of the digital copies of AKF show that they are already being discovered. The first issues of AKF began appearing online in early February 2017, so this analysis only accounts for a few months of usage. At the time of writing, the Internet Archive showed that individual issues and volumes from AKF had been downloaded between 8 and 169 times each, for a total of 5,621 downloads. BHL's instance of Google Analytics indicates that AKF has been viewed mostly in the United States thus far, but at this early date, it has also seen usage in the Netherlands, Paraguay, Australia, Switzerland, and Colombia. In the US, usage has been seen in 18 states and the District of Columbia. By viewing the service providers that some users display, we can see that AKF has been used on-site by at least two specific zoos and a veterinary association, as well as at the Smithsonian.

Future Work

As AKF has only been available on BHL for a few months, it is too early to fully measure the results of having the back issues of this periodical available in an open access format. By looking at the online usage data again at a later date, we will be able to see if the rate of discovery is changing, and if the reach appears to be expanding geographically. An additional interesting measure would be to see if older issues of AKF are cited in articles more frequently after they became available online, though this would require a deeper analysis. Anecdotal, qualitative evidence such as testimonials from users, may also indicate the impact of this project.

Despite the major benefits to having AKF digitally available in BHL, there is still one enhancement that would make a major difference for users: article level metadata. Essentially, BHL (and most digital libraries) offer two extremes of metadata granularity: one is providing access to the periodical title level and the individual volume level, and the other is the full-text OCR (letters/words) level. BHL goes an extra step, one level up from letters and words to scientific name recognition, which provides a controlled vocabulary upon which to search and sort as well. The missing level of indexing is an access point for each title and author for each *article* within a volume. Article titles and authors are the most common way that researchers search for and cite literature.

By default, items in BHL are described at the periodical title and volume level using the same bibliographic metadata that libraries use to describe items in their catalogs. As a result, AKF is described with its title and with each volume numbered. This means that searching for the title, author(s), or subject(s) of an article in AKF would not yield the desired result in the BHL today.

It is possible to remedy this: BHL staff (and staff members of BHL Partner libraries) can provide additional metadata manually. However, this article level information must be first *created*, and then manually applied to each volume. This process can be very time consuming. Additionally, this process can become complicated in the case of a periodical like AKF where the publication has a wide variety of content segments rather than just traditional ‘articles’ (for example, announcements). Once what warrants a new segment is determined the creation of the segment metadata (often called ‘article-ization’ for journals) is done. As BHL has no central staff for this kind of bibliographic work and with thousands of titles to go through, this approach does not scale easily. A future project is being planned to test a crowdsourced project to create article metadata for AKF by rallying the zoo and zoo librarian community to offer expertise and time.

And AKF is hopefully only the beginning of open access to publications related to zookeeping and its allied fields. Providing additional titles online in an open access format makes it possible for professionals to leverage the best possible research and care in the field, by supporting information sharing and exchange, world-wide. If additional relevant in-copyright titles are not just made open access, but also added to the BHL alongside AKF, animal care professionals can turn to one portal for much of the information they might need for their research, and have access to the same tools and indexing features available through the BHL interface.

Expanding the consortial membership of the BHL is part of this effort as well. While BHL has a large number of Partner Libraries, few of them have materials related to zoo keeping. With the Smithsonian Libraries as a Founding Member of the BHL, the consortium started with a zoo library, but has not yet been able to expand Institutional Membership in that subject area. If other prominent zoo libraries were to become Affiliates or Members of the BHL, it would be possible to digitize relevant out-of-copyright literature from the holdings of additional libraries. Institutional Membership inquiries and suggestions for the addition of specific titles (in or out of copyright) are encouraged, and can be made via the BHL's Feedback Page (http://www.biodiversitylibrary.org/contact).

While BHL's primary audience is scientific taxonomists, it serves many diverse audiences, including researchers, educators, students, and artists. Zookeepers and their colleagues are implied as part of many of these groupings, but they are not specifically targeted. More outreach to these communities of practice could have impacts on the speed of information sharing and knowledge creation within their fields. Providing (or providing connections to) the tools, services, and content that might best support the work of researchers is part of the library community's role in the research process However, the best advocates for access to new sources of information or new services and tools are fellow community members. Users of the AKF or other titles in the BHL can help colleagues and students become aware of this resource, and help to guide others in how to best leverage the tools that it provides (rather than relying on librarians alone). BHL helps with this by providing Promotional Materials on its wiki (http://biodivlib.wikispaces.com/Promotional+Materials), which can be used for this purpose.

Appendix A: OCLC WorldCat Holdings for *Animal Keepers' Forum*

Library/Institution Name	Volumes/Issues held (OCLC 647999504 in WorldCat)
Smithsonian Libraries (National Zoological Park Library)	All volumes and issues
National Agricultural Library	v.8-40 [issues missing]
Delaware Valley University (Joseph Krauskopf Memorial Library)	Unconfirmed holdings
Wildlife Conservation Society Library (Bronx Zoo Library)	v.6:no.8 to present
SUNY College of Technology at Alfred (Hinkle Memorial Library)	Unconfirmed holdings
North Carolina State University (NCSU Libraries)	v.3:no.5 to present [issues missing]
Davidson County Community College Library	Unconfirmed holdings
Niagara County Community College (Henrietta G. Lewis Library; NCCC Library)	Unconfirmed holdings
Ohio State University Libraries	v.8-11; v.18 to present [issues missing]
Jefferson Community College (Jefferson Community College Library)	Unconfirmed holdings
Michigan State University Libraries (Main Library)	v.14+
Portage Public School	Unconfirmed holdings
Unity College, Dorothy W. Quimby Library (Quimby Library)	v.6, v.10, v.12 to present [issues missing]
John G Shedd Aquarium Library	v.15 to present [issues missing]
University of Wisconsin - Madison (General Library System)	v.4-10; v.20-42 [issues missing]
Saint Louis Zoo Library	Unconfirmed holdings
Disney's Animal Kingdom	Unconfirmed holdings
University of Missouri -- Columbia. (J. Otto Lottes Health Sciences Library)	v.4 to present [issues missing]
Kansas State Historical Society	1977-2003
Friends University (Edmund Stanley Library)	v.31 to present
K-State Libraries (Kansas State University, Hale Library)	v.10-40
Houston Community College	Unconfirmed holdings
Colorado State University (Morgan Library)	v.1-8,11,19-22,24-35
University of California, Davis Health Sciences Libraries (Carlson Health Sciences Library (HSL) & Blaisdell Medical Library (BML))	v.40 to present
Stiftung Tierärztliche Hochschule Hannover, Bibliothek	1980-1983
Universität Zürich (University of Zurich)	2004, 2014 to present
Charles Sturt University Library (CSU - Bathurst)	v.24:no.12-v.29:no.12 [issues missing]

Appendix B: Quick Start Guide to *Animal Keeper's Forum* in the Biodiversity Heritage Library

Open Access to the Animal Keepers' Forum (AKF)

- Available via the Biodiversity Heritage Library (BHL) with permission from AAZK
- Title in BHL here: www.biodiversitylibrary.org/bibliography/125504

Search by Scientific Name in BHL

1. Type any scientific name into the BHL search box
2. Click on the Scientific Names tab (far right)
3. Choose the appropriate name from the list
4. View bibliography listing all mentions of that species name throughout the BHL corpus
    - Names are discovered using an algorithm over uncorrected, automatically generated full-text: this feature should not be considered exhaustive or authoritative
    - List is automatically sorted A-Z, and therefore all AKF results will appear clustered together towards the beginning of the list.

Search the full-text of issues of AKF via the Internet Archive

- Full-text search across the BHL corpus within BHL is still under development
- You can, however, search the full-text of a particular issue by using the Internet Archive (IA), a BHL Partner, and the service upon which BHL is built.
    1. Open an item in BHL (a particular book/volume/issue)
    2. Click *Download Contents* (upper right, drop down menu)
    3. Choose *View at Internet Archive* from drop down menu
    4. Click on the magnifying glass next to the book image in IA (alt text = *search inside*)
        - Note: Do not use the search box in this view, it defaults to searching all of IA!
    5. Type the text you seek into the search box (text = *search inside this book*), press enter
    6. Each occasion of your search term within this book will be marked on the scroll bar (bottom) – click on one to go to that page, or hover to 'peek' at the text

Download entire items (issues/volumes) from BHL

1. Open an item in BHL (a particular book/volume/issue)
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    c. OCR (optical character recognition, aka the full-text .txt file)
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5. Your PDF will be emailed to you in minutes to hours, depending on various factors. They are generated on demand, so response times vary. Contact BHL if wait time is over an hour, could indicate system error.

Suggest new titles for digitization in BHL

- Use this form for requests (or other help!): http://www.biodiversitylibrary.org/contact
- Desired content in-copyright? (published in 1923 or later?). If you can help BHL negotiate with a publisher by sharing your networks, please do so!

Keeping Tigers: Zookeeper Participation in Ensuring the Survival of Wild Malayan Tigers

By

Christine Anne, Lead Zookeeper

Woodland Park Zoo

Seattle, Washington

Abstract

Thirteen zookeepers from twelve different zoos around North America traveled to Peninsular Malaysia in June of 2016 to actively participate in Malayan tiger (*Panthera tigris jacksoni*) conservation. This opportunity was offered by the Malaysian Conservation Alliance for Tigers and their Realm of the Tiger program, through their Conservation Action for Tigers initiative. The purpose of this trip was to enhance zookeeper knowledge and experience in tiger conservation in Asia, in order to contribute to educational outcomes at their representative zoos. Zookeepers participated in anti-poaching surveillance walks that included jungle trekking, camping with aboriginal people, as well as animal tracking and camera trapping. This was a five day experience of a lifetime in Taman Negara National Park and the Yu River Wildlife Corridor. The Yu River Wildlife Corridor is an adjacent area on the border of Taman Negara, where anti-poaching efforts are conducted in order to prevent poaching within the corridor and the park. This paper recounts some of the experiences of the keepers and the importance of keeper involvement in these in situ programs.

Introduction

Thirteen zookeepers from twelve different zoos around North America traveled to Peninsular Malaysia in June of 2016 to actively participate in Malayan tiger (*Panthera tigris jacksoni*) conservation (Appendix 1). This opportunity was offered by the Malaysian Conservation Alliance for Tigers (MYCAT) and their Realm of the Tiger program, through their Conservation Action for Tigers (CAT) initiative. MYCAT was started in 2003 as a collaborative effort of non-governmental organizations. The Malaysian Nature Society, TRAFFIC Southeast Asia, Wildlife Conservation Society-Malaysia and WWF-Malaysia work together to ensure the survival of Malayan tigers and the forests they inhabit. The program is supported by the Department of Wildlife and National Parks Peninsular Malaysia. As a result of this partnership, the National Tiger Conservation Action Plan was developed in 2008, as well as a citizen participation initiative called Conservation Alliance for Tigers to aid in anti-poaching work (MYCAT, 2017). Dr. Kae Kawanishi is the General Manager of MYCAT, a leading Malayan tiger researcher and the program lead for the CAT walks. This anti-poaching program allows citizens to join researchers in protecting the forest and sensitive wildlife areas.

From this larger program, the Realm of the Tiger was developed. It focusses on zookeeper and zoo professional participation with additional educational experiences that allow them to go back to their zoos and increase their conservation impact. The program took place in peninsular Malaysia, within Taman Negara National Park and bordering region of the Yu River Wildlife Corridor. Taman Negara is peninsular Malaysia's largest National Park, and is slightly larger than the state of Rhode Island (Department of Wildlife and National Parks Peninsular Malaysia, 2008) (Figure 1). MYCAT researchers conduct a majority of their research within Taman Negara, while the CAT Walks focus primarily on the transitional area of the Yu Wildlife Corridor that sits between Taman Negara and the Sungai Yu Forest Reserve (Department of Wildlife and National Parks Peninsular Malaysia, 2008)(Figure 2).

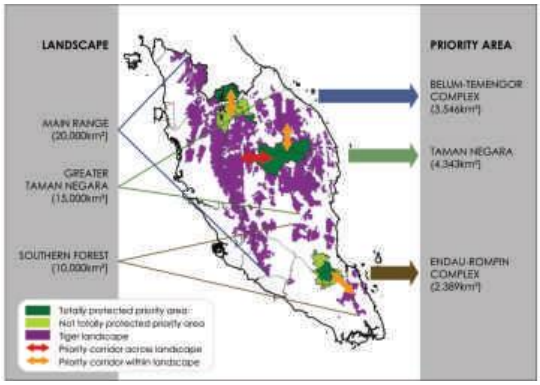

Figure 1

Figure 2

The Realm of the Tiger program is a five day extended CAT Walk experience, developed specifically for zookeepers and zoo staff. The program works to enhance zookeeper knowledge and experience in tiger conservation in Asia in order to contribute to conservation and educational outcomes at their representative zoos. The CAT Walks also serve as in situ conservation participation by helping to prevent poaching.

Upon arrival at Taman Negara, the group loaded up into the back of open air trucks and traveled the narrow hilly roads through the dense forest to the river, then to the fire look-out tower for the official welcome and introductions. The large size of the zookeeper group required that it be divided into two groups depending on level of intensity for the CAT Walks. The groups were designated as the Yin group and the Yang group by Dr. Kawanishi. The Yin group included shorter, easier hikes, while the Yang group participated in longer more difficult hikes. Yin Group zookeepers included Christine Anne, Woodland Park Zoo; Annabel Marcum, Potter Park Zoo; Sydney Kessler, Knoxville Zoo; Kate Barszczowski, Little Rock Zoo; and Erin Dauenhauer-Dakota, Naples Zoo. The group also included Fred Koontz, Vice-President of Field Conservation, Woodland Park Zoo, and Jeremy Dwyer-Lindgren, Photographer, Woodland Park Zoo. The Yang group zookeepers included Ashleigh Lutz-Nelson, San Francisco Zoo; Anna Chaney, Busch gardens; Brian Czarnik, Brookfield Zoo; Kristen Clark Beatty, National Zoo; Ivy Brower and Nick Pottratz, Zoo Miami; Tyler McCullough, Akron Zoo; and Amanda Ista, Milwaukee Zoo. The groups were led by guides employed by MYCAT and alternated between Dr. Kawanishi; Ashleigh Seow, Citizen Conservation Specialist; Suzalinur Manja Bidin ("Man"), Senior Programme Officer; and Alex, Forest and Batek Asli Specialist. Accommodations and food were arranged by MYCAT and all CAT Walks started at the base Chengal house with the exception of the hiking that took place after spending the night in the jungle.

CAT Walk 1

The first day of hiking for both groups included a specially permitted hike into Taman Negara to check camera traps set up for tiger research. The Yin group hiked along the Taman Negara River and the first camera trap site was found empty, as the camera had been stolen. There was a chance that an elephant possibly pulled the camera off the cable and threw it, as this had happened before, but after searching the area the group was unable to locate the camera. Cameras occasionally go missing, and with them go all the data collected for that site. The second camera trap site was intact and the group was able to remove the memory card from the device and put it into the digital camera to check images. Those images included sun bears, leopards, a golden cat, and Sambar deer, among others. The group reset the camera on a different tree and hiked back down the trail to eat lunch and relax in the river.

While the Yin group was having a relaxing hike and river relaxation, the Yang group was out on their Taman Negara hike. This group hiked in at a different starting point to check cameras on an alternate trail. This hike was to be about 6 hours, and cover some rougher terrain including elevation and off trail trekking with dense bush and spikey vines. The initial hike was along the trail to the Gua Gajah to an elephant cave to eat lunch and refresh. This cave was home to bats, and frequented by elephants, evident from all of the elephant droppings and elephant tracks in and near the cave. At that point it was time to head back, using a slightly different route in order to cover more ground to look for snares from poachers. The group was to help cut a new path back out to monitor a new area for possible poaching. This new trail ended up covering more ground than initially planned for as the return hike was extended an additional four hours to the road making it a twelve mile hike. A good lesson that GPS isn't always accurate and researchers can get diverted when they are working in the back country.

This day was also filled with wildlife viewings and wildlife signs. Groups spotted a Prevost squirrel at the park entrance, a king fisher, turtles in the river, leeches, langurs, hornbill, a monitor lizard was hanging out by the road, bantang at the park entrance, butterflies, and lots of elephant signs on the trails. This was a testament to the abundance and diversity of wildlife in the park. Most of these sightings were along the road to the park, or along the road within the park.

CAT Walk 2

On the morning of the second day, the Yin group prepared for a day hike and overnight stay in the jungle. The hike started at a limestone outcropping where porcupines commonly nest and feed on the snails that use the limestone to build their shells. Poachers set small metal live traps for the porcupines and hanging traps for baiting serow that frequent the area. The group searched the base of the limestone wall for any signs of poacher activity and did not find any signs in that area. The group then headed up to the ridge to check on an area called Bird Valley. This area was heavily poached in the past with a single days patrol turning up over 92 bird snares. The group did not find any snares, but did find a blind, an area where a person would sit at the base of a tree and attract birds to an area nearby to trap them. The group stopped for a break at a large log where the MYCAT team had stashed some old tiger snares for demonstration (Figure 3). A large wild boar headed up the trail toward the group as the group was getting ready to move on. The group scattered for cover and the boar passed without incident and the group headed to camp.

Figure 3

After arriving at camp the group met with the aboriginal Batek Asli tribes people that were there making fire and dinner. There were a total of five nomadic families in the forest for the night. These families rely on the forest for food and shelter, and are very knowledgeable about the plants and animals they share the forest with. The group had the opportunity to swim with the Batek Asli children in the river, and chat with the tribe's people throughout the evening. The guide Alex was in an immersion program with the tribe, was fluent in Malay and the Batek Asli dialect, and was able to translate between keepers and tribes people.

While Yin group was busy hiking into camp, the Yang group ventured out on a day hike. The hike took them along the corridor next to a new four lane highway that had palm oil plantations on one side leading up to the Taman Negara's primary forest and rubber trees on the other side leading to secondary forest. There is a corridor area under the highway meant for wildlife to cross. This crossing is very important for the movement of wildlife in this landscape. There was a dead palm civet that had been hit by a vehicle on

Conservation Impacts

The experience of traveling to Malaysia to actively participate in conservation and research was meaningful to the keepers that participated and important for Malayan tigers. The experience provided keepers with a deeper understanding of Malayan tiger natural history and the complex bioregions they are from. Zookeepers are also part of a larger zoo audience where the information learned on the trip can be conveyed in more meaningful way. For tigers, the experience provided a resource by which the keepers helped reduce the possibility of them being poached, poaching of other animals, including necessary tiger prey, and forest products through their physical presence of being in these vulnerable areas. When people see value, either intrinsic or economic, they are more likely to support its survival into the future, whether it is an animal species or a landscape (Buckley et al., 2016).

As Zookeepers, there is a larger platform by which to disseminate information to the public through the zoo community. This includes other staff members, volunteers, and the general public that visits zoos. Many of the keepers returned to their zoos and gave presentations to large groups, either within their zoo or for external stakeholders. These presentations discussed the experience of being in Malaysia, participating in conservation efforts to protect Malayan tigers, and seeing the primary threats to decreased tiger populations first hand. This experience also allowed keepers to speak about the impacts of palm oil and other monoculture plantations, and forest modifications impacting tigers and all other wildlife that share the same forest.

Keepers donated money to MYCAT as part of the program to support continued research efforts within Taman Negara, one of the last strongholds for Malayan tigers. The donations also provided economic support to the local communities to help facilitate tiger conservation and forest survival into the future. Additional funds were provided by keepers and AAZK chapters to fund two additional camera traps within the Yu river corridor in memory of late Malayan tiger keeper Stacey Konwiser, who had originally signed up to come on the trip to Malaysia. Overall, the anti-poaching efforts of MYCAT have recovered over 136 snares, 104 reports to the wildlife crime hotline, while walkers have traversed and protected over 2,044 square kilometers of the Yu River Wildlife corridor in over 300 CAT Walk expeditions (MYCAT, 2017).

Since this Zookeeper trip last year, there have been many positive advances for the protected areas of the Yu River Wildlife corridor and Taman Negara. MYCAT launched a highway viaduct restoration project to replant the underpasses in order to create protected corridors for animals to pass through, under the highway. There was one tiger captured on a camera trap image, and multiple instances of tiger pug marks along research and CAT Walk routes (MYCATb, personal communication, 2017). MYCAT hosts a Realm of the Tiger experience for Zookeepers every year and more information about when these trips are scheduled can be obtained by contacting MYCAT. MYCAT also hosts citizen CAT walks throughout the year that anyone is welcome to join.

Appendix 1

Participating Keepers and Zoos (tigers at the respective zoos)

- Ashleigh San Francisco Zoo (Amur tiger *Panthera tigris altaica* and Sumatran tiger *Panthera tigris sumatrae*)
- Ivy and Nick Zoo Miami (Sumatran tiger)
- Tyler from Akron Zoo (Sumatran tiger)
- Brian from Brookfield Zoo (Amur tiger)
- Kristen from National Zoo (Sumatran tiger)
- Anna from Busch Gardens (Bengal tiger *Panthera tigris tigris* and Malayan tiger)
- Annabel from Potter Park Zoo (Amur tiger)
- Amanda from Milwaukee County Zoo (Amur tiger)
- **Sydney from Knoxville Zoo (Malayan tiger)**
- **Erin from Naples Zoo (Malayan tiger)**
- **Kate from Little Rock Zoo (Malayan tiger)**
- **Christine from Woodland Park Zoo (Malayan tiger)**

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Commented [AL1]: Czarnik

The Trials and Tribulations of Reptilian Mixed Species Exhibits

By

Saul Bauer, Herp Keeper IV

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Columbus, Ohio

The dynamics of herpetological exhibits in zoos are changing. Rather than exploiting fear and phobias with dimly lit enclosures, frightening exhibitry littered with skulls and ominous sounds zoos are focusing on conservation and education minded exhibits. Building on this, single species exhibits are also quickly becoming a thing of the past. Guests expect a more interactive and dynamic display of natural behaviors in specific ecosystems. This can pose unique sets of challenges but as more zoos adapt this into their collection a larger pool of resources becomes available. Inherent risks are posed when experimenting with multi-species exhibits. Carefully analyzing, mitigating to the best of ability and weighing the risks can lead to more vibrant and engaging displays. The Columbus Zoo started exploring the possibility of incorporation mixed species exhibit across the zoo rather than limiting to just the centralized reptile building.

Reptile House Selection Process

Although many reptile pathogens are species specific, great care was taken when selecting animals to place on exhibit together. *Mycoplasma pneumoniae* is a common chelonian pathogen and, although typically asymptomatic, confirmed infected animals are not placed with non-infected collection. Our larger concern was with *Entomoeba invadens*, a common, harmless aquatic turtle pathogen that can be deadly to snakes. PCR testing, although not 100% accurate was performed on every aquatic turtle that snakes would potentially be moving in with. With zero positive results we felt comfortable putting a yellow anaconda *(Eunectes notaeus)* in with our South American turtle exhibit. Many of our exhibits were tailored for housing snakes, chelonians and lizards so other than décor and habitat props, selection was based mostly on cohabitation ability. Again, the easiest decisions were with chelonians and snakes, as aggression is not likely. We currently have multiple exhibits housing various species successfully. We also house Prehensile tailed skinks *(Corucia zebrata)* with Solomon Island leaf frogs *(Ceratobatrachus guentheri)*; a common and successful practice.

Exhibit Selection

Redesigning exhibits not meant for reptiles is usually not a feasible option. When venturing outside of the reptile building, consideration of animal safety and containment was a priority. Would all animals involved live harmoniously and is there any risk of escape. With this in mind we determined the easiest and most practical animals to begin introducing to other areas were turtles and tortoises into regional aviaries. Most or all aviaries have underground or drive-in ground fence line, as turtles and tortoises can be quite the diggers. And other than curiosity or investigative purposes birds and chelonians of larger size typically cohabitate amicably. Being a northern zoo subject to winter conditions, seasonal spaces for turtles summering in aviaries is a must. We currently have Asian giant pond turtles *(Orlitia borneensis)* living in a moat with either Red Crowned Cranes *(Grus japonensis)* or tufted deer *(Elaphodus cephalophus)* in our Asia Quest region. The deer actually seem quite fond of the turtles and there are no issues to date. We also have Yellow-headed temple turtles *(Heosemys annandalii)* in our Australia region's bird lake with black swans *(Cygnus atratus)* and painted storks *(Mycteria leucocephala)*. With

success in these two areas we have recently brought in radiated tortoises *(Astrochelys radiata)* which will soon be introduced into our African Forest aviary with a multitude of avian species. We plan to keep expanding into other areas as we evaluate and hope to incorporate Asian forest tortoises *(Manouria emys)* into our Asia Quest region's aviary during the summer and flying fox exhibit during winter months.

Benefits and Concerns

We have had many positive guest responses in regards to multi species exhibits. Guests spend longer at exhibits and have the ability to witness natural behaviors from species' interaction. Turtles and tortoises that spend their summers outside are able to benefit from natural sunlight and open conditions. It is also a unique form of enrichment for all animals involved. Unpredictability in reptiles is always a concern. Snakes can cohabitate for years with no incident and unsuspectedly decide to consume a cage mate. Turtles and tortoises can live harmoniously then arbitrarily start fighting. Mitigating risk to the best of ability, careful planning and monitoring clever enclosure design can lead to unique exhibits that enhance the guests experience and the conservation message through the glass.

A Day in the Life: The Story of Managing 62 Flighted Macaws

By

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Abstract

Ever wonder what it's like to work with 62 flighted macaws? This paper discusses how we used positive and differential reinforcement to overcome challenges we encountered during the management and daily care of our birds. We gave the choice to participate in daily training and shows to our 3 flocks of 20 plus macaws each through stepping up, weighing, show behavior, enrichment, and a variety of husbandry procedures. This paper explores some of the challenges we faced, the ways in which we worked through them, and the different ways to keep the mental and physical welfare of the birds a priority by providing them power over their environment.

Introduction

At a major theme park in Central Florida, 62 flighted macaws consisting of 7 species have been flying in shows for 3 years. Hyacinth, Military, Scarlet, Blue and Gold, Blue- throated, Greenwing, and Red-fronted macaws fly a half mile to the perch location, where they are reinforced with various food items. After about 5 minutes on the perch, the cue is given to leave and they fly a half mile back to their aviary, where they secure themselves into a flight full of individual cages called 934s pre-baited with bowls including fruits, vegetables, and dry variable. Half of the team of trainers is out at the perch to interpret the experience on microphone, reinforce birds, and communicate with the team in the aviary which birds have made it to the perch. The team at the aviary releases and catches the birds. Once secured in the 934s, the macaws receive an additional nut in their pre-baited bowl. All 62 birds have the choice to participate in each part of their day. It has been shown that control is a primary reinforcer (Friedman, 2014). By combining that power of control with the use of positive reinforcement daily, we have worked through each challenge faced and maintained consistent desired behavior more often than not when free flying these large flocks of macaws.

Body

From the moment we initiate communication and contact with the birds, they have control over the situation. Giving the birds the choice to participate begins with simply asking the birds to step up. We look at it as a two-way conversation, as all training and interacting with animals should be. We ask a clear question by presenting our flat hand, with the other hand holding the

reinforcer in a closed hand. The main reinforcers used are Pretty Bird and Zupreem pellet. If the bird holds up a foot, that is his/her way of saying “yes, I would like to step up”. Once the bird steps up on the hand, we give them the reinforcer. This is used throughout the day with other behaviors we may ask of the birds.

One of the most common times to ask for stepping up is when we weigh our birds. Each morning, we weigh our birds while also assessing the overall body condition and behavior of each individual. We ask the birds to step up on our hand, walk them to the scale, ask them to step up onto the scale, take their weight, and walk them back to a perch afterwards. Due to the reinforcement history that has been built by being weighed daily, the scales have become a place the birds want to be. With 20 birds exhibiting the behavior of flying to the scales, we quickly learned we needed a better way to manage how we weighed all the birds.

Differential reinforcement is defined as any operant training procedure in which certain kinds of behaviors are systematically reinforced and others are not (Chance, 2003). This is also known as shaping. Using differential reinforcement, we gave each bird a station spot of perching either along the walls or on a table, thereby giving them a job to do and a way to clearly understand how to earn reinforcers. They could not jump on the scale if they were stationing on their specific spot. By having individual spots to sit, we were able to avoid birds constantly flying to the scales to earn those reinforcers. We did find some birds still flew at the scales from time to time, so we decided to take their stations a step further. We either gave them a high value toy to play with while on their station or gave them a specific job to do. The jobs were to grab the wire of the wall with one foot and at times to additionally grab/touch the wire with their beaks. Toys and additional behaviors enabled us to overcome the undesired behavior of jumping at the scales when the birds were not being cued to do so.

With 20 plus macaws living together, we found that at times we had issues with birds chewing on each other’s tails. The best way to deal with this challenge was to give our birds as much enrichment and browse as possible. The more shreddable the enrichment, the better it seems to be for beak health and the less tail chewing we see. We also see a higher interaction rate between our birds and the enrichment.

The birds receive a wide variety of enrichment items. We give them foraging troughs made from untreated 2’x4’s. These are filled with items such as browse leaves, all natural compressed pine kitty litter, shredded paper, and cut up browse, and are covered with paper or cardboard. They are hung up with L-hooks but also secured with screws and washers from the outside of the flight to assure the birds can’t remove them from the wall. This has been an awesome way to encourage natural foraging behaviors as well. Additionally, browse is provided multiples times a week in their aviaries for them to destroy. The browse is attached onto high perches as well as placing some into holes we cut into a tree log that is secured into the ground of the flight. We also place browse vertically into a wooden browse holder and horizontally onto a metal hinged t-perch (Figure 1) that is brought down to secure the browse before it is brought back up. Paper

and cardboard attached to cut pieces of untreated 2’x4’ and secured to the aviary wall with screws and washers are great items for the birds to rip apart as well. In addition to the enrichment and browse we add to the flights every day, we provide a variety of perches. We’ve made hanging perches such as anchor/”T” perches (Figure 2), swinging perches (Figure 3), and “meeting” perches (Figure 4).

Figure 1

Figure 2

Figure 3

Figure 4

With the wide variety of browse, enrichment items, and multiple size and types of perches offered, the birds have various options to play, forage, and choose where they want to hang out and how they want to spend their time.

The main part of the day consists of the flights the birds make through the park. Twice daily, each flock has the door to their flight opened, cueing them to fly the half mile to the perch in the park. The birds live in an aviary we call “Site B” that has 4 large flight cages, three where birds live throughout the day and one where the birds come home after each show, which is the catch flight. When initially training this behavior, we used 50 foot lifts so we could get above the tree line. This allowed the birds to build the muscles required to fly up and over the trees, and gave them the sightline to the next lift along the path. As they landed on each lift, they were reinforced with peanuts and other variable high value treats. Once they were flying to each lift and to the perch without hesitation, we began lowering the lifts one by one so their flights were a little further each time. That lead to the full half mile flight they do now. Along the path, the birds fly over rivers, exhibits, and trees. As the behavior was trained, some birds chose not to fly or participate so we evaluated the health of those birds and their ability to perform the desired behavior. We determined some of those birds were not the right tool for this job. Many of those birds have gone on to succeed in other shows and behaviors elsewhere.

Once on the perch, the birds are reinforced until they are cued to fly home. This, however, isn’t always what happens. There are times due to alarm calls, or other reasons, that the birds will fly off the perch and head home before they are cued to do so. Alarm calls are types of screaming vocalizations that come when the birds are uncomfortable, possibly due to predators in the area. This situation is where choice and the science of behavior modification have been applied. Once the birds have left their flight, the door is kept open. The door to the catch flight is kept

closed and a black covering on the outside acts as the S-delta. An S-delta tells the birds that no reinforcement is available at this time. Basically, when the birds see the catch door is shut with the black covering visible, the birds are given the information that they cannot earn the high value reinforcer like the nut and bowl of food. While using this system we've seen the birds come over the tree line towards the aviary and, after seeing the S-delta, turn around to head back to the perch! When they fly back to the perch they get another nut, thus reinforcing the behavior of coming back to the perch, and then are cued to fly back home. If the birds come back to the aviary early without being cued and stayed home rather than returning to the perch, that's okay too. We secure them in the release flight for lower value reinforcers such as vegetables. We keep the high value reinforcers like nuts contingent upon performing the behavior we have asked them for.

So what happens, you ask, if the birds fly out to the perch but don't come home? Well, that's another challenge we have had to work to overcome. Generally this looks like the birds practicing the behaviors of flying tree to tree, browsing, and playing in the park. Throughout the time the macaws have been flying in the park we've seen competing reinforcers between what we give the birds at Site B and other items that are freely available in the park, such as acorns, seed pods, and general browse in the trees. If we see the behavior practiced for multiple days we may give the birds time off from the show, be it just one show or a full day. When given time off, the bird is pulled out of the flock and would spend that time in a 4'x6' or 8'x8' cage in the aviary. The time off from shows can help break the pattern and routine being created. We also increase the value of the reinforcer when coming home. Instead of just a peanut or almond for coming home, we may give out Brazil nuts or walnuts to increase the likelihood they will come home faster the next show. Multiple nuts or higher value ones seem to be a great option to help overcome them sitting out in trees. However, the first autumn we encountered what we now refer to as "Acorn Apocalypse". Acorns had sprouted in the Oak trees along their flight path and almost all of our birds chose to sit in the trees and eat/pick all the acorns instead of coming to the perch or going home. We tried giving bigger and better reinforcers when they came home with more nuts or items like Brazil nuts or walnuts. We tried keeping shows shorter to see if getting more reinforcers at home and less in the park would help. We also gave birds time off from shows so they wouldn't continue to practice that behavior of sitting in the park. Finally, the acorns were gone from the Oak trees and the birds eventually got back on track.

So what does it look like when the birds do come home? The catch flight is set up with individual cages called 934s. The name 934 came from the Harry Potter reference of platform 9 ¾. The name came because the caging is in between sizes of other similar cages and we all started calling them 934s. The 934s are pre-baited with water bowls and food bowls that have fruits, vegetables, and a dry variable (crackers, pretzels, popcorn, etc.). These are different for the AM vs PM flights for the birds. When they fly in, all the doors to the 934s are open and the birds can pick which one they want to put themselves into. Once in, we give them a nut and close the door behind them. If the birds do not want to go into the 934s, they don't have to. This could be a way they self-regulate how much food they eat. We want these 934s to stay positive for many reasons, one of the biggest being that this is how we transport the birds anywhere they may need to go. So if they seem uncomfortable, i.e. pacing back and forth, slicked back feathers, or slow to load into the 934, we leave the door open. We monitor the birds that choose not to go

into the 934 and, when possible, we walk them right back into the release flight they will be in for the day.

After coming into the catch and being secured, the release flight will then be prepared for the birds with high value “go home” toys that are ‘supervision only’ toys, and we put up more browse or enrichment into the flight as well. These ‘supervision only’ toys have lots of metal or fire hose pieces attached to untreated 2’x4’s which are what makes them a short term but high value toy. We put mixed vegetables onto the tables, giving them additional reinforcers for flying home and moving from the catch flight into the other flight. The doors to each 934 are opened and most of the birds fly from the catch flight into the other flight. Any birds that do not fly over are simply walked over on the hand. This is another way the birds can exercise control over their environment. The 934s have changed throughout time as well to make them easier for the birds to load and unload themselves. We attached perches to the tops of them to make it easier to land on and secured the doors with an eye hook to stay open. This way, if the birds fly directly to the open door, the door won’t shift or close on them. We also added shields as visual barriers to the outsides so birds who live in the flight next door and did not fly in that show wouldn’t have to sit and watch the other birds eating all the high value treats.

One of the last ways in which our birds have control over their daily environment was through different husbandry practices. Training animals to participate in their health care leads to less stress during procedures that may need to be done. Our birds are trained to voluntarily participate in nail trims. We use a Dremel to shape their nails, and the birds can either put a foot up onto the wire of a 4’x6’ cage or in the 934 or stand on a bow perch with 1”x1” wire (Figure 5) and the nails can be shaped from below.

Figure 5

Each bird is an individual. We determine which way we start the training based on the specific individual, it is a study of one. If the birds seem to exhibit behavior that tell us they are uncomfortable, such as hesitation to come near the Dremel or step onto the perch, we will try another method to see if that is more comfortable. By asking them to put a foot up on the wire, they have the ability to move away from the Dremel if desired. If they continue to come back and put their foot up on the wire we know they are willing to participate in their nails being trimmed. Once trained, we continue to do nail trims whenever that individual has sharp nails again or as necessary to maintain the behavior.

Another husbandry procedure the birds voluntarily participate in is mite and other feather parasite treatment. Rather than catch birds up to spray them with mite spray we trained them! We took the base stand from a 934, attached a perch to one side, and built a plywood wall with a hole cut into it. We ask the birds to put their heads through the hole. If they choose to put their heads through the hole we reinforce them and spray them. We recently took it a step further and only sprayed the birds if they target to a target pole once their head is through the hole. This allows the birds to choose when they are sprayed. For both of these husbandry behaviors we use their pelleted diet for the reinforcers.

Conclusion

Through positive and differential reinforcement we train and maintain desired behaviors in the face of different challenges that we encounter while free flying 20 plus macaws at a time. By setting the stage for success, we have been able to overcome the challenges listed in this paper. Our macaws have control over their environment in all aspects of their day. Through stepping up, weighing, flying in show, interacting with enrichment, and husbandry procedures each bird can decide whether they participated or not. We constantly have looked for ways to improve each aspect of their day so we can provide the safest, best environment for the birds. Animal welfare is a top priority at NEI and we want our birds to enjoy their job as much as we enjoy ours.

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The Shape of Raptor Training at the Downtown Aquarium

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Downtown Aquarium

Denver, CO

Abstract

This paper describes how positive reinforcement, choice, and control were used to retrain a rehabilitated bird as an ambassador after challenges were experienced using traditional raptor training methods. A red-tailed hawk (*Buteo jamaicensis*), Roja, was injured in the wild in the summer of 2004 and was taken to the Rocky Mountain Raptor Program in Fort Collins, Colorado. Due to severe injury, her right eye was removed. Though she was fully flighted, she was non-releasable due to her sight issues. Roja came to the Downtown Aquarium in April of 2005 and became an animal ambassador. Her initial training used traditional falconry methods such as manning, tethering and strict weight management. Roja often experienced crash landings and missed cues during training, possibly due to her visual impairment. To compensate for this sight impairment, it was decided to train Roja to come to a red circle to start each training session. This served as an obvious visual cue that a session had started and instilled choice in this bird. We were able to use this method and the shape to train flights from perch to trainer, flights from trainer to trainer, voluntary weights, and even voluntary nail trims. Due to the success of this method with Roja, it has also been applied to a non-releasable golden eagle (*Aquila chrysaetos*), Jackson.

Introduction

In April of 2005, the Downtown Aquarium was given the opportunity to house an injured, non-releasable red tailed hawk named Roja. Roja had been brought to the Rocky Mountain Raptor Program in Fort Collins, CO in the summer of 2004. She was found near a road by a passer-by and was presumed to be hit by a car. After examination, it was determined that she had injuries to the whole right side of her body including an injury to her right eye. The eye was so severely injured that it had to be removed and the space sewn shut. During her rehab at the Rocky Mountain Raptor Program, she was tested for flight and for hunting skills. She is a fully flighted bird, but was unable to successfully hunt live prey. Because of this, she was deemed non-releasable and the center began trying to find her a permanent home. The Downtown Aquarium was contacted and agreed that, with extensive training, the red tailed hawk could make a great program animal.

Traditional Raptor Training Methods

Some raptor training draws on traditional falconry methods that have been in practice for thousands of years. The traditional process of habituating a raptor to being in the presence of humans is called manning. In falconry, manning can be done in two different ways. The first draws on a practice called “waking.” Waking takes advantage of the bird’s state of shock right after it has been trapped. During this time, the trainer exposes the birds to many different things while depriving the bird of rest for at least 24 hours and of food for up to two days (Ash, 2017). The advantage to this method is that the bird is quickly desensitized to a lot of stimulus. The

other traditional method of manning is to keep the bird in a dark room or hooded. This way, new things can be introduced at the trainers pace. The lights can be slowly raised and new things can be slowly introduced. An advantage to this method is that the bird has little to no stress during the process, but it can take much longer (Ash, 2017).

Tethering is the process of restraining a bird by tying it to a perch (Arent and Martell, 1996). Tethering can be used to facilitate training, prevent injury, to restrain in a yard that isn't fully enclosed, or to restrain on display. This method can be advantageous since handling a new bird is easier when tethered because the bird cannot get away. The trainer can step up the bird directly from the tether without it flying away. This causes it to face its fear of a trainer. Exposing a bird to an intimidating situation repeatedly will decrease its sensitivity to it (Arent and Martell, 1996). The alternative to tethering a bird is to free loft it. Free lofting is the practice of allowing the bird to have open access to perching in a mew without being tied down to anything. It is said that some birds are too energetic to be free lofted and have to be tethered to prevent injury (Arent and Martell, 1996).

Strict weight management is the practice by which a bird is kept within its flying weight range. If a bird is too low in weight, it will not have enough energy to fly. Conversely, if a bird is too heavy, there will be no food motivation to work. A typical raptor flying weight range is 90% of its typical weight range (Arent and Martell, 1996). Strict weight management is facilitated by getting daily weights on the bird and giving or withholding food based on weight and behavior.

Initial Training Methods

Roja's initial time in human care was at the Rocky Mountain Raptor Program in Fort Collins, Colorado. At first, it was hoped that her injuries would heal enough that she would be able to be released into her native habitat. Because of this, other then what was needed in her recovery, human interaction was minimal. This is done so that the animal retains its natural behavior around humans in order to be successful in its native habitat. Once it was known that she was going to be a non-releasable bird and was placed at the aquarium, her training began.

When she first arrived at the aquarium, Roja was housed in an indoor enclosure made of 1"x1" mesh. She shared a room with a Golden Eagle housed in the same type of enclosure. In order for her to be taken out of her enclosure, she had to step on a glove and allow for her equipment to be put on. According to the records, this was done a few different ways. The most prevalent way was to use a baiting technique to get her to come towards the trainer and the glove. The trainer would throw food to the ground to entice her to come down and then move close enough to grab her jesses and step her up onto the glove. There were times over the course of five years that she was tethered in her indoor enclosure, at which point the trainer would grab the tether and work the glove up the tether and towards Roja and secure her jesses that way. At this point, her equipment would be put on and she would be walked to a yard where she would either be free lofted or tethered. Yet another way to get her, was to bait her into a crate. She was also brought to appearances using all of the aforementioned methods. It is unclear from the records what the rate of reinforcement was during all of these steps.

The records for that time period show what seems to be some uncomfortable body language given off by Roja. There were times where she sustained injuries caused by avoidance and escape behaviors. There may have also been a sight issue, since she only had one eye. It was also listed that she bated fairly often during walks from her enclosure to the yard or from her enclosure to an appearance. The records did show that usually once she was at an appearance, she seemed comfortable on the glove.

In 2010, the raptors were moved to an outdoor mew. It had two mew spaces with a weathering yard attached.

Training of the Shape and Using the Shape for Other Behaviors

In July of 2013, one of the trainers came up with an idea to start to station train Roja using small plastic red circle. Instead of the previous method of throwing food to the ground to bait the hawk or tethering her for ease, food would now be placed on the red circle on the ground. The thought was that the shape would give her a clear visual signal of where to go, since she had potential sight issues. This would hopefully prevent her from flying into the mesh and injuring herself. It had also been seen that she frequently missed her mark when flying or missed the second trainer when flying from trainer to trainer. There was also an auditory cue paired with the shape. The trainer would double whistle blast and use the shape to indicate when a session was going to begin (Figure 1). In less than a month, Roja was reliably coming to the shape for the start of a session without being baited there with food. This method was allowing her to have choice and control over her environment. If she heard and saw the cue to come to the start of a session and chose not to, the trainer would leave and try again later. She was given choice and control over starting her sessions.

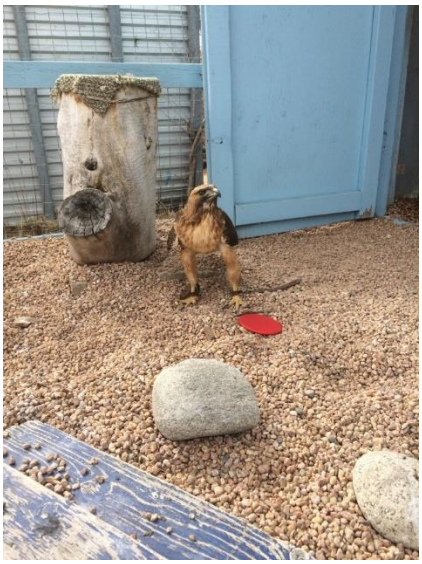

Figure 1

After the shape was reliable as a start of session, it was used to ask Roja to go to different places in her enclosure. The shape could be thrown down anywhere on the ground or put on any of her stumps and if she came to it, she would be rewarded with food from the glove (Figure 2). If she refused, the trainer would LRS, redirect, or ask for the same behavior again, using

principles of positive reinforcement training. Once she was at the shape and taking food from the glove, it wasn't a hard approximation to get her to step up on to the glove for reinforcement (Figure 3). Eventually, the trainer was able to hold the shape in the glove and ask Roja to fly directly to it for reinforcement. The trainer was then able to put her equipment on and take her out for presentations.

Figure 2

Figure 3

The next obstacle was to get her to reliably go into a crate for longer transport to offsite presentations. The shape was used, as usual, to ask her to the glove and to have her allow the trainer to put her equipment on. Two methods of crating were tried: backing her in then putting her on a perch or facing her through the door and allowing her to hop to the perch. She did better with ore choice and control, so we ended up crating her facing the perch and having her hop in.

After the shape and the crate were reliable, we could move to other things. Positive reinforcement, choice and control were used to train flights from a perch to the trainer (Figure 4), flights from trainer to trainer, a voluntary weight, and even a voluntary nail trim (Figure 5).

Figure 4

Figure 5

Trainers were so confident in this type of training that it was started with the rehabbed golden eagle that lived at the aquarium as well.

Conclusion

From the above information, it can be seen that positive reinforcement training can be used for raptors. In our case, Roja benefited from having more choice and control over her training sessions. There were plenty of times where she did not want to come to shape to start a session, and that was acceptable to her trainers. She has now been using this method of training since 2013 and thriving on it. Recently, the Downtown Aquarium had to relocate both of its raptors. Roja went to Happy Hollow Zoo in California. Within four days of her arriving at that facility, we received the following email:

"Roja is doing very well. Thank you for all of your hard work with her, it really has shown in how she's making the transition here. She gets to go out in the sun on most days and is already taking food on the glove for her trainer. She is attentive and calm while being worked with, which also shows the time and attention you all put in to her. We think that she will easily transition into programs once she is out of quarantine." (Heather Vrzal, Happy Hollow Park and Zoo Curator)

In our case, it goes to show that positive reinforcement, choice, and control can go a long way when training any animal, including raptors.

Acknowledgements

I would like to thank all of the previous and current staff at the Downtown Aquarium in Denver that worked with Roja, especially Christine Montgomery for allowing me to write a paper about something that she mostly trained. I would also like to thank Happy Hollow Park and Zoo for agreeing to take such good care of Roja when we were unable to keep her in Denver.

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Making Mountains of Dollars Out of Molehills of Coin

Chawna Schuette[1], Lee Hart[2], Ali Striggow[3], Jim Haigwood[4]

Goals

AAZK Chapters across North America have some pretty basic common goals. Grow the chapter, raise funds for conservation efforts, and build the profession. We aren't working diligently cleaning coins out of fountains all hours of the evening or creating fundraisers just to throw a chapter pizza party. So, why DO we do it? We expand our membership through dedicated recruitment and retention initiatives in order to increase our impact by being intentional with our Chapter goals and helping our members to reach their professional such as conference, network, grants, and field work, as well as achieve Chapter conservation goals as a whole and be able to give to important causes. We want to put our money where our passion is. As a chapter, how do we do that? We need to make mountains of dollars out of mole hills of coin of course!

Many chapters have found unique and fun ways to grow and be successful financially. There is nothing better in AAZK than sharing for the purpose of not reinventing the wheel. Many of these ideas aren't new, but they can be improved upon, they can be remastered, and we can definitely describe some details about what works and what doesn't in building upon some of these concepts. Bake sales, fundraisers, get them in the door and get some money for a good cause. We all get the idea. "But what am I doing wrong?" "Why isn't it working?" "Why is that chapter so successful and we aren't?" There are lots of reasons and we are no exception to that rule. We're here to share what's worked and hasn't worked for our respective chapters and what we've learned through trial and error.

Animal Art

Many chapters find the sale of animal artwork to be a valuable fundraising tool, however there are many factors to consider when launching an animal artwork program. Animals that participate in the animal art program belong to the host institution, keeper time to do the work belongs to the host institution as well and needs to be okayed. Animal painting is part of an enrichment program in many cases and this can limit availability. The paint and canvases are frequently purchased by AAZK but may be purchased by the institution. All of these can be gray areas, so developing a memorandum of understanding is recommended when possible to clarify safety standards, time management, limitations on paintings produced, species that paint in the program, and how proceeds are divided.

Each host institution will be different, for example the Greater Houston Chapter has a limit on how many painted items can be sold each year since our host institution also sells animal art and painting experiences. Because of this limitation we find that the most effective use of our animal paintings is as silent auction items at select fundraisers. We always set a minimum starting price and we are frequently shocked by which paintings are the favorites and bring in the most money. One year the winner was a painting made with shed rattlesnake skin and one year it was a painting made by a domestic chicken! For the St. Louis chapter, we find that it's very important to maintain a good working relationship with each animal area and understand the needs of each species, seasonal limitations, and how it may affect supply and demand. We also developed a program to track art sales and donate a portion of proceeds back to our host institution's endowment. Onsite sales at events such as Jammin' at the Zoo, Parent's Picnic, and Zoofari have been a wonderful way to market our animal art program and have helped to increase our online sales locally during the holidays. The key to success was adding animal art sales online and shipping. Our sales grew by around 90 percent when we implemented this as a part of our program along with our increased marketing. We are also increasing animal art availability and affordability by making prints available this year. Getting organized also made a huge difference in our success. Having one rep from each unit who paints and communicates with the art team from AAZK has made a huge difference in streamlining. Creating an AAZK art team to answer emails quickly and make online ordering available was a big game changer to our program. Designating a weekly shipping day for animal art makes it easy for the team and straightforward for customers. Communication of flat rate pricing and shipping fees for all animal paintings and creating a list of available species on our website as well as a link available through our institution website was also extremely helpful. Purchases can be made directly through our website by filling out an order form or via email for specific questions.

It is also very important to think critically about your market and your pricing. In the beginning stages of art sales with the Ozarks chapter, we originally tried to price our paintings at a fairly high dollar value and had different prices for different species. As a result we only sold a few paintings here and there, and despite collecting a lot per piece, it didn't raise much money in the long run. After much chapter discussion, we voted to lower the prices slightly which helped; but it wasn't until another drop in price along with a simplification of price points that we started to see a real uptick in sales. Our current everyday prices on canvas paintings are roughly half of what they were when we started, are not species specific, and our canvases are in a simple small/medium/large price scale. Once we found that sweet spot for the general public visiting the zoo, we learned through trial and error that adapting to our market would continue to drive sales. When we work with galleries they have actually asked us to increase our prices during

hangings. I'm certain this is partly to increase their commission, however it also reflects the price points to which their customers are comfortable spending. To justify this increase, we have created special pieces for these types of events such as having our more artistic members paint patterns or geometric shapes on the canvases prior to the animals contributions. Inversely, at multi-vendor events, we often run sales and give our members working the event some room to move on prices, particularly when someone is interested in multiple pieces. The thought of that initially made some chapter members cringe, but after realizing how much it could increase our fundraising, they got on board.

Appropriate pricing aside, in order to sell art, you need a product that people want to purchase in the first place. It is a good idea for your membership to learn about color theory in order to create appealing pieces. Also, it is very wise to go by the idea that less is more. Don't try to do more than 3 colors on a painting, don't use too much paint, and don't worry about the animal covering the entire canvas because negative space is important too. Don't forget to have someone take some clear, quality, photographs of your animals to include with the paintings and to label the painting's animal artist. Greater Houston Chapter has found it helpful to include an artist "bio" with the painting giving some fun facts about the animal.

One last suggestion for successful art fundraising is to not overspend on your supplies. The economy multi-packed canvases available at our local craft stores sell just as well as the high grade gallery canvas, so watch for sales and use coupons to stock up when you can. The same goes for paint. As long as it's safe for your animals, the paint color is going to matter more than the brand. We have found a premium store brand that is about two thirds of the price of comparable paints that is just as smooth and vibrant. For a real money saver option, when available, The Ozarks Chapter will buy large packs of scrap cut to size matte boards, mark them at about half the price of our canvases and have paintings in which we've literally spent pennies on. Another option for animals who walk through paint and across canvas is to put down canvas paper, butcher paper, or even lightweight cardboard underneath and around the canvas you're painting on. You'd be surprised how many excellent footprints you'll get on the material surrounding the canvas and you can use those to make inexpensive magnets. Greater Houston Chapter has had a lot of success selling these small magnets at some of our smaller events where people may not be able to afford a full size painting.

Another easy art related fundraising idea that Greater Houston chapter incorporates into other fundraisers, is making upcycled shrinky-dink charms relating to the fundraiser. Simply collect #6 plastic, draw your designs on the plastic with sharpies (keep in mind they will end up about ¼ of the starting size after you shrink them), use a hole punch to

punch a hole where you'll want to attach the charm to a ring, and bake them on a foil lined cookie sheet in an oven that has been preheated to 275 for anywhere from a few seconds to 2 minutes depending on the size of your design. Make sure you keep an eye on them so you don't completely melt them! If they curl up and don't flatten out fairly quickly after you take them out of the oven you can flip them over and throw them back in the oven for a couple seconds and they should flatten out again. You can turn the charms into keychains, wine charms, and jewelry.

Trivia Related/Beer Fundraisers

Trivia Night is another event that is very capable of raising funds for the chapter, but it can also be a tremendous failure as we have learned. You have to really watch your overhead expenses, such as rental fees on a hall, and make sure you choose a location you can fill. Gaging turnout for a new event can be hard but it's better to start small, sell out, and increase capacity as you go. Advertising and marketing your event is key to success. Getting the word out early and reaching outside of your normal channels of zoo docents, volunteers, and staff whenever possible will help fill your seats. Think outside the box for additional ways to raise money during your event. People like being able to bring their own food, but having chapter members bring a baked item you can sell for 50 cents is a great way to increase your profits. Selling beer and wine is a fantastic way to increase your profit (asking local breweries or even your host institution if they can donate alcohol to your event is a great way to increase profit of sales) but there is usually a charge for a picnic license you will need to consider. The Ozarks chapter usually offers one drink ticket to each person who registers early online, as does St. Louis, and this really cuts down on the line at the door, gets people playing and buying goods and alcohol quickly, and keeps your event running smoothly. It's so important that your chapter has a quick way to handle cash, checks and credit/debit cards such as the Square system, or even multiple Squares for larger events, to keep event check in running smoothly and ensure everything starts on time. Keeping the event fun, light, and making sure the word gets out that everyone had a blast will help grow your event for future years. No matter what your event is, it can't be stressed enough that social media, early sign up, reminders, and communication about the event is the key to succeeding. If you don't tell people, they won't show up. The number of times our chapter has said, if only we got the word out sooner is countless and I know we have been less successful because of that mistake.

One of the Greater Houston Chapters most successful fundraising initiatives has been our Local Beer for Local Species event series, which raises money for species found in Texas through the sale of locally brewed beer. With this series we partner with a local brewery who donates the sales from one keg of beer to our fundraiser. We also make pint glasses to sell at the events. "I developed this fundraiser series based loosely on the Drinking for Conservation series that Point Defiance AAZK does. Originally I was

trying to follow their format and work with local bars to host events but was having a hard time getting any of them to sign on. One night I was at one of our local breweries and struck up a conversation with one of their employees who gave me the name of "the" person to talk to if we wanted to have an event. I reached out to that person, we developed a plan, and we were off and running." (Ali Striggow) The moral of the story is that sometimes it's all about luck and finding the right person to talk with. That being said, think of who you know, who your chapter members know, and who your friends know that might be able to get you in the door. And talk to strangers because in the end you never know who will end up helping you out. In the last year we've expanded this event format and hosted Cinco de Gato for ocelots at a local bar that served local beer. We've also held two events for non-native species. Gulp for Growls raised money for the Prusten Project and tiger conservation. We also had an event just the other night called Cheers for Conservation to raise money to sponsor the Lilongwe Wildlife Trust in Malawi to attend the PASA conference. This was with a new brewery partner and also featured trivia!

Each of our Local Beer for Local Species events has featured a custom pint glass and with each release we have requests from people across the country for glasses to be mailed to them. We always had to tell people that we weren't set up for mailing but we finally decided to change that and launched our online store. Like, St. Louis found with their shipping of animal art, organization and communication is key! Currently officers and board members are responsible for shipping and we sign up for coverage by the week. Any orders that are received within the week that you sign up for are your responsibility to ship and we tell the customers that orders will ship in 5 business days. We help minimize the environmental impacts of shipping by saving boxes from home and work and shredding empty grain bags to use as box filler.

Local Restaurants/Working Locally

While AAZK/LA is often best known for Bowling For Rhinos, we have also held other unique fundraisers that people might not be as familiar with. One strategy that we have utilized to increase our success is to hold fundraisers that tie into some of the conservation projects that our zoo already supports. This strategy has both helped to increase interest for the fundraiser and to further strengthen our bond and credibility with our zoo's management. An example of this was with our Holiday Hot Chocolate Sales. The Los Angeles Department of Water and Power used to have an annual holiday light show near the zoo's parking lot. We chose to take advantage of this situation and sell hot chocolate to the people who were parking in the zoo's parking lot to see the lights.

All of the money raised at this fundraiser was donated to Fauna and Flora International's project to mitigate human/elephant conflict in the Cardamom Mountains in Cambodia.

Historically this was the Los Angeles Zoo's most heavily supported conservation program. The importance of this fundraiser and its ability to strengthen our relationship with the zoo was especially evident in 2009 when an animal rights organization was trying to halt the construction of our new elephant exhibit and take away our elephant, "Billy". While we were selling hot chocolate and raising funds for elephant conservation we also took that opportunity to highlight the plight of elephants in the wild, explain what our new exhibit was going to look like, and ask people to sign a petition to move forward with the construction of our new exhibit. We were a very young chapter in 2009 and the work we did raised thousands of dollars for elephant conservation, helped to defeat the agenda of the animal rights activists, and also cemented our stature with zoo management. We were now recognized as an incredible asset and an entity worth working with and supporting.

We whole-heartedly concur with the Houston chapter about the importance of going out of your way to develop relationships and utilizing an "in" to hold a fundraiser when you can. One of our more dedicated AAZK members has a brother who owns a successful go-kart racing facility. As a result of this relationship and his generosity we were able to utilize this very popular venue to hold the Gorilla Grand Prix there. The United Nations and a number of zoos celebrated 2009 as the Year of the Gorilla. The Los Angeles Zoo held events at the Zoo to highlight the plight of gorillas and the work the work the zoo has done for their conservation. Once again, we piggybacked off the Zoo's efforts and had the Gorilla Grand Prix. We raised money for this event by charging people to race go-karts. It was a huge success and we were able to make more than $5,000 for gorilla conservation.

Not all fundraisers have to be a huge amount of work. Many restaurants will allow you to hold fundraisers at their facility and then donate a percentage of the proceeds generated by the food sales of the people that came in for the fundraiser that day. AAZK/LA has held a few of these fundraisers at the California Pizza Kitchen. These events, while typically easy to put together, provide many benefits to the chapter aside from generating financial support. They allow individuals in the chapter, who may not want to take on a big fundraising event like Bowling For Rhinos, leadership opportunities and a way to promote the conservation of the species they are passionate about. Our Chapter has been able to raise thousands of dollars for lesser-known species like the southern hairy-nosed wombat and vaquita as a result of these fundraisers. These fundraisers can also develop relationships with people outside our zoo community. Aside from developing a relationship with the business, our message can also reach its customers who may not know about the plight of the vaquita or how zoos are trying working to save endangered species. We held a similar event at a local comedy club called Laughs for Giraffes the last two years. You can also attache trivia contests or other elements to these events to increase attendance, but be warned this can also increase the workload.

However, typically the added camaraderie and interest can make the investment well worth it.

Other fundraising opportunities that AAZK/LA has had success with are cell phone collection and recycling and bake sales. Cell phone collections not only generate funds, but they also provide an educational opportunity, give zoo patrons an opportunity to participate in a conservation effort, decrease the amount of toxic chemicals going into our water, and help to halt the destructive mining practices used to make the materials for handheld devices. In addition to regular bake sales, we have recently added a twist and invited a taco truck to come to the zoo at lunch time. This has been an incredibly popular event and, with the number of food trucks growing exponentially in many urban areas, the possibilities are endless.

Building Innovative New Ideas

The Ozarks Chapter has had notable recent success with a couple new ideas. First, if you can get your facility on board, purchase a coin funnel. Ours was a fairly large upfront investment, but it paid itself off within the first year. The model we chose was around $1,700 and a staff member built a sturdier locking wooden base for us at no cost. We then got permission to place it in an indoor animal viewing space that offered high foot traffic and protection from the elements. The chapter voted that every $500 dollars raised would go to a North American conservation organization or another effort of the chapter's choosing. Our members appreciate the increased opportunities to request support for efforts they have a personal interest in.

The Greater Houston Chapter also maintains a coin funnel on zoo grounds which we use to raise money both for our chapter and for conservation organizations. We split the months with odd numbered months going to the chapter budget and even numbered months available for conservation organizations. AAZK members may request the coin funnel proceeds to go to a conservation organization that they feel is deserving and we vote between all received requests for the month to pick two to fund. June is exclusively reserved for BFR fundraising.

The Ozarks Chapter’s newest fundraiser is two years old and still has plenty of room to grow. We were lucky to have a member join who was knowledgeable about, and had local connections to, one of the fastest growing sports in America, disc golf. He pitched the idea of working with a local tour organizer and promoter to add a conservation fundraiser and Disc'n for Cheetahs was born. With this fundraiser we have been able to raise around $2400 in the last two years for Action for Cheetahs in Kenya. The beautiful thing about this fundraiser is that the chapter hasn't had to invest a large amount of

energy in raising the money. We advertise that a small portion of the entry fee ($5.00) will go to the charity with the rest going towards payouts and the promoter. We then approach local businesses for sponsorship opportunities. The Presenting Sponsor(s) are used to cover the costs of the discs that are handed out in the player's pack and get their logo incorporated into the design of the disc's stamp. We then find supporting sponsorships and hole sponsors to cover the cost of disc golf related items we purchase at a discount from the promoter for a raffle that we hold at the event. The promoter has also donated extra raffle items from his store and items from tour sponsors that he solicits himself, while the chapter has received additional items from local businesses and included animal art too. All money raised from this raffle goes straight to the fundraiser. Finally our local Coca-Cola© bottling company donates plenty of water and sports drinks for the event and a local food truck who was invited out to the event last year donated 15% of their profits.

The promoter handles the registration and tournament payouts as well as advertising and flyers. Payouts go fairly deep into the final rankings and are what really draw large numbers of participants to the event. We have also taken the measures to make the event a Professional Disc Golfers Association (PDGA) C tier tournament, further improving registration numbers. The first year drew around 60 registered golfers and the second year jumped to 90. Roughly 95% of all the registrants have been reached through our association with the promoter. Our only additional work has been soliciting a design for the disc stamp (which an artistic keeper did free of charge), any advertisement we wished to do on our own, reserving the course for the day of the event (which has been free of charge), marking the out of bounds areas of the course prior to the tournament, creating artwork with the cheetahs to be used as trophies and a handful of volunteers committing to work the raffle that day.As stated earlier, this fundraiser has a lot of room to grow through new sponsorship, increasing the number of hole sponsors, and expanding the tournament. Additionally, to bring us around full circle on our talk of successful fundraising, we have been talking about incorporating our tried and true animal art into a sale that would take place at the event.

It's important to think beyond events when considering fundraising and chapter income. A couple years ago the Greater Houston chapter made the decision to put a line item in our by-laws stating that 20% of every fundraiser, with the exception of BFR and with a cap of $200, would go towards our chapter budget. We did this because we felt that we were spending a lot of time and energy trying to raise operating funds for the Chapter when we wanted to be putting that energy towards conservation fundraising. By implementing this system we were able to accomplish both goals. We are always very careful when promoting events to not say things like, "100% of proceeds go to organization xyz" and we are upfront and honest with all donors, event partners, and

beneficiaries. We've found that people are very understanding when we explain the reasoning behind this policy. We do still hold the occasional bake sale with the funds going strictly to the chapter but these are behind the scenes for zoo staff only. And let's be honest, the zoo staff are usually the ones asking us to have another one because they want some delicious treats!

Know When to Stop

One final important thing to touch on is recognizing when a fundraiser is no longer working for your chapter and being willing to let it go. In the past the Greater Houston Chapter has tried temporary tattoos/face painting, Leaping for Lemurs at a trampoline gym, and many other fundraisers that were, at one time, great events. However, for one reason or another interest started to wane, funds raised dropped, and they became more work than they were worth. With each of these events we struggled with the decision to let the fundraiser go but in the end it was the right choice. Don't waste chapter time and energy on a fundraiser or event that no longer fits.

There are a lot of different ideas here; concepts that have helped bolster these chapters from lowly beginnings, when we weren't able to send members to conferences often or award conservation grants, to being some of the most successful chapters in AAZK, but we didn't get where we are without some effort. Our success is due to innovative ideas, commitment and dedication to the cause, and passion for growing our chapters because we believe in the good work we do and we have seen our efforts pay off time after time. We hope that sharing some of these ideas can help other new and struggling chapters to develop new ideas and build upon our successes. There are so many opportunities out there to fundraise and while the work can sometimes be daunting I am sure we would all agree there is no better feeling afterward knowing that your hard work made a difference. The biodiversity crisis we are facing can seem like an insurmountable problem, but AAZK chapters across North America are making a difference. The greatest gift of AAZK is the community network it creates for us to share ideas and improve ourselves for the sake of the animals that we care for and the work that we do. Our critics are loud and the problems we are trying to overcome are great, but we are all proving, day in and day out, that we are up to the challenge.

[1]Chawna Schuette, Keeper of Herpetology, Saint Louis Zoo

[2]Lee Hart, Tropical Asia Keeper Dickerson Park Zoo

[3]Ali Striggow, Children's Zoo Keeper, Houston Zoo

[4]Jim Haigwood, Senior Animal Keeper, Los Angeles Zoo

PASA: A Unique Alliance to Protect Africa's Primates

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Introduction

The Pan African Sanctuary Alliance (PASA), the largest association of wildlife centers in Africa, includes 22 organizations that collectively house more than 3,000 rescued primates. Prior to PASA's formation, these organizations had similar goals and were facing similar challenges, but largely did not communicate with one another. In 2000, conservationists and primatologists arranged a meeting in Uganda to bring them together for the first time. The directors of the organizations agreed there was a need for improved ongoing communication, and as a result PASA was formed. Although PASA's headquarters is now in Portland, Oregon and it is a registered nonprofit in the U.S., it was created by the African wildlife centers. Figure 1 and Table 1 show the Alliance's members and their locations.

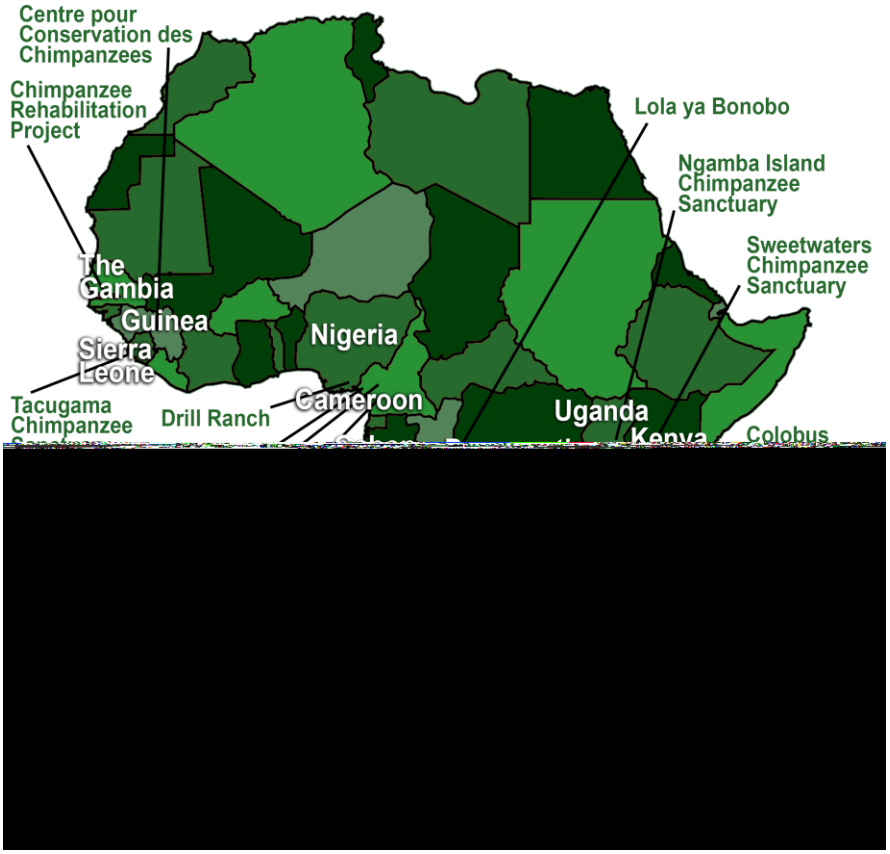

Figure 1: Map of PASA member wildlife centers

Table 1: PASA members and their locations

PASA Member Wildlife Center	**Country**
Ape Action Africa	Cameroon
Centre pour Conservation des Chimpanzees (CCC)	Guinea
Chimfunshi Wildlife Orphanage	Zambia
Chimpanzee Eden	South Africa
Chimpanzee Rehabilitation Project	Gambia
Colobus Conservation	Kenya
CRPL (Lwiro Primate Rehabilitation Centre)	D.R. Congo
Drill Ranch	Nigeria
Fernan-Vaz Gorilla Project	Gabon
HELP-Congo	Congo
Jeunes Animaux Confisques au Katanga (J.A.C.K.)	D.R. Congo
Lilongwe Wildlife Centre	Malawi
Limbe Wildlife Centre	Cameroon
Lola Ya Bonobo	D.R. Congo
Ngamba Island	Uganda
Projet Protection des Gorilles-Congo	Congo
Projet Protection des Gorilles-Gabon	Gabon
Sanaga-Yong Chimpanzee Rescue	Cameroon
Sweetwaters Chimpanzee Sanctuary	Kenya
Tacugama Chimpanzee Sanctuary	Sierra Leone
Tchimpounga Chimpanzee Rehabilitation Centre	Congo
Vervet Monkey Foundation	South Africa

Despite working in extraordinarily challenging conditions, members of the Alliance are making significant strides in primate welfare and conservation. They collaborate with law enforcement agencies to reduce wildlife crime by rescuing confiscated animals, give lifelong care to primates orphaned by the bushmeat trade and the illicit pet trade, work to stop the hunting and trafficking of endangered species, defend critical habitat from exploitation, and conduct community development and education programs that reach more than 500,000 people each year across Africa. Additionally, PASA member wildlife centers provide employment for nearly 700 African people and inject millions of dollars into local economies annually.

PASA's Programs

PASA's unique accreditation process brings credibility to wildlife centers, and PASA membership gives them access to a global network of advisors and other specialists. Additionally, PASA helps its members succeed by advocating for them internationally, providing funding and technical support during emergencies, and building their capacity through training in topics such as strategic planning, public education and community engagement, veterinary treatment, and animal care.

In addition to advocating for and supporting its member organizations, PASA collaborates with them on large-scale conservation initiatives.

Some of PASA's newest projects include:

Cameroon Conservation Education Program: In 2015, PASA and its member organizations in Cameroon launched the Cameroon Conservation Education Program with the goals of (1) determining the most effective approach to inspiring Cameroonian children to protect their country's wildlife and other natural resources, and (2) collaborating with the Ministry of Education and experts on education in Cameroon to integrate wildlife conservation into the national school curriculum, so that all schoolchildren in Cameroon will learn the value of protecting animals and their habitats. This is expected to engender a long-term nationwide shift in the population's attitudes and behavior regarding conservation, resulting in an increase in the number and size of protected areas, stronger legal protections for natural habitat, and an increase in the abundance of endangered species in Cameroon. After a very successful pilot, PASA, Sanaga-Yong Chimpanzee Rescue, and Ape Action Africa are expanding this program with the objective of reaching 4,500 youth in 2017.

Edutainment Films Program: The Edutainment Films Program is a pioneering initiative in Africa to distribute high-quality, engaging films that were primarily created for African audiences. The flagship movies of the program were produced by the nonprofit Nature for Kids, which makes excellent, entertaining films with messages about environmental conservation. In a pilot program, hundreds of thousands of people in Cameroon saw the films on national television and on the national train system. Following this tremendous success, PASA is expanding this program to include ten African countries. Figure 2 shows the program being implemented at a school in Zambia.

Figure 2: Staff of Chimfunshi Wildlife Orphanage in Zambia showing an edutainment film to schoolchildren

Reintroduction Data Synthesis Project: Currently, PASA is developing a Reintroduction Data Synthesis Project, which will be the first known comprehensive synthesis of successes and failures of African primate release efforts. Although reintroductions can be highly valuable for conservation in that they

increase the population sizes of endangered species in the wild and bring stronger protection to their habitat, many reintroductions of African primates have been conducted by trial-and-error and some are unsuccessful. In order to increase the success rate, it is valuable to outline the best practices for primate reintroductions based on a comprehensive review of the methods and results of releases that have been conducted across Africa. PASA will work closely with the staff of wildlife centers to analyze their data and quantify aspects of individual survival, reproduction, and integration into wild groups.

The combination of PASA's global network and its member organizations' local expertise and connections uniquely positions the Alliance to produce lasting changes to protect Africa's great apes and monkeys.

Figure 3: Nyango, a Cross River gorilla at Limbe Wildlife Centre in Cameroon

Research at PASA Member Wildlife Centers

In addition to playing an essential role in securing a future for Africa's primates and their habitat, almost all PASA member wildlife centers host researchers. This cooperation has helped to shed light on numerous topics in primatology and evolutionary anthropology.

Research at PASA member sanctuaries has helped to elucidate the evolutionary roots of human cognition through large-scale comparisons of how human children and apes solve problems. For example, studies directly comparing the performance of chimpanzees (*Pan troglodytes)*, bonobos (*Pan paniscus)*, and children in cognitive tests have shown that whereas apes and children solve problems involving physical reasoning—for example, distinguishing different quantities, using tools, and remembering the locations of objects—fairly similarly, children quickly surpass apes when faced with problems about social reasoning,

such as imitating others' actions or inferring others' mental states. This has provided support for the "cultural intelligence hypothesis"— that what is special about human cognition is that we specifically excel at skills needed for cultural learning and transmission (Herrmann *et al.* 2007; Wobber *et al.* 2014).

Additionally, research in PASA wildlife centers has reinvigorated the study of ape cooperation, sharing, and helping (Bullinger *et al.* 2011; Bullinger *et al.* 2014; Engelmann *et al.* 2015; Engelmann & Hermann 2016; Hare & Kwetuenda 2010; Melis & Tomasello 2013; Melis *et al.* 2006a, b; Melis *et al.* 2009; Melis *et al.* 2011; Rekers *et al.* 2011; Schneider *et al.* 2012; Tan & Hare 2013; Warneken *et al.* 2007). This work has shown that chimpanzees are incredibly sophisticated at collaborating to gain mutual benefits (Melis *et al.* 2006a, b; Melis *et al.* 2009). Moreover, they help others solve problems, for example by providing conspecifics with access to out-of-reach objects or food (Melis *et al.* 2011; Warneken *et al.* 2007). This work has also revealed an important difference: whereas humans tend to solve problems together, chimpanzees often prefer to solve problems individually unless they absolutely need a partner (Bullinger *et al.* 2011; Melis *et al.* 2006a; Rekers *et al.* 2011).

Recent work in sanctuary populations has been critical for our understanding of bonobos in comparison to chimpanzees. Research in PASA member wildlife centers has provided evidence that chimpanzees and bonobos tend to differ in how they behave socially (Hare *et al.* 2007; Wobber, Wrangham *et al.* 2010; Woods & Hare 2011), make decisions (Rosati & Hare 2012b; Rosati & Hare 2013), remember spatial locations (Rosati & Hare 2012a; Rosati 2015), and even react hormonally to different situations (Wobber, Hare *et al.* 2010; Wobber *et al.* 2013). Furthermore, samples collected at sanctuaries have allowed researchers to map the bonobo genome, reconstruct the evolutionary history of chimpanzees and bonobos, and identify genetic differences between them (Prüfer *et al.* 2012).

Finally, research in sanctuaries has revealed new insights about human evolution. A comparative study on energy expenditure showed that humans have a higher metabolic rate than other apes, helping to explain how humans evolved energetically-costly traits such as a large brain and more frequent reproduction (Pontzer *et al.* 2016). Richard Wrangham's influential "cooking hypothesis" argues that early adoption of a high-energy cooked diet played a critical role in our species' ability to grow large brains (Wrangham 2009). Research in PASA sanctuaries has revealed that chimpanzees possess some cognitive and behavioral skills needed to engage in cooking behaviors, providing important behavioral tests of this hypothesis (Warneken & Rosati 2015; Wobber *et al.* 2008).

Conclusion

Although the Pan African Sanctuary Alliance and its member organizations may be known largely as animal protection organizations, they play a vital role in the conservation of, and research on, African primates. More information is available at https://www.pasaprimates.org and https://www.facebook.com/pasaprimates.

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Breaking the Enrichment and Plant Cycle: Getting Better Results in Exhibit Landscaping

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Northwest Trek Wildlife Park

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Introduction

How do you maintain lush habitats for an animal exhibit? Every facility, zookeeper, horticulturist faces this struggle. No matter the size and the complexity of an exhibit, the vegetation takes a beating from the animals, the weather, and the staff.

The list of challenges we face when trying to establish new plants is lengthy.

Animals dig, chew, urinate on, claw, nest, roll on, hide in, cache food items in, create pathways through, climb on, push over, break apart, strip bark, consume, and seek out plants in a variety of enriching ways.

Exhibits may be small, have poor drainage, have too much shade, have too much sun, areas have excessive soil compaction, weather, and nutrient loads due to fecal and food may not be conducive for the plants.

The keeper routine itself can reduce plant growth. We all are creatures of habit, following the same pathways day after day being the most efficient in our routine. We are guilty of over trimming and of breaking branches to clear them out of our way. We use chemicals to clean and scrap or dig up substrate to remove soiled areas. We smash through vegetation to check our exhibits and perimeters. If we are being honest, watering the vegetation is not really high on our to-do list.

Then there is enrichment. How would the animal know that the new plants just meticulously placed in their home weren't for them?

No matter what or how we offer enrichment, we have inadvertently trained our animals to seek out these new items daily. We have made this an enrichment game. What did the keeper leave us today? Who can get there first? This unfortunately includes those new plants. The horticulturist follows the same pattern of hiding plants and covering them with their "novel" introduced scents. We should not be surprised that the plants are immediately discovered and interacted with.

For several years at Northwest Trek Wildlife Park the horticulturist and keeper staff has been working together to enhance our exhibit vegetation through staff education. We have the most success when we work together, teaching across departments the various skills to help tackle exhibit design. Zoo keepers know their individual animals and species. They understand animal behavior and can redirect an animal's focus. Zoo keepers understand how their animals use their exhibit and why. The horticulturists know what and how to successfully landscape through design, toxicology, and plant selection.

Everyone has had those discussions that the only way the vegetation will grow and provide the lush habitat everyone wants is if the animal is excluded from the landscape plants. Is this the only way to

successfully establish plants? The circling of this question across departments encouraged us to compile a list to guide staff in exhibit plantings based on our success working together in carnivore exhibits.

These include:

- Have good drainage. Look at the topography and design the yards to funnel water to a location that can be used as a mud zone, used to improve water availability for plants, or moved out of the exhibit. These areas can be "designed" into the exhibit to meet animal and aesthetic needs. A mud pond is great for establishing aquatic plants giving animals' additional browse and while satisfying grooming needs. Drainage rock can help reduce mud in high traffic areas or be used to create dry stream beds that can be used for enrichment.
- Use native plants when possible. They are meant for the climate and will hold up best to the weather conditions, insects, and diseases.
- Use plants that have course leaves, thorns, and are not palatable. Always check for any toxicology concerns.
- Grass seed and sod viewing hotspots every spring and fall.
- Furniture placement is important. Place items in high traffic areas to direct drainage. Identify visitor's viewing areas and place furniture in a zig-zag or layered fashion to break up the bare pathway appearance. Plants will grow around the furniture being protected by them.
- Give lots of daily browse, grass, and sod, so the animals are desensitized to the plant types as much as possible. When possible, give them the same plant types that will be used in the landscaping.
- Provide substrate piles for enrichment and remodel furniture when adding new plants.
- Use plant plugs or bare root bundles. Potted container plants are easy to pull out and the animals seem attracted to the potting soil mix. Provide potting soil mix separately as enrichment so they don't have to destroy the plant to sniff the soil.
- Have the horticulturist "touch" other items in the exhibit not just the new plants. The animals are interested in the novel person's scent. For the same reason we have veterinarians and vet techs participate in training sessions, desensitizing the animal to their presence, have the animals meet the horticulturists. Desensitize them to their scent and tools.
- Add branch debris to cover around roots and over grass seed to protect them while the plants are establishing.
- Plant for growth through fence lines or protected areas so the base of the plant is protected.
- Try for two exhibit renovations each year for replanting, adding substrate, and new furniture. Animal care and horticulture staff should meet to plan out the design to meet both the aesthetic and animal's needs.
- Rub animals bedding on new planting areas.
- Monitor the success of keeper plantings compared to horticulturist plantings.
- Give the substrate used in planting to the animals in advance on exhibit for them to explore. Then use it for planting.
- Use large furniture pieces and tuck the plants in and underneath to protect roots and crowns of the plants.
- Never just add one item. Overwhelm the novelty by planting in high numbers and more than you need.
- Design the exhibit based on the "worst" looking month. This helps with furniture placement and plant selection.

- Have work groups or volunteers pull out items or add substrate to the exhibit but do not have them plant. Use the group for the heavy lifting, but their scent could mean then end of your new plants.
- Have the items in the area for the animals to see and smell but not touch. Stage items just outside the exhibit or holding area.
- Use enrichment to reduce the focus on the new plants.

When enhancing exhibit vegetation, staff should consider each species natural history and individual history to understand their reasons for destroying the plants and how husbandry changes or additions can modify them (Chart 1). This includes seasonal variation within the species.

Chart 1: Canid Natural History Examples of Plant Uses and Options to Reduce Plant Damage

Types of Destruction/ Damaging Behavior	**Enrichment/Husbandry Additions**
Territory pathways	Allow the pathways they create (perimeter checks)- create zig zag pattern with furniture to break up the straight line appearance.
Rubs/ Grooming	Provide multiple items for grooming, including pools, varied substrate, textured brushes, training
Chewing	Offer browse, bones, chew toys, antlers, pinecones, etc.
Digging	Provide large substrate areas, let the denning area be their choice not where it's the most convenient for staff
Caching	Provide substrate piles, leaf litter, bramble, bedding
Marking	Eliminate over cleaning, maintain scent areas and bedding
Social play	Provide items that encourage pack play and cooperative interactions, training

Based on previous observations, we hypothesized that staff can overcome the novelty of introducing new plants in a grey wolf (*Canis lupis*) exhibit by changing how vegetation is planted. We tested the effects of the following techniques in decreasing initial damage on plants by the wolves.

These included:

- Giving browse for enrichment when planting. Use the same plants that are used in landscaping.
- Desensitize the animals to the novel scent of the horticulturist.
- Use animal bedding on the surface and around plantings.

- Give animals access to the planting substrate before it is used in planting.
- Does the focus of the animal vary based on who plants the individual plantings?

Methods

In order to test if we can counter species behavioral motives for destroying plants, we designed 2 experiments using our grey wolf pack. Our pack is a 3 member, sibling group born in 2013. Their habitat is ¾ quarter of an acre, primarily of 80 year old Douglas fir (Pseudotsuga menziesii) over-story canopy with varied topography. In the first experiment we used Western swordferns (*Polystichum munitum*) and in the second we used red alder (*Alnus rubra),* vine maple (*Acer circinatum*), Western balsam popular/ cottonwood (*Populus trihocarpa*) and red-twig dog wood (*Cornus sericea*) saplings. These are all common native plants to the Pacific Northwest Region that are regularly used in our exhibits. These plants are all non-toxic and are commonly dug up, trampled on, chewed on, and basically destroyed by our canids when we attempt to plant them in their exhibit space.

In each experiment the planting area was divided into 3 plots. A horticulturist plot, a keeper plot, and a control plot. To monitor the effects of novel horticulture scent, the horticulturist only manipulated the plants allocated for his designated plot. For the control plot in each experiment, both the keeper and the horticulturist dug out planting holes to "prep" the area for planting. Each testing phase consisted of the horticulturist and the keeper each randomly planting 5 plants in their designated plot area, followed by the testing manipulation. A total of 30 plants were used for each experiment. The plot locations were predetermined based on exhibit design needs, supportive habitat, and selected to have moderate to heavy level of staff and wolf traffic. We wanted to avoid areas where the wolves typically left alone, since the goal is to plant is areas that need restoration. Following each planting the horticulturist continued to prune, remove invasive plants manually, and work in the exhibit to spread scent throughout. All materials were delivered to the wolf area before planting, so the animals could smell and see the items beforehand.

Experiment 1: Western Swordferns

Experiment 1 was divided into 3 phases. In the first phase we tested how the scent of keeper versus the horticulturist on the sword ferns affected their survivability. In this phase all plants were only handled by either the horticulturist or the keeper for their respected plot. The second phase tested whether the horticulturist scent could be masked by planting the ferns with composted mulch amendment that the wolves had access to for 1 week prior to use. The third phase tested scent masking as well, this time adding soiled straw that had been used as wolf bedding. The straw and compost amendment was spread throughout each plot and around individual ferns.

Experiment 2: Tree Saplings

Experiment 2 was divided into 3 phases. The first phase tested whether using horticulturist scented browse throughout the week as part of the wolves' enrichment reduced their focus on the new plantings. The provided browse was cuttings from the same tree species used in the experiment. Browse was offered as bedding, chews toys, bramble piles for foraging, and stuffed in other enrichment items. The second and third phase followed the same design as experiment 1, applying the compost amendment and straw bedding respectively.

For each phase, the wolf interactions with the plants were rated 1 – 5 (Chart 2) and recorded daily for 7 days following planting.

Chart 2: Rating System Based on Active Wolf Interaction

- Rating of 1: No damage.
- Rating of 2: Minor damage. Includes: chewing, bent branches, scent marking, trampling
- Rating of 3: Moderate damage. Includes: broken branches, digging around plant
- Rating of 4: Advance damage. Includes: plant dug out of ground but still at plot, roots exposed but can be replanted.
- Rating of 5: Extreme damage. Includes: plant dug out and removed from plot, plants chewed, roots damaged. Survivability of plant after replanting very low.

Results

For the keeper plots, we found that by adding wolf bedding or providing browse reduced the initial interaction on individual plants by the wolves. When comparing overall damage during the 7 day window, these additions were similar to the control (Chart 3 & 4, Graph 1 & 3).

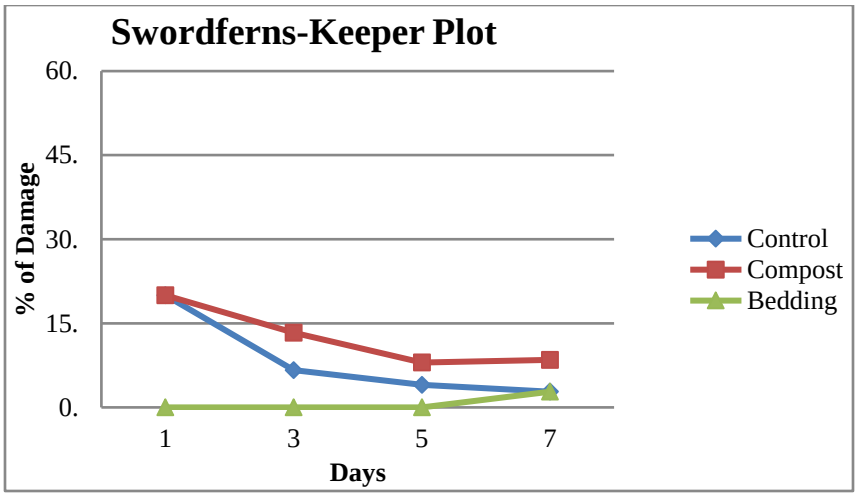
In the horticulturist plots, initial damage to individual plants was increased when adding browse or compost amendment compared to the control. The overall damage during the 7 day window was greatly decreased with the addition of wolf bedding (Chart 3 & 4, Graph 2 & 4).

For both experiments adding the exhibit compost amendment to the plants increased the wolf interaction and damage on individual plants.

Chart 3: Percent of Observed Damage- Swordferns

		1 Day	3 Days	5 Days	7 Days
Keeper	Control	20	6.67	4	2.8
	Mulch	20	13.33	8	8.5
	Bedding	0	0	0	2.8
Hort	Control	20	20	12	11.4
	Mulch	20	53	40	28.6
	Bedding	40	20	8	8.6

Graph 1: Swordfern Damage Observed over 7 Days in the Keeper Plot



Graph 2: Swordfern Damage Observed over 7 Days in the Horticulturist Plot

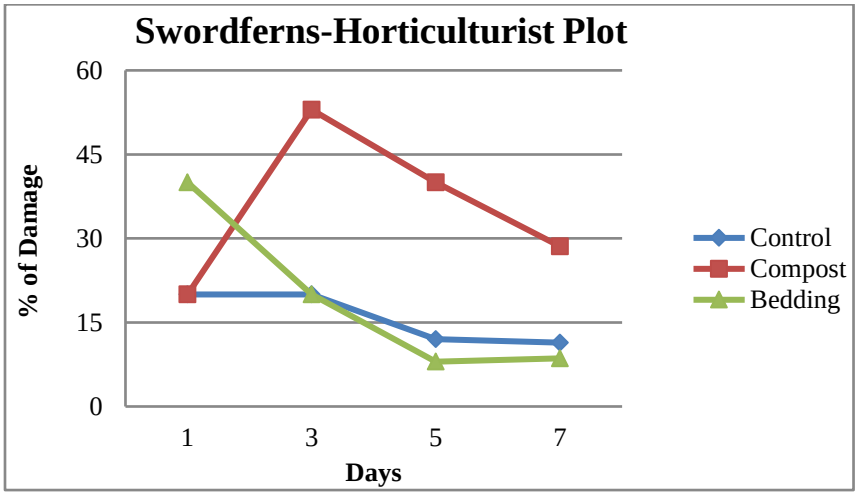
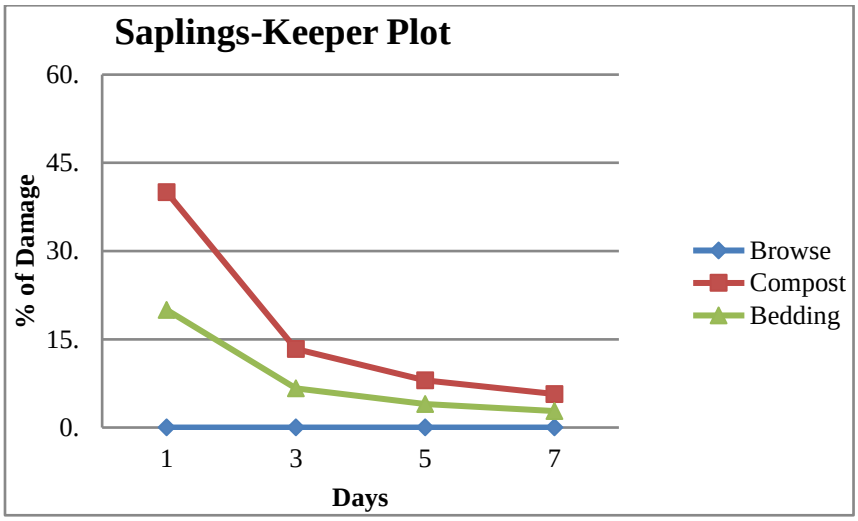


Chart 4: Percent of Observed Damage-Saplings

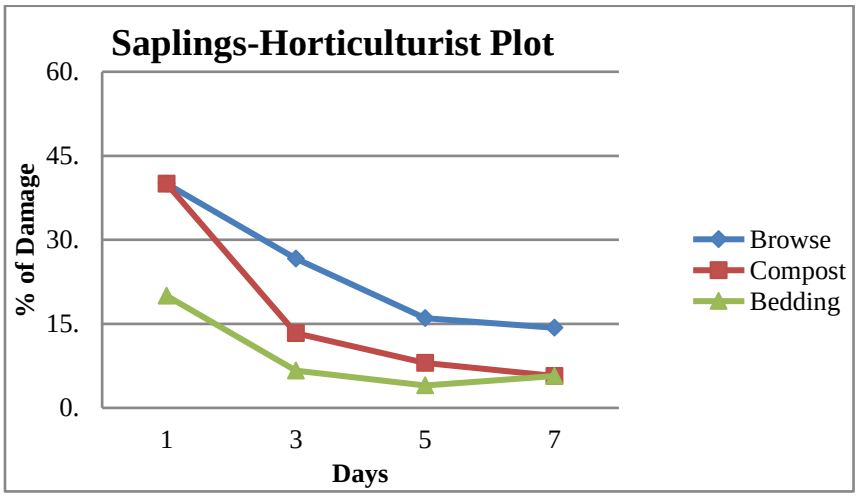
		1 Day	3 Days	5 Days	7 Days
Keeper	Browse	0	0	0	0
	Mulch	40	13.33	8	5.7
	Bedding	20	6.67	4	2.8
Hort	Browse	40	26.67	16	14.3

	Mulch	40	13.33	8	5.7
	Bedding	20	6.67	4	5.7

Graph 3: Sapling Damage Observed over 7 Days in the Keeper Plot



Graph 4: Sapling Damage Observed over 7 Days in the Horticulturist Plot



Discussion

The experiments showed us some results contrary to our hypothesis. We had expected to find the results as descending in damage percentages as: control, compost, and then bedding. Based on previous experiences that the wolves seem to seek out the potted plant material over bare-root, we did not expect

that by adding the compost prior to the wolves would increase their interaction on individual plants. We had hoped that we could add organic matter to the exhibit for the benefit of the plants while reducing interest in the compost amendment by providing the compost to the wolves for 1 week. Planting the "Right plant, Right place" seems more important; than altering the existing soil for overall plant success. The selection of native and or climate condition appropriate plants that do not need additional soil provides better overall success rate.

One of our main questions was "Can you get past the novelty of introducing new plants to exhibit spaces by changing how it was planted and who planted it?' Our hypothesis was based on previous observations that the novelty of unfamiliar staff and new items wears off within a few days. If you can reduce the interaction during that time frame the overall interest in the planting reduces and the survivability is high. Both experiments showed an interest period under 7 days before the novelty wore off and the plant damage dropped significantly from minimum to almost none.

By using soiled bedding material from the pack around the plantings, we found that you can counter species behavioral motives for destroying plants by at least partially masking the unfamiliar scent.

As we expected, keeper planted material does not experience as much damage by wolves as horticulturist plantings. We are not suggesting that keepers should solely plant in their exhibit spaces, but that it is an important factor to keep in mind. The specialized skills of both departments should be relied on in partnership to help guarantee success of exhibit planting. Previous observations have shown us that when horticulture staff, volunteers, and interns alone plant than we experience high loses and damage.

Providing browse eliminated wolf interaction on the keeper plot but increased damage seen on the horticulturist plot. This could be due to all the browse offered for enrichment had been handle by the horticulturist therefore his plot was part of the enrichment. In additional experiments testing browse handled solely by keeper staff should be included.

The second experiment included 4 plant species. We noticed that red alder experienced the highest damage levels; while red-twig experienced the least. We suspect that this is a result of palatability and texture of material. Carnivores, like herbivores, may have strong individual preferences to browse types. Browse preference tests could help staff in the selection of plant types for landscaping.

At 3 months after the plantings, we have 100% survivability of 60 plants added to the exhibit. Some of the plants are along a wolf and keeper pathway and sustain passive damage but no active wolf interactions have been seen.

In the future we hope to replicate this study with other canids and potentially felids to determine if by simply adding their soiled bedding to plantings can effectively mask horticulturists scent and the novelty of plantings for an overall higher success rate.

Local Conservation Efforts at Houston Zoo

By
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Introduction

Our mission at the Houston Zoo is to connect communities with wildlife, inspiring action to save animals in the wild. In working to fulfill this mission the staff looks for opportunities to apply their skills and passions toward saving wildlife and educating the public. While some staff members can travel around the world to work on conservation projects, a greater number of staff members are discovering opportunities closer to home. These local conservation projects offer many benefits to the participants including shorter travel, less time commitment, and lower expenses. By working with local partners, staff members with all levels of animal experience can make a difference toward the conservation of wildlife.

Local Examples

Working with Monarch Watch and experienced on-site staff, team members go through an orientation class to the project including identification and handling of different butterfly species, animal migration patterns and the importance of wildlife conservation. After going through the training class, staff are then able to sign up for available shifts. These shifts are offered during work hours so they must be approved through their supervisor. Teams are comprised of 5-8 individuals and are led by an experienced butterfly handler (picture 1). The shifts are only 1-2 hours each day on zoo grounds, so the time commitment and travel are small. They collect the Monarch butterflies in nets, tag the butterfly, log the data, and then release them back into the wild. This has been a great opportunity for staff members with little or no animal conservation experience, or limited availability to make a difference within the community. Staff from all departments have participated in this activity. The diversity of the teams allows participants to work with people from other departments developing a sense of comradery. More information regarding the Monarch Watch, as well as an animated migration map for the monarch butterfly, can be found at www.monarchwatch.org.

Photo by Dale Martin
Picture 1: Team members during shift

Due to our proximity to the Galveston Bay Houston Zoo, staff members can schedule quick day trips to the coast to do beach clean ups. There is one officially designated day each year that the community gets together to clean large areas of the beaches. These are heavily attended by people from the local communities as well as visitors to the area. The Houston Zoo, working with other local conservation organizations, sets up tables and talks to the public about what they can do locally to save wildlife (picture 2). While this large-scale clean-up is only done once a year, staff members at the Houston Zoo also organize smaller clean-up events throughout the year to clean various locations along the shores. Staff members can drive down in the morning, clean a section of the beach while talking to beach goers regarding their impact on their local ecosystem and then drive home in the afternoon. These smaller groups can make large impacts on the health of these ecosystems.

Photo by John Register
Picture 2: Staff interaction with public during beach cleanup event

Our sea lion staff members, wanting to make an impact in reducing the amount of monofilament line that was abandoned, started a program in 2014 along the Surfside jetty in Galveston Bay. Working with the National Oceanic and Atmospheric Administration (NOAA) they constructed and installed five monofilament collection tubes (picture 3), they schedule regular clean-ups and promote public education and dialogue. These organized trips to the jetty bring together groups of staff members, zoo volunteers, interns and other conservation groups (picture 4) and produce amazing results. Since August 2014, they have collected 916 pounds of recycling, 1,608 pounds of trash and 190 pounds of monofilament.

Photo by Martha Parker
Picture 3: Staff collecting monofilament from collection tubes

Photo by John Register
Picture 4: Cleaning up monofilament line along jetty

The Abandoned Crab Trap Removal Program was created in 2001. This program creates a 10-day crab trap closure every year in February. Any crab traps left in the water during this time are considered abandoned and can be disposed of properly. Since 2002, volunteers have removed 32,705 abandoned traps from Texas waters. -*Texas Parks and Wildlife*. The Houston Zoo participates in this event every year. Some of the staff bring their own boats to go out and collect traps while other staff members collect the traps on the shore and separate recyclable material from trash (picture 5). They also collect data on species found entangled within the traps. Last year, members from our admissions staff came as a group to this event. While they may not have possessed a high amount of animal handling skills they knew that they could make a tangible difference in conserving animals in the wild at this event. They were very excited with their successes in this project (picture 6). They knew they were making a difference in the community and they were quick to share their experiences with their co-workers and zoo visitors when they returned.

Photo by John Register
Picture 5: Crab trap removal

Photo by John Register
Picture 6: Celebrating a successful conservation event

Staff Conservation Fund

The Staff Conservation Fund is an opportunity for Houston Zoo staff to donate money into a fund that assists the staff in learning the principles of a conservation initiative and to provide financial support to assist in conservation efforts. This fund, started in 2004, continues to be a huge success towards our conservation mission. The Staff Conservation Fund committee, which approvals all projects and funding, is comprised of members from all different departments within the Houston Zoo. They receive between two and six project proposals each year. These project proposals fall into three categories: Sustainability, Conservation Program Development, and Conservation Program Enhancement. The Sustainability project allows staff to implement green initiatives on or off zoo grounds. The Conservation Program Development project assists the staff in learning the processes in the development of a conservation initiative. The Conservation Program Enhancement project allows staff members to transfer their professional expertise for the enhancement of an existing conservation project. To date, 58 staff members have been able to work on over 100 projects through this initiative. These projects have had direct impact on 25 different wildlife species. About half of the Houston Zoo staff donates money to this initiative every year.

One example of a local project that was funded through this program was an on-site composting bin project lead by an animal keeper and a horticulturist (picture 7). They could use these funds to design and built several composting bins that are being used today to reduce the amount of impact on the environment.

Photo by Stephanie Adams
Picture 7: Composting bin

Working with NOAA

The Houston Zoo has been partnering for several years with the National Oceanic and Atmospheric Administration to help with endangered and injured sea turtles. There are five species of sea turtles inhabiting the Gulf of Mexico including Kemp's Ridley, Green, Leatherback, Atlantic hawksbill and Loggerhead sea turtles. This partnership includes participating in sea turtle surveys every week documenting sea turtle activity, locating nest sites and recovering injured wildlife. Another way that the Houston Zoo is helping conserve the sea turtle population is by providing veterinary care when needed. Our head veterinarian, Dr. Joe Flanagan, is known world-wide for his work with injured sea turtles. Dr. Flanagan has removed countless numbers of hooks from sea turtles (picture 9), repaired damaged shells and other health related issues.

Photo by Dale Martin
Picture 9: Dr. Flanagan removing hook and line from Kemp's Sea Turtle

Saving Wildlife Training Opportunities

This year the Houston Zoo has initiated a new exciting program in alignment with our mission. The Houston Zoo encourages and supports its' employees in work that contributes to saving wildlife. To accomplish this the Houston Zoo provides opportunities for employees to engage in saving wildlife trainings so they gain a deeper understanding of how their positions and zoo wide operations are in fact, saving wildlife. The saving wildlife training opportunities are set up to have formalized structures to ensure staff are learning the principals of conservation, contributing to wildlife protection activities and realizing their role in saving wildlife. All staff members are eligible to participate in up to three zoo-sponsored saving wildlife training opportunities per calendar year. These training opportunities include Monarch Butterfly Tagging, Sea Turtle Survey, Crab Trap Clean-up and Surfside Jetty Clean-up. The time contributed to each approved training opportunity is considered time worked. The experience that is gained with these opportunities are very important to achieving our mission.

Conclusion:

The Houston Zoo is looking at several different ways to achieve our mission statement to connect communities with animals and to inspire action to save wildlife. Staff members are collaborating with conservation leaders throughout the world to save wildlife and ecosystems. Some of these partnerships involve working at a local level which allows a greater level of diverse staff participation.

References

Texas Parks and Wildlife- Abandoned Crab Trap Removal Program
http://tpwd.texas.gov/landwater/water/conservation/Crab_trap/Crab_trap.phtml

Hand-rearing, Reintroduction and Veterinary Management of a Female Gaur Calf

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Gaur *(Bos gaurus)* are the largest species of extant wild cattle, with bulls weighing up to 907 kg (2,000 lbs), and reaching a shoulder height of over six feet (Choudhury, 2002). Gaur are listed as vulnerable due to habitat loss and over hunting, and are found in scattered populations throughout Southeast Asia (IUCN, 2015). The Bronx Zoo currently houses a herd of seventeen gaur, exhibited within Wild Asia, an area of the park which features much of the zoo's large ungulate exhibits and seeks to replicate the forests, meadows and mud wallows found throughout the continent of Asia. On October 13, 2014, a new born gaur calf was discovered among the herd. Keepers spent time watching the calf's interactions with the herd, however no maternal interactions were seen from any of the females, the calf was not observed nursing and also had difficulty standing. The following day, the calf was separated from the herd for a neonatal exam, at which time it was determined that the calf was not nursing based on her bloodwork (low blood glucose, negative gluteraldehyde test and low total protein), as well as the calf having an overall weak demeanor. It was decided to remove the calf from the herd for hand-rearing.

The female gaur calf weighed 26.5 kg (58.6 lbs) and was taken to the Bronx Zoo's Wildlife Health Center, where her umbilicus was dipped in betadine, and she was treated with antibiotics and received subcutaneous fluids. Hospital staff began the process of training the calf to drink from a bottle. Initially, the bottle fed formula consisted of a mixture of 5 ounces of colostrum mixed with 1 liter of whole cow's milk. Hospital staff also stimulated the calf to assist her in defecating (Fig. 1). The following day, the calf began to receive three feedings of 1000 ml of whole cow's milk and 5 ounces of colostrum. By the second day of hand-rearing, the calf was already beginning to accept drinking from a bottle, at which time hospital staff began training the calf to drink from a wall mounted bottle rack to help limit the calf's association with people (Fig. 1).

After spending approximately one week at the Wildlife Health Center, the gaur calf was returned back to the zoo's Wild Asia complex for care by mammal keeper staff. The calf, named Pocahontas, was housed by herself in a hoofstock stall adjacent to the adult gaur herd. By this point the calf was receiving two feedings a day of 1750 ml made up of a custom designed milk formula (BMC1), whole cow's milk and colostrum. The BMC1 milk replacer consisted of 100 ml whole cow's milk to 1 gram Resource Beneprotein, which added a source of protein to the calf's diet, and 4 grams of Multimilk, a carbohydrate free milk replacer (Eidlin, 2009). The calf was weighed daily by being placed in a crate and then on a scale. At approximately 20 days of age, keeper staff began having the calf follow them to the gaur holding corral, and feeding her first bottle of the day in this much larger space while the adult herd was shifted into another corral. This allowed her to become more comfortable with both smelling the adult gaur and spending time in this new corral before being reintroduced to the herd. The zoo's maintenance staff installed a 'creep,' a small calf sized opening between the gaur corral and an adjacent empty corral to assist in the future reintroduction of the calf with her herd mates (Fig. 2). This was set-up by attaching a sheet of wood in the frame of an existing doorway to lower the height of the opening. A pin was installed to allow the door to be locked open just wide enough to allow the calf to comfortably pass through to the empty corral should she be intimidated or aggressed by the herd.

When the calf turned approximately one month of age, she was given access to the adult herd of gaur for the first time. The calf immediately went through the creep to investigate her herd mates, but was quickly chased around the corral by the inquisitive adult gaur. The creep was effective as the calf ran into the adjoining empty corral. Introductions were a slow process as the calf was initially reluctant to re-enter the corral with the adult animals. Keeper staff continued to give the calf access to the herd each day, and continued to feed her first bottle of the day by calling the calf into the adult gaur corral and feeding her through an additional cracked door. Over time, this helped the calf gain more confidence with entering the corral with the adult animals (Fig. 3).

Midway through the reintroduction process, Pocahontas was observed producing very loose stool, at which time

introductions were halted with the herd. The calf's bottle was diluted temporarily with 50% water to help her to re-hydrate from the bout of loose stool that lasted several days. Reintroductions resumed approximately one week later. At a month and half old, the calf was receiving two bottles of 3500 ml BMC1 per day and was observed beginning to eat grain and hay for the first time. Over time, Pocahontas gained more confidence around the adult animals, and would allow them to approach her, and later would initiate physical contact with them herself. On December 2, 2014, after careful observation and the conclusion that the calf was comfortable with the herd, Pocahontas was transitioned to living full time with the adult gaur. Keeper staff continued to bottle feed the calf twice a day by cracking a corral door and placing the bottle in a wall mounted bottle rack. By two months of age Pocahontas was transitioned from drinking the BMC1 formula to drinking 3000 ml of whole cow's milk twice a day. The calf was brought in to an adjoining corral every other day to be weighed. Pocahontas weighed 62.9 kg (138.8 lbs) the day she was fully integrated with the herd.

On January 25, 2015, keeper staff first reported seeing what appeared to be a loose ball of skin on the abdomen of the calf in front of her left rear leg. Within three days, the area became very firm to the touch and was reported as swelling to the size of a softball (Fig. 4). While keeper staff had begun to wean Pocahontas off the bottle, it was decided to halt the weaning process to keep the calf tractable. On March 9, 2015, Pocahontas was immobilized and was taken back to the Wildlife Health Center where it was discovered the swelling was a seroma, a build-up of fluid under the skin. It is hypothesized that the seroma may have occurred as a result of trauma received by the calf getting hit by the horns of an inquisitive adult gaur, which was seen by keeper staff on multiple occasions. The calf was anesthetized to lance, drain, and suture close the seroma. Long-acting antibiotics were administered at the time of surgery. The calf was then returned to Wild Asia where she was once again placed in a hoofstock stall by herself. Two days later the calf was returned to living with the adult gaur herd. Four days after the seroma surgery, the seroma recurred and was drained with no restraint by veterinary staff as keepers fed the calf her bottle. Vet staff returned three days later and injected the calf with another long lasting antibiotic. Keeper staff were instructed to palpate the seroma site daily to toughen the area. Nine days later the seroma was resolved. The calf was only receiving two feedings of 1500 ml of whole cow's milk per day by this point, and was weaned from the bottle the following day.

While it was a slow process, Pocahontas transitioned very well to living with the adult gaur herd. She quickly learned to shift between corrals and after spending the winter in the off-exhibit gaur management space, she transitioned very readily to going on exhibit with the adult herd. She is now fully integrated into the dynamics of the herd and no longer seeks the companionship of the keeper staff. It is difficult to tell that she is even a hand reared animal. Pocahontas can now be seen in the zoo's Angkor Forest, a mixed species exhibit of gaur and Eld's deer (*Rucervus eldii*) seen by monorail within the Bronx Zoo's Wild Asia. Special thanks is extended to Wildlife Health Center staff for stabilizing Pocahontas after she was rejected by her dam, the zoo's maintenance staff for designing a gaur calf sized creep, Mammal Department managers, as well Wild Asia keeper staff for the daily care of Pocahontas.

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